Appendix A—1992 Board of Health and Environmental Sciences Order

BEFORE THE BOARD OF HEALTH AND ENVIRONMENTAL SCIENCES
OF THE STATE OF MONTANA

In the Matter of the Petition for Modification of Quality of Ambient Waters Submitted by Noranda Minerals Corporation for the Montanore Project	Docket No. BHES-93-001-WQB

FINAL DECISION AND STATEMENT OF REASONS

BACKGROUND

1. The Montanore Project, a proposed underground copper and silver mine located in northwestern Montana, is a joint venture between Noranda Minerals Corporation (Noranda) and the Montana Reserves Company. The proposed project includes the development of a mine in Sanders County and the construction of a mill and associated mine waste disposal facilities in Lincoln County, 18 miles south of Libby, Montana.

2. On December 13, 1989, Noranda filed a petition for Change in Quality of Ambient Waters with the Montana Board of Health and Environmental Sciences (Board) for the proposed Montanore Project. Supplemental Information in Support of the Petition was submitted in May 1992. (The December 13, 1989 petition and the supplement submitted in May 1992 are hereinafter referred to as "Petition").

3. The Petition to allow lower water quality was submitted by Noranda because ". . . the proposed mining and milling operation cannot be designed without the expected occurrence of excess water from precipitation and mine flow." (December 13, 1989 Petition).

4. On November 20, 1992, the Board held a public hearing on

the petition to lower the quality of waters impacted by Noranda's proposed Montanore Project pursuant to ARM 16.20.705. The Board considered oral and written testimony offered prior to and at the hearing, the Petition, and the final environmental impact statement (FEIS) prepared for the proposed project by the Montana Department of Health and Environmental Sciences (Department), the Montana Department of Natural Resources and Conservation, the U.S. Forest Service, and the Montana Department of State Lands.

5. Noranda's proposed method of mine water discharge would lower the water quality for certain parameters in the surface and groundwater where the ambient quality for those parameters is higher than the applicable water quality standards. The ambient concentrations, Noranda's requested changes from ambient concentrations, and the Montana Water Quality Standards are shown in Table 1.

Table I

Ambient quality, requested concentrations, and the Montana Water Quality Standards. All units are in mg/l.

	Existing Water Quality[a]	Noranda Requested Concentration[b]	Applicable Standard[c]
Surface Water			
Chromium	<0.02	0.005	0.011
Copper	0.002	0.003	0.003
Iron	0.08	0.1	0.3
Manganese	<0.02	0.05	0.05
Zinc	0.02	0.025	0.0271
NO3 + NO2 as N	0.13	5.5[e]	10[d]
Ammonia, Total	0.08	1.5	2.2
Tot. Diss. Solids	29	100.0	250
Groundwater			
Chromium	<0.02	0.02	0.05
Copper	<0.02	0.1	1
Iron	<0.19	0.2	0.3
Manganese	<0.45	0.05	0.05
Zinc	<0.06	0.1	5
NO3 + NO2 as N	0.36	10	10
Ammonia, Total	--	--	--
Tot. Diss. Solids	108	200	500

[a] Surface water values are based on data for Libby, Ramsey and Poorman creek given in tables 3-14 in the FEIS. Ground water values are based on data for wells in the adit, land application and tailing pond areas given in table 3-18 in the FEIS.

[b] Based on table 2-1(R) in the May 1992 Supplement to the petition.

[c] Except for nitrate these are based on the lowest applicable standard.

[d] The 10 mg/l standard is to protect public health; however, the highest allowable level which will not cause undesirable aquatic life is 1 mg/l [ARM 16.20.633 (1)(e)].

[e] Noranda changed their request to 1.0 mg/l at the Hearing

6. Pursuant to ARM 16.20.705(6), the Board's final decision on a petition to allow degradation must be accompanied by a statement of reasons stating the basis for the decision and explaining why degradation is or is not justified.

FINAL DECISION AND ORDER

The petition of Noranda to lower water quality in the groundwater and surface water adjacent to the proposed Montanore Project is granted with the following conditions:

(1) Petitioner shall provide secondary treatment or equivalent as required by ARM 16.20.631(3). The Department has determined that land treatment as proposed by the applicant, with at least 80% removal of nitrogen, will satisfy this requirement. In addition, this treatment will also satisfy the requirements of ARM 16.20.631(3) with regard to metals. Accordingly, the Department shall review Petitioner's design criteria and final engineering plans to determine that at least 80% removal of nitrogen shall be achieved.

(2) Design criteria and final engineering plans and specifications shall be submitted to the Department at least 180 days prior to any new or increased anticipated discharge from the Montanore Project and must be approved in writing by the Department prior to any activities that would cause degradation of surface or ground water.

(3) In determining allowable changes in nitrate concentration in receiving waters, the Board bases its decision on the site

specific facts of each case, taking into account the protection of beneficial uses.

In this case, the Board finds, based on the evidence presented, that the Department's recommended limit of 1.0 mg/l inorganic nitrogen in surface water should not be exceeded. The petition is therefore granted with the Department's recommended limit of 1.0 mg/l for total inorganic nitrogen in surface waters. The requested limit of 10.0 mg/l in ground water is granted subject to the following conditions. The concentration of total inorganic nitrogen in the ground water shall not exceed levels reflecting less than 80% removal by the treatment process and shall not cause exceedences of 1.0 mg/l total inorganic nitrogen in Libby, Ramsey or Poorman Creeks.

Surface and ground water monitoring, including biological monitoring, as determined necessary by the Department, will be required to ensure that the allowed levels are not exceeded and that beneficial uses are not impaired.

(4) The Board adopts into this Order the modifications developed in Alternative 3, Option C, of the Final EIS, addressing surface and ground water monitoring, fish tissue analysis and instream biological monitoring. Monitoring plans shall be submitted to the Department at least 180 days prior to any new or increased anticipated discharge from the Montanore Project and must be approved in writing by the Department prior to the commencement of any activity that would cause degradation of surface or ground water in the project area. The monitoring plan shall contain a

system of surface and ground water monitoring locations sufficient to determine compliance with this Order.

(5) Changes from ambient quality requested in the Petition for constituents, other than those containing nitrogen, will not, after treatment as specified in paragraph 1 of this Order, adversely affect beneficial uses and are therefore granted.

(6) Based on the evidence presented at the hearing, the Board has determined that Petitioner has affirmatively demonstrated that the changes granted herein are justifiable as the result of necessary social or economic development.

(7) Noranda shall provide annual funding to the department so that the department can perform sufficient independent monitoring to verify the monitoring performed by the company. Such funding shall not exceed the actual cost of such monitoring and in no case may it exceed $35,000 annually (in 1992 dollars).

(8) The provisions of this Order are applicable to surface and ground water affected by the Montanore Mine Project located in Sanders and Lincoln County, Montana, and shall remain in effect during the operational life of this mine and for so long thereafter as necessary.

STATEMENT OF REASONS

The Board's reasons for allowing a change in the ambient quality of waters impacted by the proposed Montanore Mining Project are as follows:

1. Under Section 75-5-303(1), MCA, of the Montana Water

Quality Act, the Board may authorize lower water quality if a demonstration is made that degradation is justified due to necessary economic or social development. If degradation is authorized, the Board must ensure that existing and anticipated uses are fully protected.

2. Section 75-5-303(2), MCA, requires ". . . the degree of waste treatment necessary to maintain that existing high water quality." Section 75-5-304, MCA, and ARM 16.20.631 require treatment and standards of performance for activities that may impair water quality. In particular, ARM 16.20.631(3) requires that industrial wastes, at minimum, must be treated using technology that is the best practicable control technology available (BPCTCA), or, if BPCTCA has not been determined by EPA, then the equivalent of secondary treatment as determined by the Department. If it has been demonstrated that there are no economically and technologically reasonable methods of treatment or practices that would result in no degradation, then the Board will determine whether lower water quality is justified due to necessary economic or social development. As part of this determination, the Board must require as a prerequisite BPCTCA (or if BPCTCA has not been determined by EPA, the equivalent of secondary treatment as determined by the Department). The Department has determined that land treatment as proposed by the applicant, with at least 80% removal of nitrogen shall be achieved, will satisfy the requirements of ARM 16.20.631(3) with regard to nitrogen and metals.

3. Application of treatment as discussed in the Petition would maintain existing water quality except for possible increases in nitrate, chromium, copper, iron, manganese, zinc, total dissolved solids (TDS), and ammonia. The requested increases would not adversely affect any beneficial uses except for the increase in nitrate. The effects of nitrate increases on beneficial uses are discussed below.

4. The proposal for mine wastewater disposal submitted by Noranda relies on a tailing impoundment, collection systems, and land treatment for wastewater disposal. Monitoring would be required to ensure that allowed levels of nitrate and other compounds would not be exceeded. This proposal would result in lower ambient water quality for all of the parameters that are the subject of this Petition.

5. The preferred alternative identified in the FEIS discusses land treatment prior to disposal. Water treated by the methods discussed under this alternative would substantially reduce the amounts of inorganic nitrogen in the surface and groundwater.

The testimony submitted at the hearing further confirms that land application is an appropriate treatment methodology for nitrogen reduction.

Because the land treatment proposed by Noranda would reduce suspended solids and metal concentrations on a year-round basis, the resulting concentrations of metals after dilution would not impair existing uses in these waters.

6. Published studies indicate that very low levels of

nutrients may stimulate algal growth, but that these studies have added both nitrogen and phosphorus (a situation not strictly applicable here since phosphorus would not be added in this case) and that to protect against the development of undesirable growth in streams and rivers, the Department believes inorganic nitrogen should not exceed 1.0 mg/l.

The Board, based upon the evidence submitted by the Department and by Petitioner, accepts 1.0 mg/l as the maximum allowable concentration of inorganic nitrogen in Libby, Ramsey and Poorman Creeks, for protection of all beneficial uses.

7. The analysis of land treatment in the FEIS demonstrates that this treatment (secondary treatment as defined by the Department), would achieve compliance with the allowable concentration of 1.0 mg/l of inorganic nitrogen in surface water. At the Hearing, Noranda changed its request from 5.5 mg/l of nitrate to 1.0 mg/l total soluble inorganic nitrogen. This level should adequately protect existing beneficial uses. However, biological monitoring is necessary to insure protection of beneficial uses and to assure compliance with ARM 16.20.633(1)(e), as well as other applicable standards.

8. Beneficial uses of the groundwater would not be impaired if a nitrate concentration of 10 mg/l was allowed, as requested in the petition. However, concentration of inorganic nitrogen in ground water at this level may cause violations of the standards imposed by the Board. Therefore, allowable amounts of inorganic nitrogen in ground water will be governed by the land application

treatment requirements and the surface water limits imposed by the Board.

9. Concerns were raised at the hearing regarding the ability of the Department to fund the cost of State-conducted monitoring at the Montanore Project to ensure compliance with limitations imposed by the Board in granting the Petition.

10. An analysis of the necessary economic or social development associated with the proposed project has been submitted by Noranda in its Petition and further discussed in the EIS. Further testimony was submitted by the Petitioner at the hearing regarding the importance of the Montanore Project for economic or social development in Lincoln and Sanders County. The need for the proposed project is to develop a source of copper and silver for the production of world wide commodities. Information presented to the Board indicates that the construction and operation of the Montanore Project will have beneficial economic and social impacts in Lincoln and Sanders Counties during the 18 years of its operation. Increased direct and indirect employment and increases in local government revenues associated with the mining project will benefit the impacted area. In addition, the lower water quality associated with the proposed development will be negligible.

For the reasons stated above, the Board finds that degradation resulting from the Montanore Mining Project is justified.

Dated this 20 day of November, 1992.

Raymond W. Gustafson

RAYMOND W. GUSTAFSON, CHAIRMAN, BOARD OF HEALTH AND ENVIRONMENTAL SCIENCES

Appendix D—Proposed 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— Montanore 230-kV Transmission Line Minimal Impact Standard Assessment

Appendix K—Water Quality Data

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10. An analysis of the necessary economic or social development associated with the proposed project has been submitted by Noranda in its Petition and further discussed in the EIS. Further testimony was submitted by the Petitioner at the hearing regarding the importance of the Montanore Project for economic or social development in Lincoln and Sanders County. The need for the proposed project is to develop a source of copper and silver for the production of world wide commodities. Information presented to the Board indicates that the construction and operation of the Montanore Project will have beneficial economic and social impacts in Lincoln and Sanders Counties during the 18 years of its operation. Increased direct and indirect employment and increases in local government revenues associated with the mining project will benefit the impacted area. In addition, the lower water quality associated with the proposed development will be negligible.

For the reasons stated above, the Board finds that degradation resulting from the Montanore Mining Project is justified.

Dated this 20 day of November, 1992.

Raymond W. Gustafson

RAYMOND W. GUSTAFSON, CHAIRMAN, BOARD OF HEALTH AND ENVIRONMENTAL SCIENCES

Appendix C— Agencies' Conceptual Monitoring Plans, Alternatives 3 and 4

Appendix C. Agencies' Conceptual Monitoring Plans

C.1 Introduction

This appendix contains the agencies' conceptual monitoring plans for Alternative 3. MMC would develop final monitoring plans for the agencies' approval before the Evaluation Phase for the selected alternative in the KNF's ROD. Each plan would include a section on quality assurance measures that ensure the reliability and accuracy of monitoring information as it was acquired. For example, surface water quality sampling would follow DEQ's *Quality Assurance Project Plan (QAPP), Sampling and Water Quality Assessment of Streams and Rivers in Montana, 2005* (DEQ 2005). Each plan would describe data quality objectives for sampling, which would include specific methods for analysis and quantification, and criteria for assessment of the data. All plans would identify action levels, which when reached would require MMC to implement a corrective measure. MMC would submit the final plans to the agencies early enough so at least 1 year of data could be collected before extension of the Libby Adit started.

All monitoring would require an annual report unless otherwise specified. The format and requirement needs for reporting would be reviewed and finalized by the agencies. Reports would be submitted to other review agencies as identified by the KNF and the DEQ. After submittal of a monitoring report, the agencies may call a meeting with all other relevant agencies to review the monitoring plan and results, and to evaluate possible modifications to the plan or permitted operations.

The monitoring described in the following sections have two, overarching objectives. The first is to assess if the alternative selected in the KNF's ROD is adversely affecting the environment. The second objective is to monitor the effectiveness of the agencies' mitigation measures described in EIS and ROD. The monitoring plans are expected to be dynamic, and change as new data were collected and analyzed.

C.2 Air Quality

C.2.1 Objective

The objectives of air quality monitoring are to monitor annual production information and emission sources, and to assess effectiveness of wind erosion control measures at the tailings impoundment site.

C.2.2 Locations, Parameters, and Frequency

MMC would submit to the agencies for approval a general operating plan for the tailings impoundment site including a fugitive dust control plan to control wind erosion from the 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.

MMC would install, operate, and maintain three air monitoring sites in the vicinity of the mine and facilities. The exact location of the monitoring sites would be approved by the agencies and meet all applicable siting requirements contained in the Montana Quality Assurance Manual (1997), ARM 17.8.202 and 17.8.204; the EPA Quality Assurance Manual (EPA 2008a, 2008b); and 40 CFR Parts 50, 53, and 58; or any other requirements specified 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 C-1 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 was 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.

Table C-1. Air Quality Monitoring Locations, Parameters, and Frequency.

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

C.2.3 Inspections

DEQ's Air Resources Management Bureau personnel would perform on-site inspections of the operation on a random basis on a frequency of at least once per year. Air monitoring reports would be submitted and reviewed on a quarterly basis. The overall effectiveness of the proposed air pollution control measures, with emphasis on the adequacy of wind erosion prevention at the tailings impoundment, would be evaluated on an ongoing basis.

C.2.4 Reporting

MMC would use air monitoring and quality assurance procedures that are equal to or exceed applicable requirements MMC would provide the DEQ with annual production information for all emission points in the annual emission inventory request. The request would include all sources of emissions identified in the emission inventory contained in the permit analysis. The following information would be provided:

- Amount of ore and waste handled
- Amount of diesel used (surface equipment and underground equipment separately)
- Amount of propane used
- Amount of explosives used (RU Emulsion explosive and High Explosive separately)
- An estimate of vehicle miles traveled on on-site access roads
- Amount of disturbed acreage (including tailings impoundment area)
- Other emission-related information the DEQ may request

MMC would submit quarterly data reports within 45 days after the end of the calendar quarter and an annual data report within 90 days after the end of the calendar year. The annual report may be substituted for the fourth quarterly report if all required quarterly information is included in the report. The quarterly report would consist of a narrative data summary and a data submittal of all data points in AIRS format. This data would be submitted electronically. The narrative data summary would include:

- A topographic map of appropriate scale with coordinates and a true north arrow showing the air monitoring site locations in relation to the plant, any nearby residences and/or businesses, and the general area
- A hard copy of the individual data points
- The quarterly and monthly means for PM_{10}, $PM_{2.5}$, and wind speed
- The first and second highest 24-hour PM_{10}, $PM_{2.5}$ concentrations and dates
- A quarterly and monthly wind roses
- A summary of the data collection efficiency
- A summary of the reasons for missing data
- A precision and accuracy (audit) summary
- A summary of any ambient air standard exceedances
- Calibration information

The annual data report would consist of a narrative data summary containing:

- A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the plant, any nearby residences and/or businesses, and the general area
- A pollution trend analysis
- The annual means for PM_{10}, $PM_{2.5}$, and wind speed
- The first and second highest 24-hour PM_{10}, $PM_{2.5}$ concentrations and dates
- The annual wind rose
- An annual summary of data collection efficiency
- An annual summary of precision and accuracy (audit) data
- An annual summary of any ambient standard exceedance
- Recommendations for future monitoring

C.3 Cultural Resources

C.3.1 Objective

Cultural resources would be monitored to ensure protection for cultural resources not identified during initial surveys from adverse effects during construction, and that all cultural resources that were to be avoided were not adversely affected during construction.

C.3.2 Locations, Parameters, and Frequency

Before the Construction Phase, MMC would complete a cultural resource inventory for areas of the alternatives selected in the ROD that have not been pedestrian surveyed. Surveys would meet the requirements of the 36 CFR 800 regulations and the guidelines in the 2009 KNF Site Inventory Strategy. Eligibility assessments for historic properties within the selected alternatives, as outlined in the ROD, would be completed and formally resolved through the SHPO and/or the Keeper of the National Register pursuant to 36 CFR 800, before project impacts to properties occurred. MMC would prepare a mitigation plan for all NRHP-eligible properties determined through a formal determination of effect to be adversely affected by the project. The mitigation plan would be submitted for review and approval by the KNF if on National Forest System lands in consultation with the SHPO and the Advisory Council on Historic Preservation.

Monitoring would be required during any land disturbing activity that has potential to adversely affect unidentified sites. The areas to be monitored would be identified in the ROD. Monitoring must be completed by a qualified archaeologist meeting the Secretary's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716). The KNF would contact the Confederated Salish and Kootenai Tribes and Kootenai Tribe of Idaho (Tribes) and the Tribes would be afforded the opportunity to monitor construction activities. If previously unrecorded cultural properties, human remains, or funerary objects are discovered during any activity by MMC, MMC would immediately:

- Cease the activity in the area of the discovery and secure the area with a 100-foot (30-meter) buffer by attaching temporary fencing to trees. No disturbance would occur in securing the site.

- Notify the county coroner if the discovery was human remains, and the KNF Forest Archaeologist if the discovery was on National Forest System lands or the SHPO Archaeologist if the discovery was on lands other than National Forest System lands
- Notify the KNF Forest Archaeologist if the discovery was a funery object and was on National Forest System lands or the SHPO Archaeologist if the discovery was on lands other than National Forest System lands
- The KNF Forest Archaeologist would consult with the SHPO and with the Tribes if the properties are prehistoric.

Following notification, MMC would retain a qualified archeologist and:

- Determine appropriate mitigation measures for the discovery of cultural properties following Native American Graves Protection and Repatriation Act procedures outlined in 43 CFR 10, if on National Forest System lands, or the Montana Human Skeletal Remains and Burial Site Protection Act procedures outlined in 22-3-801, MCA, if on lands other than National Forest System lands. Mitigation plans for discoveries on National Forest System lands would be submitted to the KNF Archaeologist for review and comment.
- Consult with Montana SHPO on the proposed mitigation measures, and the Tribes on the proposed mitigation measures if the properties were prehistoric.
- Follow procedures for submitting mitigation measures outlined in the Montana Human Skeletal Remains and Burial Site Protection Act in the event that the Native American remains or funerary objects were discovered on state or private lands.

C.3.3 Reporting

In 2010, the KNF and Montana SHPO entered into a Programmatic Agreement that described certain requirements of the parties to mitigate the unavoidable adverse effects on historic properties. As part of the report submitted annually to the agencies, MMC would provide information on the mitigation implemented during the prior year pursuant to the Agreement. The report also would discuss any previously unidentified cultural resources encountered during construction.

C.4 Wetlands

C.4.1 Objective

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 this section may be modified in a Corps 404 permit.

The objective of the wetlands monitoring also would be to evaluate the possible indirect effects of the project. Inventory and monitoring of groundwater dependent ecosystems, including wetlands, is described in sections C.10.3.2.2, Additional GDE Inventory and C.10.3.2.3, Continued GDE Monitoring. Groundwater monitoring of wetlands in the impoundment area is described in section C.10.5.4.2, Pumpback Well System Monitoring.

C.4.2 Locations, Parameters, and Frequency

Monitoring would follow the Corps' Regulatory Guidance Letter (RGL 06-3) (Corps 2008a) that addresses monitoring requirements for compensatory mitigation projects. Performance standards for the three wetlands parameters: hydrophytic vegetation, hydric soil, and appropriate hydrology would be established in the 404 permit. Additional performance standards based on functional assessment methods may be incorporated into the performance standard evaluations to determine if the site was achieving the desired functional capacity.

Vegetation data would be collected at established quadrat sampling points along established transects to determine vegetation composition. Hydrology data from shallow groundwater wells or piezometers in each mitigation site would be collected in spring and fall. Soil conditions also would be investigated for evidence of saturation. Wetland functional assessments would be conducted using the same methodology used to estimate required levels of compensatory mitigation as part of the monitoring program. Boundaries of successful wetland establishment areas would be established annually to determine if the total mitigation area attains the intended design area. Monitoring would also be performed for the non-wetland channel mitigation sites. Specific monitoring requirements and methods would be included in the Final Compensatory Mitigation Plan for the Montanore Project.

The monitoring period for wetland and non-wetland mitigation must be sufficient to demonstrate that the compensatory mitigation project has met performance standards, but not less than 5 years. Some compensatory mitigation projects may require inspections more frequently than annually during the early stages of development to identify and address problems that may develop. Monitoring of the wetland and non-wetland mitigation sites would be performed semi-annually during the first 5 years of mitigation.

C.4.3 Reporting

Monitoring reports would follow the requirements described the Corps' RGL 06-3. The reports would have these main sections: a project overview, a discussion of monitoring requirements and performance standards, a data summary, appropriate maps of mitigation sites, and a conclusions section. The Corps would review the reports annually to assess the status of the compensatory mitigation and to evaluate the likelihood of the mitigation to meet the performance standards. Monitoring would continue until all performance standards were met. The Corps would complete a site visit to verify that conditions of the mitigation sites were consistent with the monitoring reports before considering mitigation successful.

C.5 Wildlife

C.5.1 Objective

The objective of the wildlife monitoring would be to evaluate the effects of the mine and the effectiveness of mitigation measures during all mine phases. In addition, as described below, MMC would contribute to efforts to monitor grizzly bear movements between the Cabinet-Yaak Ecosystem and Northern Continental Divide Ecosystem. If appropriate, mitigation measures may be modified based on results of monitoring.

C.5.2 Locations, Parameters, and Frequency

C.5.2.1 General Wildlife

During construction and the first 3 years of mill operations, MMC would monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. The numbers of animals killed by vehicle collisions would be reviewed by the KNF, in cooperation with the FWP, and if necessary, mitigation measures would be developed and implemented to reduce mortality risks. MMC would also monitor and report (within 24 hours) all grizzly bear, lynx, wolf, and black bear mortalities within the permit area and along the access roads. If a T&E species mortality occurred, and the grizzly bear specialists or law enforcement officer felt it were necessary to avoid grizzly bear or other T&E species mortality, MMC would be required to haul the road-killed animals to a disposal location approved by FWP.

C.5.2.2 Grizzly Bear

Under the direction of the KNF, MMC would implement or fund access changes on numerous roads prior to either the Evaluation Phase or the Construction Phase. MMC would monitor the effectiveness of closure device at least twice annually, and complete any necessary repairs immediately.

Prior to the start of the Construction Phase, MMC would provide funding for bear monitoring in the area along U.S. 2 between the Cabinets and the Yaak River and/or the area between the Cabinet-Yaak Ecosystem and Northern Continental Divide Ecosystem as identified by FWP. The linkage identification work along U.S. 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 one seasonal worker for 6 months per year for 3 years, salary for one GIS technician for 6 months per year for 3 years, and 10 GPS collars and collar rebuilds each year for 3 years. Other monitoring methods may be considered if approved by the Oversight Committee. Should a permitted project be implemented or a future project be proposed that have adverse effects on the grizzly bear in the Cabinet-Yaak Ecosystem, funding for this monitoring could be required of those projects, potentially changing the funding required by MMC.

MMC would contribute funding to support monitoring of bear movements and population status in the Cabinet Mountains to confirm the effectiveness of mitigation measures implemented to provide a secure north to south movement corridor. The Forest Service would ensure that adequate funding, provided by MMC, is 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. If not, the information would help in developing new management strategies that would be incorporated in the Biological Opinion through appropriate amendments. Funding would supplement ongoing research and monitoring activities in the Cabinet-Yaak Ecosystem, 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. Funding would include money for the following (but not limited to): trapping, hair sampling and analysis, radio collars, flight time, monitoring native and augmented grizzly bears, and data analysis, including all equipment and support materials needed for such monitoring. The Forest Service would ensure that funding, provided by MMC, is available on an annual basis, 2 months in advance of the fiscal year (October) of the year it is to be used for the life of the mine. Details of the monitoring activities and budget would be outlined in the Management Plan. Funding would be provided prior to starting the Construction Phase and would continue throughout the life of the mine through the Closure Phase.

C.5.2.3 Lynx

The KNF would monitor new snow compaction activities (such as snowmobiling) in the project area and take appropriate action if compaction monitoring identifies increased predator access to new areas.

C.5.2.4 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 drainage. Surveys would be conducted for 2 consecutive years prior to 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 was significantly impacting goat populations, mitigation measures would be developed and implemented 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.

C.5.2.5 Migratory Birds

MMC would either fund or conduct monitoring of landbird populations annually on two, standard Region One monitoring transects within the Crazy and Silverfish PSUs. The Poorman Transect (480-811-533) is located in the Poorman Creek drainage southwest of the Poorman Tailings Impoundment Site, and the Miller Creek Transect (480-411-527) is located slightly southeast of transmission line Alternative D. Currently, the KNF conducts monitoring every other year on these two transects as part of the Region One Landbird Monitoring Program. Monitoring has been conducted since 1994, and would be continued using the standard Region One Landbird Monitoring Protocol (USDA Forest Service 1998). This effort could be integrated into the current Region One monitoring program, or could be contracted by MMC. This monitoring effort would continue to provide data on bird species composition along with population trend data in the two PSUs where project activities are proposed.

C.5.3 Reporting

Reporting requirements would be described in a Comprehensive Grizzly Bear Management Plan. This plan is discussed in greater detail in the agencies' wildlife mitigation plans for Alternatives 3 and 4 in Chapter 2.

C.6 Geotechnical

C.6.1 Objective

A geotechnical monitoring program would be implemented as part of MMC's approved operating permit. The principal emphasis of the program would be directed at the tailings impoundment, but other facilities would be included as warranted. Specific monitoring requirements such as information needs, monitoring location, instrument type, monitoring frequency, reporting requirements, and threshold values for remedial action would be finalized in a stand-alone geotechnical monitoring plan developed during the final design process for the tailings impoundment (See section 2.5.3.5.2, Final Design Process in Chapter 2). The plan would identify monitoring requirements for pre-construction, construction, operations, and closure.

The objectives of the geotechnical monitoring program as it pertains to the tailings impoundment, and appurtenances, and other facilities as appropriate, would be to:

- Collect additional analytical data for use in ongoing impoundment design and operations
- Identify previous unknown site conditions
- Confirm critical design assumptions
- Monitor site conditions during construction and operations
- Assist in assessing material used in dam construction
- Estimate tailings quantities and physical characteristics of impounded tailings

In all alternatives, MMC would develop a geotechnical monitoring plan as a condition of permit approval. The details of the monitoring plan would be subject to agency approval prior to implementation, and the plan would incorporate monitoring techniques and protocols which meet the above-stated objectives.

C.6.2 Locations, Parameters, and Frequency

The monitoring program would emphasize the following tailings impoundment related components: foundation conditions, dam construction, operational stability, material balance, impoundment capacity, and water balance. Because the coarse (sand) fraction of the tailings would be used in the construction of the tailings embankment, a material mass balance would be carried out on an annual basis to assess embankment material needs and whether sufficient building materials would be available to meet the construction requirements. Quantities of tailings from the mill, waste rock from mine development, and borrow materials form on-site sources would be recorded to document material type and quantities used in embankment construction as well as the fine grained tailings material sent directly to the impoundment.

A geotechnical monitoring plan adopted for all action alternatives would incorporate many if not all of the monitoring elements listed in Table C-2. The exact type of monitoring technique used for data collection, location of monitoring devises and frequency of data collection would be finalized during the final tailings impoundment design process and incorporated into a monitoring plan presented to the agencies prior to project initiation.

Table C-2. Geotechnical Monitoring.

Monitoring Location	Item	Monitoring Parameters	Frequency	Comments
Embankment Foundation	Piezometers	Pore pressures	Monthly	Simple standpipe, and electronic pressure transducers; monitoring during construction and operations; visual inspections by mine personnel
Impoundment Embankment	Piezometers - Main dam - Saddle dam - Beach area	Pore pressures	Monthly	Simple standpipe, and electronic pressure transducers; monitoring during construction and operations . Monitoring of potential pore pressures and phreatic surface in the embankment and tailings; visual inspections by Professional Engineer
	Inclinometers - Main dam	Deformation (inches)	Monthly	
Impoundment Embankment	Material quantities: Cycloned sand, borrow, and mine waste rock	Tons, and cubic yards per year	Annually	Annual reconciliation of fill materials; visual inspections by Professional Engineer
Impoundment Embankment	Material properties	Density and gradation	Weekly	A QA/QC program would be implemented to measure and monitor density and gradation; visual inspections by Professional Engineer
Impoundment Area	Pressure transducer Pond elevation	Tailings density Tailings water volume	Annually	Estimate of in-situ tailings density; remaining impoundment capacity Tailings water volume

The use of piezometers to monitor interstitial pore pressures is an industry accepted practice, and the array of available instrumentation for this purpose is extensive. Devices have been adapted for continuous recording and for monitoring from off-site locations. At Montanore, piezometers would be installed in the dam foundation to measure pore pressures during construction, with particular attention given to areas where the glaciolacustrine clay may be present in the foundation. Appropriate pore pressure "trigger" levels would be established based on stability analyses, to provide a management tool to respond to higher than predicted pore pressures if encountered. Piezometers would be installed in the cycloned sand dam as it is constructed in order to monitor the pore pressure build-up and to assess “drawdown” of cyclone water within the dam fill. The piezometers cables would be buried and lead to a common readout station at the toe of each dam where continuous data reading equipment would be installed out of the way of the embankment construction operation.

Inclinometers would be used to monitor potential deformation of the tailings embankment which could be an indication of foundation failure. The inclinometers would be extended up through the dam fill as the embankment is constructed. It is highly likely some inclinometers would be damaged during the embankment raising process and would be have to be abandoned. They would be replaced as needed over the course of the impoundment life.

Visual observation would be a critical component of the monitoring program. Mine personnel would be assigned inspection responsibilities to be conducted as part of their assigned duties. A quarterly inspection report would be submitted to the agencies as part of the monitoring requirements. Items such as embankment seepage, freeboard adequacy, beach width, cracks in the embankment, evidence of slope failure, erosion features along the dam and abutments, and changing trends in seepage quantities, piping, and wet spots, are representative of the kinds of observational features which could be indicative of potential problems with the tailings impoundment and the kinds of features which would be noted and documented during a visual inspection.

During the construction phase of the impoundment, QA/QC of dam construction activities would be carried out by a qualified third party engineering consultant. Prior to the commencement of construction responsibilities of the site engineer(s) would be detailed in an agency-approved field manual and would include standard field and laboratory quality control tests.

During the operation phase of the mine and tailings impoundment, geotechnical monitoring would continue at the locations and frequency established in the monitoring plan. Of particular interest for monitoring during operations would be pore pressures in the impoundment embankment and foundation as the embankment is raised. In situ tailings consolidation within the impoundment would also be monitored to assist with closure planning The monitoring program would continue into the closure stage, although the frequency of monitoring would likely be reduced as steady state conditions within the impoundment and embankment were approached . The following type of monitoring could be incorporated into a closure monitoring program:

- Installation of piezometers within the tailings impoundment pond area to monitor the progressive “drawdown” of the phreatic surface
- Installation of settlement plates and in situ pressure transducers within the tailings to monitor the consolidation and settlement of the tailings to help confirm the predicted consolidation behavior of the tailings at closure.

C.7 Subsidence

A subsidence monitoring plan would be implemented as part of all action alternatives. An initial plan would be developed before the Evaluation Phase and would be approved by the agencies before any underground development could commence. The geotechnical monitoring would be an update to geotechnical monitoring procedures and methods specified in DEQ Operating Permit

#00150 and the 1993 ROD. MMC would submit a final mine plan, including final plans for geotechnical monitoring, following completion of the Libby Adit evaluation program to the agencies for approval. During final design, MMC would back-analyze the pillar design at the Troy Mine that led to the pillar failure and compare the Troy Mine design in effect at the time of the failure with the Montanore design. As pillar designs were refined, numerical modeling would be undertaken to further evaluate expected design performance, including the potential for shear failure at the pillar/roof or pillar/floor interface. Improving the understanding of the structural setting, including faulting, jointing, bedding, and the horizontal stress regime would improve the geotechnical design. The description of the Troy Mine pillar design (Davidson 1987) indicates that adverse pillar orientation with regard to bedding dip may have played a role in the pillar collapse, 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, mapping and statistical analysis of joint frequency and attitude, strain-relief overcoring, and further exploratory drilling.

MMC has completed some initial numerical modeling to examine the issue of pillar columnization and sill stability between the two ore zones. The modeling would be expanded during final design, as interaction of workings may be crucial to overall pillar/sill stability. MMC would complete roof support analyses would be completed during final design to finalize the support plan and mining span.

The monitoring during the phases after the Evaluation Phase 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 in a continual process of modification throughout the course of mining as new data was collected and analyzed. Due to the variability in geologic conditions and the physical response of the underground environment to mine development, modifications to the mine plan may need to be incorporated to safeguard against adverse environmental conditions. The specific details of an initial subsidence monitoring plan would be developed during the final mine design phase, and would be subject to approval by the agencies. Should mining be approved, monitoring information would be evaluated in conjunction with data collected from an extensive rock mechanics testing program and from underground mapping of geologic structures and discontinuities (e.g., faults, joint sets). Collectively, over time the data from these various sources would help develop a model of rock behavior in response to underground mining which could be used to guide ongoing mine development in an environmentally safe manner.

C.8 Reclamation

C.8.1 Objective

The objectives of reclamation monitoring would be to assess the reestablishment of a viable vegetation community following reclamation, to determine the appropriate fertilizer mix required for successful reclamation, and to assess the effectiveness of weed control measures. The monitoring also would be used to determine if the criteria for revegetation success and bond release were met.

C.8.2 Locations, Parameters, and Frequency

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 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. At the end of mine operations, MMC would conduct similar vegetation monitoring every year at sites representative of various types of disturbance until bond release. The number and location of representative sites would be approved by the agencies. The following characteristics would be evaluated:

- Plant species responses (germination, growth, competition)
- Total and vegetative 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 bare-root versus containerized stock

Vegetative 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.

C.8.3 Reporting

A report summarizing survey data would be submitted annually to the agencies. MMC would develop reclamation bond release criteria as part of the overall reclamation plan reviewed and approved by the agencies. Part of the release criteria would involve specific, qualitative measurement of revegetation success.

C.8.4 Bond Release

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 was 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 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 – ills and gullies were not disrupting the post-mining land use or re-establishment of the vegetative cover; or contributing to a violation of water quality standards for a receiving stream

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 was stable but still did not meet reclamation success criteria, MMC may modify the plan and reseed again, and would request bond release by the agencies.

MMC would regrade and revegetate areas where rills and gullies inhibit reclamation. If rills and gullies persisted, MMC would review run-on conditions and regrade or install sediment control features as appropriate. If site stability was 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 could request bond release by the agencies. If after 3 years, the percent of weeds at the reclaimed site were 50 percent or less of the control site's weed population, MMC could request bond release.

C.9 Geochemistry

C.9.1 Introduction

Although the risk of acid generation and trace metal release from the project is generally low, some rock to be mined has the potential to affect surface and groundwater resources. For this reason, the agencies' alternatives (3 and 4) would require additional geochemical characterization and monitoring of water flow and quality in the Libby Adit, to address uncertainty and validate predictions of future water quality provided in the Draft EIS. Until such data became available, the agencies' alternatives require that rock be placed on a liner and managed to control potential impacts to water quality. This mitigation strategy recognizes that additional material needed for testing would be accessible during the Evaluation Phase. It also recognizes the value of historical Libby Adit and active Troy Mine workings as full-scale, real-time geochemical analogs for the proposed Montanore facilities. Waste rock management would be adapted as additional monitoring data become available to inform the mitigation strategy for various facilities under changing water balance conditions throughout mine life.

MMC prepared a Waste Rock Characterization Plan (Geomatrix 2007) that reviews the available geochemistry data (see Table 2 in MMC's plan). It also provided a general plan for additional geochemical characterization work including:

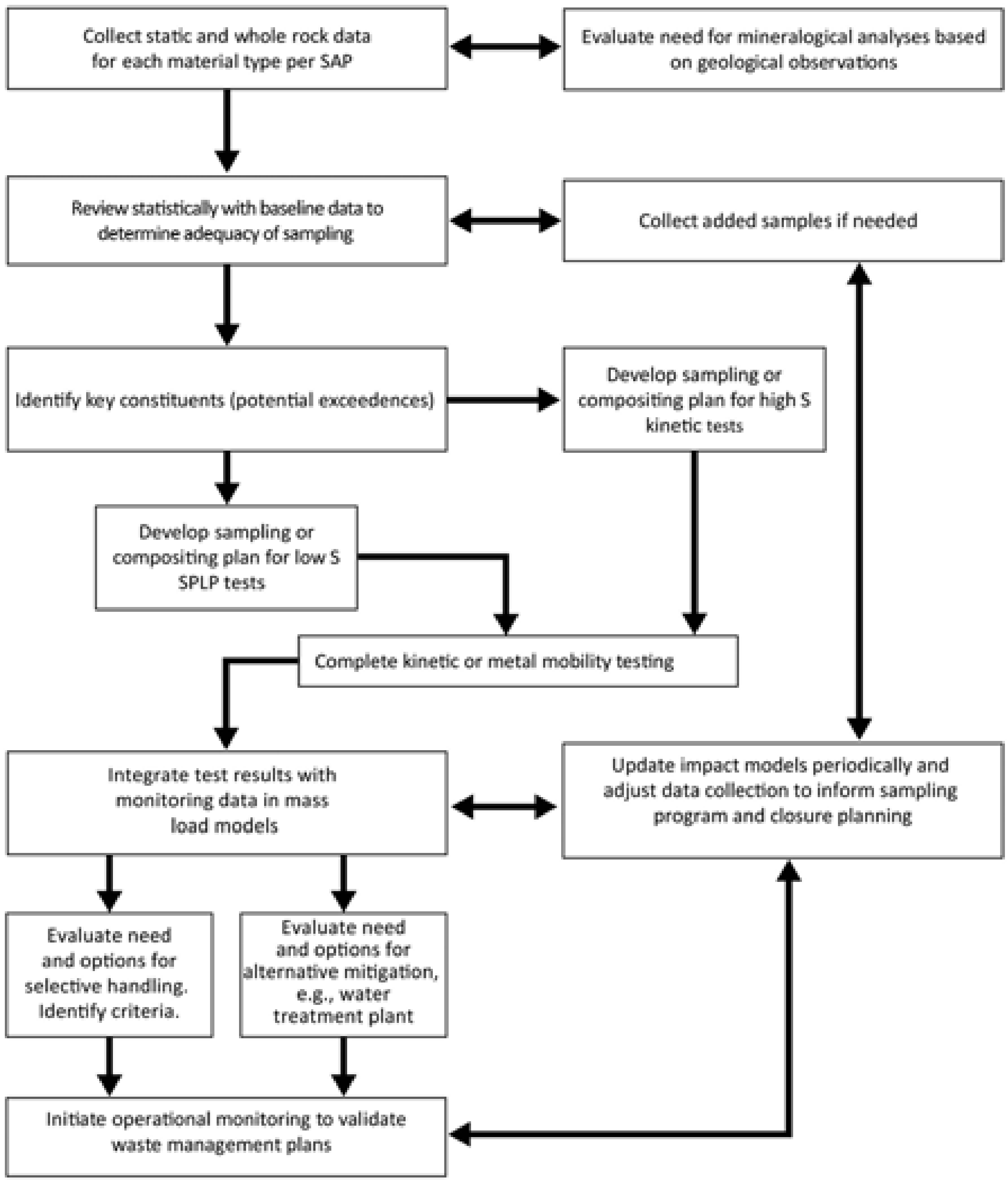
- Collection of representative waste rock samples from the adits, ore zones, barren zones, and above and below ore zones, at least every 500 feet in adits and for every 100,000 tons of waste rock produced in mine workings.
- Analysis of samples using static test methods (acid base accounting, total sulfur, and pH measurements).
- Kinetic or metal mobility testing of select samples, based on static test results.
- Characterization of residual water-soluble nitrate on waste rock mined during the evaluation adit program, for use in predicting nitrate concentrations in meteoric water from waste rock placed outside the mine.
- Designation of fixed sampling points for in situ characterization of pH changes over mine life, based on rock sampling.
- Correlation of sample and analytical geochemistry data with water quality data.
- Re-evaluation of sampling and waste rock management plans based on cumulative data.
- Annual reporting of sampling, analysis, and results.

Review of the Draft EIS raised concern about perceived uncertainty in the data, and requested additional detail about the specific timing, intensity, and methods of proposed sampling and analysis. In particular, concern was raised about the coordinating the collection and interpretation of Evaluation Phase data with management of mined rock during operations, and a plan for integrating new information with baseline data was requested.

In response to these concerns, a hydrogeochemistry working group comprising agency and interdisciplinary team members reviewed all available hydrogeochemical data, discussed apparent uncertainties, and reconsidered sampling and analysis needs. A portion of that committee focused specifically on geochemistry issues. This Sampling and Analysis Plan (SAP) presents the recommendations of the geochemistry working sub-group and expands upon the approach described by Geomatrix (2007), with a goal of informing the development of risk-based mitigation strategy. As with all plans, MMC would develop a final SAP for the agencies' approval before the Evaluation Phase for the selected alternative in the KNF's ROD.

The goal of the SAP is to ensure adequate characterization of acid generation and metal release potential for each of the proposed mine facilities throughout the mine life cycle. The general approach to the sampling and analysis program is summarized in Figure C-1. Two distinct phases of data collection, during the Evaluation/Construction and Operations phases of mine life, are identified in this SAP. Data from both phases would be evaluated statistically to determine overall sampling adequacy and to update impact models periodically, thus ensuring appropriate mitigation and closure planning.

Figure C-1. Decision Matrix for Geochemical Sampling and Analysis.



Data addressing perceived gaps that may influence water quality predictions and waste management practices would be collected during the Evaluation Phase, prior to initiation of construction and operations. During the Evaluation Phase, additional rock would be exposed for sampling and analysis of its potential to release metals, allowing the mine plan to be revised for any needed mitigation. This SAP also provides guidance for integration of Evaluation Phase with EIS analysis and waste rock management plans, prior to initiation of construction, as well as establishment of selective handling criteria as appropriate. This would ensure proper management of mined materials in protecting water resources. As the agencies' mitigation would require that all mined material be managed as though there is potential impact to water quality, until additional testing or monitoring data demonstrate otherwise, there is little risk to the environment using this approach.

An ore production-based strategy for operational verification of the EIS assessment is also provided, which mirrors the approach suggested by Geomatrix (2007) and described in the Draft EIS. Data collected during mine construction and operations would be used to update water quality predictions for comparison with water flow and quality monitoring data and reported for agency review, as suggested by Geomatrix (2007).

Data produced under the Operations Phase SAP would be integrated with the EIS and Evaluation Phase data going forward, to evaluate rock management effectiveness and provide data for facility closure.

C.9.2 Mine Plan and Material Balance

Waste rock would be produced from the Prichard and Burke Formations during development of access, ventilation, and conveyor adits. Waste rock would also be produced from a barren, lead-enriched halo zone that separates two copper-silver ore zones within the upper portion of the lower member of the Revett Formation, and from mineralized (non-ore) halo zones that lie between the ore zone and the underlying Prichard and Burke Formations. MMC's estimate of tonnage for waste rock, ore, and tailings production during each phase of mine life is summarized in Table C-3.

During the Evaluation Phase, MMC would sample the ore zone to revise resource models and facilitate metallurgical testing as needed. Rock would be exposed in all waste zones during the Evaluation Phase and can be sampled for characterization as appropriate. Metallurgical testing of bulk samples obtained during the Evaluation Phase could provide samples of tailings for additional environmental characterization.

Upon completion of the Evaluation Phase and the agencies' approval of operating plans, MMC would proceed with construction of additional adits that would expose (similar to the Libby Adit) more of the Prichard and Burke Formations. Development would also begin in the lower Revett Formation during construction, which would continue and expand during mining operations. The volume of rock produced from each formation would vary over mine life (Table C-3).

Table C-3. Montanore Material Balance, by Phase of Mine Life.

Rock Type	Current	Evaluation	Construction	Operations Year 1-5	Operations Year 6+	Closure and Post-closure	Total	Proposed Placement Pending Analysis
Prichard waste rock	377,700	0	1,181,160	0	0	0	1,558,860	Tailings impoundment/ construction
Burke waste rock	42,470	0	153,480	0	0	0	195,950	Tailings impoundment/ construction
Revett halo (non-lead) waste rock	4,160	0	812,980	78,050	115,470	0	1,010,660	Tailings impoundment/ construction
Revett barren lead waste rock		0	136,880	248,680	234,770	0	620,330	Underground
Revett combined waste rock		553,500	0	0	0	0	553,500	Lined Libby Adit pad
Total Waste Rock	424,330	553,500	2,284,500	326,730	350,240	0	3,385,800	
Revett ore			500,000	19,500,000	100,000,000	0	120,000,000	Mill
Tailings			0	23,000,000	75,000,000	0	98,000,000	Tailings impoundment

Notes:
Prichard includes Prichard-Burke transition rock
Revett waste reported as combined when data do not distinguish barren lead from other halo zones
Operational rock type defined by formation and mineral halo

C.9.3 Baseline Geochemistry and Water Quality Data

Geochemical and in situ monitoring data that were available for inclusion in the impact analysis are summarized in Table C-4. Together with geochemical data from other Revett-type copper-silver deposits at Troy and Rock Creek, and monitoring data from the Libby Adit and Troy Mine, these data indicate low overall potential for acid generation, with low to moderate associated potential for metal release. Use of differing approaches to sampling and analysis over time has produced a data set that is inconsistent in terms of detection limits, suites of analytes, and frequency of sampling. Uncertainty that arises from these issues can be resolved through sampling of rock as it becomes available during the Evaluation Phase of development.

The specific type, quality, and adequacy of data available for incorporation into the EIS is discussed in detail in reports by Geomatrix (2007), Enviromin (2007), ERO Resources Corp. (2011), and discussions of the Montanore hydrogeochemistry workgroup (see minutes of meetings from 2009 and 2010 on file with the agencies). In-depth review of these data is not repeated in this plan.

In situ monitoring data collected within and adjacent to the Libby Adit, and water quality data from the Troy Mine, provide further information that can also be used to inform decisions about relative need for additional geochemical characterization and rock management. The Libby Adit provides a real-time, full-scale geochemical analog for Prichard and Burke Formation waste that is currently exposed in underground workings, and the Troy mine data describe a comparable analog for the Revett Formation where it is exposed underground. Available water quality data collected in and around the Libby and Troy adits were discussed in the Draft EIS, as well as in Geomatrix 2007. More recent data were integrated with pre-2007 data in a comprehensive water quality report (ERO Resources Corp. 2011). A statistical summary of these data, together the number of detected values and data reduction methods necessary to analyze the baseline conditions, are provided in the report.

Table C-4. Summary of Geochemical Analyses and In Situ Water Quality Data.

<table>
<tr><th>Test</th><th>Prichard</th><th>Burke</th><th>Revett Halo (non-lead)</th><th>Revett Barren Lead</th><th>Revett Combined</th><th>Revett Ore</th><th>Tailings</th></tr>
<tr><td>Static</td><td>70</td><td>19</td><td>41</td><td>25</td><td></td><td>35</td><td>1</td></tr>
<tr><td>Kinetic</td><td>2</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>ND</td></tr>
<tr><td>Metals</td><td>2</td><td>0</td><td>0</td><td>13</td><td>14</td><td>12</td><td>ND</td></tr>
<tr><td>Mineralogy</td><td>ND</td><td>ND</td><td></td><td></td><td>10</td><td>17</td><td>13</td></tr>
<tr><td>Source of in situ Monitoring</td><td colspan="2">Libby Adit</td><td colspan="2"></td><td colspan="2">Troy Mine</td><td></td></tr>
<tr><td>In situ Parameters</td><td colspan="2">pH, metals, nutrients</td><td colspan="2"></td><td colspan="3">pH, metals, nutrients</td></tr>
<tr><td>Intended location of rock</td><td colspan="2">Adit, construction, tailings</td><td colspan="4">Underground workings</td><td>Tailings</td></tr>
</table>

ND = No data

C.9.4 Evaluation Phase Sampling and Analysis

This section describes sampling and analyses needed to address uncertainties in existing geochemical data and to delineate a plan for applying those data, together with water quality data, to rock management in a timely manner. Following review of available data by lithology and waste type throughout the mine life cycle, and review of chemistry data for geochemical analogs at Rock Creek, the Libby Adit and the Troy Mine, the geochemistry workgroup agreed that available in situ data reduce the need for further pre-construction characterization of the Revett ore, Prichard waste rock, and Burke waste rock zones that are already exposed. Confirmation sampling in zones that have not yet been mined is needed for these lithologies. The lower Revett waste halo and barren lead zones are also not addressed by these analogs and require further evaluation. The fundamental approach relies on a combination of available in situ water quality and geochemical data from all Revett copper-silver deposits, together with Evaluation Phase data, to reduce risk through adaptive waste rock management. The SAP thus seeks to prioritize sampling and testing to ensure that data needed to modify waste management plans are available at the start of construction. A decision matrix to be used in refining the SAP, based on data as they become available, is provided as Figure C-1. The following explanations are provided to guide sampling and analysis efforts.

Sample Type: The purpose of geochemical characterization is to describe the acid generation potential (using static and kinetic methods), metal/metalloid release potential, and nitrate release potential for mined ore, waste rock, and impounded tailings. Waste rock would be exposed in underground workings or used in surface construction at the proposed mine. There are multiple waste lithologies, which include the Prichard, Burke, and several mineral-halo zones within the Revett Formation. These materials would be exposed to changing weathering conditions throughout mine life; during active mining, or where placed above ground, rock would be exposed to oxygen; following closure, when underground workings would be flooded, oxygen exposure and related oxidation would be greatly reduced. Materials requiring geochemical characterization are summarized based on lithology, grade, geochemical conditions, and placement in Table C-5.

Number: Number of samples to be collected is based on minimum requirements for a simple, normally-distributed data set, and would be modified in the context of observed lithological and mineralogical variability. Sampling density would also consider results of preliminary geochemistry analyses and in situ monitoring data. During baseline characterization, sampling would focus on covering the range of variability in mineralization, rather than on spatial or volumetric coverage which would be the focus during operational validation. Tonnage-based guidelines, such as those provided by the Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (Price 2009), are more appropriate for operational monitoring programs. Determination of adequate sampling would be an iterative process, involving review of known information with new data to determine whether the number of samples is sufficient to describe the observed variability, such as suggested in the Global Acid Rock Drainage Guide (International Network for Acid Prevention 2008).

Table C-5. Summary of Material Types Based on Location, Weathering Condition, Grade, and Lithology.

Location	Weathering Condition	Material Type	Lithology
Underground Rock left in back and rib, or backfilled within mined out workings. Rock exposed in adits	Partially saturated, aerobic, during dewatering and active mining	Ore	Revett – ore
		Waste	Revett – barren Pb
			Revett – chalcopyrite
			Revett – pyrite
			Revett – sphalerite
			Burke
			Prichard
	Saturated, anaerobic, post-dewatering and following groundwater rebound	Ore	Revett – ore
		Waste	Revett – barren Pb
			Revett – chalcopyrite
			Revett – pyrite
			Revett – sphalerite
			Burke
			Prichard
Surface Rock stockpiled at adit on liner Rock stockpiled within tailings impoundment footprint on liner Rock used in construction of tailings dam, roads, etc.	Variably saturated, aerobic	Waste	Burke
			Prichard
Tailings impoundment	Saturated, anaerobic under active placement conditions Unsaturated tailings post-dewatering	Tailings	Processed Revett ore

The sufficiency of characterization would also be considered in context of the capacity of the mitigation strategy to address uncertainty as well as the potential cost of failed mitigation. For example, collection of more samples of a single rock type to identify variations in metal concentration that lie within the capacity of a planned water treatment plant may be less important than collecting samples from distinct rock types which may identify different metals that would need to be incorporated into the design of that treatment plant. Likewise, extensive characterization of a rock type that represents a small percentage of total mined material (like the lower Revett halo zones) is less likely to reduce future costs of water treatment than thorough characterization of rock (like the Prichard) that represents a large portion of the waste.

The number and type of geochemical tests are shown in Table C-6. The specific available geochemical and monitoring data, identified risk, uncertainty about existing information, conclusions of the geochemistry sub-group, requirements for additional geochemical sampling and analysis, and requirements for water quality monitoring for geochemistry during the Evaluation Phase are described below for each rock type.

The sampling and analysis plans would be reviewed, and if appropriate, modified by the geochemist charged with implementing this program, in consultation with the agencies. The intensity of future sampling and method of analyses would be determined by geological observation and review of available data.

Table C-6. Evaluation Phase Geochemical Testing.

Test	Prichard	Burke	Revett Halo (non-lead)	Revett Barren Lead	Revett Ore	Tailings	Total Samples
ABA	8[1]	8[1]	24[1]	8	8	5	61
Whole Rock	8[1]	8[1]	24[1]	8	8	5	61
Kinetic (acid)	1[2]		3[1,2,3]	2[2,3,4]			6
Particle size	1[2]		3[1,2,3]	2[2,3,4]			6
SPLP (non-acid)	8[1]	1[1]			2	5	16
Mineralogy	4[5]	1[5]	3[5]	2[5]	2	5	17
In situ Monitoring	Libby Adit inflow quality; waste rock stockpile				Review of Troy Mine data		
In situ Parameters	pH, metals, nutrients						
Use of rock	Adit, construction, tailings		Underground workings			Tailings	

[1]Or more as appropriate, per geological description/halo
[2]Composite
[3]Unsaturated kinetic columns
[4]Saturated kinetic columns
[5]As appropriate

C.9.4.1 Prichard Formation

C.9.4.1.1 Available Geochemical and Monitoring Data

Adequate static testing has been completed (n=70). Limited laboratory kinetic tests were completed, which included analysis of arsenic, cadmium, copper, iron, lead, manganese, silver and zinc (Geomatrix, 2007, Appendix B-2). Metal mobility tests and mineralogical analyses have not been completed. A better geological delineation of operational distinction between Burke and Prichard Formations, along with revised tonnage estimates, is needed. There is also a need to clarify factors influencing nitrate release from Prichard waste after blasting. Long-term in situ monitoring of pH, nutrients, and metal release from the Prichard has been conducted at the Libby Adit (sample ID: RAW-1), and more recently for the waste rock stockpile on the pad outside of the Libby Adit (sample ID: WRS-1). Monitoring has been conducted upgradient of the Libby Adit at LB-200 and downgradient, in monitoring wells MW-07-01 and MW-07-02 and at surface water station LB-300. These data are summarized statistically in the Surface Water Quality Technical Report (ERO Resources Corp. 2011).

C.9.4.1.2 Risk

The risk of acid generation by the Prichard Formation is low. The more important risk associated with waste mined from the Prichard is metal and nitrate release via adit water or seepage from surface facilities constructed with Prichard waste rock. Of particular concern is the tailings impoundment, which is planned to be constructed partly with Burke and Prichard waste rock. A secondary risk of metal and nitrate release from Prichard exposed within the adits also exists.

C.9.4.1.3 Uncertainty

Key issues include:

- Range of ABA values in Prichard Formation yielding NP/AP ratios that suggest a potential for acid generation that is inconsistent with results of in situ monitoring data, which show consistently neutral pH. This suggests mineralogical encapsulation of reactive minerals in non-reactive silica, similar to that observed in the Revett Formation, which has not been verified through mineralogical testing of the Prichard Formation.
- Limited humidity cell testing confirms the overall non-acid generating results of the more comprehensive in situ monitoring record.
- An incomplete list of metal analytes, which were measured in prior kinetic tests at relatively high detection limits (above concentrations currently needed to evaluate compliance), does not fully address metal release questions.
- Possible differences in metal release potential between expansion areas within the Prichard (*e.g.*, areas that have not yet been exposed) and areas that have already been characterized. This would be addressed using SPLP tests with analysis of a complete list of metals at appropriate detection limits. These data would support development of a composite for a humidity cell test to confirm previous findings and collect a complete metal analysis.
- The relatively massive and consistent character of the Prichard waste rock suggests that sub-handling of portions of this unit (based on selective handling criteria) may be problematic if future tests indicate that mitigation to meet water quality standards would be needed. This would be considered in light of any potential for long-term metal release.

C.9.4.1.4 Conclusions

- The current results of metal and nutrient release testing on the Prichard Formation as waste rock, particularly for arsenic, copper, lead, antimony and nitrate, confirm the fact that additional monitoring is required.
- Historical, ongoing, and continued monitoring of water quality within and downgradient of the Libby Adit is more valuable in predictions of water quality than additional kinetic testing.
- As the mine expanded into undisturbed portions of the Prichard Formation, limited geological, mineralogical, and geochemical analyses would be conducted to test for geochemical variability within the formation and validate baseline models as mining proceeds.

C.9.4.1.5 Future Geochemical Analyses

- Additional characterization of metal release potential, either through SPLP, kinetic testing or monitoring work, is needed to validate the conclusions of existing mass load models of potential impacts associated with water quality in adits and downgradient of facilities constructed with Prichard waste rock (such as the tailings impoundment).
- Geological description and hand specimen mineralogy would be used to describe new exposures of Prichard and link those exposures to historically monitored Prichard exposed in the Libby Adit and on the waste rock pad outside the adit.
- QEMSCAN (quantitative evaluation of minerals by scanning electron microscopy) or petrography (XRD/SEM-EDS) of a small number of representative samples (here estimated as 4, which would be adjusted to fit geological observations) would be used to compare new and historically mined Prichard, and to explain observed differences between static and kinetic tests of ARD potential.
- Acid base account (Modified Sobek), whole rock (e.g. 55 element ICP using Chemex method MEMS41, aqua regia digestion) and SPLP (EPA Method 1312 as modified) testing of 8 to 10 representative samples collected from any portions of Prichard not currently exposed or previously sampled. One kinetic test of composited Prichard, with compositing based on ABA, whole rock, and SPLP results, to confirm non-acid characteristics and measure metal release potential.
- Nitrate and trace metal release would be monitored using data from mine and adit water before treatment (e.g., RAW-1) and from waste rock stockpiles (e.g., WRS-1)
- Particle size analysis of run-of-mine Prichard rock using standard ASTM methods would be needed to scale laboratory results to prediction of field scale processes.
- Compare laboratory test results with water quality sample results.

C.9.4.2 Burke Formation

C.9.4.2.1 Available Geochemical and Monitoring Data

There have been enough static tests completed (n=19) to describe the underlying range of acid generation characteristics, but no kinetic, metal release potential, or analytical mineralogy tests of the Burke Formation have been completed. Better geological delineation of operational distinction between Burke and Prichard Formations, with revised tonnage estimates is needed, along with clarification of potential for nitrate release. Burke rock mined from the Libby Adit is monitored in situ, as discussed above for the Prichard Formation.

C.9.4.2.2 Risk

The risks associated with the Burke Formation are negligible.

C.9.4.2.3 Uncertainty

A small quantity of Burke rock would be disturbed during adit development. Acid risk is low, and potential for nutrient and metal release is as described above for the Prichard Formation. Specific issues include:

- Range of ABA values in Burke Formation yield NP/AP ratios that suggest little potential for acid generation, consistent with results of in situ monitoring which show neutral pH.

- Potential metal release by Burke Formation rock where exposed underground or in constructed surface facilities requires evaluation. These data need to be sufficient to support mass load modeling of adit water quality and predictions of water quality downgradient of facilities constructed with Burke Formation rock.

C.9.4.2.4 Conclusions

- No humidity cell testing is warranted for Burke rock due to consistently high ABA values. Historical, ongoing, and continued monitoring of water quality within and downgradient of the Libby Adit is more important to predictions of water quality than kinetic testing of the Burke Formation.
- Metal and nutrient issues, and sampling and analysis, are the same as those described for the Prichard Formation.
- As the mine expands into undisturbed portions of the Burke Formation, limited geological, mineralogical, and geochemical data would be collected to verify consistency within the formation as mining proceeds.

C.9.4.2.5 Future Geochemical Analyses

- Geological description and hand specimen mineralogy.
- Acid base and whole rock “fingerprint” analysis of 8 to 10 samples
- SPLP testing of at least one composited sample that represent the range of mineralogy and chemistry observed in the Burke formation, based on geological mapping and the range of metal content observed in the whole rock analyses.
- More detailed mineralogy, and additional SPLP tests, if elevated metal levels were to be noted in these tests, to understand metal mineral residence and mobility.
- Nitrate release would be predicted using in situ monitoring data from RAW-1, WRS-1, and runoff from any future waste rock stockpiles.
- Particle size analysis of run-of-mine Burke rock using standards ASTM methods would be conducted following kinetic tests to scale laboratory results to prediction of field scale processes.
- Water quality monitoring as described for the Prichard Formation.

C.9.4.3 Revett Formation – Waste Rock

Mineral zonation within the lower Revett was mapped in detail at Troy by Hayes (1983) and Hayes and Einaudi (1986), who identified multiple sulfide-carbonate facies surrounding the copper-sulfide mineralization of the ore body. These pyrite-calcite, chalcopyrite-calcite, and sphalerite-calcite sulfide haloes, are likely to be intercepted by the Montanore adits below the ore zone. Zones of galena-calcite are also recognized, which occur as interbeds in immediate proximity to the ore zone, and are referred to as the “barren lead zone.” During exploration, the barren lead zone was sampled and characterized as potentially acid generating based on humidity cell tests. The other halos that are likely to exist below the ore zone have not yet been drill tested and their extent, character, and probable production volume are not well known, although preliminary data suggest that they are thin at Montanore. For this reason, testing of the “barren lead” zone are distinguished from the “non-barren lead” zones in the following discussion.

C.9.4.3.1 Revett Barren Lead Waste Zone (Galena halo)

Available Geochemical and Monitoring Data

Static (n=25) and kinetic (n=1) tests of acid drainage potential have been completed. Metal concentrations were measured in humidity cell effluent (n=1) for an incomplete list of analytes at relatively high detection limits and there is no analytical mineralogical characterization of this zone at Montanore, making comparison with geological analogs exposed at the Troy Mine less robust. Water quality data collected in the underground workings at Troy represent the cumulative effect of water interacting with all of the Revett waste and ore zones. It is not possible to assign water quality to individual halo zones.

Risk

Kinetic testing in a humidity cell indicates potential for acid generation and associated metal release from the lead zone. MMC has designated this material for special handling and would design underground facilities to minimize its disturbance. Barren zone (non-ore) containing galena that is mined and removed to surface would be placed on a lined pad, until it can be replaced underground. While on the pad and stored underground, this material would be exposed to partially saturated, aerobic conditions until dewatering ends and the backfilled mine void is saturated with groundwater. The extent of groundwater rebound may vary, and groundwater modeling results suggest that the entire void would not fill for 490 years (Geomatrix 2011). For the purposes of this SAP, it is assumed that barren lead waste would be exposed to weathering under both aerobic and anaerobic conditions. The potential for oxidation, with associated acid production and metal release, would change depending upon oxygen availability and encapsulation.

Uncertainty

It is likely that barren zone leachate would be acidic, with elevated metal concentrations. The principle uncertainty is about the magnitude of metal release, and its response to variable oxygen exposure.

Conclusions

- Although this material is designated for selective handling, further characterization under unsaturated, aerobic conditions is needed to understand its metal release potential within the underground workings during mining and the following refilling period.
- Further, as its geochemical behavior is expected to change as a result of saturation when groundwater rebounds at closure, additional characterization of acid generation and trace metal release potential under saturated conditions is also warranted.
- As the mine expands into undisturbed portions of the barren lead zone, limited geological, mineralogical, and conformational geochemical analysis would be conducted to verify mineralogical and geochemical consistency with the tested zones as mining proceeds.

Future Geochemical Analyses

- Geological description and hand specimen mineralogy.
- Acid base account and whole rock testing of 8 to 10 representative samples collected from the barren lead zone during evaluation adit work. Number of samples would be adjusted to represent range of mineralization.

- Two kinetic tests (ASTM humidity cell test method, run until steady state chemistry is observed) of representative rock composited based on static tests to confirm magnitude of potential acid generation and analyze for a complete suite of metals at appropriate detection limits. One test would be run under unsaturated conditions and one would be saturated, to represent variable weathering conditions.
- QEMS or petrography (XRD/SEM-EDS) of two samples, weathered under both aerobic and anaerobic test conditions (or more, based on geologic observations) would be used to establish baseline within barren lead zone for future mineralogical assessment of variability.
- Particle size analysis of run-of-mine Revett barren lead waste rock using standard ASTM methods is needed to scale laboratory results to prediction of field scale processes.

Water Quality Monitoring

- Continued evaluation of available monitoring data from Troy Mine.
- Water quality samples would be collected downgradient of barren lead zone material following underground placement.
- Chemistry of water in saturated zones would be monitored as they are developed to predict long-term chemistry for closure work.
- Changes in nutrient concentrations would be monitored in situ to predict underground nutrient loading from the barren lead waste.

C.9.4.3.2 Revett Formation –Non-Lead Barren Waste Zone

Available Geochemical and Monitoring Data

Limited geological description of volume and mineralogy is available. Static tests have been completed for lower Revett waste (n=41), but the relationship of these samples to the individual halo zones is unclear. Limited (n=1) kinetic tests of acid drainage potential for a composite of lower Revett waste has been completed, with analysis of a limited suite of metals at relatively elevated detection limits. No analytical mineralogy has been completed. Water quality data collected in the underground workings at Troy represent the cumulative effect of water interacting with all of the Revett waste and ore zones. It is therefore not possible to assign water quality to individual halo zones using Troy monitoring data.

Risk

Detailed mapping of the individual halo zones present at Montanore has not been completed and production volumes have not been calculated. It is possible that small (inconsequential) amounts of this rock would be intercepted, yet presence of divalent (iron) sulfide minerals in the halo zones as mapped at Troy suggests risk for sulfide oxidation and acid generation. Results of the available kinetic test data do not support acid risk or release of elevated metal concentrations.

Uncertainty

The risk associated with this material may be minimal due to anticipated small volumes of rock from each halo zone. Uncertainty exists about potential for acid, metal, and nutrient release.

Conclusions

- Characterization of Revett halo zone behavior under unsaturated, aerobic conditions is needed to understand its chemical behavior as a source term in the underground workings, as well as its behavior if used as construction material.
- As the geochemical behavior of this zone would be expected to change as a result of saturation when groundwater rebounds at closure, additional characterization of acid generation and trace metal release potential under saturated conditions could be useful if material is shown to be acid generating.
- The relative volume and extent of halo exposure, as well as static test results, would dictate whether saturated and unsaturated kinetic testing is warranted for the individual halo zones. The need for testing is contingent upon the volume identified during the evaluation adit work.

Future Geochemical Analyses

- Detailed, well-documented geological description and hand specimen mineralogy, to map halo zones.
- Revise calculated production volumes for halo zones
- Acid base account and whole rock "fingerprint" analysis of 8 to 10 samples to characterize geochemical variability of rock for development of a composite for kinetic testing.
- Test a composited sample from each mapped halo zone in a kinetic test (including a complete suite of metals at appropriate detection limits). As this rock is likely to report to surface facilities, use standard unsaturated kinetic test methods.
- If >1% of waste by volume were produced from a halo zone with static test results that suggest strong potential to generate acid, which would then trigger selective handling with subsequent underground placement, conduct additional column test work under saturated conditions to produce data representing underground long-term behavior of this material.
- As the mine expanded into undisturbed portions of the barren lead zone, limited geological, mineralogical, and conformational geochemical analysis would be conducted to verify consistency within the formation as mining proceeded.
- Particle size analysis of run-of-mine non-lead Revett waste rock using standard ASTM methods would be needed to scale laboratory results to prediction of field scale processes.

Water Quality Monitoring

- Evaluation of ongoing, publicly available monitoring data from Troy Mine.
- When possible, collect water quality samples downgradient of any reactive halo zone material following underground placement.
- Monitor chemistry of water from saturated zones as they were developed to predict long-term chemistry for closure work.
- Changes in nutrient concentrations in situ would be monitored to predict nutrient loading from the blasted portions of the non-ore halo zones.

C.9.4.4 Revett Formation – Ore

C.9.4.4.1 Available Geochemical and Monitoring Data

Static tests of ore have been completed (n=25). Kinetic testing (n=1) with characterization of metal release potential for an incomplete suite of metals at elevated detection limits has also been completed. More comprehensive characterization of metal release potential, together with analytical mineralogy, has been completed for ore within the Rock Creek portion of the Rock Creek-Montanore deposit (Enviromin 2007; Maxim Technologies, Inc. 2003). Water quality data collected in the underground workings at Troy represent the cumulative effect of water interacting with all of the Revett waste and ore zones. It is not possible to assign water quality specifically to ore zones.

C.9.4.4.2 Risk

Long-term monitoring of the mined underground workings at Troy, where ore left underground is exposed to groundwater, indicates neutral pH with low but increased concentrations of metals common in the ore zone, such as copper, silver, and lead.

C.9.4.4.3 Uncertainty

Uncertainty about the environmental geochemistry of ore left underground is primarily related to the prediction of metal concentrations post-mining.

C.9.4.4.4 Conclusions

- Static test results suggest that a portion of the ore zone has potential to generate acid, yet the kinetic test and in situ monitoring results do not support the potential for acid generation. This has been shown to be the result of non-acidic sulfide minerals and silica encapsulation of sulfide minerals within the Revett ore zone (Maxim Technologies, Inc. 2003).
- Characterization of ore behavior under unsaturated, aerobic conditions is needed to understand its chemical behavior as a source of metals in the underground workings.
- As its geochemical behavior would be expected to change as a result of saturation when groundwater rebounds, additional in situ monitoring of acid generation and trace metal release from backfilled waste under saturated conditions is needed to predict chemistry of the mine pool post closure.

C.9.4.4.5 Future Geochemical Analyses

- Acid base account and whole rock “fingerprint” analysis of 8 samples to characterize geochemical variability of samples for use in composite for kinetic testing.
- Metal mobility tests for one or more composited samples with a complete suite of metals at appropriate detection limits. Static test results would be used to develop composites.
- Analytical mineralogy quantifying sulfide mineralogy and silica encapsulation would be completed for Montanore and Troy, to compare with that completed by Maxim (2003) for Rock Creek. This would support the use of the Troy and Rock Creek ore deposits as geochemical analogs for Montanore, and confirm the predicted lack of acid generating sulfides and low reactivity of encapsulated sulfides in the ore zone.

C.9.4.4.6 Water Quality Monitoring

- Evaluation of available monitoring data from Troy Mine.

- Monitor chemistry of water from saturated zones as they were developed
- Changes in nutrient concentrations in situ would be monitored to predict nutrient loading from the blasted portions of the ore zone.

C.9.4.5 Tailings

C.9.4.5.1 Available Geochemical and Monitoring Data

Static tests of tailings reject from the process proposed for Montanore (n=1) have been completed with no kinetic tests of acid drainage potential or characterization of metal release potential. Analytical mineralogy and whole rock analyses were completed for tailings that was produced using a similar process to float ore samples from the Rock Creek portion of the Montanore-Rock Creek deposit (n=13). Due to limited access to bulk samples for metallurgical testing, no tailings would be available for further environmental testing until the evaluation adit was developed. Water quality data collected from the Troy tailings impoundment, and from downgradient water resources at Troy, are believed to represent conditions anticipated for Montanore, which would use a similar process to concentrate ore by flotation (Enviromin 2007).

C.9.4.5.2 Risk

Total sulfur analyses of tailings generated through bench scale testing of ore from Rock Creek shows low concentrations of sulfur with little potential for acid generation. The relatively high surface area of the ground tailings does increase metal release in tailings effluent. Long-term monitoring of the impoundment at Troy indicates neutral pH with elevated concentrations of metals common in the ore zone, such as copper, silver and lead. The primary risk associated with tailings is metal release, with secondary risk of elevated nitrate concentrations.

C.9.4.5.3 Uncertainty

The potential for acid generation by Montanore tailings would likely be low based on negligible levels of post-flotation sulfur content in samples from Rock Creek, but would be confirmed through testing of Montanore tailings when samples were available. The geochemical behavior of tailings would be expected to change as a result of desaturation when dewatering occurred at closure, but no kinetic test data are available to represent this process.

C.9.4.5.4 Conclusions

- Tailings are highly homogeneous and therefore can be represented with a composite sample from the metallurgical testing reject sample.
- Characterization of its behavior under saturated, anaerobic conditions is needed to understand its chemical behavior as a source term in the operational impoundment.
- Additional characterization of acid generation and trace metal release potential under unsaturated conditions is also warranted.

C.9.4.5.5 Future Geochemical Analyses

- Acid base accounting and whole rock "fingerprint" analysis of a composited sample to characterize geochemical variability of tailings.
- Evaluate whether routine quality control measurements in mill could provide a measure of geochemical variability, thereby reducing the magnitude of this testing.

- Kinetic tests may not be necessary, due to low sulfide content, but metal release potential tests using SPLP methods would be conducted on a representative suite of samples. As metallurgical testing proceeds, tailings characteristics may vary. Possible classes of material to be studied using SPLP would include whole tailings, and coarse and fine tailings fractions. This would to a certain extent be defined by the metallurgical test work. As tailings are expected to be highly homogeneous, no compositing strategy would be required.
- A particle size analysis of tailings, using standard ASTM sieving protocols, would be needed for evaluation of silica encapsulation influence on metal and sulfur reactivity in ground tailings.

C.9.4.5.6 Water Quality Monitoring

- Evaluation of ongoing, publicly available surface and groundwater monitoring data from the Troy Mine impoundment.
- Monitoring of chemistry of water from the impoundment would continue as the impoundment water balance changes through mine life.
- Monitoring of changes in nutrient concentrations would facilitate prediction of tailings seepage chemistry.
-

C.9.5 Operations Phase Sampling and Analysis

Operational sampling and analysis would focus on validation of baseline conclusions, through periodic collection of Burke, Prichard, and Revett waste rock samples. Samples would be collected based on tonnage, at a rate that provides coverage of the mineralogical variability observed in mined rock. Geomatrix recommended sampling at least every 500 feet in adits and for every 100,000 tons of waste rock (Geomatrix 2007). This level is approximately consistent with guidelines provided by the Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (Price 2009), which suggest 50 samples per 4 million tons of waste. Likewise, a sample of tailings can be collected periodically at the tailings line drop box, although collection of sampling can be less frequent than waste rock due to the relative homogeneity and characterization that is done for metallurgical processing. Ultimately, the relative frequency of sampling would be based on "variability within the analysis results for critical parameters, prediction objectives, and required accuracy" (Price 2009).

If test work conducted during the Evaluation Phase allowed rock mined during Construction and Operations phases to be classified for management (e.g., there are no inconclusive kinetic tests, and rock requiring management is clearly delineated), static testing of volumetrically representative rock samples using mineralogical description, whole rock analysis, acid base accounting, with occasional metal mobility testing of composites, would provide an adequate basis for evaluating the consistency of mined rock with baseline samples. Water quality monitoring would be as described in section C.9, Water Resources. Following the Evaluation and Construction phases, and the first 5 years of Operations Phase, the agencies would review the data to determine adequacy of sampling and analysis, and management practices.

Of particular interest for operational sampling are locations where waste rock was exposed to oxidation, in surface stockpiles, constructed facilities, or as backfill in underground workings.

Periodic collection of water quality samples downgradient of such facilities would allow long-term behavior to be evaluated in support of closure planning.

C.9.6 Sample Collection and Analysis

C.9.6.1 Collection

Sampling during the Evaluation Phase is focused on addressing specific gaps in existing knowledge, or on comparison of newly mined rock from a given lithology with rock that was mined and sampled historically. Sampling would specifically follow the guidelines provided in the SAP, as approved by the agencies, and would be focused on collection of samples across the range of observed mineralization and geological conditions observed. Sampling would proceed as follows:

- Sites would be located on a map and photographed
- Geological description, including lithology, structure, mineralogy, evidence of sulfide, carbonate, and iron oxide, would be completed at each site.
- A representative sample of at least 2 kilograms, allowing sufficient mass for preparation of splits suitable for completion of baseline static ABA, whole rock, and metal mobility tests with enough material archived for composite development and/or mineralogy would be collected.
- The number of samples would follow the guidelines provided in Table C-6, but may vary to accommodate the range of observed mineralogical variation.
- Material would be dried, bagged in plastic to prevent oxidation for shipment to a lab.
- Sample would be crushed to passing 3/8" sieve, and then randomly split using established protocol to obtain subsamples for relevant analyses.
- Care would be taken to document elements of sampling and analytical uncertainty.

C.9.6.2 Analytical Methods

Samples would be analyzed using the following methods, or by comparable methods approved in advance by the agencies:

- Whole rock metal content – EPA method 3050B http://www.epa.gov/wastes/hazard/testmethods/sw846/pdfs/3050b.pdf, or ALS Chemex method MEMS41 aqua regia digestion followed by ICP, contact www.alsglobal.com
- Acid Base Accounting (ABA) – modified Sobek Method, after Lawrence and Wang, 1997 http://technology.infomine.com/enviromine/ard/Acid-Base%20Accounting/acidbase.htm#Lawrence Sobek
- Synthetic Precipitation Leachability Procedure – EPA Method 1312, http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/1312.pdf

C.9.7 Data Analysis

As operational data were collected, they would be summarized in an accessible spreadsheet or database format, and evaluated statistically to evaluate sampling adequacy and modify sampling goals as appropriate. Specifically, the distribution of values would be plotted and standard descriptive statistics would be calculated. The relative adequacy of sampling would be calculated, so that the need for additional sampling could be considered. As a general rule, greater characterization would be needed for material posing more risk to water quality.

Criteria to be used for evaluation of individual sample results include comparison of whole rock analyses with standard crustal abundance for elements of concern and comparison of metal mobility results with water quality standards. Metal concentrations in whole rock cannot be directly correlated with metal mobility due to solubility constraints imposed by the minerals that host the metals.

Acid base account results would be evaluating using the following criteria. Rock that is potentially acid generating has an NNP (calculated as NP minus AP, in units T/kTon as $CaCO_3$) less than 20, or an NP/AP ratio of less than 1. Rock that is non-acid generating has an NNP greater than 20 or and NP/AP ratio greater than 3. Values that lie between these values are uncertain and require kinetic testing.

Kinetic tests using ASTM standard method D5744-96 would be conducted for a minimum of 20 weeks testing and terminated only with regulatory approval. For interpretation of the results, guidance is provided in the the Global Acid Rock Drainage Guide (International Network for Acid Prevention 2008) or Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (Price 2009) for prediction of acid generation and metals mobility potential.

Models used to predict future water quality would periodically be revised to incorporate new data. Results of these models would identify the need to adopt or modify selective handling criteria, if appropriate, to mitigate impact based on consultation between agencies and mine site geology staff. Models would be updated prior to start of construction, and every 5 years through mine life, if water quality standards change or if unanticipated changes in water quality were observed.

Data would be reviewed in the context of waste management and risk mitigation strategies, and used to evaluate the most relevant closure strategies (e.g., bulkheads, flooding, etc.). Following completion of the Evaluation Phase, the need to handle material selectively would be reevaluated and criteria for material placement would be established. Where possible, trigger values that would enable mining personnel to identify rock for selective handling or to determine the need for mitigation would be identified. A routine reporting schedule would be developed in consultation with the agencies.

C.10 Water Resources

C.10.1 Introduction and Objectives

MMC and its predecessors have collected and reported ambient surface and groundwater quantity and quality data as well as aquatic biology data (see Chapter 3). Additional monitoring would be required to supplement this original data collection and provide long-term monitoring for the project. The objective of the monitoring is to provide a long-term assessment of the water resources and groundwater dependent ecosystems that could be affected by the mine. Monitoring would be maintained during the life of the project. Post-mining surface water and groundwater monitoring would be continued for a period of time to be specified by the agencies during review of MMC’s Final Closure Plan.

The following monitoring would be implemented in one or more of six phases of the project: Pre-Evaluation, Evaluation, Construction, Operations, Closure, and Post-Closure. The first phase would be a Pre-Evaluation Phase of data collection and monitoring to collect additional data before additional dewatering and extension of the Libby Adit started. Monitoring during the next phase, Evaluation Phase, would be designed to monitor the potential effects of the dewatering of the Libby Adit, and the storage of waste rock at the Libby Adit Site. The activities associated with the Evaluation Phase are described in section 2.5.2 in Chapter 2. Monitoring during the next two phases, Construction and Operations, would generally be the same, except for the addition of sediment monitoring, as discussed during those phases. The Closure Phase would cover the period when mill operations ceased, and site reclamation and closure were implemented. The last phase, Post-Closure, would be the monitoring conducted after the adits were plugged, and reclamation of mine facilities was completed. The objectives described in the following sections apply to facilities proposed in Alternative 3. Objectives would be similar for other alternatives and would reflect the facility location of each alternative. An overview of the hydrology and aquatic biology monitoring locations for Alternative 3 is shown in Figure C-2.

C.10.2 Funding

The Montana Board of Health and Environmental Sciences (the Board of Environmental Review's predecessor) approved a "Petition for Change in Quality of Ambient Waters" to increase the concentration of select constituents in surface and groundwater above ambient water quality (Appendix A). The Order remains in effect and MMC would be responsible for ensuring compliance with the Order's provisions. One provision of the Order was the requirement that Noranda (now MMC) provide funding to the DHES (now DEQ) so that the DEQ could perform sufficient independent monitoring to verify monitoring performed by Noranda (now MMC). The funding would not exceed the actual cost of the agencies' independent monitoring, and or $35,000 annually, whichever was less (in 1992 dollars).

The monitoring may include independent collection or analysis of surface water, groundwater, or aquatic life samples, independent interpretation of monitoring data, or other activities the agencies deemed necessary to verify MMC's monitoring. When extension of the Libby Adit began, MMC would provide $54,000 annually to the DEQ; $35,000 in 1992 dollars is $56,000 (2011 $), using the Consumer Price Index as the inflation factor. Any funding exceeding the agencies' actual cost would be returned to MMC annually or rolled over for the following year. The funding would increase annually in accordance with the Consumer Price Index. The funding would continue throughout the project until the Post-Closure Phase and final bond release, or the agencies' approval to cease monitoring.

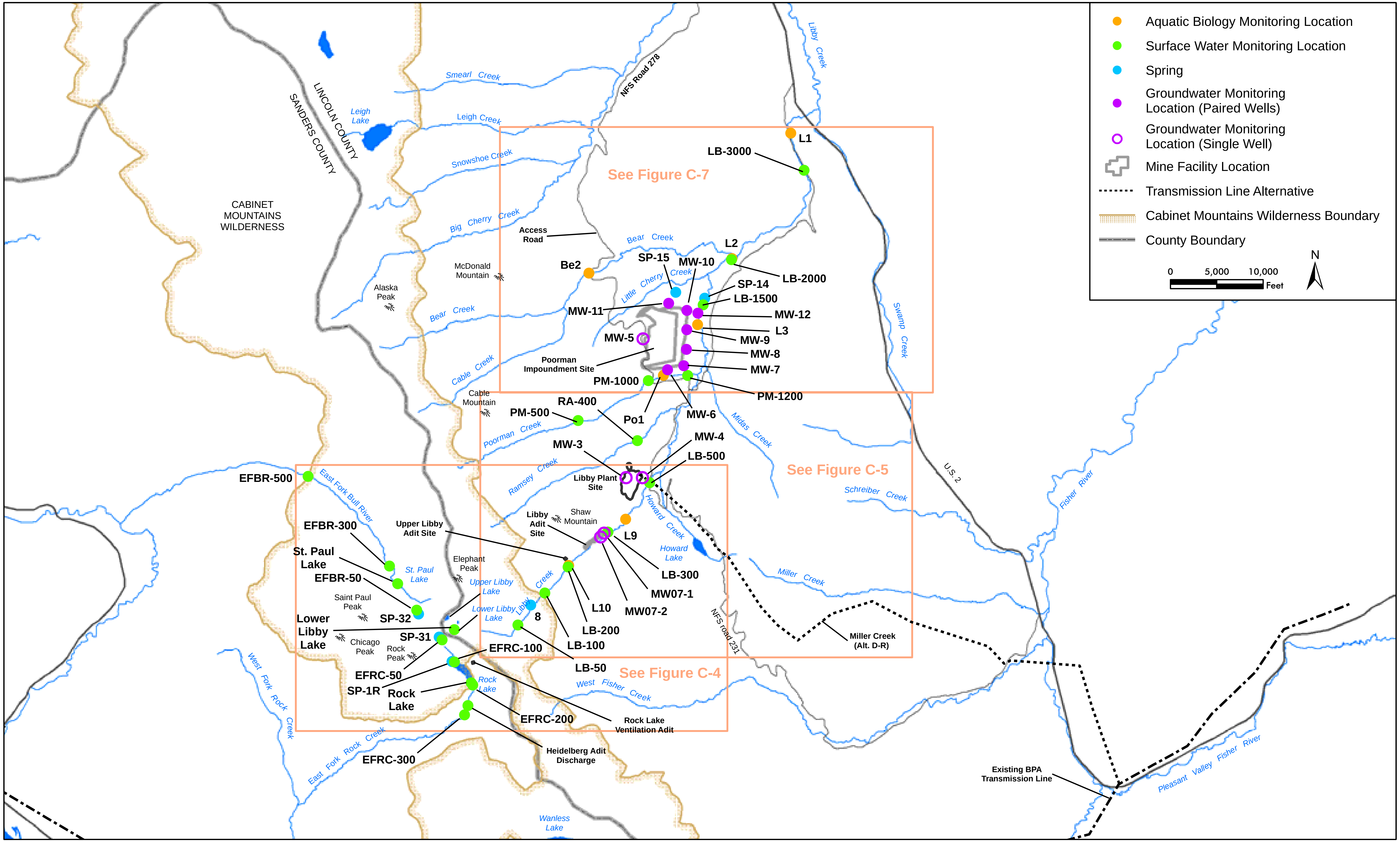


Figure C-2. Current and Proposed Hydrology and Aquatic Biology Monitoring Locations

C.10.3 Pre-Evaluation Phase

C.10.3.1 Objective

MMC is maintaining groundwater levels in the Libby Adit at 7,200 feet from the adit portal. Water from the adit is pumped to the surface, treated at the Water Treatment Plant, and then discharged at a MPDES-permitted outfall at the site. The Pre-Evaluation Phase covers monitoring up to when MMC would begin additional dewatering of the Libby Adit. The objectives of data collection and monitoring during this phase are to:

- Characterize groundwater conditions overlying portions of the Libby Adit
- Characterize groundwater quality flowing into the Libby Adit
- Identify and characterize groundwater dependent ecosystems (GDEs) in the upper Libby Creek, upper East Fork Rock Creek, and East Fork Bull River drainages
- Characterize water levels, water supply, and water quality of Rock Lake
- Characterize streamflows and water quality upper East Fork Rock Creek, and East Fork Bull River
- Characterize flows and water quality of two benchmark streams near, but outside of the range of influence of expected mine or adit inflows (Bear Creek east of the divide, and Swamp Creek west of the divide)
- Characterize changes in water levels and water quality in a benchmark lake near, but outside of the range of influence of expected mine or adit inflows (Wanless Lake)
- Assess effects of discharge of treated water on surface water and groundwater adjacent to the Libby Adit

C.10.3.2 Groundwater Dependent Ecosystem Inventory and Monitoring

C.10.3.2.1 Previous Inventory and Current GDE Monitoring

In 2009, MMC completed a groundwater dependent ecosystem (GDE) inventory focusing on areas at or below about 5,600 feet on the north side of the Libby Creek watershed (Figure C-3) (Geomatrix 2009). Additional inventory was completed in 2010. The additional inventory consisted of inventorying GDEs identified in 2009 using the Forest Service Level 2 Sampling Protocol for GDEs (USDA Forest Service 2011) and the threatened, endangered, and Region 1 sensitive species lists (Geomatrix 2010).

MMC completed surveys for wetlands, springs, and perennial and ephemeral streams in the Poorman Impoundment Site and the adjacent Little Cherry Creek Impoundment Site in 2005 and 2007 and the Corps issued a preliminary jurisdictional determination for waters of the U.S at both sites. Surveys for sensitive plants, amphibians, and reptiles also were completed at both sites. No additional GDE inventory of the impoundment sites is needed.

In 2011, MMC installed two nested shallow piezometers in wetlands in the Poorman Impoundment Site, one nested pair in wetland #15 and one nested pair in wetland #17. To confirm the source of the water, sampling for stable water isotopes (18O and deuterium) and tritium will occur four times during the year over a 2-year period and will catch the high and low points of the hydrograph.

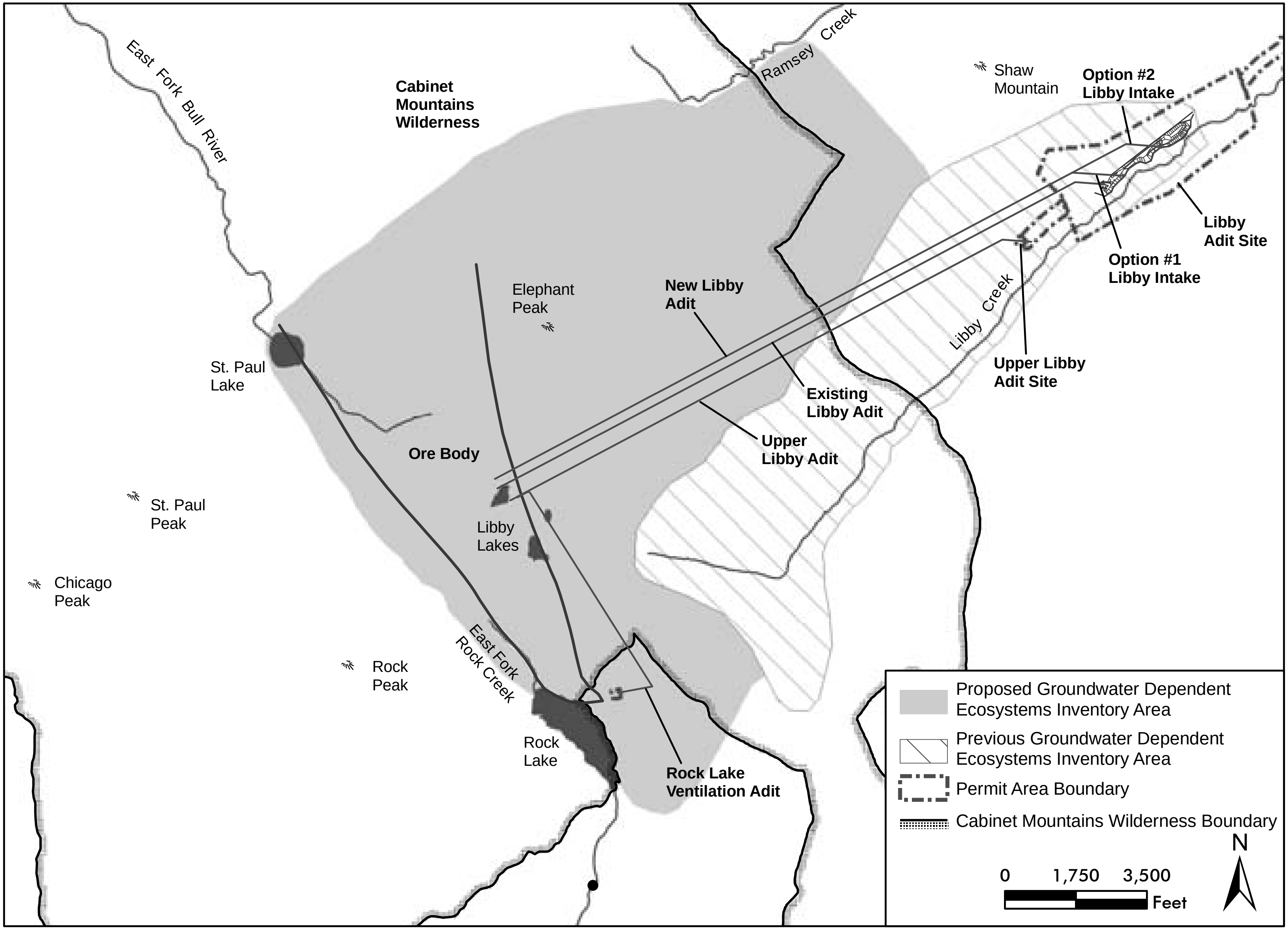


Figure C-3. Previous and Proposed Groundwater Dependent Ecosystems Inventory Areas

East Fork Rock Creek

MMC is currently monitoring GDEs in the East Fork Rock Creek and Rock Lake areas (Figure C-4). GDE monitoring activities are:

- Measuring water levels in Rock Lake continuously using a pressure transducer datalogger in the lake and a nearby barometric pressure datalogger (minimum of one data point every hour) and downloading data twice per year (early summer and early fall)
- Measuring water levels using a permanent datum in Rock Lake in early summer and early fall
- Measuring flow and field parameters (pH, specific conductance, dissolved oxygen, and temperature) in Heidelberg Adit discharges in early summer and early fall

Upper Libby Creek

MMC is currently monitoring GDEs and water quality in Libby Creek and Lower Libby Lake (Figure C-5). Monitoring activities are:

- Measuring water levels in Lower Libby Lake using a pressure transducer datalogger in the lake and a nearby barometric pressure datalogger continuously (minimum of one data point every hour) and downloading data twice per year (early summer and early fall)
- At the spring/seep complex in upper Libby Creek (located at the Spring 8 site), collecting vegetation information annually at transects and quadrants using the Forest Service Level 2 monitoring protocol as a basis for a project specific protocol
- Measuring groundwater levels at two nested piezometer sites at the spring/seep complex in upper Libby Creek at the Spring 8 site.

Current surface water monitoring is discussed in section C.10.3.3, Surface Water Monitoring.

C.10.3.2.2 Additional GDE Inventory

MMC would complete a Level 2 GDE inventory focusing on areas potentially affected by mine inflows. The inventory would be completed between mid-August and mid-September at least 1 year before extension of the Libby Adit started. The inventory area is shown on Figure C-3, and is based on areas of groundwater drawdown predicted by the 3D groundwater model. The inventory area may change if the 3D groundwater model used to assess effects was updated and predicted greater or lesser effects. An inventory would help identify and rank GDEs based on their importance in sustaining critical habitats or species. The inventory would be conducted in accordance with the most current version of the Forest Service's *Inventory and Monitoring Protocols for Groundwater Dependent Ecosystems* (USDA Forest Service 2011). After MMC submitted the inventory report to the agencies, the agencies would determine which GDEs would be monitored during subsequent phases.

Springs

The inventory area shown on Figure C-3 would be surveyed for springs. In this initial inventory, the flow of each spring would be measured twice, first between mid-August and mid-September during a time of little or no precipitation. The same springs identified and measured in mid-August through mid-September would again be measured when the area was initially accessible

(June or July). The most accurate site-specific method for measuring spring flow would be used. Any spring with a measurable flow between mid-August and mid-September would be assessed for its connection to a regional groundwater system, based on flow characteristics (e.g. possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation), water chemistry, and the hydrogeologic setting (associated geology such as the occurrence or absence of colluvium or alluvium).

In addition to identifying springs in the GDE inventory area, MMC would locate and monitor springs outside of the area potentially affected by mine dewatering or other activities. The number of springs to be monitored would be determined following completion of the initial GDE inventory. Springs would be categorized by location (west side of the Cabinets and east side of Cabinets), altitude and hydrogeologic setting. The flow of each spring would be measured between mid-August and mid-September during a time of little or no precipitation. The springs would be used as benchmark springs and for evaluating compliance with action levels.

Wetland and Riparian Vegetation

The inventory area shown on Figure C-3 would be surveyed for groundwater dependent wetlands, fens, and riparian areas. At each critical GDE habitat identified from the inventory, a vegetation survey using the Forest Service Level 2 Sampling Protocol for GDEs (USDA Forest Service 2011) would be completed. Initial survey data would include site photos and points, GPS site locations, basic site descriptors, and plant species composition, focusing on hydrophytes (plants that are able to live either in water itself or in moist soils).

Streamflow

In the initial inventory, the flow of any stream in the GDE inventory area currently not being monitored (Figure C-3) would be measured when the area was initially accessible in the spring, bimonthly during the late spring and summer months and weekly between mid-August and mid-September. The most accurate site-specific method for measuring stream flow would be used. Measurements would be taken so that gaining stream reaches could be mapped, and then monitoring locations would be refined to focus on gaining reach lengths and flow. An example of how to determine if stream segments are gaining water from the regional groundwater system is to collect synoptic flow measurements within as short a time period as possible at short intervals along the stream segments within the inventory area. Streams would be assessed for their connection to a regional groundwater system based on flow measurements, water chemistry, the associated hydrogeology, such as faults or the occurrence or absence of colluvium and/or alluvium, and possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation.

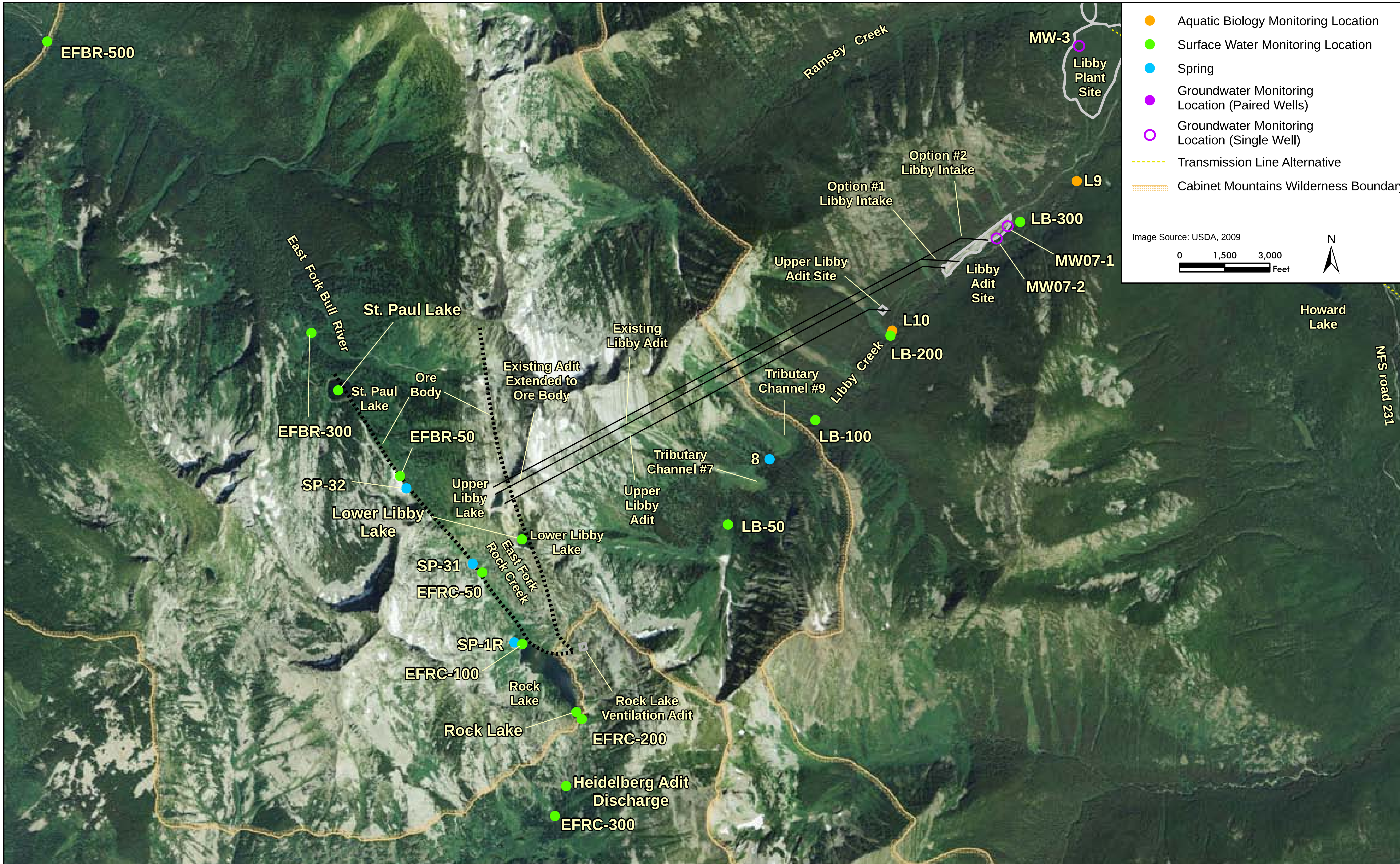


Figure C-4. Current and Proposed Hydrology and Aquatic Biology Monitoring Locations in Mine Area

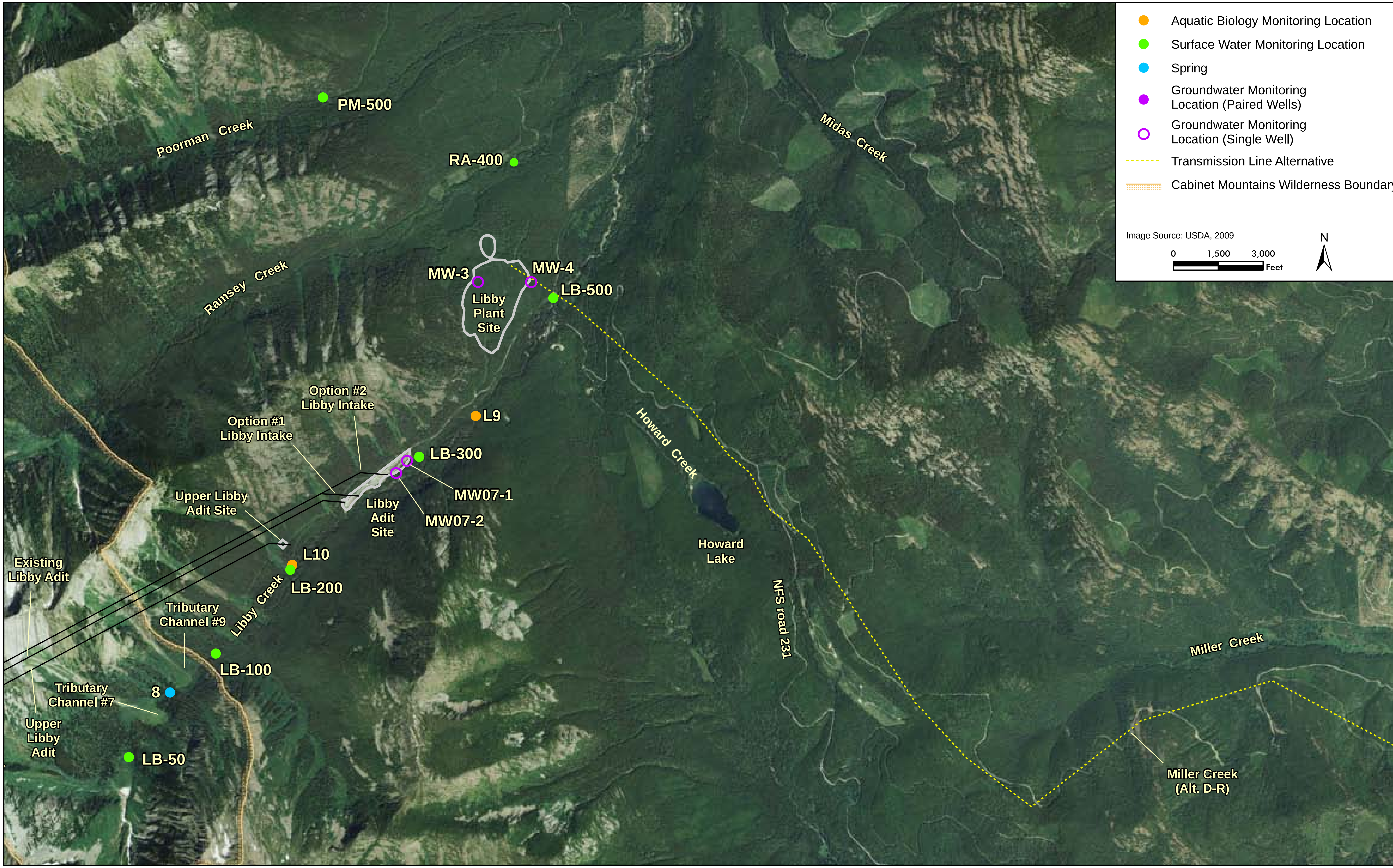


Figure C-5. Current and Proposed Hydrology and Aquatic Biology Monitoring Locations in Upper Libby Creek

C.10.3.2.3 Continued GDE Monitoring

GDE monitoring currently being conducted would continue. Additional GDE monitoring would have locations and frequency specified based on inventory data and on the local hydrogeology and proximity to the mine or adit void. MMC would submit to the agencies for approval a GDE Monitoring Plan for important GDEs found during the inventory. The plan would be incorporated into an overall Water Resources Monitoring Plan. The plan's objective is to effectively detect and minimize stress to flora and fauna from effects on surface water or groundwater due to mine dewatering. The plan would be submitted to the agencies for approval after the GDE inventory was completed and early enough for at least 1 year of data to be collected before extension of the Libby Adit started. The plan would include piezometers in critical locations. The plan would include a monitoring schedule, a mitigation plan, and mitigation implementation triggers. The results of the initial inventory, subsequent inventories, and monitoring would be reported in annual reports to the agencies.

C.10.3.3 Surface Water Monitoring

C.10.3.3.1 On-going MPDES Monitoring

MMC currently is pumping water from the Libby Adit to the surface, treating it at the Water Treatment Plant, and then discharging it at a MPDES-permitted outfall at the site. In accordance with the MPDES permit, MMC is collecting quarterly samples from Outfall 001 and LB-300 for flow rate, temperature, nitrogen compounds, sulfate, and total recoverable metals. Whole effluent toxicity testing of the Wastewater Treatment Plant effluent also is being conducted.

The monitoring associated with the existing MPDES permit currently being implemented would continue during subsequent phases as long as there was a discharge of any mine drainage or process water to any MPDES-permitted outfall. Monitoring requirements described in any permit revision would be incorporated into the monitoring.

C.10.3.3.2 Benchmark Stream, Lake, and Spring Sites

It may be difficult to separate the effects of mine dewatering and other activities that could affect streamflow or the volume and water level of Rock Lake from natural variability and the effects of climate change. For this reason, benchmark sites located outside of the area potentially affected by the Montanore mine would also be monitored beginning during the Pre-Evaluation Phase and continuing through all phases. MMC would locate and monitor springs outside of the area potentially affected by mine dewatering or other activities. Springs would be categorized by location, altitude and hydrogeologic setting. The springs would be used as benchmark springs and for evaluating compliance with action levels.

Two streams have been chosen as benchmark streams, one in the Libby Creek watershed (Bear Creek), and one on the west side of the mountain divide (Swamp Creek). Swamp Creek drains Wanless Lake, which would be used as a benchmark lake for Rock Lake. Wanless Lake is slightly larger and has a slightly larger watershed than Rock Lake, is at a similar altitude, has similar topography, is located within the Revett formation, is bisected by the Rock Lake fault, and is within the 3D groundwater model domain. Monitoring locations in Bear Creek would be similar to monitoring locations in upper Libby Creek, and monitoring locations in Swamp Creek would be similar to those in upper East Fork Bull River and East Fork Rock Creek. Monitoring at the benchmark sites would be the same and would occur at the same time and frequency as monitoring at the comparable sites with the area influenced by the mine. Bear Creek, Swamp Creek, and Wanless Lake would also be used for evaluating compliance with action levels.

C.10.3.3.3 Other Surface Water Monitoring

Past Monitoring

MMC completed a synoptic flow event along upper Libby Creek in September 2010. Streamflow was measured at LB-50, LB-100, and LB-200), as well as immediately upstream and downstream of the tributary channels entering Libby Creek. Flow also was measured in the tributary channels, if present. Additional measurements of Libby Creek also were completed between LB-50 and LB-100, and upstream of LB-50. Field parameters of pH, specific conductance, dissolved oxygen, and temperature were measured at selected sites. MMC also surveyed tributary channels #7 and #9 up to about 5,600 feet to determine if any springs were in the upper channel areas (Figure C-5).

Future Monitoring

In addition to monitoring required by the MPDES permit, MMC is conducting the following monitoring (Figure C-5), which would continue during the Pre-Evaluation Phase or would begin at that time:

- Measuring Rock Lake inflow (EFRC-100) and outflow (EFRC-200) twice per year in early summer and early fall using the most accurate site-specific method available
- Collecting water quality samples from EFRC-100 and EFRC-200 once per year in late summer/early fall
- In the Pre-Evaluation Phase and all subsequent phases, collecting flow measurements at EFRC-50, EFRC-100, EFRC-200, EFBR-300, EFBR-500 and the two Swamp Creek sites at the same time every year for the purpose of establishing long-term trends (on or about July 10, August 10, September 10 and October 10)
- In the Pre-Evaluation Phase and all subsequent phases, collecting water quality samples at EFRC-100 EFRC-200 at the same time every year for the purpose of establishing long-term trends (on or about July 10, August 10, September 10 and October 10) of parameters listed in Table C-9 and Table C-10; complete the same sampling at the inlet and outlet of Wanless Lake;
- Sampling Rock Lake and Wanless Lake as described in the following paragraph
- Measuring flow at spring SP-1R site in early summer and late fall
- Measuring streamflow at LB-50, LB-100, LB-200, LB-300, LB-500, three new stations upstream of LB-50, and two new stations between LB-50 and LB-100 bimonthly from July 15 to October 15, and biweekly from August 15 to September 15
- Measuring water stage in Libby Creek at LB-200 and continuous flow using a pressure transducer datalogger and nearby barometric pressure datalogger (minimum of one data point every hour) and downloading data twice per year (early summer and early fall)

- Collecting samples from LB-100, LB-200, LB-300, and LB-500 for analysis of major cations, nutrients, and metals, and field parameters of pH, specific conductance, dissolved oxygen, and temperature on a routine basis; complete the same sampling in the Pre-Evaluation Phase and all subsequent phases at the two benchmark sites in Bear Creek

During the Pre-Evaluation Phase and during all subsequent phases, MMC would sample Rock Lake water quality monthly during July through October by vertical profile sampling. A temperature profile would be collected before any water quality samples were collected. Samples would be collected at the center of the lake from the epilimnion (upper, warmest layer of a stratified lake) and the hypolimnion (cooler, bottom layer of a lake). Samples would be analyzed for all parameters in Table C-10 except metals. A sample from a 5-foot depth would be analyzed for chlorophyll-a. A secchi disk would be used to measure water clarity. USDA Forest Service field sampling and data analysis protocols would be followed (E&S Environmental Chemistry, Inc. 2010). Wanless Lake, the benchmark lake for Rock Lake, would be sampled in the same way during the same sample event. MMC would install a pressure transducer datalogger in Wanless Lake during the Pre-Evaluation Phase to monitor lake levels continuously (minimum of one data point every hour).

During the Pre-evaluation Phase, MMC would collect sufficient streamflow measures at LB-200 and benchmark site BC-50 on Bear Creek (a minimum of 8 times per year during the increasing, peak and decreasing limb of the hydrograph and during low flows) to establish a stage/discharge relationship.

C.10.3.4 Groundwater Monitoring

MMC is monitoring groundwater levels and water quality in the Libby Adit. Groundwater levels are measured using a pressure transducer in a representative borehole (5200R) in the Libby Adit. Measurements are made at hourly intervals, and downloaded quarterly. In 2010, MMC collected representative samples from inside the Libby Adit (e.g. at 5,200-foot level) and from the spring at site 8 along upper Libby Creek and analyzed them for oxygen-18, deuterium, and chlorofluoro-carbons.

For water quality, samples are collected monthly at the raw water holding tank (sample ID: RAW-1) at the Libby Water Treatment Plant and at wells MW07-1 and MW07-2, and analyzed for the parameters shown in Table C-11. This monitoring would continue during subsequent phases whenever discharges from the Water Treatment Plant occurred. Water quality monitoring associated with the Libby Adit discharge would continue during the Pre-Evaluation Phase.

C.10.4 Evaluation Phase

C.10.4.1 Objectives

During the Evaluation Phase, MMC would dewater the existing Libby Adit to its full length and extend it to beneath the ore body. MMC would collect additional information about the deposit, as well as geotechnical, geochemical, and hydrological data to support a bankable feasibility study. Building on the inventory and monitoring completed during the Pre-Evaluation Phase, the objectives of monitoring during the Evaluation Phase are to:

- Monitor and characterize groundwater overlying the Libby Adit between the current dewatered location and the ore body
- Monitor and characterize groundwater quality flowing into the Libby Adit
- Assess effects of additional dewatering of the Libby Adit
- Characterize groundwater adjacent to the Rock Lake and Snowshoe faults
- Assess effects on GDEs in the upper Libby Creek, East Fork Rock Creek, and East Fork Bull River drainages
- Assess effects on Rock Lake, and upper East Fork Rock Creek, and East Fork Bull River drainages
- Assess effects of treated water discharge on surface water and groundwater adjacent to the effluent discharge points
- Characterize groundwater quality at the Libby Plant Site, Poorman Impoundment Site, and the Libby Loadout

C.10.4.2 Groundwater Dependent Ecosystem Monitoring

GDE monitoring currently being conducted and any additional GDE monitoring implemented during the Pre-Evaluation Phase would continue. The monitoring required as a result of the Pre-Evaluation Phase GDE inventory would be implemented. Criteria required to decide which characteristics to monitor are traits that: 1) *have a defined relationship with groundwater levels:* there needs to be confidence that a measured response within a parameter reflects altered ground-water levels rather than other abiotic/biotic factors; 2) *are logistically practical*: parameters should be practical to measure within the constraints of a wilderness setting; parameters that reflect landscape responses by GDEs of wide distribution, such as remote sensing of hydrophytic vegetation health, could be considered; and 3) *have early warning capabilities*: it is important to consider the lag time between changed groundwater levels and environmental condition or health. The response of vegetation parameters influenced by changed groundwater levels can take a long time to become manifested and further reductions may occur before impacts of previous changes are realized; consequently, parameters with rapid responses are favored (e.g. groundwater levels in piezometers), as they provide advanced warning of significant stress or degradation on the system, as well as providing the opportunity to determine whether intervention or further investigation is required. Nevertheless, some GDE values may have to be measured through parameters with a greater lag time (e.g. hydrophytic vegetation community composition).

Table C-7 identifies the specific monitoring options for GDEs in the inventoried area. After the initial survey, this table would help to establish the methods that would be used to monitor GDEs. Additional monitoring of GDEs may be required, depending on the outcome of the GDE inventory.

Table C-7. Groundwater Dependent Ecosystem Monitoring Options.

Surface Resource Component	Look For:	Using:
Springs, Lakes, and Streams	Flow changes	Flow monitoring
	Lake level changes	Continuous level recorder
	Groundwater level changes	Piezometers
Wetland and Riparian Vegetation	Groundwater level changes	Piezometers
	Dieback, early desiccation, habitat decline	Photo points, field surveys, remote sensing
	Soil moisture stress	Tensiometers
	Plant water potential/ turgor pressure changes	Pressure bomb technique
Amphibians, Mollusks, Macroinvertebrates, Fish	Population decline, community composition change	Field surveys
Terrestrial animals	Population/usage decline	Field surveys

Springs

In addition to the spring at Site 8, the flow in any spring determined to be supported by the regional groundwater system or whose connection to the regional groundwater system might be uncertain would be measured annually between mid-August and mid-September during a period of little or no precipitation. During flow measurements, observations regarding possible short-term sources of water supply, such as nearby late-season snowfields, would be made. A spring that was determined, after repeated flow measurements, not to be connected to the regional groundwater system may be eliminated from additional monitoring.

Wetland or Riparian Areas

Potential monitoring options for wetlands (including fens) and riparian areas are listed in Table C-7. Monitoring would depend on the nature and location of the wetland or riparian area, and generally would include vegetation cover (woody, herbaceous, and bryophtyes), and groundwater level measurements.

Streamflow

Streamflow measurements are discussed in the following section on Surface Water Monitoring. For streams within the GDE monitoring areas determined to be supported by the regional groundwater system or whose connection to the regional groundwater system might be uncertain, such stream segments would be measured bimonthly between July 15 and October 15 each year using appropriate methods. If the agencies determine, after repeated flow measurements, that a stream segment is not connected to the regional groundwater system, such locations may be eliminated from additional monitoring.

C.10.4.3 Surface Water Monitoring

Surface water monitoring would be required for the purpose of detecting water quality impacts from mine facilities and detecting flow changes due to mine dewatering. Locations, frequency, and the purpose of surface water monitoring locations are listed in Table C-8. Parameters listed in may be modified in the MPDES permit. New monitoring locations would be developed in collaboration with the agencies. Flow and field parameters would be measured at monitoring locations in the upper part of various drainages (Table C-9). For locations where flow would be measured with continuous electronic recording, the flow measuring device would be capable of measuring lows flows, and remain in place during, but not necessarily measure, high flows. For continuously recorded sites, MMC would collect sufficient streamflow measurements (a minimum of 8 times per year during the increasing, peak and decreasing limb of the hydrograph and during low flows) to establish a stage/discharge relationship. Parameters to be sampled for and analyzed at each surface monitoring location where quality was the focus is provided in Table C-10. Dissolved metal analyses (except for aluminum) are not needed because sufficient dissolved metals data have been collected at monitoring sites in Libby Creek during baseline monitoring. Laboratory analytical methods would conform to those listed in 40 CFR 136. Laboratory reporting limits would comply with the Required Reporting Values found in the most current Montana's water quality standards (Circular DEQ-7; DEQ 2010a). If data collected under this plan were to be used for compliance purposes for the MPDES permit, minimum limits specified in the MPDES permit must be achieved. Flow measurements would be made using the most accurate site-specific method available and appropriate for the site.

Table C-8. Surface Water Monitoring Locations—Evaluation Phase.

Station	Location	Frequency	Parameters	Purpose
East Fork Rock Creek Drainage				
EFRC-50	Just below SP-31	Continuous electronic recording	Stage	Monitor dewatering
EFRC-100	Inflow to Rock Lake	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10)	Monitor dewatering
Rock Lake	Near south end of lake Vertical profile sampling at center of lake	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10 except metals)	Monitor dewatering
EFRC-200	Below Rock Lake where measurable, such as at exposed bedrock slightly downstream from lake	On or about 7/10, 8/10, 9/10, 10/10 On or about 7/10, 8/10, 9/10, 10/10	Flow Quality (Table C-10)	Monitor dewatering
EFRC-300	Above Rock Creek Meadows	On or about 7/10, 8/10, 9/10, 10/10	Flow (Table C-9)	Monitor dewatering
Heidelberg Adit	Below Rock Lake	On or about 7/10, 9/10	Flow (Table C-9)	Monitor dewatering
	Additional GDE sites	To be determined	To be determined	Monitor dewatering
East Fork Bull River Drainage				
EFBR-50	Just below SP-32	Continuous electronic recording	Stage	Monitor dewatering
EFBR-300	At base of steep slope below St. Paul Lake where measurable	On or about 7/10, 8/10, 9/10, 10/10	Flow (Table C-9)	Monitor dewatering
EFBR-500	Just below wilderness boundary	On or about 7/10, 9/10 On or about 9/10	Flow (Table C-9) Quality (Table C-10)	Monitor dewatering
	Additional GDE sites	To be determined	To be determined	Monitor dewatering
Libby Creek Drainage				
Lower Libby Lake	Near outlet	Continuous electronic recording	Stage	Monitor dewatering
LB-50	Above Wilderness boundary	Biweekly 8/15-9/15 Bimonthly 7/15-10/15	Flow (Table C-9)	Monitor dewatering
Spring 8	Above Wilderness boundary	Annual Monthly 7/15-10/15	Level 2 GDE vegetation protocol Water levels	Monitor dewatering
LB-100	Just below Wilderness boundary	Biweekly 8/15-9/15 Bimonthly 7/15-10/15	Flow (Table C-9)	Monitor dewatering

Station	Location	Frequency	Parameters	Purpose
LB-200	Above Libby Adit	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10)	Monitor dewatering
LB-300	Upstream of Howard Creek confluence	On or about 7/10, 8/10, 9/10, 10/10, or as specified by MPDES permit	Quality (Table C-10) or as specified by MPDES permit	Monitor Libby Adit Site
LB-500	Near Libby Plant Site	On or about 7/10, 8/10, 9/10, 10/10	Quality (Table C-10)	Monitor Libby Adit Site and Libby Plant Site
Benchmark Sites (Outside of Mining Influence)				
SC-1	Swamp Creek below Wanless Lake	On or about 7/10, 8/10, 9/10, 10/10	Flow (Table C-9)	Comparison to EFRC-300 and EFBR-300
SC-2	Swamp Creek at Wilderness boundary (comparable to EFBR-500)	On or about 7/10, 9/10 On or about 9/10	Flow (Table C-9) Quality (Table C-10)	Comparison to EFBR-500
BC-50	Bear Creek below Wilderness boundary	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10)	Comparison to LB-200
BC-500	Bear Creek below Cable Creek	On or about 7/10, 8/10, 9/10, 10/10	Quality (Table C-10)	Comparison to LB-500
Wanless Lake	To be determined Vertical profile sampling at center of lake	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10 except metals)	Monitor dewatering
WL-1	Inlet to Wanless Lake	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10)	Comparison to EFRC-100
WL-2	Outlet from Wanless Lake	On or about 7/10, 8/10, 9/10, 10/10 On or about 7/10, 8/10, 9/10, 10/10	Flow Quality (Table C-10)	Comparison to EFRC-200

Table C-9. Flow and Field Parameters for Surface Water Samples and Required Reporting Values.

Parameter	Current Required Reporting Value
Flow (cfs or gpm)	Within 10% accuracy
pH (s.u.)	0.1
Dissolved Oxygen (mg/L)	0.05
Specific Conductivity (µS/cm)	1.0
Turbidity (NTU)	1.0
Termperature	-

Table C-10. Proposed Monitoring Parameters and Required Reporting Values for Surface Water Samples.

Parameter	Current Required Reporting Value (mg/L unless otherwise specified)	Parameter	Current Required Reporting Value (mg/L)
Flow (cfs or gpm)	Within 10% accuracy	Aluminum, dissolved (0.45 µm filter)	0.03
pH (s.u.)	0.1	Antimony	0.003
Dissolved oxygen	0.05	Arsenic	0.003
Specific conductivity (µS/cm)	1.0	Cadmium	0.00008
Total dissolved solids	1.0	Chromium	0.001
Total suspended solids	1.0	Copper	0.001
Sodium	0.025	Iron	0.05
Calcium	0.02	Lead	0.0005
Magnesium	0.0025	Manganese	0.005
Potassium	0.01	Mercury	0.00001
Bicarbonate	1.0	Silver	0.0005
Chloride	0.028	Thallium	0.0002
Sulfate	0.16	Zinc	0.01
Nitrate+nitrite, as N	0.01		
Ammonia, as N	0.05	Total alkalinity (as $CaCO_3$)	0.26
Total inorganic nitrogen	Calculated	Total hardness (as $CaCO_3$)	1.0
Total phosphorus,as P	0.005	Turbidity (NTU)	1.0
Ortho-phosphate	0.005	Chemical oxygen demand‡	5.0
Silica	-	Oil and grease‡	1.0

Note: Metals are total recoverable unless otherwise specified.
Achievable reporting limits shown for parameters without a Circular DEQ-7 required reporting value
‡For discharges associated with stormwater runoff.

C.10.4.4 Groundwater

Groundwater monitoring would be required for the purpose of detecting water quality impacts from mine facilities and for detecting groundwater level changes from the underground mine and adits. A summary of all groundwater monitoring requirements are shown on Table C-12.

C.10.4.4.1 Mine Area Locations and Frequency

Piezometers

Because the mine workings (mine void and adits) would be located over a large area partially beneath the CMW, the most efficient means for obtaining groundwater level data would from within the mine voids. Because the ability to drill from within the mine voids may be limited to about 400 feet, based on the MMC exploration plan, numerous piezometers would be required (Figure C-6).

An array of small diameter boreholes would be installed from within the mine, and instrumented with continuous recording pressure transducers. The boreholes would be drilled in a radial or fan pattern from the mine workings so that the degree of heterogeneity can be assessed as heads change in the fractures surrounding the mine. Each drill station would consist of two boreholes, drilled about 30 degrees from the horizontal from drift, 180 degrees apart, and a third borehole drilled vertically upward from the drift (Figure C-6). Boreholes to be drilled vertically upward from the drift are indicated in Figure C-6 with a "v" symbol. Because the intent of the underground piezometers is to obtain pre-mining pressure data and to track drawdown as the mine void was dewatered, it is essential that the piezometers be drilled out in front of the existing working face when possible. 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.

The first station would be located at the current terminus of the partially dewatered Libby Adit. The purpose of these piezometers is to start recording water levels as soon as possible after dewatering the existing adit. Water levels in the fractures in the surrounding rock would begin responding as soon as dewatering began and rather than waiting until the adit was extended. These piezometers would record hydraulic response as the adit was extended with the associated dewatering. A second station on the Libby Adit would be located about half way between the current terminus and the ore body (about 1,500 feet). All subsequent monitoring stations, as shown in Figure C-6, could use planned exploration boreholes so that no additional boreholes would be required.

The groundwater pressure would be continuously recorded using either a transducer with a built in datalogger or with separate transducers and dataloggers. The data would be recorded at least hourly and would be downloaded at least quarterly to ensure proper operation of the equipment, status of battery power for the dataloggers, and to establish groundwater pressure trends.

The location and number of sites would be determined after reviewing water level data collected during the first 2 years to evaluate the response of the groundwater system to dewatering and whether the existing monitoring network density was sufficient. A plan would be developed for the additional piezometers to be installed in the remainder of the underground mine production area based on information gathered from the Evaluation Phase.

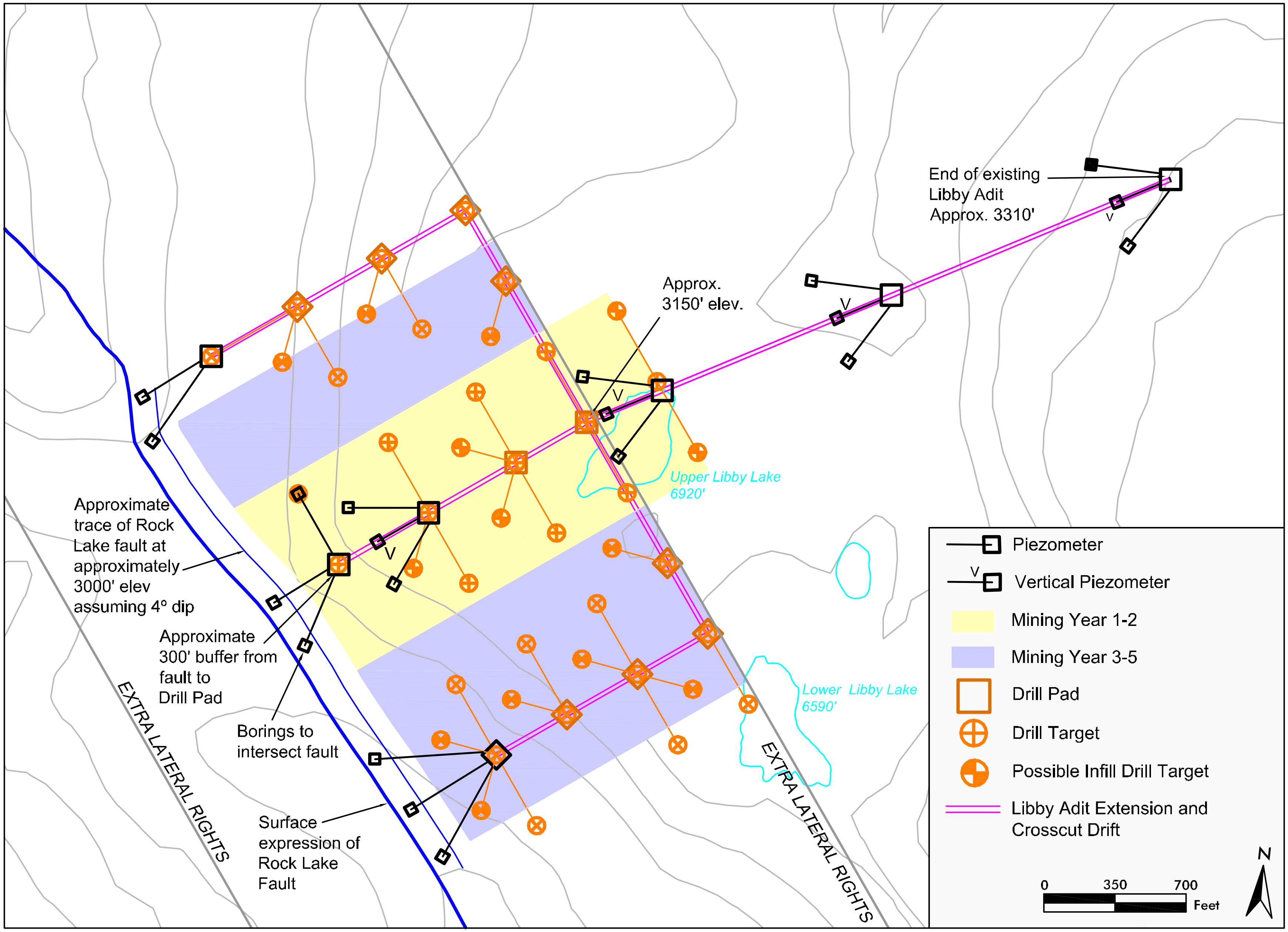


Figure C-6. Proposed Underground Piezometers

Groundwater Isotope Analysis

During the late-summer/early-fall baseflow period, MMC would use stable isotope chemistry to compare seepages into Libby Adit or mine void to samples from GDEs and stream baseflow. Isotopes analyzed would include oxygen-18 and deuterium. In addition, analytes such as tritium or chlorofluorocarbons would be used to establish approximate age of the water. Seepages into the Libby Adit or mine void would be used as benchmark chemistry for the deep aquifer. Major constituents (major anions and cations) would be used to determine relative residence time and travel distance in the aquifer when compared with other groundwater discharges from the same aquifer. The evolution of water chemistry would be graphically determined on trilinear plots. MMC would use age dating of groundwater to separate older groundwater from younger groundwater. Springs discharging older water would be assumed to be supplied by a deeper regional source.

C.10.4.4.2 Libby Adit Site, Libby Plant Site, Poorman Impoundment Site, and Libby Loadout

Location, Frequency, and Parameters

The monitoring of the two wells at the Libby Adit Site, MW07-01 and MW07-02, currently being conducted would continue during subsequent phases as long as there was a discharge to the MPDES-permitted outfalls to groundwater. Two new wells would be established at the Libby Plant Site, one upgradient of the site and one downgradient (Figure C-7). Four new wells would be established at the Libby Loadout (see Figure 12 in Draft EIS). The monitoring wells at the plant site and Libby Loadout would be installed and sampled quarterly for parameters listed Table C-11 for 1 year before the Construction Phase began to establish pre-operation conditions. Monitoring requirements after initial characterization was completed is listed in Table C-12.

A seepage collection system beneath the tailings impoundment and dam would be built to minimize seepage to groundwater from the tailings impoundment. Pumpback wells would be installed to capture seepage not collected by the seepage collection system. During the Evaluation Phase, MMC would complete aquifer testing at the Poorman Impoundment Site and finalize the design of the pumpback well system. After the system was design, at least seven groundwater monitoring wells would be installed downgradient of the pumpback wells before construction of any of the impoundment facilities (Figure C-7). At least four of these wells would be constructed as nested pairs to monitor both shallow and deeper flow paths from the impoundment. The wells would be located so that the cross-sectional area below the impoundment was adequately covered by the monitoring wells. If any preferential flow paths were encountered during the construction of the impoundment or installation of monitoring wells, they would be monitored independently. The installation of pairs of nested wells is intended to monitor a reasonable vertical thickness of the saturated zone. The monitoring wells at the impoundment site would be installed and sampled monthly for parameters listed Table C-11 for 1 year before the Construction Phase began to establish pre-operation conditions. Monitoring requirements after initial characterization was completed is listed in Table C-12.

Laboratory analytical methods would conform with those listed 40 CFR 136. Laboratory reporting limits would comply with the Required Reporting Values found in the most current Montana's water quality standards (Circular DEQ-7). If data collected under this plan were to be used for compliance purposes for the MPDES permit, minimum limits specified in the MPDES permit must be achieved.

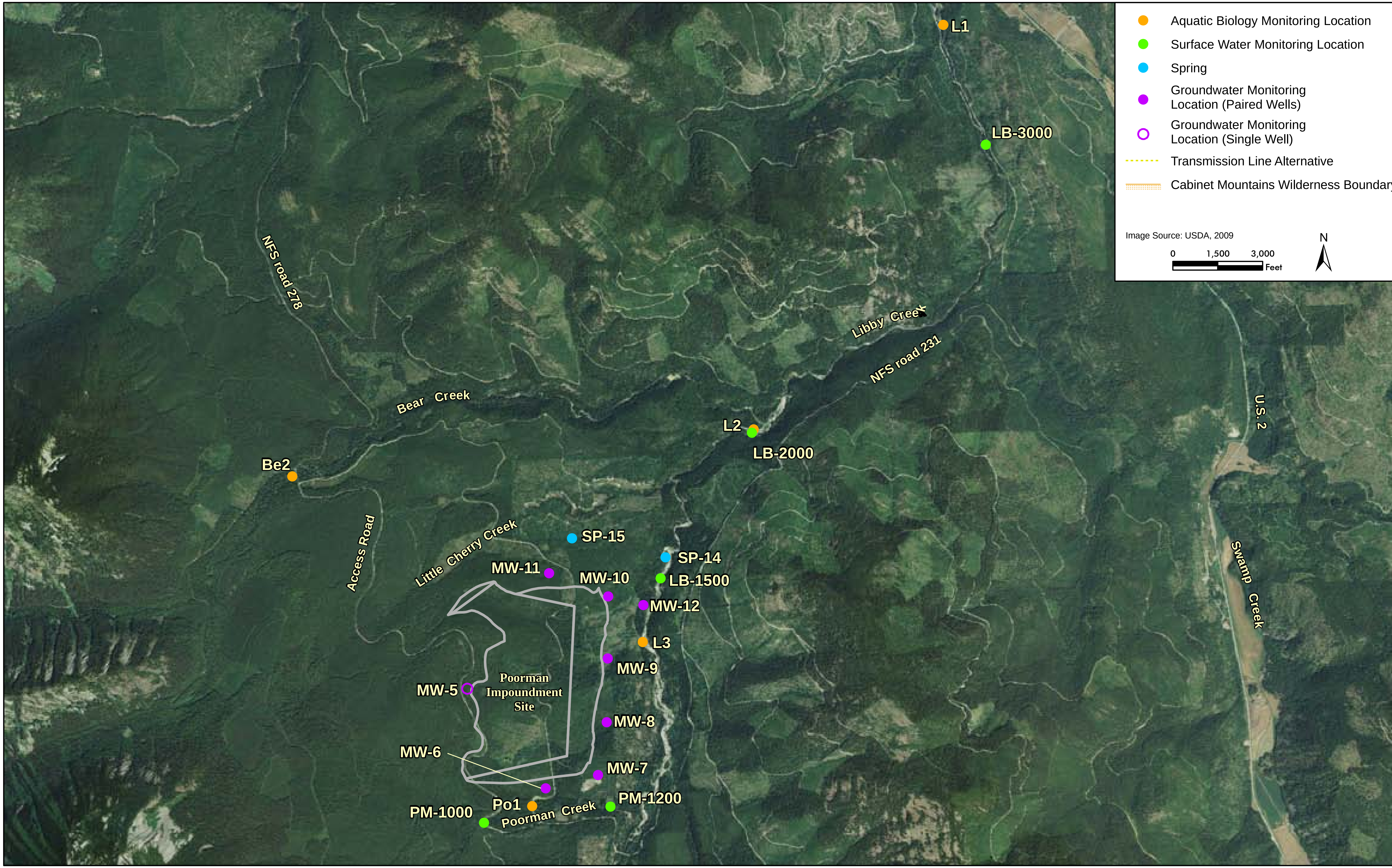


Figure C-7. Current and Proposed Hydrology and Aquatic Biology Monitoring Locations in Impoundment Area

Table C-11. Proposed Monitoring Parameters and Required Reporting Values for Groundwater and Mine and Tailings Water.

Parameter	Current Required Reporting Value (mg/L unless otherwise designated)	Parameter (Dissolved Metals)	Current Required Reporting Value (mg/L)
pH (s.u.)	0.1	Aluminum	0.03
Dissolved Oxygen	0.05	Antimony	0.003
Specific Conductivity (µS/cm)	1.0	Arsenic	0.003
Total dissolved solids	1.0	Cadmium	0.00008
Sodium	0.025	Chromium	0.001
Calcium	0.02	Copper	0.001
Magnesium	0.0025	Iron	0.05
Potassium	0.01	Lead	0.0005
Bicarbonate	1.0	Manganese	0.005
Chloride	0.028	Mercury	0.00001
Sulfate	0.16	Silver	0.0005
Nitrate+Nitrite, as N	0.01	Thallium	0.0002
Ammonia, as N	0.05	Zinc	0.01
Total Phosphorus as P	0.005		
Ortho-phosphate	0.005		
Field Temperature			
Total Alkalinity (as $CaCO_3$)	0.026		
Total Hardness (as $CaCO_3$)	1.0		
Acrylamide†	0.01 or lowest possible		

†In tailings impoundment water and groundwater downgradient of the tailings impoundment during operations.
Achievable reporting limits shown for parameters without a Circular DEQ-7 required reporting value.

Table C-12. Groundwater Monitoring Requirements.

Well Number	Location	Depth/Screen Interval	Required Data	Monitoring Frequency and Phase	Purpose
Libby Creek Drainage					
MW07-1 and MW07-2	Downgradient of adit facilities	Existing wells at Libby Adit	Water Levels Water Quality	Quarterly during discharges	Assess potential impacts from Water Treatment Plant discharge
3	Upgradient Plant Site	Water table plus 50 feet	Water Levels Water Quality	Quarterly Construction through Closure	Background data
4	Downgradient Plant Site	Water table plus 50 feet	Water Levels Water Quality	Quarterly Construction through Closure	Assess potential impacts from Plant Site
Poorman Impoundment Site					
5	Upgradient tailings impoundment	Water table plus 50 feet	Water Levels Water Quality	Monthly Construction through Closure	Background data
6 – 12	Downgradient of seepage collection system	Nested pairs – screened in surficial (if saturated) material and bedrock	Water Levels Water Quality	Monthly Construction through Closure	Assess potential impacts from impoundment seepage and effectiveness of pumpback well system
Wetlands LCC-35A and LCC-39A	Between Little Cherry Creek and Poorman Impoundment	Nested pairs – screened adequately to assess gradient	Water Levels	Monthly April through September Construction through Closure	Assess potential impacts from pumpback well system
Libby Loadout					
13 – 16	Around loadout facility	Water table plus 20 feet or bedrock, whichever is shallower	Water Levels Water Quality	Quarterly Construction through Closure	Assess potential impacts from loadout activities
Mine and Adits					
Numerous (see Figure C-6)	From within adit(s) and mine void; drilled radially in all major directions	100's to 1,000 feet from the adit/mine	Water pressure above transducer	Continuously (at least one measurement per hour)	Monitor changes in groundwater pressure as adits/mine advance

C.10.4.5 3D Groundwater Models Update

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. MMC anticipates the mine area model's uncertainty for predicting inflows and water resource impacts would be reduced based on the empirical data obtained from underground testing. Effects on surface resources would be re-evaluated based on the revised modeling. The agencies would modify the monitoring described in the following section for the Construction and Operations phases if necessary to incorporate the revised model results.

C.10.5 Construction and Operations Phases

C.10.5.1 Objectives

During the Construction and Operations phases, MMC would build and operate two new adits in the Libby Creek drainage, an underground mine, the Libby Plant, the Poorman Impoundment, the Miller Creek transmission line alignment, access roads, and the Libby Loadout. With minor differences associated with suspended sediment sampling (see section C.10.5.3.2,Suspended Sediment), the monitoring during the Construction and Operations phases would be the same. The objectives of monitoring during the Construction and Operations phases are to:

- Assess effects of continued dewatering of the Libby Adit and the dewatering of the mine void
- Assess effects on GDEs in the upper Libby Creek, East Fork Rock Creek, and East Fork Bull River drainages
- Assess effects on wilderness lakes, and upper East Fork Rock Creek, East Fork Bull River, Libby Creek, and Poorman Creek drainages
- Assess effects of discharge of treated water on surface water and groundwater adjacent to the Libby Adit
- Assess the effectiveness of the pumpback well system at the tailings impoundment
- Assess effects on groundwater quality at the Libby Plant Site, Poorman Impoundment Site, and the Libby Loadout

C.10.5.2 Groundwater Dependent Ecosystem Monitoring

GDE monitoring currently being conducted, and any additional GDE monitoring implemented during the Evaluation Phase would continue.

C.10.5.3 Surface Water Monitoring

C.10.5.3.1 Water Quality Locations, Frequency, and Parameters

The monitoring of sites established during the Pre-Evaluation and Evaluation phases would continue, and additional sites on Poorman and Libby creeks would be monitored (Table C-13). Based on the project water balance, discharges from the Water Treatment Plant at the Libby Adit Site are not anticipated during the Operations Phase. Monitoring of LB-300 would only occur when there was a discharge from the water treatment plant.

Table C-13. Surface Water Monitoring Locations—Construction and Operations Phases.

Station	Location	Frequency	Parameters	Purpose
East Fork Rock Creek Drainage				
EFRC-50	Just below SP-31	Continuous electronic recording	Flow (Table C-9)	Monitor dewatering
EFRC-100	Inflow to Rock Lake	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10)	Monitor dewatering
Rock Lake	Near south end of lake Vertical profile sampling at center of lake	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10)	Monitor dewatering
EFRC-200	Below Rock Lake where measurable, such as at exposed bedrock slightly downstream from lake	On or about 7/10, 8/10, 9/10, 10/10 On or about 7/10, 8/10, 9/10, 10/10	Flow (Table C-9) Quality (Table C-10)	Monitor dewatering
EFRC-300	Above Rock Creek Meadows	On or about 7/10, 8/10, 9/10, 10/10	Flow (Table C-9)	Monitor dewatering
Heidelberg Adit	Below Rock Lake	On or about 7/10, 9/10	Flow (Table C-9)	Monitor dewatering
	Additional GDE sites	To be determined	To be determined	Monitor dewatering
East Fork Bull River Drainage				
EFBR-50	Just below SP-32	Continuous electronic recording		Monitor dewatering
EFBR-300	At base of steep slope below St. Paul Lake where measurable	On or about 7/10, 8/10, 9/10, 10/10	Flow (Table C-9)	Monitor dewatering
EFBR-500	Just below wilderness boundary	On or about 7/10, 9/10 On or about 9/10	Flow (Table C-9) Quality (Table C-10)	Monitor dewatering
	Additional GDE sites	To be determined	To be determined	Monitor dewatering

Station	Location	Frequency	Parameters	Purpose
Libby Creek Drainage				
Lower Libby Lake	Near outlet	Continuous electronic recording	Stage	Monitor dewatering
LB-50	Above Wilderness boundary	Biweekly 8/15-9/15 Bimonthly 7/15-10/15	Flow (Table C-9)	Monitor dewatering
Spring 8	Above Wilderness boundary	Annual Monthly 7/15-10/15	Level 2 GDE vegetation protocol Water levels	Monitor dewatering
LB-100	Just below Wilderness boundary	Biweekly 8/15-9/15 Bimonthly 7/15-10/15	Flow (Table C-9)	Monitor dewatering
LB-200	Above Libby Adit	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Stage Quality (Table C-10)	Monitor dewatering
LB-300	Upstream of Howard Creek confluence	On or about 7/10, 8/10, 9/10, 10/10 or as specified by MPDES permit	Quality (Table C-10) or as specified by MPDES permit	Monitor Libby Adit Site
LB-500	Near Libby Plant Site	On or about 7/10, 8/10, 9/10, 10/10	Quality (Table C-10)	Monitor Libby Plant Site
LB-1500	Downstream of Poorman Creek	On or about 7/10, 8/10, 9/10, 10/10	Quality (Table C-10)	Monitor Poorman Impoundment Site
LB-2000	Downstream of Little Cherry Creek confluence	On or about 7/10, 8/10, 9/10, 10/10	Quality (Table C-10)	Monitor below Poorman Impoundment Site
LB-3000	Upstream of Crazyman Creek confluence	On or about 7/10, 8/10, 9/10, 10/10	Quality (Table C-10)	Integrated effect site
Ramsey Creek and Poorman Creek Drainage				
RA-400	Mid-Ramsey Creek	Continuous electronic recording	Flow (Table C-9)	Monitor dewatering
PM-500	Upstream on Poorman Creek	On or about 7/10, 8/10, 9/10, 10/10	Quality (Table C-10)	Benchmark site; ambient quality
PM-1200	Upstream of Libby Creek confluence	Biweekly 8/15-9/15 Bimonthly 7/15-10/15 On or about 7/10, 8/10, 9/10, 10/10	Flow Quality (Table C-10)	Monitor dewatering Monitor Poorman Impoundment Site
Benchmark Sites (Outside of Mining Influence) -- same as Evaluation Phase				

C.10.5.3.2 Suspended Sediment

The KNF conducts continuous suspended sediment monitoring during the ice-free period with an automated sampler near LB-3000 on Libby Creek (Figure C-2), and on West Fisher Creek. The continuous suspended sediment monitoring would continue during construction and post-construction of the mine and transmission line facilities. MMC would either fund the existing KNF monitoring or they would implement their own monitoring efforts in Libby Creek. Any other suspended sediment monitoring required by the MPDES permit also would be implemented.

If the agencies were to observe increased suspended sediment concentrations that could not be explained by natural events such as snowmelt or large precipitation events, then they would investigate the source of the increased sediment load to the stream. If the agencies determined that sediment discharge was occurring to a stream from a construction or post-construction mine or transmission line site, MMC would be required, after notification from the agencies, to implement measures to eliminate the sediment source to the stream within 24 hours.

Prior to the beginning of construction of mine and transmission line facilities, MMC would be required to obtain a MPDES permit for storm water discharges associated with construction activities. The permit would require MMC to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP), identifying Best Management Practices (BMPs) used to minimize or eliminate the potential for pollutants to reach surface water through storm water runoff. The pollutants would primarily be sediment, but also wastes or fuels that might be stored at a construction site. During construction, MMC would inspect the BMPs would be at least once every 14 calendar days, and within 24 hours after any precipitation event of 0.5 inches or greater, or a snowmelt event that produced visible runoff at the construction site.

MMC would maintain the BMPs so they remained effective. Post-construction, BMPs would be inspected at least monthly (during the snow free period) until revegetation was successful and, as during construction, within 24 hours after any precipitation event of 0.5 inches or greater or a snowmelt event that produced visible runoff. Inspection and monitoring of storm water BMPs would continue until the areas disturbed during construction were finally stabilized. Final stabilization is defined as when a vegetative cover has been established with a density of at least 70 percent of the pre-disturbance levels, or equivalent permanent, physical erosion control reduction methods have been employed. Final stabilization using vegetation would be accomplished using a seed mixture approved by the agencies. The agencies expect that full stabilization would occur within 2 years of the completed activities.

C.10.5.4 Groundwater Monitoring

C.10.5.4.1 All Facilities

Groundwater monitoring conducted during the Evaluation Phase would continue through the Construction and Operations phases (Table C-12). Based on the project water balance, discharges from the Water Treatment Plant at the Libby Adit Site are not anticipated during the Operations Phase. Monitoring of wells at the site would only occur when there was a discharge from the treatment plant.

At the Poorman Impoundment Site, flow measurement weirs would be installed downstream of the Seepage Collection Dam and, during operations, in any areas of observed flows. Any groundwater seeps adjacent to the impoundment would be sampled quarterly for parameters listed in Table C-11. Reclaim water in the tailings impoundment would be sampled monthly at the reclaim pond within the impoundment and analyzed for the parameters shown in Table C-11.

C.10.5.4.2 Pumpback Well System Monitoring

The intent of a pumpback well monitoring system would be to confirm that complete groundwater capture downgradient of the tailings impoundment had been established and that it was maintained until discharges from the tailings impoundment were no longer considered process water. The water level data from pumpback monitoring wells would be used to adjust pumping rates of the pumpback wells and/or add additional pumping capacity. Selected monitoring wells would be equipped with continuous water level measuring/recording devices to provide at least four measurements per day. The water levels in wells not equipped with recording devices would be measured by hand at least once per month. The measured water level data would be compared with predicted drawdown at these locations to determine whether full capture had been established. The pumpback well system would be modified, as necessary, to maintain capture, based on the water level data.

One year before mill operation started, MMC would install two nested shallow piezometers in each of two wetlands (LCC-35A and LCC-39A). Water levels in the piezometers would be measured four times over the annual hydrograph. The purpose of the monitoring would be to determine hydraulic gradient at the wetlands and to assess the source of hydrologic support to the wetlands. Vegetation in these two wetlands also would be monitored, following the methods used for the GDE monitoring (section C.10.4.2, Groundwater Dependent Ecosystem Monitoring. The monitoring would continue through the Closure Phase as long as the pumpback well system operated.

Springs SP-14 and SP-15 adjacent to the impoundment site would be monitored for flow. The flow of each spring would be measured twice, once in early June or when the area was initially accessible, and once between mid-August and mid-September during a time of little or no precipitation. The monitoring would begin 1 year before construction and continue through the Closure Phase as long as the pumpback well system operated. The most accurate site-specific method for measuring spring flow would be used.

C.10.5.5 Water Balance

MMC would maintain a water balance as part of the monitoring effort. The detailed water balance would include inflows and outflows to the project facilities. The monitoring information would be used to modify, as necessary, operational water handling and to develop a post-mining water management plan. As part of this monitoring, MMC would measure and report the items listed in Table C-14.

During operations, annual surveys of the impoundment, including water stored in 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. These measurements would be provided as monthly (or more frequently if requested by the agencies) and annual averages and totals in a quarterly hydrology report.

Table C-14. Water Balance Monitoring Requirements.

Item	Monitoring Parameters	Frequency	Comments
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	
Approximate water storage in impoundment	Gallons	Semi-annually	
Mine and adit inflows	Gallons	Daily	Compiled monthly and reconciled on an annual basis
Fresh water makeup or potable water use	Gallons	Daily	
Dust suppression at the impoundment	Gallons	Daily	
Dust suppression at other facilities	Gallons	Daily	
Pumpback well groundwater/seepage collection	Gallons	Daily	
Seepage collection from any waste rock stockpile	Gallons	Daily	
Discharge at any MPDES-permitted outfall	Gallons	Daily	
Seepage collection pond pumping rate	Gallons/day	Daily	
Reclaim pumping rate	Gallons/day	Daily	
Precipitation at impoundment site	Inches	Daily	
Evaporation at impoundment site	Inches	Daily	
Approximate pond areas	Acres	Monthly	
Approximate wet and dry beach and dam areas	Acres	Monthly	

C.10.6 Closure and Post-Closure Phases

Surface and groundwater monitoring conducted during the Construction and Operational phases would continue into the Closure Phase. A closure and post-closure monitoring plan would be submitted to the agencies for approval before the Evaluation Phase began. A final closure and post-closure monitoring plan would be submitted 3 to 4 years before mine closure. The plan would incorporate monitoring information obtained during the mining period in the design of monitoring locations and sampling frequency. The objectives of monitoring during the Closure and Post-Closure are to:

- Assess effects of refilling of the mine void and adits on surface and groundwater resources in upper Libby Creek, East Fork Rock Creek, and East Fork Bull River drainages
- Assess effects of discharge of treated water on surface water and groundwater adjacent to the Libby Adit until all direct discharges ceased
- Assess effects on groundwater quality at the Libby Plant Site, Poorman Impoundment Site, and the Libby Loadout until these facilities were reclaimed

The plan would include measuring water levels in the mine void through the Rock Lake Ventilation Adit. Mine water quality and geochemical analysis of rock surrounding the mine void would be made during the Operations Phase. Hydrologic data would be collected in all phases through the Operations Phase, and would be integrated into the groundwater model. The need for continued monitoring beyond the Closure Phase would be based on these data. The Financial Assurance section of Chapter 1 describes the mechanisms available to the agencies for ensuring funds would be available should continued monitoring beyond the Closure Phase be required.

C.10.7 Action Levels

This section discusses the agencies' preliminary action levels, or some measurable change in a monitoring parameter that would require MMC action. Final action levels would be described in the final monitoring plan.

C.10.7.1 Surface Water Quality

MMC would monitor discharges permitted under the MPDES permit and report any serious incidents of noncompliance in accordance with the permit. MMC would report any serious incidents of noncompliance as soon as possible, but no later than 24 hours from the time MMC first became aware of the circumstances. The following examples would be considered serious incidents: any noncompliance which may seriously endanger health or the environment; any unanticipated bypass which exceeds any effluent limitation in the permit; or any upset which exceeds any effluent limitation in the permit. MMC would provide a written report with 5 days of the time that MMC became aware of the circumstances. The written submission would contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times; the estimated time noncompliance is expected to continue if it has not been corrected; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The MPDES permit also contains action levels for reporting of the discharge of toxic substances for which effluent limits were not established in the permit.

MMC would monitor flows and water quality in benchmark springs and streams outside of the area potentially affected by mine dewatering, as well as changes in the level and water quality of the benchmark lake (Wanless Lake). Based on the monitoring, MMC would establish a relationship between flows and/or water quality in benchmark springs and streams (described in the previous section on lakes and streams) and flows in any monitored spring or stream, as well as changes in the lake level and water quality of Rock Lake. Flows, lake level changes, and water quality in all monitored springs, lakes and streams would also be evaluated using simple linear regression or other appropriate statistical analyses. MMC would provide the analysis in the annual report. The trend analysis would follow Forest Service protocols (E&S Environmental Chemistry, Inc. 2010), or another method approved by the agencies. If the relationship in quantity and quality between benchmark and monitored springs, lakes and streams after adit dewatering began was statistically significantly less ($p<0.05$) than pre-mining or if the concentration of monitored parameters showed an increasing significantly trend ($p<0.05$), MMC would flag the flow change, lake level change or water quality parameter for agency review. If the agencies decided that some action were necessary, it would provide written notification to MMC, requesting submittal of a work plan within 30 days. The work plan would have to contain a detailed assessment of the changes, recommendations for additional monitoring (spatial and/or temporal), development of conceptual mitigation, or other actions to address the situation. The work plan would contain a schedule for implementing the proposed measures. Within 30 days, the agencies would be required to: (i) approve, in whole or part, the plan; (ii) approve the plan with conditions; or, (iii) disapprove, in whole or in part, directing that a revised work plan be submitted. If the agencies were to disapprove the plan, an explanation would accompany the disapproval.

C.10.7.2 Groundwater Quality

Action levels for groundwater compliance wells are listed in Table C-15. Action levels for selected parameters are included to provide an early detection of adverse groundwater conditions and to verify the effectiveness of the tailings impoundment pumpback well system. Parameters selected for development of action levels are based on their presence at low concentrations in the downgradient aquifers, but at elevated concentrations in process water. Exceedance of these levels would require additional action by MMC, but would not be considered a violation of the MPDES permit or Montana groundwater standards.

In addition to assessing relationship of detected concentrations to action levels, MMC would present a trend analysis of all data for the parameters listed in Table C-15 in its annual report. A statistically significant increasing trend ($p<0.05$) in concentration ofr any parameter would be discussed.

If monitoring indicated that these action levels had been exceeded in any compliance well, MMC would notify the agencies of the exceedance within 5 working days. If the agencies decided that additional actions were necessary, the procedures regarding a work plan described for surface water quality would be implemented.

Table C-15. Action Levels for Groundwater Compliance Wells.

Parameter	BHES Order Non-degradation Limit (mg/L)	Groundwater Standard (mg/L)	Action Level (mg/L)§
Nitrate + nitrite, as N	10	10	5
Total dissolved solids	200	—	150
Sulfate	—	—	20
Potassium	—	—	10
Chromium	0.02	0.1	0.01
Copper	0.1	1.3	0.05
Iron	0.2	—†	0.1
Manganese	0.05	—†	0.025
Zinc	0.1	2	0.05

"—" = No applicable concentration.
mg/L = milligrams per liter.
§If the ambient concentration in any individual monitoring well consistently exceeded 50 percent of an action level, the action level would be increased accordingly.
†The concentration of iron or manganese must not reach a concentration that interferes with the uses specified in the surface and groundwater standards (ARM 17.30.601 et seq. and 17.30.1001 et seq.). The Secondary Maximum Contaminant Level of 0.3 mg/L for iron and 0.05 mg/L for manganese, which is based on aesthetic properties such as taste, odor, and staining, may be considered as guidance to determine the levels that would interfere with the specified uses.

C.10.7.3 Groundwater Flow

C.10.7.3.1 Mine Area

MMC would monitor flows from the mine and adits, as well as from individual fractures in the vicinity of the Rock Lake Fault and Rock Lake. If mine and adit inflows greater than 800 gpm occurred over a 2-month period or excessive tailings water occurred in excess of what could be managed by storage in the tailings impoundment, MMC would notify the agencies within 2 weeks. MMC would then implement excess water contingency plans described in Chapter 2, such as grouting or treatment and discharge at the Water Treatment Plant.

If the mine void encountered substantial groundwater inflows in the vicinity of the Rock Lake Fault or Rock Lake, MMC would notify the agencies within 5 business days. "Substantial groundwater inflows in the vicinity of the Rock Lake Fault or Rock Lake" means a flow from any individual fracture within 1,000 feet of either the Rock Lake Fault or Rock Lake with total flow greater than an average of 50 gpm over a 24-hour period. The agencies would evaluate the inflow data and direct MMC to take appropriate actions. MMC would then evaluate the possible effect to Rock Creek and Rock Lake and provide an evaluation report to the agencies within 30 days after initial agency notification.

MMC would monitor the flow in benchmark springs outside of the area potentially affected by mine dewatering, and establish a relationship between flows in benchmark springs (described in the previous section on springs) and flows in any monitored springs. Flow in all monitored springs would also be evaluated using simple linear regression or other appropriate statistical analyses. If the relationship in flow between benchmark springs and monitored springs after adit dewatering began was statistically significantly less ($p<0.05$) than pre-mining, MMC would provide the analysis in the annual report. If the agencies decided that additional actions were necessary, the procedures regarding a work plan described for surface water quality would be implemented.

C.10.7.3.2 Tailings Impoundment Area

MMC would establish a pumpback well monitoring system adjacent to the pumpback wells in the impoundment area (see section C.10.5.4.2, Pumpback Well System Monitoring). Water levels would be measured continuously in some wells using electronic data recorders and monthly by hand in other wells. Within 30 days of the end of each month, MMC would analyze the performance of the pumpback well system and assess the extent of capture of any seepage entering the groundwater beneath the tailings impoundment. If monitoring indicated that full capture of the seepage was not being achieved, MMC would notify the agencies within 5 working days. If the agencies decided that additional actions were necessary, the procedures regarding a work plan described for surface water quality would be implemented.

C.10.7.4 Wetland or Riparian Areas

The initial GDE inventory information (see section C.10.3.2, Groundwater Dependent Ecosystem Inventory and Monitoring) would be used to develop a prevalence index (Corps 2008b). Many plant species have been given wetland indicator status of obligate wetlands, facultative wetlands, facultative, facultative upland, or upland based on probabilities of occurring in wetlands. The USDI Fish and Wildlife Service compiled a list of plants and their wetland indicator status (USDI Fish Wildlife Service 1993). If a drying trend were to occur at a wetland and riparian site, the composition of plants would be expected to shift from a dominance of obligate wetland and facultative wetlands species to a higher percentage of facultative wetland and facultative upland species. For example, sphagnum moss, an obligate wetlands species found at site 8, would be an indicator of slight shifts in hydrological conditions because this plant does not have roots and is dependent on water saturating the soil for all or most of the growing season. A prevalence index of 3.0 or less indicates that hydrophytic vegetation is present (Corps 2008). A prevalence index would be identified for each wetland and riparian site monitored.

If the prevalence index of any monitored wetlands is 50 percent greater than its baseline index (such as 1.5 to 2.3) or is above 3 for 2 consecutive years, MMC would provide the analysis in the annual report. If the agencies decided that additional actions were necessary, the procedures regarding a work plan described for surface water quality would be implemented.

Other monitoring options such as piezometers would be used to facilitate or strengthen monitoring effectiveness. If a change in seep or spring flow, water level, or water quality were noted outside the baseline data for an individual site or set of sites, or a trend was observed that was not observed during pre-mining monitoring, then a re-evaluation of those potentially affected habitats would be conducted and documented for comparison against initial survey information. Depending on a combination of biological or physical variables or the severity of plant indicator decline, the agencies may require more rigorous monitoring.

C.10.8 Plan Management

C.10.8.1 Quality Assurance/Quality Control

As part of each plan for environmental monitoring, MMC would develop Sampling and Analysis Plan (SAP) and a Quality Assurance Project Plan (QAPP) and submit them to the agencies for approval. Collectively, these procedures would compose a plan that ensures the reliability and accuracy of monitoring information as it was acquired. QA/QC procedures would include both internal and external elements. Internal elements may include procedures for redundant sampling such as random blind splits or other replication schemes, chain of custody documentation, data logging, and error checking.

Written reports to document the implementation of the plan would be an integral part of monitoring reports. Any variances or exceptions to established sampling or data acquisition methods during monitoring must be documented. Documentation would include a discussion of the significance of data omissions or errors, and measures taken to prevent any occurrences. Reports would be submitted to the appropriate agencies with the annual report, unless otherwise requested.

C.10.8.2 Sample Collection and Data Handling

Collection, storage, and preservation of water samples would be in accordance with EPA procedures (EPA 1982). Grab samples would be collected from streams and springs, and groundwater samples would be obtained using low flow sampling techniques. Samples would be cooled immediately after collection. Metals in water samples must be preserved by adding nitric acid in the field to lower the pH to less than 2.0 or as appropriate to meet standard industry sampling protocols.

Groundwater samples for metal analyses would be field filtered through a 0.45 micron filter to allow measurement of the dissolved constituents. Chemical analysis of water samples must be by procedures described in 40 CFR 136 (EPA 2007), EPA-0600/4-79-020, or methods shown to be equivalent. All field procedures must follow standard sampling protocols as demonstrated through the quality assurance and quality control documentation.

MMC would use a sample control plan, which includes sample identification protocol, the use of standardized field forms to record all field data and activities, protocol for collecting field water quality parameters, and the use of chain-of-custody, sample tracking and analysis request forms. MMC would develop a master file of all field forms and laboratory correspondence. MMC would meet the laboratory method-required holding time for each constituent being analyzed.

MMC would ensure representativeness of samples collected by locating sampling stations in representative areas and by providing quality control samples and analyses. Quality control samples would include blind field standards, field cross-contamination blanks, and replicate samples. Quality control samples would be at a minimum frequency of 1 in 10. In addition, MMC would use EPA-approved laboratories. If revised sampling methods or QA/QC protocols change, MMC would incorporate those as directed by the agencies.

C.10.8.3 Data Reporting

Any reporting required in the MPDES permit would continue as long as there was discharge of any mine drainage or process water to a MPDES-permitted outfall. MMC would submit water quality and flow measurement data to the KNF and DEQ in an electronic format acceptable to the agencies within 10 working days after receipt of final laboratory results. All submitted analytical data would comply with DEQ's minimum reporting requirements for analytical data (DEQ 2009). MMC would develop and maintain an agency-accessible, password-protected website that hosted electronic data. MMC would prepare a report briefly summarizing hydrologic information, sample analysis, and quality assurance/quality control procedures following each sample interval. The report would be posted on MMC's website within 4 weeks after receipt of final laboratory results.

The annual report, summarizing data over the year, would include data tabulations, maps, cross-sections and diagrams needed to describe hydrological conditions. Raw lab reports and field and lab quality results also would be reported. 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, to determine if differences exist:

- Between sampling stations
- Between an upstream benchmark station and the corresponding downstream station
- Between sampling time (monthly, growing season/non-growing season)
- Between stream flow at the time of sampling (for example, low flow during the fall compared to low flow during the winter)
- Between sampling years
- Trend analyses would be included where applicable and/or quantifiable

The annual report would be posted on MMC's website within 90 days after receipt of the final laboratory results for the final quarter of the year. A formal review meeting would be arranged within 2 weeks of MMC submitting the monitoring report to the agencies. The formal review meeting would involve representatives from the reviewing agencies and MMC. The review could result in various outcomes:

- Determine that no change in the monitoring programs or mine operation plans was needed
- Require modifications to the monitoring programs
- Require new treatment or mitigation measures to be implemented as part of the mine project
- Require MMC to implement necessary measures to ensure compliance with applicable laws and regulations

At the end of the first monitoring year and following submittal of the annual report, MMC would meet with the agencies to discuss the monitoring results. Following the annual review, the agencies would decide whether a change in monitoring or operations would be required.

C.11 Aquatic Biology

C.11.1 General Requirements

MMC would conduct aquatic biological monitoring before, during, and after project construction and operation at stream stations that are within and downstream of project disturbance boundaries and at benchmark stations that are upstream of potential influence from the project. At replicate sample locations within each station, multiple parameters that are likely to display small-scale variability and likely to be correlated would be assessed. Replicated sample locations would be selected to be as similar as possible across stations. This sampling design would allow analysis of data using a before-after/control-impact approach, and would allow use of univariate and multivariate statistical methods. This sampling design is intended to identify natural variability and isolate the influence of water quality and fine sediment deposition on stream biota and habitat.

MMC would collect surface water quality samples at each aquatic biological monitoring station during each monitoring period to assist in interpretation of the data. MMC would also conduct salmonid population surveys and salmonid tissue chemistry surveys to provide additional information to assess the influence of the project on stream biota.

C.11.2 Monitoring Locations and Times

MMC would conduct aquatic biological monitoring at seven stations (Table C-16 at the end of this section); Figure C-2; Figure C-4 through Figure C-7). Five stations are within or downstream of the proposed disturbance boundaries. Two stations are upstream of potential project impacts and would serve as benchmark stations. Stream reach length would vary depending on the monitoring task and station.

Monitoring frequency would vary, depending on the monitoring task and station (Table C-17 at the end of this section). Some tasks would be conducted three times annually: prior to runoff from the higher elevations in the spring (typically April or May), during summer (typically early August to September), and prior to ice formation (typically October). Other tasks would be conducted annually during the summer period, or less frequently as described below.

C.11.3 Substrate and Fine Sediments

During the summer monitoring period, percent surface fines would be quantified using a grid sampling device as described in the R1/R4 methodology (Overton et al. 1997) at each quantitative macroinvertebrate sample (Surber sample) location. Embeddedness would be also quantified at each Surber sample location by tallying each stone within the Surber sampler frame that is <50% embedded. Substrate size would be quantified by measuring the narrow dimension of these same stones. By conducting these tasks at the Surber sample locations, the data would provide quantitative measures of substrate at all stations in similar habitat and under similar depth and flow conditions, and would improve the ability to isolate the influence of water quality and fine sediments on benthic macroinvertebrates (see below). Samples would be collected within the shortest reach available that meets the macroinvertebrate sample location criteria (see below).

Also during the summer period, in the fish monitoring reaches (L1, L3, L9, and Be2 see below), the substrate monitoring methods described above would be supplemented with the McNeil Core substrate sampling method. Ten representative core samples would be collected from potential spawning locations in scour pool tail crests and low-gradient riffles within the salmonid population survey reach at each of the four stations. Fewer core samples would be collected if 10 suitable locations are not located within the survey reach.

During all three monitoring periods, DEQ methods for assessing sediment impairment (DEQ 2010b) would be followed at all monitoring stations. These methods would include Wolman pebble counts, grid tosses, measurement of residual pool depth, and pool counts (Wolman 1954, DEQ 2010b). Reach lengths for this monitoring component would be 20 times the bankfull width.

C.11.4 Habitat

Habitat surveys would be conducted annually in the summer in the fish monitoring reaches (L1, L3, L9, and Be2 see below). Fish structures developed as mitigation also would be monitored. Instream habitat data collection would generally follow the R1/R4 methods developed by the FS (Overton et al. 1997). Habitat types within the stream reaches would be identified and measured individually. Measurements at recognized units within each habitat type would include length, wetted width, bank width, average depth, maximum depth, substrate type, type of bank vegetation, percent undercut bank, and percent eroded bank. These habitat measurements are consistent with the Inland Native Fish Strategy (INFS) goals. Additionally, other measurements, such as pool frequency, number of pieces of large woody debris, and lower bank angle, would be recorded to document further attainment of the riparian management objectives set by INFS (USDA Forest Service 1995).

C.11.5 Routine Physical/Chemical Features

MMC would measure the following routine physical and chemical parameters at all aquatic biological monitoring stations during all monitoring periods: stream discharge, air and water temperature, pH, total alkalinity, specific conductance, sulfate, and the metals listed in Table C-10. EPA approved methods or other acceptable methods specified in the monitoring plan would be used.

C.11.6 Benthic Macroinvertebrates

MMC would collect five quantitative samples and one qualitative sample of benthic macroinvertebrates from all aquatic biological monitoring stations during the summer period. Methods used would generally follow the guidelines described in the DEQ's macroinvertebrate sampling protocol (2006) for the collection of quantitative Hess samples and semi-quantitative jab samples. Quantitative samples would be collected using a 500-micrometer mesh Surber sampler rather than a Hess net because Surber samplers have been used by the FWP in Libby Creek beginning in 2000 (Dunnigan et al. 2004). The continued use of the Surber sampler thus would allow for better comparisons with past data. Quantitative samples would be collected from the riffle/run habitats in the stream. Specific sampling locations at each station would be standardized, to the extent possible, for depths between 0.5 and 1.0 feet and flow velocities of less than 1.5 feet per second. MMC would collect the qualitative jab sample with a 500-micrometer mesh net in all microhabitats not sampled during the collection of the quantitative samples, such as aquatic vegetation, snags, and bank margins. Benthic macroinvertebrates collected with the net would be used to provide supplemental information on species composition at the sites and to determine the relative abundance of the taxa inhabiting aquatic habitats at the sampling station.

Parameters analyzed would include density, number of taxa, number of *Ephemeroptera*, *Plecoptera*, and *Trichoptera* (EPT) taxa, number of Ephemeroptera taxa, number of Plecoptera taxa, percent non-insects, percent predators, percent burrower taxa, the EPT index, percent EPT individuals, Shannon-Weaver diversity index, Simpson diversity index, the Hilsenhoff Biotic Index (HBI) and the biotic condition index (BCI). Several of these parameters are among the metrics calculated by the DEQ as part of its data analysis (DEQ 2006) and also allow for the calculation of the Montana multi-metric index for mountain stream (Jessup et al. 2006). The use of other metrics such as evenness, Simpson's diversity index, and the BCI have been recommended by FS personnel to allow for comparisons with previously collected data within this region (Steve Wegner, personal communication, 2006). Additionally, these data would be analyzed using the Observed/Expected (O/E) Model developed for Montana (Jessup et al. 2006). To summarize these data, four common statistical measures would be used (mean, standard deviation, coefficient of variation, and standard error of the mean), plus other appropriate measures (EPA 1990).

Quality assurance for macroinvertebrate data would follow DEQ guideline (DEQ 2005; 2006) and would be conducted randomly on 10 percent of the samples, with 95 percent agreement for taxonomic and count precision required. MMC also would maintain a permanent taxonomic reference collection that contains all benthic species collected from project area streams. Taxa identification in this collection would be documented and confirmed by a qualified, independent macroinvertebrate taxonomist (DEQ 2006). This reference collection would be maintained by MMC through the period of post-operational monitoring. Following this period, the collection would be transferred to a depository selected by the agencies for permanent scientific reference.

C.11.7 Periphyton and Benthic Chlorophyll-a

MMC would sample periphyton and benthic chlorophyll-a at all aquatic biological monitoring stations concurrent with the proposed benthic macroinvertebrate population sampling during the summer period. Qualitative periphtyton would be collected following DEQ's template sampling method (2011a). Quantitative benthic chlorophyll-a samples would be collected following DEQ's template sampling method (2011b). One sample would be collected from each Surber sample location prior to collecting macroinvertebrates (see section C.11.6; Table C-17), for a total of five samples from each monitoring station. In addition, L9 (LB-300) and L3 (LB-1000) would be sampled 3 times per year (approximately July 10, August 10, September 10) to assess if nuisance algal was present. The summer sampling of all sites may suffice for one of the three sampling events at L9 and L3. The sampling method could be modified, with agency approval, to scrub additional delimited areas from the same location if previous sampling efforts had a high percentage of below detection limit results, provided the use of appropriate methods and detection limits.

C.11.8 Salmonid Populations

To determine possible changes in salmonid populations associated with development of the Montanore Project, MMC would monitor salmonid populations in Libby Creek and Bear Creek annually during the summer period. The FWP would complete the monitoring if they were conducting surveys at the approximate locations described below during summer. MMC would conduct the monitoring if the FWP was not already doing so and if the required permits were granted to MMC. If the required permits were not granted for some or all of the salmonid population monitoring, relative fish abundance by species and size class would be determined using the direct enumeration snorkeling technique (Thurow 1994 cited in Overton et al. 1997). Day and night snorkel surveys would be conducted in an upstream direction, using a dive light at night. Fish species and lengths would be documented to the extent practical without capturing fish. Fish counts, species identifications, and length determinations would be tallied for each macrohabitat type in each reach. If portions of reaches were too shallow for snorkeling, they would be surveyed from the banks. Bank surveys would also be conducted to tally young of the year fish.

MMC would monitor salmonid populations in Libby Creek in three stream reaches (L1, L3, L9), and in Bear Creek (Be2) using the following procedures. The stream reach would be blocked by netting at its upstream and downstream limits to prevent fish movement into or out of the sample reach during the sampling. Sampling procedures would include multiple-pass depletion electroshocking to collect salmonids from a 300-yard (or 300-meter) reach of stream. All salmonids would be identified, measured for length, and released. Population densities of each salmonid species captured during the study would be estimated, where adequate sample sizes permit, using a maximum-likelihood model (e.g. Seber and Le Cren 1967, MicroFish 3.0). The condition of all captured salmonids would be recorded following an examination for overt signs of disease, parasites, or other indications of surface damage. Length-frequency data would be analyzed to determine whether species were naturally reproducing in or near the stream reaches. These methods may be modified if FWP conducted the monitoring. A monitoring report would be submitted annually to the KNF, the FWP and the DEQ.

The same salmonid monitoring procedures would be used to monitor salmonid response to fish mitigation projects implemented by MMC. Beginning in the year prior to a fish mitigation project, salmonids would be monitored using the approved methods. In subsequent years (yearly), the mitigation monitoring at each site would be repeated. The salmonid population data from stations L1 and Be2 would be used as controls to assess if observed changes were a natural event.

Similarly, MMC would monitor the recreational use levels at all fishery access sites that were modified for mitigation purposes. Beginning the year before, and extending at least 5 years after implementation, MMC would conduct creel surveys to document use by the targeted users of each access project.

C.11.9 Bioaccumulation of Metals in Fish Tissue

MMC would conduct monitoring studies that measure background concentrations of copper, cadmium, mercury, lead, and zinc in the fish in Libby Creek to provide a basis for comparison in order to document any potential changes in the concentrations of these metals due to construction and operation of the Montanore mine. Fish tissue monitoring would be conducted if the required permits were granted to MMC. If the required permits were not granted for some or all of the fish tissue monitoring, MMC would report the most relevant data that are available for the project area.

Prior to construction and once construction has begun, the FWP or MMC would collect five rainbow trout or rainbow trout hybrids (*Oncorhynchus* sp.) annually from Sites L1, L3, and Be2 for a period of 5 years, with each trout collected being greater than 4 inches in size. Collections would be completed during the summer period, concurrent with the fish population surveys.

Homogenized whole-fish tissue samples would be analyzed to determine copper, cadmium, mercury, zinc and lead concentrations. Thereafter, if no increasing trends in metal concentrations have been identified after the initial 5-year period, MMC would resample each site at a 3-year interval to document any trends in bioaccumulation of these metals. Test procedures would be the same as those used for baseline testing, unless changed by the agencies.

C.11.10 Sampling Trip and Annual Reporting

Within one week of completing biological sampling, MMC would submit a brief report to appropriate review personnel in the DEQ, the KNF, and the FWP. This report would include brief statements about stream conditions observed at each monitoring station and would alert the review personnel to any marked changes in monitoring data relative to the cumulative monitoring record.

On or before March 1 of each year, MMC would submit an annual aquatic monitoring report that contains summaries of all aquatic monitoring data collected during the previous year. Each report also would discuss trends in population patterns and evaluate changes in stream habitat quality, based on all data collected to date for the project. Reference to appropriate scientific literature would be included. Recommendations in these reports can include modifications to increase monitoring efficiency or to provide additional data needs.

C.11.11 Annual Review and Possible Revision of the Monitoring Plan

Within one month after MMC submits the annual report, an annual meeting would be held to review the aquatics monitoring plan and results, and to evaluate possible modifications to the plan. This meeting would include personnel from the DEQ, KNF, FWP, MMC, and other interested parties.

Table C-16. Aquatic Biology Monitoring Stations.

Reach	Nearest Upstream Activities	Station ID (surface water ID)	Station Comments	All Non-fish Monitoring	Fish Population and Habitat	Fish Tissue Metals
Bear Creek						
1	none	Be2 (BC-500)	Upstream benchmark	X	X	X
Poorman Creek						
2	Impoundment	Po1 (PM-1000)	Impact assessment	X		
Libby Creek						
1	Mine dewatering	L10 (LB-200)	Upstream of Upper Libby Adit	X		
2	Libby Adit	L9 (LB-300)	Impact assessment	X	X	
4	Impoundment	L3 (LB1000)	Integrated impact assessment	X	X	X
5	Impoundment	L2 (LB-2000)	Integrated impact assessment	X		
6	All	L1 (LB-3000)	Integrated impact assessment	X	X	X

Table C-17. Aquatic Biology Monitoring.

Task category	Task	Timing			Number of Stations	Method	Replication per Station and Within-Station Locations
		Spring	Summer	Fall			
Benthic Biota	Macroinvertebrates, quantitative		X		all	Surber samples for lab taxonomy	5 sites with most similar microhabitat near station
	Macroinvertebrates, qualitative		X		all	kicknet sample for lab taxonomy	1 sample from all habitats in 100 ft reach that includes Surber sample locations
	Periphyton, quantitative		3X/season X		L9 and L3 all	samples from rock surface for chlorophyll-a determination (DEQ SOP 2011b)	at each of the 5 Surber sites
	Periphyton, qualitative		3X/season X		L9 and L3 all	picking and scraping all varieties for lab taxonomy (DEQ SOP 2011a)	1 sample from all habitats in 100 ft reach that includes Surber sample locations
Habitat	Canopy cover		X		all	densiometer	at each of the 5 Surber sites
	Water velocity		X		all	flow meter at 0.6 m depth	at each of the 5 Surber sites
	Stream discharge	X	X	X	all	velocity-area principle / 0.6 m depth	1 transect at station
	Fish habitat survey		X		4	R1/R4	same 100 yd reach as salmonid survey
Substrate	Embeddedness		X		all	Tally <50% embedded stones	at each of the 5 Surber sites
	Substrate size distribution		X		all	Measure <50% embedded stones	at each of the 5 Surber sites
	Surface fines		X		all	49 point grid	at each of the 5 Surber sites
	Spawning gravel		X		4	McNeil cores for lab analysis and field settling cone	maximum obtainable up to 10 samples within 100 yd salmonid survey reach
	Sediment impairment	X	X	X	all	DEQ 2010b SOP	20 bankfull widths
Water Quality	Conductivity	X	X	X	all	meter	1 measurement at station
	pH	X	X	X	all	meter	1 measurement at station
	Water temperature	X	X	X	all	meter	1 measurement at station
	Water chemistry sample	X	X	X	all	grab sample for comprehensive lab analysis	1 sample at station
Fish	Salmonid population survey		X		4	multiple-pass electrofishing or snorkel	extending from station to 100 yd upstream
	Salmonid tissue metals samples		X		3	*Oncorhynchus* sp. whole-fish Cu, Cd, Hg, Pb, Zn	5 fish per survey reach

C.12 References

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Appendix D—Proposed Environmental Specifications for the 230-kV Transmission Line

STATE OF MONTANA/USDA FOREST SERVICE
ENVIRONMENTAL SPECIFICATIONS FOR MONTANORE 230-KV TRANSMISSION LINE

CONTENTS

DEFINITIONS

ACCESS EASEMENT:	Any land area over which the OWNER has received an easement from a LANDOWNER allowing travel to and from the project. Access easements may or may not include access roads.
ACCESS ROAD:	Any travel course which is constructed by substantial recontouring of land and which is intended to permit passage by most four-wheeled vehicles.
ARM:	Administrative Rules of Montana
BEGINNING OF CONSTRUCTION:	Any project-related earthmoving or removal of vegetation (except for clearing of survey lines).
BOARD:	Montana Board of Environmental Review
CFR	Code of Federal Regulations
CONTRACTOR:	Constructors of the Facility (agent of owner)
DAY	Monday through Friday, excluding all state or federal holidays
DEQ:	Montana Department of Environmental Quality
DNRC:	Montana Department of Natural Resources and Conservation
FWP:	Montana Fish, Wildlife, and Parks
EXEMPT FACILITY:	A facility meeting the requirements of 75-20-202, MCA and accompanying rules.
FS:	United States Department of Agriculture, Forest Service
KNF:	Kootenai National Forest
LANDOWNER:	The owner of private property
MCA	Montana Code Annotated
MDT	Montana Department of Transportation
NFSL:	National Forest System Lands
OWNER:	The owner(s) of the facility, or the owner’s agent.

ROD: Record of Decision

SENSITIVE AREA: Area which exhibits environmental characteristics that may make them susceptible to impact from construction of a transmission facility. The extent of these areas is defined for each project and may include any of the areas listed in Circular MFSA-2, Sections 3.2(1)(d) and 3.4(1).

SHPO: State Historic Preservation Office

SPECIAL USE SITES: All locations other than structure locations and roads needed for the construction, operation, and decommissioning of the transmission line, and shall include, but not be limited to, staging areas, helicopter landing and fueling sites, pulling and tensioning sites, stockpile sites, splicing sites, borrow pits, construction campsites, and storage or other building sites.

INTRODUCTION

The purpose of these specifications is to ensure mitigation of potential environmental impacts during the construction and interim reclamation of the 230-kV transmission facility associated with the proposed Montanore Project. These specifications do not apply to the Sedlak Park substation, loop line, buried 34.5-kV powerline associated with the Montanore Mine, or to the mine itself. All other mine-related disturbances are covered by a Montana Department of Environmental Quality (DEQ) hard rock operating permit and Forest Service (FS) Plan of Operations. These specifications vary from those typically prepared by DEQ for other transmission line facilities because the specifications also incorporate FS requirements. These specifications are intended to be incorporated into the texts of contracts, plans, Plan of Operations, and specifications.

Decommissioning of the transmission line will be covered by the final reclamation and closure plan described in Appendix at the end of this document.

For non-exempt facilities, the Montana Major Facility Siting Act supersedes all state and local government environmental permit requirements. DEQ, however, returns the authority to determine compliance of the proposal facility with state and federal standards for air and water quality standards. State laws for the protection of employees engaged in the construction, operation on maintenance of the proposal facility also remain in effect (Section 75-20-401, MCA).

Appendices at the end of these specifications refer to individual topics of concern and to site-specific concerns. Certain of these Appendices, shall be prepared by the OWNER working in consultation with DEQ and FS prior to the start of construction and submitted for approval by the DEQ and FS. Other Appendices shall be prepared by the DEQ and FS at the time a decision is made whether to approve the project.

GENERAL SPECIFICATIONS

0.1. SCOPE

These specifications apply to all lands affected by the 230-kV transmission line, excluding the Sedlak Substation and loop line and the 34.5-kV power line. As provided in ARM 17.20.1902 (10), the certificate holder may contract with the property owner for revegetation or reclamation if the property owner wants different reclamation standards from (10) (a) applied on the property and that not reclaiming to the standards specified in (10)(a) and (b) would not have adverse impacts on the public and other landowners. Where the LANDOWNER requests practices other than those listed in these specifications, DEQ may authorize such a change provided that the STATE INSPECTOR is notified in writing of the change and that the change will not be in violation of: (1) the Certificate; (2) any conditions imposed by the DEQ or (3) the DEQ's finding of minimum adverse impact; (4) the regulations in ARM 17.20.1701 through 17.20.1706, 17.20.1901, and 17.20.1902.

On private land, these specifications shall be enforced by the STATE INSPECTOR. On NFSL, enforcement shall be the joint responsibility of the STATE INSPECTOR and the KNF INSPECTOR.

0.2. ENVIRONMENTAL PROTECTION

The OWNER shall conduct all operations in a manner to protect the quality of the environment.

0.3. CONTRACT DOCUMENTS

It is the OWNER'S responsibility to ensure compliance with these specifications. If appropriate, these specifications can be part of or incorporated into contract documents to ensure compliance; in any case, the OWNER is responsible for its agent's adherence to these specifications in performing the work.

0.4. BRIEFING OF EMPLOYEES

The OWNER shall ensure that the CONTRACTOR and all field supervisors are provided with a copy of these specifications and informed of the applicability of individual sections to specific procedures. It is the responsibility of the OWNER to ensure its CONTRACTOR and CONTRACTOR's Construction Supervisors comply with these measures. The OWNER'S Project Supervisor shall ensure all employees are informed of the applicable environmental specifications discussed herein prior to and during construction. Site-specific measures provided in the appendices attached hereto shall be incorporated into the design and construction specifications or other appropriate contract document. The OWNER shall have regular contact and site supervision to ensure compliance is maintained.

0.5. COMPLIANCE WITH REGULATIONS

All project-related activities of the OWNER shall comply with all applicable local, state, and federal laws, regulations, and requirements that are not superseded by the Major Facility Siting Act.

0.6. LIMITS OF LIABILITY

The OWNER is not responsible for correction of environmental damage or destruction of property caused by negligent acts of DEQ or FS employees during construction, operation maintenance, decommissioning, and reclamation of the proposal project.

0.7. DESIGNATION OF SENSITIVE AREAS

DEQ and FS, in their evaluation of the transmission line, have designated certain areas along the right-of-way or access roads as SENSITIVE AREAS as indicated in Appendix A. The OWNER shall take all reasonable actions including the measures listed in Appendix A to avoid adverse impacts in these SENSITIVE AREAS.

0.8. PERFORMANCE BONDS

To ensure compliance with these specifications, prior to any ground disturbing activity, the OWNER shall submit a BOND ("TRANSMISSION LINE CONSTRUCTION AND RECLAMATION BOND") to the State of Montana or its authorized agent pertaining specifically to the reclamation of designated access roads, special use areas, and adjacent land disturbed during construction (Appendix B). The TRANSMISSION LINE CONSTRUCTION AND RECLAMATION BOND shall be held to ensure cleanup and construction reclamation are complete and revegetation is proceeding satisfactory. At the time cleanup and construction reclamation are complete and revegetation is proceeding satisfactory, the OWNER shall be released from its obligation for transmission line construction reclamation and the TRANSMISSION LINE CONSTRUCTION AND RECLAMATION BOND shall be released.

Concurrently, the OWNER shall submit a separate BOND ("JOINT DECOMMISSIONING BOND") to the DEQ and FS pertaining specifically to monitoring, decommissioning of the transmission line and reclamation follow decommissioning. The JOINT DECOMMISSIONING BOND shall be subject to the FS and DEQ bond release provisions as outlined in the Reclamation Plan approved by the FS and DEQ. The approved Reclamation Plan shall contain reclamation standards as stringent as those found in ARM 17.20.1902(10).

0.9. DESIGNATION OF STRUCTURES

Each structure for the transmission line shall be designated by a unique number on plan and profile maps and referenced consistently. Any reference to specific poles or structures in the Appendices shall use these numbers. If this information is not available because the survey is not complete, station numbers or mileposts shall indicate locations along the centerline. Station numbers or mileposts of all angle points shall be designated on plan and profile maps.

0.10. ACCESS

When easements for construction access are obtained for construction personnel, provision shall be made by the OWNER to ensure that DEQ will be allowed access to the special use areas, right-of-way, and to any off-right-of-way access roads. Where such easements are obtained on private land to provide access to NFSL, such provisions shall also be made for the KNF INSPECTOR. Liability for damage caused by providing such access for the STATE INSPECTOR or KNF INSPECTOR shall be limited by section 0.6 LIMITS OF LIABILITY.

0.11. DESIGNATION OF STATE INSPECTOR AND KNF INSPECTOR

DEQ shall designate a STATE INSPECTOR or INSPECTORS to monitor the OWNER'S compliance with these specifications and any other project–specific mitigation measures adopted by DEQ as provided in ARM 17.20.1901 through 17.20.1902. The FS shall designate a KNF INSPECTOR or INSPECTORS to monitor the OWNER'S compliance with the Plan of Operations for activities on NFSL. The STATE INSPECTOR shall be the OWNER's liaison with the State of Montana on construction, post-construction, and construction reclamation activities for the certified transmission line on all lands. The KNF INSPECTOR and the STATE INSPECTOR shall coordinate lead roles for construction, post-construction, and reclamation activities for the certified transmission line on NFSL. All communications regarding the project shall be directed to the STATE INSPECTOR and on NFSL, to the KNF INSPECTOR and STATE INSPECTOR. The names of the INSPECTORS are in Appendix C.

1.0. PRECONSTRUCTION PLANNING AND COORDINATION

1.1. PLANNING

1.1.1. Planning of all stages of construction and maintenance activities is essential to ensure that construction-related impacts shall be kept to a minimum. The CONTRACTOR and OWNER shall, to the extent possible, plan the timing of construction, construction and maintenance access requirements, location of special use areas, and other details before the commencement of construction.

1.1.2. At least 45 days before the start of construction, the OWNER shall submit plan and profile map(s), both on paper and an electronic equivalent agreed to by the DEQ and FS, to DEQ and the FS depicting the location of the centerline and of all construction access roads, maintenance access roads, structures, clearing back lines, and, to the extent known, special use sites. The scale of the map shall be 1:24,000 or larger. Specifications and typical sections for construction and maintenance access roads shall be submitted with the plan and profile maps(s). When these materials are submitted, access road locations shall have been flagged on the ground for review by the KNF and STATE INSPECTORS.

1.1.3. At least 45 days before the start of construction, constructing or reconstructing roads, the OWNER shall submit a Road Management Plan to the FS and DEQ. This plan shall detail the specific location of all roads that need to be opened, constructed, or reconstructed. The OWNER must receive written approval of the plan from the FS and DEQ prior to gaining access on any closed road or beginning any surface disturbing activity. This plan, once approved, shall be incorporated into Appendix D.

1.1.4. If special use areas are not known at the time of submission of the plan and profile, the following information shall be submitted no later than 5 days prior to the start of construction. The location of special use areas shall be plotted on one of the following and submitted to the KNF and STATE INSPECTORS: ortho-photomosaics of a scale 1:24,000 or larger, or available USGS 7.5' plan and profile maps of a scale 1:24,000 or larger, and an electronic equivalent agreed to by the DEQ and FS.

1.1.5. Changes or updates to the information submitted in 1.1.2 through 1.1.4 shall be submitted to the DEQ and FS for approval as they become available. In no case shall a change be submitted less than 5 days prior to its anticipated date of construction. Where changes affect designated SENSITIVE AREAS, these changes must be submitted to DEQ and FS 15 days before construction and approved by the STATE INSPECTOR on all lands and the KNF on FS lands prior to construction.

1.2. PRECONSTRUCTION CONFERENCE

1.2.1. At least one week before commencement of any construction activities, the OWNER shall schedule a preconstruction conference with DEQ and the FS. The KNF and STATE INSPECTORS shall be notified of the date and location for this meeting.

1.2.2. The OWNER's representative, the CONTRACTOR's representative, the designated INSPECTORS, and representatives of affected state and federal agencies who have land management or permit and easement responsibilities shall be invited to attend the preconstruction conference.

1.3. PUBLIC CONTACT

1.3.1. Written notification by the OWNER's field representative or the CONTRACTOR shall be given to local public officials in each affected community prior to the beginning of construction to provide information on the temporary increase in population, when the increase is expected, and where the workers will be stationed. If local officials require further information, the OWNER shall hold meetings to discuss potential temporary changes. Officials contacted shall include the county commissioners, city administrators, and law enforcement officials. It is also suggested that local fire departments, emergency service providers, and a representative of the Chamber of Commerce be contacted.

1.3.2. The OWNER shall negotiate with the LANDOWNER in determining the best location for access easements and the need for gates.

1.3.3. The OWNER shall contact local government officials, MDT, or the managing agency, as appropriate, regarding implementation of required traffic safety measures.

1.4. PRECONSTRUCTION SURVEYS

1.4.1. The OWNER shall complete prior to construction an archaeological survey of all NFSL and State land proposed for surface disturbance associated with transmission line construction. A similar survey on private land shall be coordinated with the LANDOWNER and be completed, if allowed by the LANDOWNER, before any land-disturbing activities occur. In addition, the OWNER shall develop a plan approved by the DEQ and FS that includes steps to be taken when sites are discovered during construction activities and describes the measures to be taken to identify, evaluate, and avoid or mitigate damage to cultural resources affected by the project. The plan (Appendix E) shall include: (1) actions taken to identify cultural resources during initial intensive survey work; (2) an evaluation of the significance of the identified sites and likely impacts caused by the project; (3) recommended treatments or measures to avoid or mitigate damage to known cultural sites; (4) steps to be taken in the event other sites are identified after approval of the plan; and (5) provisions for monitoring construction to protect cultural resources. Except for monitoring, all steps of the plan must be carried out prior to the start of construction in an area. The requirements for this plan should not be construed to exempt or alter compliance by the OWNER or managing agency with 36 CFR 800. However, compliance with 36 CFR 800 can be used to satisfy the requirements included in this section.

1.4.2. The OWNER shall complete a survey for threatened, endangered, or Forest sensitive plant species on NFSL for any areas where such surveys have not been completed and that will be disturbed by transmission line construction. Similarly, the OWNER, in coordination with the DNRC and LANDOWNER, and if allowed by the LANDOWNER on private lands, shall conduct surveys in habitat suitable for threatened, endangered, and state-listed plant species potentially occurring on non-NFSL lands. The surveys shall be submitted to the DEQ and FS for approval. If adverse effects could not be avoided, OWNER shall develop appropriate mitigation plans for agency approval. The mitigation shall be implemented before any ground-disturbing activities.

1.4.3. The OWNER shall complete a jurisdictional wetland delineation of all areas proposed for ground disturbance associated with the transmission line, including all stream crossings by roads. The delineation would be submitted to the U.S. Army Corps of Engineers for a jurisdictional determination. If discharge of dredge or fill material into waters of the U.S. can not be avoided, OWNER shall develop appropriate mitigation plans for Corps, FS, and DEQ approval. The mitigation shall be implemented before any ground-disturbing activities. All conditions associated with a 404 permit shall be incorporated into these specifications.

1.4.4. The OWNER shall either 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 or implement timing restrictions listed in Appendix I. Surveys would be conducted between March 15 and April 30, one nesting season immediately prior to transmission line construction.

2.0 CONSTRUCTION

2.1. GENERAL

2.1.1. The preservation of the natural landscape contours and environmental features shall be an important consideration in the location of all construction facilities, including roads and special use areas. Construction of these facilities shall be planned and conducted so as to minimize destruction, scarring, or defacing of the natural vegetation and landscape. Any necessary earthmoving shall be planned and designed to be as compatible as possible with natural landforms.

2.1.2. Temporary special use areas shall be the minimum size necessary to perform the work. Such areas shall be located where most environmentally compatible, considering slope, fragile soils or vegetation, and risk of erosion. After construction, these areas shall be reclaimed as specified in Section 3.0 of these specifications unless a specific exemption is authorized in writing by the STATE INSPECTOR. On NFSL, these areas shall be reclaimed as specified in Section 3.0 of these specifications unless a specific exemption is authorized in writing by the KNF and STATE INSPECTORS.

2.1.3. All work areas shall be maintained in a neat, clean, and sanitary condition at all times. Trash or construction debris (in addition to solid wastes described in section 2.14) shall be regularly removed during the construction and reclamation periods.

2.1.4. In areas where mixing of soil horizons would lead to a significant reduction in soil productivity, increased difficulty in establishing permanent vegetation, or an increase in weeds, mixing of soil horizons shall be avoided insofar as possible. This may be done by removing and stockpiling topsoil, where practical, so that it may be spread over subsoil during site reclamation.

2.1.5. Vegetation such as trees, plants, shrubs, and grass on or adjacent to the right-of-way that does not interfere with the performance of construction work or operation of the line itself shall be preserved. The Vegetation Removal and Disposition Plan (Appendix F) shall identify the specific areas where vegetation will be removed or retained to minimize impacts from the construction and operation of the transmission line. This plan must be approved by the inspectors in their areas of jurisdiction prior to construction.

2.1.6. The OWNER shall take all necessary actions to avoid adverse impacts to SENSITIVE AREAS listed in Appendix A and implement the measures listed in Appendix A in these areas. The STATE INSPECTOR shall be notified 5 days in advance of initial clearing or construction activity in these areas. In addition the KNF INSPECTOR shall be notified 5 days in advance of initial clearing or construction activity on NFSL in these areas. The OWNER shall mark or flag the clearing backlines and limits of disturbance in certain SENSITIVE AREAS as designated in Appendix A. All construction activities must be conducted within this marked area.

2.1.7. The OWNER shall either acquire appropriate land rights or provide compensation for damage for the land area disturbed by construction. The width of the area disturbed by construction shall not exceed a reasonable distance from the centerline as necessary to perform the work. For this project, construction activities except access road construction and use of special use areas shall be contained within the area specified in Appendix G.

2.1.8. Flow in a stream course may not be permanently diverted. If temporary diversion is necessary for culvert installation, flow shall be restored immediately after culvert installation, as determined by the STATE INSPECTOR on all lands, and KNF INSPECTOR on NFSL.

2.2. CONSTRUCTION MONITORING

2.2.1. The STATE INSPECTOR is responsible for implementing the compliance monitoring required by ARM 17.20.1902. The STATE and KNF INSPECTORS are responsible for implementing the compliance monitoring on NFSL. The plan specifies the type of monitoring data and activities required and terms and schedules of monitoring data collection, and assigns responsibilities for data collection, inspection reporting, and other monitoring activities. It is attached as Appendix H.

2.2.2. The INSPECTORS, the OWNER, and the OWNER'S agents shall attempt to rely upon a cooperative working relationship to reconcile potential problems relating to construction in SENSITIVE AREAS and compliance with these specifications. When construction activities cause excessive environmental impacts due to seasonal field conditions or damage to sensitive features, the designated INSPECTORS shall talk with the OWNER about possible mitigating measures or minor construction rescheduling to avoid these impacts and may impose additional mitigating measures. The INSPECTORS shall be prepared to provide the OWNER with written documentation of the reasons for the additional mitigating measures within 24 hours of their imposition. All parties shall attempt to adequately identify and address these areas and planned mitigation, to the extent practicable, during final design to minimize conflicts and delays during construction activities.

2.2.3. The INSPECTORS may require mitigating measures or procedures at some sites beyond those listed in Appendix A in order to minimize environmental damage due to unique circumstances that arise during construction, such as unanticipated discovery of a cultural site. The KNF INSPECTOR may require additional mitigating measures on NFSL. The INSPECTORS shall follow procedures described in the monitoring plan when such situations arise.

2.2.4. In the event that the STATE INSPECTOR shows reasonable cause that compliance with these specifications is not being achieved, and the OWNER has not taken reasonable efforts to remediate the situation, DEQ shall take corrective action as described in 75-20-408, MCA. In the event that the KNF INSPECTOR shows reasonable cause that compliance with these specifications is not being achieved, FS shall implement measures described in 36 CFR 228.7(b).

2.3. TIMING OF CONSTRUCTION

2.3.1. Construction and motorized travel may be restricted or prohibited at certain times of the year in certain areas. Exemptions to these timing restrictions may be granted by DEQ and FS in writing if the OWNER can clearly demonstrate that no significant environmental impacts would occur as a result. These areas are listed in Appendix I.

2.3.2. In order to prevent rutting and excessive damage to vegetation, construction shall not take place during periods of high soil moisture when construction vehicles would cause severe rutting deeper than 4 inches requiring extensive reclamation.

2.4. PUBLIC SAFETY

2.4.1. All construction activities shall be done in compliance with existing health and safety laws.

2.4.2. Requirements for aeronautical hazard marking shall be determined by the OWNER in consultation with the Montana Aeronautical Division, the FAA, and the DEQ, and FS. These requirements are listed in Appendix J. Where required, aeronautical hazard markings shall be installed at the time the wires are strung, according to the specifications listed in Appendix J.

2.4.3. Noise levels shall not exceed established DEQ standards as a result of operation of the facility and associated facilities. For electric transmission facilities, the average annual noise levels, as expressed by an A-weighted day-night scale (Ldn) shall not exceed 50 decibels at the edge of the right-of-way in residential and subdivided areas unless the affected LANDOWNER waives this condition.

2.4.4. The facility shall be designed, constructed, and operated to adhere to the National Electrical Safety Code regarding transmission lines.

2.4.5. The electric field at the edge of the right-of-way shall not exceed 1 kilovolt per meter measured 1 meter above the ground in residential or subdivided areas unless the affected LANDOWNER waives this condition, and that the electric field at road crossings under the facility shall not exceed 7 kilovolts per meter measured 1 meter above the ground.

2.5. PROTECTION OF PROPERTY

2.5.1. Construction operations shall not take place over or upon the right-of-way of any railroad, public road, public trail, or other public property until negotiations and/or necessary approvals have been completed with the LANDOWNER or FS, and on lands subject to a conservation easement, FWP. Designated roads and trails as listed in Appendix A and Appendix D shall be protected and kept open for public use. Where it is necessary to cross a trail with access roads, the trail corridor shall be restored. Adequate signing and/or blazes shall be established so the user can find the route. All roads and trails designated by any government agency as needed for fire protection or other purposes shall be kept free of logs, brush, and debris resulting from operations under this agreement. Any such road or trail damaged by project construction or maintenance shall be promptly restored to its original condition.

2.5.2. Reasonable precautions shall be taken to protect, in place, all public land monuments and private property corners or boundary markers. If any such land markers or monuments are destroyed, the marker shall be reestablished and referenced in accordance with the procedures outlined in the "Manual of Instruction for the Survey of the Public Land of the United States" or, in the case of private property, the specifications of the county engineer. Reestablishment of survey markers shall be at the expense of the OWNER.

2.5.3. Construction shall be conducted so as to prevent any damage to existing real property including transmission lines, distribution lines, telephone lines, railroads, ditches, and public roads crossed. If such property is damaged during construction, operation, or decommissioning, the OWNER shall repair such damage immediately to a reasonably satisfactory condition in consultation with the property owner. The LANDOWNER shall be compensated for any losses to personal property due to construction, operation, or decommissioning activities.

2.5.4. In areas with livestock, the OWNER shall make a reasonable effort to comply with the reasonable requests of LANDOWNERS regarding measures to control livestock. Unless requested by a LANDOWNER, care shall be taken to ensure that all gates are closed after entry or exit. Gates shall be inspected and repaired when necessary during construction and missing padlocks shall be replaced. The OWNER shall ensure that gates are not left open at night or during periods of no construction activity unless other requests are made by the LANDOWNER. Any fencing or gates cut, removed, damaged, or destroyed by the OWNER shall immediately be replaced with new materials. Fences installed shall be of the same height and general type as the fence replaced or nearby fence on the same property, and shall be stretched tight with a fence stretcher before stapling or securing to the fence post. Temporary gates shall be of sufficiently high quality to withstand repeated opening and closing during construction, to the satisfaction of the LANDOWNER.

2.5.5. The OWNER must notify the STATE INSPECTOR, KNF INSPECTOR and, if possible, the affected LANDOWNER within 2 days of damage to land, crops, property, or irrigation facilities, contamination or degradation of water, or livestock injury caused by the CONTRACTOR and/or the OWNER's activities, and the OWNER shall reasonably restore any damaged resource and/or replace where applicable damaged property. The OWNER shall provide reasonable compensation for damages to the affected LANDOWNER.

2.5.6. Pole holes and anchor holes must be covered or fenced in any fields, pastures, or ranges being used for livestock grazing or where a LANDOWNER's requests can be reasonably accommodated.

2.5.7. When requested by the LANDOWNER, all fences crossed by permanent access roads shall be provided with a gate. All fences to be crossed by access roads shall be braced before the fence is cut. Fences not to be gated should be restrung temporarily during construction and restrung permanently within 30 days following construction, subject to the reasonable desires of the LANDOWNER.

2.5.8. Where new access roads cross fence lines, the OWNER shall make reasonable effort to accommodate the LANDOWNER's wishes on gate location and width.

2.5.9. Any breaching of natural barriers to livestock movement by construction activities shall require fencing sufficient to control livestock.

2.6. TRAFFIC CONTROL

2.6.1. At least 30 days before any construction within or over any state or federal highway right-of-way or paved secondary highway for which MDT has maintenance, the OWNER shall notify the appropriate MDT field office to review the proposed occupancy and to obtain appropriate permits and authorizations. The OWNER must supply DEQ and FS with documentation that this consultation has occurred. This documentation shall include any measures recommended by MDT that apply to state highways and to what extent the OWNER has agreed to comply with these measures. In the event that recommendations or regulations will not be followed, DEQ shall resolve any disputes regarding state highways.

2.6.2. In areas where the construction creates a hazard, traffic shall be controlled according to the applicable MDT regulations. Safety signs advising motorists of construction equipment shall be placed on major state highways, as recommended by MDT. The installation of proper road signing shall be the responsibility of the OWNER.

2.6.3. The managing agency shall be notified, as soon practicable, when it is necessary to close public roads to public travel for short periods to provide safety during construction.

2.6.4. Construction vehicles and equipment shall be operated at speeds safe for existing road and traffic conditions.

2.6.5. Traffic delays shall be restricted on primary access routes, as determined by MDT on state or federal highways or FS on its roads.

2.6.6. Access for fire and emergency vehicles shall be provided for at all times.

2.6.7. Public travel through and use of active construction areas shall be limited at the discretion of the managing agency.

2.7. ACCESS ROADS AND VEHICLE MOVEMENT

2.7.1. Construction of new roads shall be the minimum reasonably required to construct and maintain the facility in accordance with the Road Management Plan in Appendix D. National Forest System, State, county, and other existing roads shall be used for construction access wherever possible. The location of access roads and structures shall be established in consultation with affected LANDOWNERS and LANDOWNER concerns shall be accommodated where reasonably possible and not in contradiction to these specifications or other appropriate FS and DEQ conditions.

2.7.2. All new roads, both temporary and permanent, shall be constructed with the minimum possible clearing and soil disturbance to minimize erosion, as specified in Section 2.11 of these specifications.

2.7.3. Where practical, all roads shall be initially designed to accommodate one-way travel of the largest piece of equipment that would be required to use them; road width shall be no wider than necessary.

2.7.4. Roads shall be located as approved in the Road Management Plan (Appendix D). Travel outside the right-of-way to enable traffic to avoid cables and conductors during conductor stringing shall be kept to the minimum possible. Road crossings of the right-of-way shall be near support structures to the extent feasible.

2.7.5. Helicopter construction techniques shall be used as specified on Figure F-6 of the draft EIS. Helicopter stringing shall also be used on the line. Where overland travel routes are used, they shall not be graded or bladed unless necessary and shall be flagged or otherwise marked to show their location and to prevent travel off the overland travel route. Where temporary roads are required, they shall be constructed on the most level land available.

2.7.6. In order to minimize soil disturbance and erosion potential, cutting and filling for access road construction shall be kept to a minimum to the extent practicable, in areas of up to 5 percent side slope. In areas of over 5 percent side slope, roads shall be constructed to prevent channeling of runoff.

2.7.7. The OWNER shall complete the measures necessary so the KNF could place all new roads constructed for the transmission line on NFSL into intermittent stored service. Such requirements are described in Appendix D. The OWNER shall restrict access to closed roads during construction. Closure devices shall be reinstalled following construction on existing closed roads. The OWNER shall cooperate with the LANDOWNER regarding private lands and the DNRC on State lands to develop a similar approach to meet the LANDOWNER's land use requirements while minimizing environmental impacts.

2.7.8. Any damage to existing private roads, including rutting, resulting from project construction, operation, or decommissioning shall be repaired and restored to a condition as good or better than original as soon as possible. Repair and restoration of roads shall be accomplished during and following construction as necessary to reduce erosion.

2.7.9. Any necessary snow removal shall be done in a manner to preserve and protect roads, signs, and culverts, to ensure safe and efficient transportation, and to prevent excessive erosion damage to roads, streams, and adjacent land. All snow removal shall be done in compliance with INFS standards.

2.7.10. At least 30 days prior to construction of a new access road approach intersecting a state or federal highway, or of any structure encroaching upon a highway right-of-way, the OWNER shall submit to MDT a plan and profile map showing the location of the proposed construction. At least five days prior to construction, the OWNER shall provide the designated INSPECTORS written documentation of this consultation and actions to be taken by the OWNER as provided in 2.6.1.

2.8. EQUIPMENT OPERATION

2.8.1. During construction, unauthorized cross-country travel and the development of roads other than those approved shall be prohibited. The OWNER shall be liable for any damage, destruction, or disruption of private property and land caused by his construction personnel and equipment as a result of unauthorized cross-country travel and/or road development.

2.8.2. To prevent excessive soil damage in areas where a graded roadway has not been constructed, the limits and locations of access for construction equipment and vehicles shall be clearly marked or specified at each new site before any equipment is moved to the site. CONTRACTOR personnel shall be well versed in recognizing these markers and shall understand the restriction on equipment movement that is involved.

2.8.3. Dust control measures on all roads used for construction shall be implemented in accordance with DEQ's air quality permit and the KNF's Plan of Operations. Where requested by residents living within 500 feet of the line, the OWNER shall control dust created by transmission line construction activities. Oil or similar petroleum-derivatives shall not be used to control dust.

2.8.4. Work crew foremen shall be qualified and experienced in the type of work being accomplished by the crew they are supervising. Earthmoving equipment shall be operated only by qualified, experienced personnel. Correction of environmental damage resulting from operation of equipment by inexperienced personnel shall be the responsibility of the OWNER. Repair of damage to a condition reasonably satisfactory to the LANDOWNER, FS, or if necessary, DEQ, shall be required.

2.8.5. Sock lines or pulling lines shall be strung using a helicopter to minimize disturbance of soils and vegetation.

2.8.6. Following construction in areas designated by the local weed control board, DEQ, or FS on NFSL as a noxious weed areas, the CONTRACTOR shall thoroughly clean all vehicles and equipment to remove weed parts and seeds immediately prior to leaving the area. Such areas are shown in Appendix K.

2.9. RIGHT-OF-WAY CLEARING AND SITE PREPARATION

2.9.1. The STATE INSPECTOR shall be notified at least 10 days prior to any vegetation clearing; the STATE INSPECTOR and KNF shall be notified at least 10 days prior to any vegetation clearing on NFSL. The STATE INSPECTOR shall be responsible for notifying the DNRC Forestry Division. All vegetation clearing shall be conducted in accordance with the Vegetation Removal and Disposition Plan (Appendix F).

2.9.2. Right-of-way clearing shall be kept to the minimum necessary to meet the requirements of the National Electrical Safety Code. Clearing shall produce a "feathered edge" right-of-way configuration, where only specified hazard trees and those that interfere with construction or conductor clearance are removed. Trees to be saved within the clearing back lines and danger trees located outside the clearing back lines shall be marked. Clearing back lines in SENSITIVE AREAS shall be indicated on plan and profile maps. All snags and old growth trees that do not endanger the line or maintenance equipment shall be preserved. In designated SENSITIVE AREAS, the INSPECTORS may approve clearing measures and boundaries that vary from the design plan prior to clearing.

2.9.3. During clearing of survey lines or the right-of-way, small trees and shrubs shall be preserved to the greatest extent possible in accordance with the Vegetation Removal and Disposition Plan and in compliance with the National Electrical Safety Code. Shrub removal shall be limited to crushing where necessary. Plants may be cut off at ground level, leaving roots undisturbed so that they may re-sprout.

2.9.4. In no case shall the cleared width be greater than that described in the Vegetation Removal and Disposition Plan and the National Electrical Safety Code, unless approved by the INSPECTORS on NFSL and the State INSPECTOR and LANDOWNER on State and private land.

2.9.5. Soil disturbance and earth moving shall be kept to a minimum.

2.9.6. The OWNER shall be held liable for any unauthorized cutting, injury or destruction to timber whether such timber is on or off the right-of-way.

2.9.7. Unless otherwise requested by the LANDOWNER or FS, felling shall be directional in order to minimize damage to remaining trees. Maximum stump height shall be no more than 8 inches or less above the existing grade. Trees shall not be pushed or pulled over. Stumps shall not be removed unless they conflict with a structure, anchor, or roadway.

2.9.8. Crane landings shall be constructed on level ground unless extreme conditions (such as soft or marshy ground) make other construction necessary. In areas where more than one crane landing per structure site is built, the STATE INSPECTOR shall be notified at least 5 days prior to the beginning of construction at those sites.

2.9.9. No motorized travel on, scarification of, or displacement of talus slopes shall be allowed except where approved by the STATE INSPECTOR on all lands, the KNF INSPECTOR on NFSL, and LANDOWNER.

2.9.10. To avoid unnecessary ground disturbance, counterpoise should be placed or buried in disturbed areas whenever possible.

2.9.11. Slash resulting from project clearing that may be washed out by high water the following spring shall be removed and piled outside the floodplain before runoff. Any instream slash resulting from project clearing to be removed shall be removed within 24 hours. OWNER shall leave large woody material for small mammals and other wildlife species within the cleared area on NFSL.

2.9.12. Use of heavy equipment to clear and remove vegetation in riparian areas shall be minimized.

2.10. GROUNDING

2.10.1 Grounding of fences, buildings, and other structures on and adjacent to the right-of-way shall be done according to the specifications of the National Electrical Safety Code.

2.11. EROSION AND SEDIMENT CONTROL

2.11.1. Clearing and grubbing for roads and rights-of-way and excavations for stream crossings shall be carefully controlled to minimize silt or other water pollution downstream from the rights-of-way. At a minimum, erosion control measures described in the OWNER's Storm Water Pollution Prevention Plan and INFS standards shall be implemented as appropriate following the review of the plan and profile map(s) required under Section 0.9 and 1.1.2.

2.11.2. Roads shall cross drainage bottoms at sharp or nearly right angles and level with the stream bed whenever possible. Temporary bridges, fords, culverts, or other structures to avoid stream bank damage shall be installed.

2.11.3. Under no circumstances shall stream bed materials be removed for use as backfill, embankments, road surfacing, or for other construction purposes.

2.11.4. No excavations shall be allowed on any river or perennial stream channels or floodways at locations likely to cause detrimental erosion or offer a new channel to the river or stream at times of flooding.

2.11.5. Installation of culverts, bridges, fords, or other structures at perennial stream crossings shall be done as specified by the INSPECTORS following on-site inspections conducted by the STATE INSPECTOR. The STATE INSPECTOR shall invite the OWNER, landowner, FWP, and local conservation districts to participate in these inspections. Installation of culverts or other structures in a water of the United States shall be in accordance with the U.S. Army Corps of Engineers 404. Activities affecting water of the State of Montana shall be in accordance with DEQ 318 permit conditions. All culverts shall be sized according to Revised Hydraulic Guide Kootenai National Forest (1990) and amendments. Where new culverts are installed, they shall be installed with the culvert inlet and outlet at natural stream grade or ground level. Water velocities or positioning of culverts shall not impair fish passage. Stream crossing structures need to be able to pass the 100 year flow event.

2.11.6. Following submittal of a plan and profile maps, but prior to construction of access roads, bridges, fill slopes, culverts, impoundments, or channel changes within the high-water mark of any perennial stream, lake, or pond, the OWNER shall discuss proposed activities with the STATE INSPECTOR, FWP, local conservation district, and KNF personnel. This site review shall determine the specific mitigation measures to minimize impacts appropriate to the conditions present. These measures shall be added to Appendix A by the STATE INSPECTOR and as appropriate by the KNF INSPECTOR.

2.11.7. No blasting shall be allowed in streams. Blasting may be allowed near streams if precautions are taken to protect the stream from debris and from entry of nitrates or other contaminants into the stream. No blasting debris shall be placed into a water of the United States without a U.S. Army Corps of Engineers 404 and DEQ 318 permit.

2.11.8. The OWNER shall maintain roads on private lands while using them. All ruts made by machinery shall be filled or graded to prevent channeling. In addition, the OWNER must take measures to prevent the occurrence of erosion caused by wind or water during and after use of these roads. Some erosion-preventive measures include but are not limited to, installing or using cross-logs, drain ditches, water bars, and wind erosion inhibitors such as water, straw, gravel, or combinations of these. Erosion control shall be accomplished as described in the OWNER's General Stormwater Permit (or MPDES Permit) and the Storm Water Pollution Prevention Plan.

2.11.9. The OWNER shall prevent material from being deposited in any watercourse or stream channel. Where necessary, measures such as hauling of fill material, construction of temporary barriers, or other approved methods shall be used to keep excavated materials and other extraneous materials out of watercourses. Any such materials entering watercourses shall be removed immediately.

2.11.10. The OWNER shall be responsible for the stability of all embankments created during construction. Embankments and backfills shall contain no stream sediments, frozen material, large roots, sod, or other materials that may reduce their stability.

2.11.11. No fill material other than that necessary for road construction shall be piled within the high water zone of streams where floods can transport it directly into the stream. Excess floatable debris shall be removed from areas immediately above crossings to prevent obstruction of culverts or bridges during periods of high water.

2.11.12. No skidding of logs or driving of vehicles across a perennial watercourse shall be allowed, except via authorized construction roads.

2.11.13. Skidding with tractors shall not be permitted within 100 feet of streams containing flowing water except in places designated in advance, and in no event shall skid roads be located on these stream courses. Skid trails shall be located high enough out of draws, swales, and valley bottoms to permit diversion of runoff water to natural undisturbed forest ground cover.

2.11.14. Construction methods shall prevent accidental spillage of solid matter, contaminants, debris, petroleum products, and other objectionable pollutants and wastes into watercourses, lakes, and underground water sources. Secondary containment catchment basins capable of containing the maximum accidental spill shall be installed at areas where fuel, chemicals or oil are stored. Any accidental spills of such materials shall be cleaned up immediately.

2.11.15. To reduce the amount of sediment entering streams, vegetation clearing in Riparian Habitat Conservation Areas on NFSL and other riparian areas on private lands shall be conducted in accordance with the Vegetation Removal and Disposition Plan and the Storm Water Pollution Prevention Plan, to be submitted for approval by the DEQ and the FS.

2.11.16. Damage resulting from erosion or other causes from construction activities and disturbance areas shall be repaired after completion of grading and before revegetation is begun.

2.11.17. Stormwater discharge of water shall be dispersed in a manner to avoid erosion or sedimentation of streams as required in DEQ permits.

2.11.18. Riprap or other erosion control activities shall be planned based on possible downstream consequences of activity, and installed during the low flow season if possible. Timing restrictions are presented in Appendix I.

2.11.19. Water used in embankment material processing, aggregate processing, concrete curing, foundation and concrete lift cleanup, and other wastewater processes shall not be discharged into surface waters without a valid discharge permit from DEQ.

2.12. ARCHAEOLOGICAL, HISTORICAL, AND PALEONTOLOGIC RESOURCES

2.12.1. All construction activities shall be conducted so as to prevent damage to significant archaeological, historical, or paleontological resources, in accordance with the requirements of 1.4.1 and Appendix E.

2.12.2. Any relics, artifacts, fossils or other items of historical, paleontological, or archaeological value shall be preserved in a manner agreeable to both the LANDOWNER and the SHPO. If any such items are discovered during construction, SHPO shall be notified immediately. If any such items are discovered on NFSL during construction, the FS Archaeologist shall also be notified immediately. Work which could disturb the materials or surrounding area must cease until the site can be properly evaluated by a qualified archaeologist (either employed by the OWNER and approved by the appropriate agency, managing agency, or representing SHPO) and recommendations made by that person based on the Historic Preservation Plan outlined in Appendix E. For sites eligible for listing in the National Registry of Historic Places, recommendations of SHPO must be followed by the OWNER.

2.12.3. The OWNER shall conform to treatments recommended for cultural resources by SHPO and the FS if on NFSL and on private land with concurrence by the LANDOWNER.

2.13. PREVENTION AND CONTROL OF FIRES

2.13.1. Burning, fire prevention, and fire control shall meet the requirements of the managing agency and/or the fire control agencies having jurisdiction. The STATE and KNF INSPECTORS shall be invited to attend all meetings with these agencies to discuss or prepare these plans. A copy of agreed upon plans shall be included in Appendix L

2.13.2. The OWNER shall direct the CONTRACTOR to comply with regulations of any county, town, state or governing municipality having jurisdiction regarding fire laws and regulations.

2.13.3. Blasting caps and powder shall be stored only in approved areas and containers and always separate from each other.

2.13.4. The OWNER shall direct the CONTRACTOR to properly store and handle combustible material that could create objectionable smoke, odors, or fumes. The OWNER shall direct the CONTRACTOR not to burn refuse such as trash, rags, tires, plastics, or other debris, except as permitted by the county, town, state, or governing municipality having jurisdiction.

2.14. WASTE DISPOSAL

2.14.1. The OWNER shall direct the CONTRACTOR to use licensed solid waste disposal sites. Inert materials (Group III wastes) may be disposed of at licensed Class III landfill sites; mixed refuse (Group II wastes) must be disposed of at licensed Class II landfill sites.

2.14.2. Emptied pesticide containers or other chemical containers must be triple rinsed to render them acceptable for disposal in Class II landfills or for scrap recycling pursuant to ARM 17.54.201 for treatment or disposal. Pesticide residue and pesticide containers shall be disposed of in accordance with ARM 17.30.637.

2.14.3. All waste materials constituting a hazardous waste defined in ARM 16.44.303, and wastes containing any concentration of polychlorinated biphenyls must be transported to an approved designated hazardous waste management facility (as defined in ARM 17.53.201) for treatment or disposal.

2.14.4. All used oil shall be hauled away and recycled or disposed of in a licensed Class II landfill authorized to accept liquid wastes or in accordance with 2.14.2 and 2.14.3 above. There shall be no intentional release of oil or other toxic substances into streams or soil. In the event of an accidental spill into a waterway, the INSPECTORS shall be contacted immediately. Any spill of refined petroleum products greater than 25 gallons must be reported to the State at the Department of Military Affairs, Disaster and Emergency Services Division at 406-841-3911. All spills shall be cleaned up in accordance with the OWNER's Emergency Spill Response Plan.

2.14.5. Sewage shall not be discharged into streams or streambeds. The OWNER shall direct the CONTRACTOR to provide refuse containers and sanitary chemical toilets, convenient to all principal points of operation. These facilities shall comply with applicable federal, state, and local health laws and regulations. A septic tank pump licensed by the State shall service these facilities.

2.14.6. Slash from vegetation clearing along the transmission line shall be managed in accordance with the Vegetation Removal and Disposition Plan, Montana law regarding reduction of slash (76-13-407, MCA) and, on NFSL, KNF objectives regarding fuels reduction.

2.14.7 On NFSL, merchantable timber shall be transported to designated landings or staging areas, and branches and tops shall be removed and piled. The FS shall be responsible for disposing of the piles on NFSL and the OWNER shall be responsible for disposal of the piles on other lands. All merchantable timber shall be removed from the transmission line clearing area on NFSL unless authorized in writing by an authorized FS representative. Non-merchantable trees and coniferous forest debris shall be removed using a brush blade or excavator to minimize soil accumulation. Excess slash shall be removed or burned in all timber harvest areas and within ½ mile of any residence. The FS shall be responsible for disposing of the piles on FS land and the OWNER shall be responsible for disposal of the piles on other lands. Non-merchantable material left within the transmission line clearing area shall be lopped and scattered unless otherwise requested by the KNF.

2.14.8. On private land, management of merchantable and non-merchantable trees as well as slash shall be negotiated between LANDOWNER and OWNER. On State land, management of merchantable and non-merchantable trees as well as slash shall be negotiated between DNRC and OWNER.

2.14.9. Refuse burning shall require the prior approval of the LANDOWNER and a Montana Open Burning Permit must be obtained from the DEQ. Any burning of wastes shall comply with section 2.13 of these specifications.

3.2.10. Burning of vegetation shall be in accordance with the Vegetation Removal and Disposition Plan. Piling and windrowing of material for burning shall use methods that shall prevent significant amounts of soil from being included in the material to be burned and minimize destruction of ground cover. Piles shall be located so as to minimize danger to timber and damage to ground cover when burned.

2.15. SPECIAL MEASURES

2.15.1 Structures and conductors with a low reflectivity constant shall be used to reduce potential for visual contrast.

2.15.2 Crossings of rivers should be at approximately right angles. Strategic placement of structures should be done both as a means to screen views of the transmission line and right-of-way and to minimize the need for vegetative clearing.

2.15.3 Based on the analysis contained in the EIS and findings made by the DEQ or the BOARD, general mitigations also may apply to construction and operation of the project. These measures are found in Appendix A.

3.0 POST-CONSTRUCTION CLEANUP AND RECLAMATION

3.1. CLEANUP

3.1.1. All litter resulting from construction is to be removed, to the satisfaction of the LANDOWNER on private lands, the DNRC on State lands, and the FS on NFSL, from the right-of-way and along access roads leading to the right-of-way. Such litter shall be legally disposed of as soon as possible, but in no case later than 60 days following completion of wire clipping. If requested by the LANDOWNER and the FS on NFSL, the OWNER shall provide for removal of any additional construction-related debris discovered after this initial cleanup.

3.1.2. Insofar as practical, all signs of temporary construction facilities such as haul roads, work areas, buildings, foundations or temporary structures, soil stockpiles, excess or waste materials, or any other vestiges of construction shall be removed and the areas restored to as natural a condition as is practical, in consultation with the LANDOWNER and the FS on NFSL.

3.2 RECLAMATION

3.2.1 Revegetation of the right-of-way, access roads, all special use area, or any other disturbance shall be consistent with the reclamation and revegetation standards and provisions contained in ARM 17.20.1902 and the approved Plan of Operations on NFSL. This plan and any conditions to the certificate approved by DEQ shall be attached as Appendix M.

3.2.2 Scarring or damage to any landscape feature listed in Appendix A shall be reclaimed as nearly as practical to its original condition. Bare areas created by construction activities shall be reseeded in compliance with Appendix M to prevent soil erosion.

3.2.3 After construction is complete, NFSL roads shall be reclaimed as described in Appendix D. Roads on private lands shall be managed in accordance with the agreement between LANDOWNER and OWNER and between DNRC and OWNER on State land.

3.2.4. Fill slopes associated with access roads adjacent to stream crossing shall be regraded at slopes less than the normal angle of repose for the soil type involved.

3.2.5. All drainage channels, where construction activities occurred, shall be restored to a gradient and width that shall prevent accelerated gully erosion (see Section 2.11.11).

3.2.6. Drive-through dips, open-top box culverts, waterbars, or cross drains shall be added to roads at the proper spacing and angle as necessary to prevent erosion. The suggested spacing of drive thru dips and relief culverts is discussed in the KNF Revised Hydraulic Guide (1990) and shall be used to establish the locations of these items.

3.2.7. Interrupted drainage systems shall be restored.

3.2.8. Sidecasting of waste materials may be allowed on slopes over 40 percent after approval by the LANDOWNER, DNRC, or FS, however, this will not be allowed within the buffer strip established for stream courses, in areas of high or extreme soil instability, or in other SENSITIVE AREAS identified in Appendix A. Surplus materials shall be hauled to sites approved by LANDOWNER, DNRC, or FS in such areas.

3.2.9. Seeding prescriptions to be used in revegetation, requirements for hydroseeding, fertilizing, and mulching, as jointly determined by representatives of the OWNER, DEQ, DNRC, FS, and other involved state and federal agencies, are specified in Appendix M.

3.2.10. During the initial reclamation of construction disturbance in areas where topsoil has been stockpiled, the surface shall be graded to a stable configuration and the topsoil shall be replaced on the disturbed area. The STATE INSPECTOR may waive the requirement for topsoil replacement on private lands on a site-specific basis where additional disturbance at a site increases erosion, sedimentation, or reclamation problems. Similarly, the KNF INSPECTOR may waive such requirements on NFSL.

3.2.11. Excavated material not suitable or required for backfill shall be evenly spread onto the cleared area prior to spreading any stockpiled soil. Large rocks and boulders uncovered during excavation and not buried in the backfill shall be disposed of as approved by the STATE and KNF INSPECTORS and/or LANDOWNER.

3.2.12. Application rates and timing of seeds and fertilizer, and purity and germination rates of seed mixtures, shall be as determined in consultation with DEQ and FS. Reseeding shall be done at the first appropriate opportunity after construction ends.

3.2.13. Where appropriate, hydro seeding, drilling, or other appropriate methods shall be used to aid revegetation. Mulching with straw, wood chips, or other means shall be used where necessary. Areas requiring such treatment are listed in Appendix M.

3.3. MONITORING CONSTRUCTION AND RECLAMATION ACTIVITIES

3.3.1. Upon notice by the OWNER, the INSPECTORS shall schedule initial post-construction field inspections following clean up and road closure. Follow-up visits shall be scheduled as required to monitor the effectiveness of erosion controls, reseeding measures, and the Reclamation and Revegetation Plan (Appendix M). The STATE INSPECTOR shall contact the LANDOWNER for post-construction access and to determine LANDOWNER satisfaction with the OWNER'S reclamation measures.

3.3.2. The STATE INSPECTOR shall document observations on all lands for inclusion in monitoring reports regarding bond release required by DEQ. Such observations shall be coordinated with the KNF INSPECTOR on NFSL and the OWNER.

3.3.3. Release of the Transmission Line Construction and Reclamation Bond shall be based on completing the activities specified in the Reclamation and Revegetation Plan (Appendix M). Failure of the OWNER to complete the activities on disturbed areas in accordance with Appendix M and successfully revegetate disturbed areas shall be cause for forfeiture for the BOND or penalties described in Section 0.3. Failure of the OWNER to adequately reclaim all disturbed areas in accordance with section 3.2 and Appendix M of these specifications shall be cause for forfeiture of the BOND or penalties described in Section 0.9. Reclamation shall be in accordance with the standards established in ARM 17.20.1902 and in forested areas the right of way and unneeded roads shall be stocked naturally or planted with trees so that upon maturity, the canopy cover approximates that of adjacent undisturbed areas. Noxious weeds shall be controlled on disturbed areas.

4.0. OPERATION AND MAINTENANCE

4.1. RIGHT-OF-WAY MANAGEMENT

4.1.1. Maintenance of the right-of-way shall be as specified in the Weed Control Plan (Appendix K) and other monitoring and mitigation plans described in the KNF's Plan of Operations. This plan shall provide for the protection of SENSITIVE AREAS identified prior to and during construction. OWNER and CONTRACTOR activities off the right-of–way such as along access roads shall be consistent with best management practices and environmental protection measures contained in these specifications.

4.1.2. Vegetation that has been saved through the construction process and which does not pose a hazard or potential hazard to the transmission line, particularly that of value to fish and wildlife as specified in Appendix A, shall be allowed to grow on the right-of-way. Vegetation management shall be in accordance with the Vegetation Removal and Disposition Plan (Appendix F).

4.1.3. Vegetative cover along the transmission line and roads shall be maintained in cooperation with the LANDOWNER on private lands, DNRC on State lands, and the FS on NFSL.

4.1.4. Grass cover, water bars, cross drains, the proper slope, and other agreed to measures shall be maintained on permanent access roads on private lands and service roads in order to prevent soil erosion.

4.2. MAINTENANCE INSPECTIONS

4.2.1. The OWNER shall have responsibility to correct soil erosion or revegetation problems on the right-of-way or access roads as they become known. Maintenance of roads on NFSL shall be in accordance with the Road Management Plan. Appropriate corrective action shall be taken where necessary. The OWNER, through agreement with the LANDOWNER, DNRC, or FS, may provide a mechanism to identify and correct such problems.

4.2.2. Operation and maintenance inspections using ground vehicles shall be timed so that routine maintenance shall be done when access roads are firm, dry, or frozen, wherever possible. New roads, and existing barriered or impassable roads used for transmission line construction on NFSL shall not be used for routine maintenance; use of such roads shall be for emergency maintenance only. Maintenance vegetative clearing shall be done according to criteria described in Appendix F.

4.3. CORRECTION OF LANDOWNER PROBLEMS

4.3.1. When the facility causes interference with radio, TV, or other stationary communication systems, the OWNER shall correct the interference with mechanical corrections to facility hardware, or antennas, or shall install remote antennas or repeater stations, or shall use other reasonable means to correct the problem.

4.3.2. The OWNER shall respond to complaints of interference by investigating complaints to determine the origin of the interference. If the interference is not caused by the facility, the OWNER shall so inform the person bringing the complaint. The OWNER shall provide the STATE INSPECTOR with documentation of the evidence regarding the source of the interference if the person brings the complaint to the STATE INSPECTOR or DEQ.

4.4. HERBICIDES AND WEED CONTROL

4.4.1. To minimize spreading weeds during construction, a joint weed inspection of the transmission line corridor and/or construction areas may be completed prior to construction areas. The joint inspection is intended to identify areas with existing high weed concentration. This joint review may include the OWNER, affected weed control boards, FS, DNRC and LANDOWNERS.

4.4.2. Weed control, including any application of herbicides in the right-of-way, shall be done by applicators licensed in Montana and in accordance with recommendations of the Montana Department of Agriculture, FS on NFSL, and in accordance with the Weed Control Plan in Appendix K.

4.4.3. Herbicides shall not be used in certain areas identified by DEQ, FS, and FWP, as listed in Appendix K.

4.4.4. Proper herbicide application methods shall be used to keep drift and nontarget damage to a minimum.

4.4.5. The OWNER shall notify the STATE and KNF INSPECTORS (if involving NFSL) in writing 30 days prior to any broadcast or aerial spraying of herbicides. The notice shall provide details as to the time, place, and justification for such spraying. DEQ, FWP, the Montana Department of Agriculture, and FS, if involving NFSL, shall have the opportunity to inspect the portion of the right-of-way or access roads schedule for such treatment before, during, and after spraying.

4.5. CONTINUED MONITORING

4.5.1. The KNF and DEQ may continue to monitor operation and maintenance activities for the life of the transmission line in order to ensure compliance with the KNF's Plan of Operations and the Certificate of Compliance.

5.0. ABANDONMENT, DECOMMISSIONING AND RECLAMATION FOLLOWING DECOMMISSIONING

When the transmission line is no longer used or useful, structures, conductors, and ground wires shall be removed, roads recontoured and disturbed areas reclaimed using methods outlined in Appendix N.

APPENDICES

Appendix A: Sensitive Areas for the Montanore Project.

The following sensitive areas have been identified on Figure D-1 of the EIS where special measures will be taken to reduce impacts during construction and reclamation activities:

- Wetlands
- Riparian areas
- Bull trout critical habitat
- Old growth habitat
- 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
- Cultural resources (not shown on Figure D-1)
- Additional areas for monitoring may be identified following the preconstruction monitoring trip by the INSPECTORS or preconstruction surveys by the OWNER (see Appendix I)

The following special measures will be incorporated into final design for these sensitive areas.

Wetlands and Riparian Areas

- Complete a jurisdictional delineation of waters of the U.S. in accordance with Section 1.4.3; avoid discharge of dredge or fill material into waters of the U.S. where practicable; develop and implement mitigation for all unavoidable impacts in accordance with Section 1.4.3.
- Construct all stream crossings in accordance with Section 2.11.5 and 2.11.6
- Locate structures outside of riparian areas if alternative locations are technically and economically feasible
- Minimize vegetation clearing and heavy equipment use in riparian areas in accordance with Sections 2.9.12 and 2.11.1

Bull Trout Critical Habitat

- Implement the timing restrictions described in Appendix I
- Implement measures for wetlands and riparian areas designed to minimize clearing adjacent to critical habitat

Old Growth Habitat

- Implement the vegetation removal procedures described in Appendix F designed to minimize clearing of old growth

Core Grizzly Bear Habitat

The OWNER shall not construct any road or trail that would reduce core grizzly bear habitat.

Bald Eagle Primary Use Areas

- Implement the timing restrictions described in Appendix I

Areas with High Risk of Bird Collisions

To prevent avian collisions with the transmission lines, the visibility of conductors or shield wires shall be increased where necessary. 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, shall be identified through a study conducted by a qualified biologist and funded by the OWNER.

Big Game Winter Range

- Implement the timing restrictions described in Appendix I

Cultural Resources

- Complete pre-construction surveys accordance with Section 1.4.1
- Conduct activities to prevent damage to significant archaeological, historical, or paleontological resources, in accordance with the requirements of 1.4.1, 2.12, and Appendix E.

Visually Sensitive and High Visibility Areas

- After completing a more detailed topographic survey, complete a detailed visual assessment of the alignment at three locations near residential properties: near the Fisher River and U.S. 2 crossing north of Hunter Creek (Section 32, T. 27 N., R. 29 W.), along West Fisher Creek (Section 2, T. 26 N., R. 30 W.), and between NFS roads 231 and 4725 southeast of Howard Lake (Section 19, T. 27 N., R. 30 W.)
- Keep the centerline at least 200 feet from private property at these locations, unless it is not technically feasible to do so
- Based on the assessment, incorporate into the Vegetation Removal and Disposition Plan (Appendix F) measures to minimize vegetation clearing and visibility from residences and Howard Lake through modification of pole height, span length, and vegetation growth factor
- Based on the assessment, modify the quantity and location of poles to be installed by helicopter to minimize visible access roads

- Do not remove any shrub species 10 feet in height or less in the clearing corridor (see Section 2.1.5)

Appendix B: Performance Bond Specifications

The Transmission Line Construction and Reclamation Bond and Joint Decommissioning Bond shall be used to ensure compliance with these specifications. The amount of the Construction and Reclamation Bond will be determined by the DEQ and FS within 45 days after the information required is Section 1.1 – 1.3 has been submitted. The Joint Decommissioning Bond will also be determined by the DEQ and FS with in 45 days the information required in Section 1.1 – 1.3 has been submitted. These bonds must be submitted prior to the start of construction. The amount of the bonds will be reviewed and updated every 5 years by DEQ and FS.

Appendix C: Name and Address of Inspectors and Owner's Liaison

STATE INSPECTOR
Environmental Science Specialist
Montana Department of Environmental Quality
P.O. Box 200901, 1520 East Sixth Avenue
Helena, Montana 59620-0901
(406) 444-____

OWNER'S LIAISON
Environmental Specialist
Montanore Minerals Corp.
34524 U.S. Highway 2 West
Libby Montana 59923
(406) 293_____

KNF INSPECTOR
Kootenai National Forest
31374 U.S. Highway 2 West
Libby Montana 59923
(406) 293-_____

Appendix D: Road Management Plan

OWNER shall develop for the lead agencies' review and approval, and implement a final Road Management Plan that describes for all new and reconstructed roads used for the transmission line the following:

- 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

OWNER shall be responsible for implementing one or more of the following measures on newly constructed roads and reconstructed roads on NFSL so they cause little resource risk if maintenance is not performed on them during the operation period and prior to their future need:

- Conducting noxious weed surveys and performing necessary weed treatments prior to storage activities
- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high-risk for blockage or failure; laying back stream banks 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

The OWNER shall decommission new transmission line roads on NFSL after removal of transmission line. OWNER shall be responsible for implementing one or more of the following measures on new roads on NFSL to minimize the effects on other resources:

- Conducting noxious weed surveys and performing necessary weed treatments prior to 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

On private lands the same measures shall be applied unless the certificate holder contracts with the landowner for revegetation or reclamation as allowed under ARM 17.20.1902.

Appendix E: Cultural Resources Protection and Mitigation Plan

The final Cultural Resources Protection and Mitigation Plan will be incorporated into these specifications.

Appendix F: Vegetation Removal and Disposition Plan

As part of final design, MMC shall prepare a Vegetation Removal and Disposition Plan for lead agency review and approval. One of the plan's goals will be to minimize vegetation clearing. The plan will identify areas where clearing will be avoided, such as deep valleys with high line clearance, and measures that will be implemented to minimize clearing. 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. It would evaluate the use of monopoles to reduce clearing in select areas, such as old growth. The plan also will evaluate the potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during life of the line. The Vegetation Removal and Disposition Plan will be part of and incorporate details of the final design for the transmission line.

Appendix G: Variations in Right-of-Way Width

DEQ does not recommend specific widths for construction easements. In accordance with the specifications, construction activities shall be contained in the minimum area necessary for safe and prudent construction and approved by the FS on NFSL.

DEQ does not recommend specific variations in right-of-way widths beyond those required to meet the National Electric Safety Code for electric transmission line operations and those necessary to meet standards established in ARM 17.20.1607 (2).

Appendix H: Monitoring Plan

The STATE INSPECTOR is responsible for implementing this monitoring plan required by 75-20-303(b) and (c), MCA, and for reporting whether terms of the Certificate and Environmental Specifications (including but not limited to adequacy of erosion controls, successful seed germination, and areas where weed control is necessary) are being met, along with any conditions in the 404 permit and the MPDES General Permit for Storm Water Discharges Associated with Construction Activity and Authorization associated with the transmission line. Additional mitigating measures may be identified by the STATE INSPECTOR or by the KNF INSPECTOR on NFSL in order to minimize environmental damage due to unique circumstances that arise during construction.

In addition to participating in preconstruction conferences, the INSPECTORS shall conduct on-site inspections during the period of construction. At a minimum the INSPECTORS will be present at the start of construction and during the initiation of construction in sensitive areas. Subsequently INSPECTORS shall strive to conduct on-site reviews of construction activities on at least a weekly schedule. More frequent monitoring may be necessary.

INSPECTORS shall record the dates of inspection, areas inspected, and instances where construction activities are not in conformance with Environmental Specifications or terms and conditions of the Certificate of Compliance for the project. Inspection reports shall be submitted in a timely manner to the OWNER's Liaison who will see that corrections are made or that such measures are implemented in a timely manner.

When violations of the Certificate are identified, the STATE INSPECTOR shall report the violation in writing to the OWNER, who shall immediately take corrective action. If violations continue, civil penalties described in 75-20-408, MCA may be imposed. In the event that the KNF INSPECTOR shows reasonable cause that compliance with the Plan of Operations is not being achieved, FS will implement measures described in 36 CFR 228.7(b).

Upon the completion of construction in an area, the INSPECTORS will determine that Environmental Specifications have been followed, and that activities described in Appendix M have been completed and vegetation is progressing in a satisfactory manner.

In the event the DEQ or FS finds that the OWNER is not correcting damage created during construction in a satisfactory manner or that initial revegetation is not progressing satisfactorily, DEQ may determine the amount and disposition of all or a portion of the reclamation bond to correct any damage that has not been corrected by the certificate holder.

Appendix I: Areas Where Construction Timing Restrictions Apply

Restrictions in the timing of tree removal are required on NFSL between April 15 and July 15 around nesting sites of the flammulated owl, black-backed woodpecker, or northern goshawk to assure compliance with the Migratory Bird Treaty Act and FS requirements. The OWNER will be required to complete surveys of the alignment to identify where timing restrictions may be required or comply with the timing restriction in all areas of potential habitat. If surveys conducted one nesting season immediately prior to construction activities do not find nesting of these species, such restrictions shall be rescinded. If surveys located nesting of these species, tree removal restrictions in an avoidance area appropriate for each species shall be in place during the nesting period until the young are fledged.

Restrictions in the timing of tree removal and other transmission line construction activities are required on all lands between February 1 and August 15 around bald eagle or osprey breeding sites to assure compliance with the Montana Bald Eagle Management Plan, Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act or FS requirements. Surveys for bald eagle or osprey nests shall be completed in appropriate habitat or timing restrictions shall be implemented in all areas of potential habitat. Surveys would be conducted between March 15 and April 30, one nesting season immediately prior to transmission line construction.

If surveys conducted one nesting season immediately prior to construction activities did not find nesting of these species, such restrictions shall be rescinded. If an active nest was found, guidelines from the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 1994) shall 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). This includes delineating a ¼-mile buffer zone for the nest site area, along with a ½-mile buffer zone for the primary use area. High intensity activities, such as heavy equipment use, are not be permitted during the nesting season (February 1 to August 15) within these two zones. The Montana Bald Eagle Working Group recommendations apply during the 5-year period following delisting of the bald eagle from the list of threatened and endangered species. If the Montana Bald Eagle Working Group recommendations lapse before the line was constructed, then the timing restrictions shall revert to the National Bald Eagle Management Guidelines issued by the US Fish and Wildlife Service in 2007.

Restrictions in the timing of transmission line construction activities in elk, white-tailed deer, or moose winter range are required between December 1 and April 30. These timing restrictions may be waived in mild winters if it can be demonstrated that snow conditions are not limiting the ability of these species to move freely throughout their range. The OWNER must receive a written waiver of these timing restrictions from the KNF, DEQ, and FWP, before conducting construction activities on elk, white-tailed deer, or moose winter range between December 1 and April 30. Timing restrictions shall not apply to substation construction.

Culvert or bridge installation is prohibited in areas of important fish spawning beds identified in Appendix A and during specified fish spawning seasons on less sensitive streams or rivers. Riprap or other erosion control activities on NFSL affecting bull trout spawning habitat can only occur during May 15 and September 1.

Other timing restrictions as negotiated by LANDOWNERS in individual easement agreements shall be incorporated into these specifications.

Appendix J: Aeronautical Hazard Markings

DEQ does not recommend aeronautical hazard markings at this time. If a potential hazard is identified during final design, DEQ will consult with the Federal Aviation Administration and Montana Aeronautics Division of MDT to determine appropriate action or aeronautical safety marking.

Appendix K: Weed Control Plan

The final Weed Control Plan will be incorporated into these specifications.

Appendix L: Fire Prevention Plan

The final Fire Prevention Plan will be incorporated into these specifications.

Appendix M: Reclamation and Revegetation Plan

An interim and final Reclamation and Revegetation Plan shall be developed and submitted to DEQ and FS for approval. This plan must, at a minimum, specify seeding mixtures and rates. It must satisfy LANDOWNER wishes, to the extent reasonable, requirements of the MPDES General Permit for Storm Water Discharges Associated with Construction Activity, and ARM 17.20.1902(10).

Because the reclamation of construction activities associated with the transmission line is considered interim and final reclamation will be required at mine closure, the primary objective of the interim reclamation plan is to provide long-term stability and control weed infestation during the operational phase of the project. The standards for interim reclamation used to determine construction bond release or to determine that expenditure of the reclamation bond is necessary to meet the requirements of the certificate for transmission lines will follow these primary objectives. MMC shall complete the following activities prior to release of the TRANSMISSION LINE CONSTRUCTION BOND:

- Implementation of the Weed Control Plan (Appendix K)
- Completion of all monitoring and mitigation described in the Cultural Resources Protection and Mitigation Plan (Appendix E)
- Completion of all interim reclamation activities described in the Reclamation and Revegetation Plan (Appendix M)
- Completion of all activities associated with roads used for transmission line construction described in the Road Management Plan (Appendix D)
- Completion of all activities associated with vegetation removal and disposal for transmission line construction described in the Vegetation Removal and Disposition Plan (Appendix F)
- Revegetation is proceeding satisfactorily.

Appendix N: Abandoning and Decommissioning Plan

Prior to the start of construction, the OWNER shall submit to the lead agencies for their approval an abandonment and decommissioning plan. Based on this plan, the agencies shall then calculate the amount of the final reclamation bond.

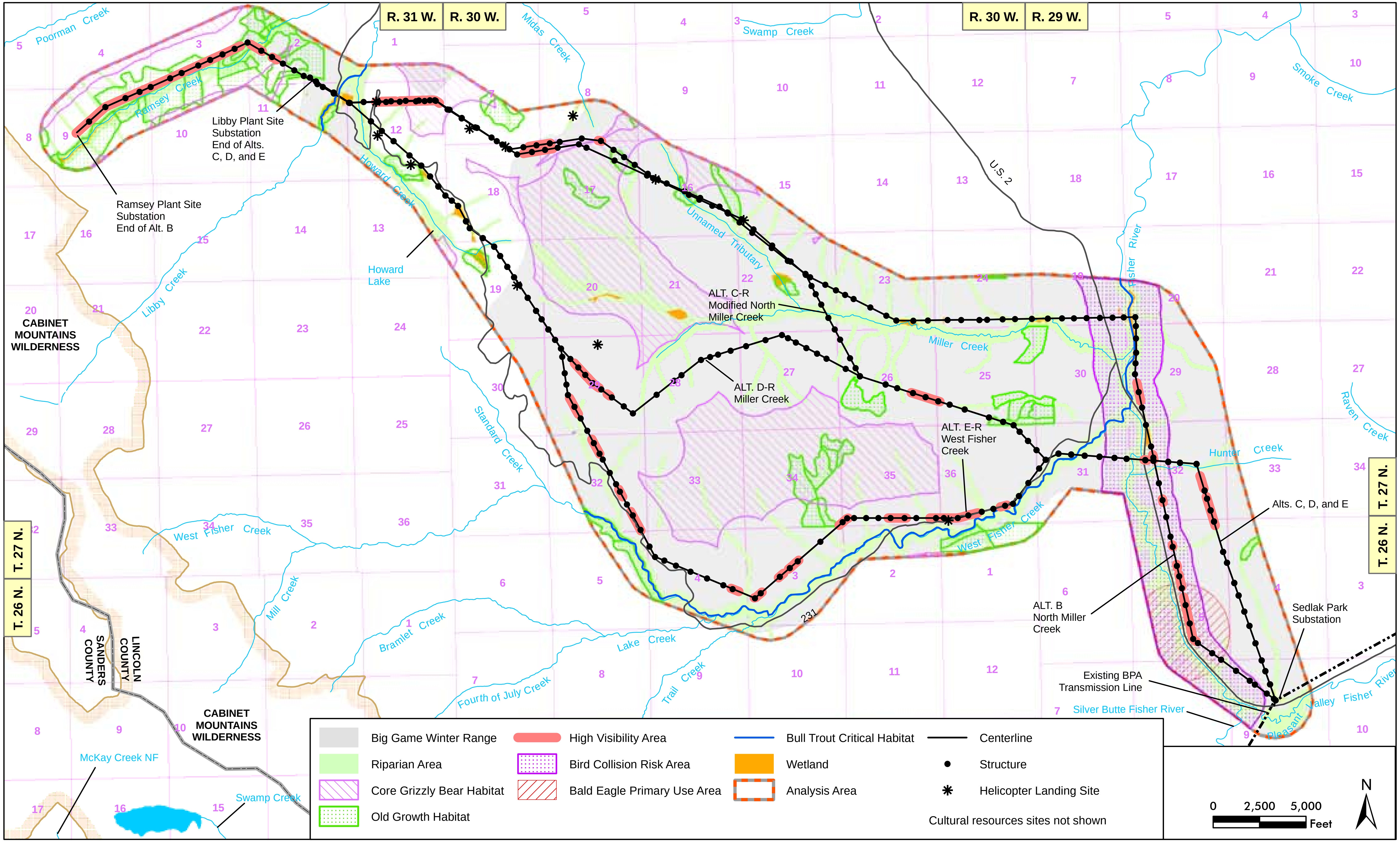

Figure D-1. Sensitive Areas Along Transmission Line Corridors

Appendix G—Water Quality Mass Balance Calculations

LAD Area Groundwater Flux

ALTERNATIVE 2

Existing Conditions (natural gradient)

	K (ft/day)	i (gradient, unitless)	depth of mixing zone (ft)	width of mixing zone (ft)	cross sectional area (A) (ft^2)
MMC values	1	0.06	56	6,860	451,388
modified K	0.22				
Ramsey Creek - LAD #1				3,040	200,032
Ramsey Creek - LAD #2				840	55,272
Libby Creek - LAD #2				1,040	68,432
Poorman Creek - LAD #2				1,940	127,652
				6,860	

Pre-LAD GW Flux:

Q=KiA		27083.28 cubic feet per day		
	K = 1 ft/day	0.31 cfs		140.68 gpm
		5958.3216 cubic feet per day		
	K = 0.22 ft/day	0.07 cfs		30.95 gpm

	cubic ft/day	cfs	gpm
Ramsey Creek - LAD #1	2,640	0.03	13.7
Ramsey Creek - LAD #2	730	0.01	3.8
Libby Creek - LAD #2	903	0.01	4.7
Poorman Creek - LAD #2	1,685	0.02	8.8
			31.0

Maximum total flux (pre-LAD plus LAD application):

Maximum gradient to have groundwater mounding to within ~10 bgs at LAD Areas is 0.122 (measured from topo map)

K = 1 ft/day	55069.336 cubic feet per day
	0.64 cfs
	286.05 gpm
K = 0.22 ft/day	12115.25392 cubic feet per day
	0.14 cfs
	62.93 gpm

LAD#1	cubic ft/day	cfs	gpm
Ramsey Creek - LAD #1	5,369	0.06	27.9
LAD#2			
Ramsey Creek - LAD #2	1,484	0.02	7.7
Libby Creek - LAD #2	1,837	0.02	9.5
Poorman Creek - LAD #2	3,426	0.04	17.8
			62.9

Allowable percolation to groundwater without flooding ground surface is:

K = 1 ft/day	145.4 gpm
K = 0.22 ft/day	32.0 gpm

	GPM
Ramsey Creek - LAD #1	14.2
Ramsey Creek - LAD #2	3.9
Libby Creek - LAD #2	4.8
Poorman Creek - LAD #2	9.0
	32.0

NOTES: Width is width of LAD area (normal to gw flow direction) + tan 5 degrees x the width added to both sides

LAD Application Rates

Maximum application rate for		200	acre LAD area		
ET during 6-mo growing season =		18	in/growing season, or	0.0082	ft/day
Precip during growing season =		13.24	in/growing season, or	0.0060	ft/day
Precip per year =		36	in/year	0.0060	ft/day
ET on 200 acres=	370.96 gpm				
Precip on 200 acres=	272.86 gpm				
		K= 1 ft/day		K = 0.22 ft/day	
Alternative 2 maximum groundwater flux rate=		145.4	gpm	32.0	gpm
		K = 1 ft/day		K = 0.22 ft/day	
Maximum LAD application rate= (for 200 acres)	ET+groundwater flux rate-precip=	**243**	gpm	**130**	gpm

Alternative 2	**Area (ac)**	**Percolation to groundwater**	**Proportion of total perc to groundwater**	**ET-PPT**	**Max Application Rate**	**LAD Total Max Application Rate**	
LAD#1		**gpm**		**gpm**	**gpm**	**gpm**	
Ramsey Creek	100	14.2	100%	49.0	63.2	63.2	LAD # 1
LAD#2							
Ramsey Creek	20	3.9	20%	9.8	13.7	66.9	LAD # 2
Libby Creek	30	4.8	30%	14.7	19.6		
Poorman Creek	50	9.0	50%	24.5	33.6		
	200					**130.1**	**total**

NOTES: Actual ET=12.71 inches is for average precipitation conditions, mountainous coniferous forest in NW Montana
Potential ET=26 inches, which is for unrestricted water availability (used by Geomatrix)
Actual ET=PET-actual soil moisture content

Calculation of 7Q10 low flows for Montanore site

7Q10 (cfs) = 0.0000728*A^(1.06)*P^(1.98)   Reference: Hortness, 2006.

A=drainage area in square miles
P=precipitation in inches

Monitoring site	Drainage Area (sq miles)	Average Watershed Area Precipitation (inches)	Average 7Q10 (cfs)	Low range 7Q10 (cfs)	High range 7Q10 (cfs)	Average 7Q10 (gpm)
LB 300	7.4	63	2.22	1.04	4.73	548
LB 800	23.9	50	4.87	2.28	10.37	2,184
LB 1000	34.1	48	6.54	3.07	13.93	2,936
LB 2000	40.7	46	7.25	3.40	15.45	3,255
PM 1000	5.8	47	0.96	0.45	2.04	431
PM 1200	6.2	46	0.99	0.46	2.10	443
RA 400	5.9	56	1.38	0.65	2.94	620
RA 600	6.8	53	1.44	0.68	3.07	647

Note: LB-300 flow value is modeled base flow for average conditions, not 7Q10 flow.

Alt 2 and 4 Flows Used In Mass Balance Calculations

Evaluation

	Average 7Q10	Mine Inflow	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	9	0	9	18	530
LB 800	2,184	9	0		9	2,175
LB 1000	2,936	9	0	9	18	2,918
LB 2000	3,255	9	0	9	18	3,237
PM 1000	431	0	0		0	431
PM 1200	443	0	0		0	443
RA 400	620	0	0		0	620
RA 600	647	0	0		0	647

Construction

	Average 7Q10	Mine Inflow	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	58	0	9	67	481
LB 800	2,184	67	0		67	2,117
LB 1000	2,936	67	0	9	76	2,860
LB 2000	3,255	76	0	9	85	3,170
PM 1000	431	0	0		0	431
PM 1200	443	0	0		0	443
RA 400	620	9	0		9	611
RA 600	647	9	0		9	638

Mining

	Average 7Q10	Mine Inflow	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	90	0	9	99	449
LB 800	2,184	108	0		108	2,076
LB 1000	2,936	113	0	9	122	2,814
LB 2000	3,255	121	247	9	377	2,878
PM 1000	431	5	0		5	426
PM 1200	443	5	0		5	438
RA 400	620	18	0		18	602
RA 600	647	18	0		18	629

Post-Mining

	Average 7Q10	Mine Inflow	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	54	0	9	63	485
LB 800	2,184	52	0		52	2,132
LB 1000	2,936	52	0	9	61	2,875
LB 2000	3,255	49	247	9	305	2,950
PM 1000	431		0		0	431
PM 1200	443		0		0	443
RA 400	620	5	0		5	616
RA 600	647	5	0		5	643

Alt 3 Flows Used In Mass Balance Calculations

Evaluation

	Average 7Q10	Mine Inflow	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	9	0	9	18	530
LB 800	2,184	9	0		9	2,175
LB 1000	2,936	9	0	9	18	2,918
LB 2000	3,255	9	0	9	18	3,237
PM 1000	431	0	0		0	431
PM 1200	443	0	0		0	443
RA 400	620	0	0		0	620
RA 600	647	0	0		0	647

Construction

	Average 7Q10	Mine Inflow	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	58	0	9	67	481
LB 800	2,184	67	0		67	2,117
LB 1000	2,936	67	0	9	76	2,860
LB 2000	3,255	76	0	9	85	3,170
PM 1000	431	0	0		0	431
PM 1200	443	0	0		0	443
RA 400	620	9	0		9	611
RA 600	647	9	0		9	638

Mining

	Average 7Q10	Mine Inflow	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	90	0	9	99	449
LB 800	2,184	108	25		133	2,051
LB 1000	2,936	113	123	9	245	2,691
LB 2000	3,255	121	247	9	377	2,878
PM 1000	431	5	81		86	345
PM 1200	443	5	81		86	357
RA 400	620	18	0		18	602
RA 600	647	18	0		18	629

Post-Mining

	Average 7Q10	Mine Inflow	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	54	0	9	63	485
LB 800	2,184	52	25		77	2,107
LB 1000	2,936	52	123	9	184	2,752
LB 2000	3,255	49	247	9	305	2,950
PM 1000	431		81		81	350
PM 1200	443		81		81	362
RA 400	620	5	0		5	616
RA 600	647	5	0		5	643

MINE DISCHARGE RATES

Rates limited by groundwater horizontal K, so flow rates are same for construction, mining and post-mining at LAD areas

For natural groundwater flow, use 35 gpm for under tailings impoundment, 31 gpm for LAD areas in Alt 2, 46 gpm for LAD areas Alts 3&4.

	Evaluation	Construction	Mining	Post-mining
	Alt 2	Alt 2	Alt 2	Alt 2
Outflows				
@ **LADs**				
ET @ LADs	98	98	98	98
Seepage to GW	32	32	32	32
To Ramsey Creek				
RA 400	14	14	14	14
RA 600	4	4	4	4
To Poorman Creek				
PM 1000				
PM 1200	9	9	9	9
To Libby Creek LB 800	5	5	5	5
Subtotal	32	32	32	32
Percent Sources--LAD Areas				
Evaluation	88.5% adit water, 11.5% mine water			
Construction	93% adit water, 7% mine water			
Mining	none			
Post-Mining	all from tailings			
Discharge from Treatment Plants				
Alt 2	133	370	0	370
Alts 3 and 4	263	500	0	500

GROUNDWATER QUALITY TREATMENT CALCULATIONS

Alternative 2

LAD applicaton area=	200	acres
LAD application rate=	130	gpm
Precipitation on 200 acres=	273	gpm
ET on 200 acres=	371	gpm
Net applied water=	32	gpm

		Mine Wastewater		Adit Wastewater During Construction		Adit Wastewater Post-Construction		Tailings Wastewater Post-Operations	
	Treatment Rate	Mine wastewater concentration (mg/L)	Concentration of percolate to groundwater (mg/L)	Construction adit wastewater concentration (mg/L)	Concentration of percolate to groundwater (mg/L)	Post-construction adit water concentration (mg/L)	Concentration of percolate to groundwater (mg/L)	Tailings impoundment post mining water (mg/L)	Concentration of percolate to groundwater (mg/L)
TDS	0%	115	467	116	471	108	439	245	995
Ammonia	50%	<0.75	<1.5	<1.4	<2.8	<0.050	<0.10	4.2	<8.5
Nitrate	50%	2.5	5.1	<33	<67	<0.36	<0.73	13	26
Antimony	50%	<0.0088	<0.018	<0.0013	<0.0026	<0.00049	<0.0010	0.015	0.030
Arsenic	50%	<0.0026	<0.0053	<0.011	<0.022	<0.00092	<0.0019	<0.0021	<0.0043
Cadmium	50%	<0.0015	<0.0030	<0.000016	<0.000033	<0.000040	<0.000081	<0.00098	<0.0020
Chromium	50%	<0.0010	<0.0020	<0.00054	<0.0011	<0.00040	<0.00081	<0.0010	<0.0020
Copper	90%	0.042	0.017	<0.0011	<0.00045	<0.0010	<0.00041	0.024	0.010
Iron	50%	<0.018	<0.037	<0.019	<0.039	<0.017	<0.035	<0.067	<0.14
Lead	90%	<0.011	<0.0045	<0.00085	<0.00035	<0.00027	<0.00011	<0.0025	<0.0010
Manganese	10%	0.22	0.80	<0.0079	<0.029	<0.0077	<0.028	0.54	2.0
Mercury	50%	<0.0000050	<0.000010	<0.000020	<0.000041	<0.000016	<0.000033	<0.000055	<0.00011
Silver	50%	<0.0030	<0.0061	<0.00025	<0.00051	<0.00025	<0.00051	<0.00050	<0.0010
Zinc	10%	<0.012	<0.044	<0.0071	<0.026	<0.0072	<0.026	<0.010	<0.037

SURFACE WATER QUALITY TREATMENT CALCULATIONS

Alternative 2

LAD applicaton area=	200	acres
LAD application rate=	130	gpm
Precipitation on 200 acres=	273	gpm
ET on 200 acres=	371	gpm
Net applied water=	32	gpm

		Mine Wastewater		Adit Wastewater During Construction		Adit Wastewater Post-Construction		Tailings Wastewater Post-Operations		WTP Quality
	Treatment Rate	Mine wastewater concentration (mg/L)	Concentration of percolate to groundwater (mg/L)	Construction adit wastewater concentration (mg/L)	Concentration of percolate to groundwater (mg/L)	Post-construction adit water concentration (mg/L)	Concentration of percolate to groundwater (mg/L)	Tailings impoundment post-mining water (mg/L)	Concentration of percolate to groundwater (mg/L)	(mg/L)
TDS	0%	115	467	116	471	108	439	245	995	100
Ammonia	50%	<0.75	<1.5	<1.4	<2.8	<0.05	<0.10	4.2	8.5	0.40
Nitrate	50%	2.5	5.1	<33	<67	<0.36	<0.73	13	26	1.3
Antimony	50%	0.010	0.020	<0.0014	<0.0028	<0.00043	<0.00087	0.015	0.030	0.0030
Arsenic	50%	<0.023	<0.047	<0.013	<0.026	<0.0013	<0.0026	<0.0050	<0.010	0.0050
Cadmium	50%	0.0015	0.0030	<0.000031	<0.000063	<0.000040	<0.000081	<0.00043	<0.00087	0.00010
Chromium	50%	<0.0010	<0.0020	<0.00076	<0.0015	<0.00075	<0.0015	<0.0040	<0.0081	0.0080
Copper	90%	0.57	0.23	<0.0016	<0.00065	<0.00083	<0.00034	0.30	0.12	0.0040
Iron	50%	2.6	5.3	<0.29	<0.59	<0.26	<0.53	1.4	2.8	0.17
Lead	90%	<0.26	<0.11	<0.0011	<0.00045	<0.00093	<0.00038	<0.044	<0.018	0.00060
Manganese	10%	0.18	0.66	<0.016	<0.059	<0.0091	<0.033	0.66	2.4	0.050
Mercury	50%	<0.0000050	<0.000010	<0.000014	<0.000028	<0.000011	<0.000022	<0.00010	<0.00020	0.000015
Silver	50%	<0.022	<0.045	<0.00025	<0.00051	<0.00025	<0.00051	<0.0020	<0.0041	0.00040
Zinc	10%	<0.028	<0.10	<0.010	<0.037	<0.012	<0.044	<0.032	<0.12	0.040

[highlighted] = dissolved result used because no total results were collected

RAMSEY CREEK at RA 400
Evaluation

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<17	620	471	12.4	439	0	467	1.6	100	0	995	0	<27	634		100
Ammonia	<0.010	620	<2.8	12.4	<0.10	0	<1.5	1.6	0.40	0	8.5	0	<0.068	634	True	TIN=1
Nitrate	0.080	620	<67	12.4	<0.73	0	5.1	1.6	1.3	0	26	0	<1.4	634	True	TIN=1
Antimony	<0.00025	620	<0.0028	12.4	<0.00087	0	0.020	1.6	0.0030	0	0.030	0	<0.00035	634		0.0056
Arsenic	<0.00025	620	<0.026	12.4	<0.0026	0	<0.047	1.6	0.0050	0	<0.010	0	<0.00087	634		0.01
Cadmium	<0.000040	620	<0.000063	12.4	<0.000081	0	0.0030	1.6	0.00010	0	<0.00087	0	<0.000048	634		0.000097
Chromium	<0.00044	620	<0.0015	12.4	<0.0015	0	<0.0020	1.6	0.0080	0	<0.0081	0	<0.00046	634		0.005
Copper	<0.0019	620	<0.00065	12.4	<0.00034	0	0.23	1.6	0.0040	0	0.12	0	<0.0025	634		0.003
Iron	<0.20	620	<0.59	12.4	<0.53	0	5.3	1.6	0.17	0	2.8	0	<0.22	634	True	0.1
Lead	<0.00014	620	<0.00045	12.4	<0.00038	0	<0.11	1.6	0.00060	0	<0.018	0	<0.00042	634		0.00055
Manganese	<0.0060	620	<0.059	12.4	<0.033	0	0.66	1.6	0.050	0	2.4	0	<0.0087	634		0.05
Mercury	<0.000020	620	<0.000028	12.4	<0.000022	0	<0.000010	1.6	0.000015	0	<0.00020	0	<0.000020	634		0.00005
Silver	<0.00025	620	<0.00051	12.4	<0.00051	0	<0.045	1.6	0.00040	0	<0.0041	0	<0.00037	634		0.00037
Zinc	<0.0023	620	<0.037	12.4	<0.044	0	<0.10	1.6	0.040	0	<0.12	0	<0.0032	634		0.025

Assumes only water to LAD area is mine and adit water, not waste rock runoff

RAMSEY CREEK at RA 400
Construction

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<17	611	471	13	439	0	467	1	100	0	995	0	<27	625		100
Ammonia	<0.010	611	<2.8	13	<0.10	0	<1.5	1	0.40	0	8.5	0	<0.070	625	True	TIN=1
Nitrate	0.080	611	<67	13	<0.73	0	5.1	1	1.3	0	26	0	<1.5	625	True	TIN=1
Antimony	<0.00025	611	<0.0028	13	<0.00087	0	0.020	1	0.0030	0	0.030	0	<0.00033	625		0.0056
Arsenic	<0.00025	611	<0.026	13	<0.0026	0	<0.047	1	0.0050	0	<0.010	0	<0.00086	625		0.01
Cadmium	<0.000040	611	<0.000063	13	<0.000081	0	0.0030	1	0.00010	0	<0.00087	0	<0.000045	625		0.000097
Chromium	<0.00044	611	<0.0015	13	<0.0015	0	<0.0020	1	0.0080	0	<0.0081	0	<0.00046	625		0.005
Copper	<0.0019	611	<0.00065	13	<0.00034	0	0.23	1	0.0040	0	0.12	0	<0.0022	625		0.003
Iron	<0.20	611	<0.59	13	<0.53	0	5.3	1	0.17	0	2.8	0	<0.22	625	True	0.1
Lead	<0.00014	611	<0.00045	13	<0.00038	0	<0.11	1	0.00060	0	<0.018	0	<0.00032	625		0.00055
Manganese	<0.0060	611	<0.059	13	<0.033	0	0.66	1	0.050	0	2.4	0	<0.0081	625		0.05
Mercury	<0.000020	611	<0.000028	13	<0.000022	0	<0.000010	1	0.000015	0	<0.00020	0	<0.000020	625		0.00005
Silver	<0.00025	611	<0.00051	13	<0.00051	0	<0.045	1	0.00040	0	<0.0041	0	<0.00033	625		0.00037
Zinc	<0.0023	611	<0.037	13	<0.044	0	<0.10	1	0.040	0	<0.12	0	<0.0032	625		0.025

Assumes only water to LAD area is mine and adit water (not TI water)

RAMSEY CREEK at RA 400
Mining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<17	602	471	0	439	0	467	4.06	100	0	995	0	<20	606		100
Ammonia	<0.010	602	<2.8	0	<0.10	0	<1.5	4.06	0.40	0	8.5	0	<0.020	606		TIN=1
Nitrate	0.080	602	<67	0	<0.73	0	5.1	4.06	1.3	0	26	0	<0.11	606		TIN=1
Antimony	<0.00025	602	<0.0028	0	<0.00087	0	0.020	4.06	0.0030	0	0.030	0	<0.00038	606		0.0056
Arsenic	<0.00025	602	<0.026	0	<0.0026	0	<0.047	4.06	0.0050	0	<0.010	0	<0.00056	606		0.01
Cadmium	<0.000040	602	<0.000063	0	<0.000081	0	0.0030	4.06	0.00010	0	<0.00087	0	<0.000060	606		0.000097
Chromium	<0.00044	602	<0.0015	0	<0.0015	0	<0.0020	4.06	0.0080	0	<0.0081	0	<0.00045	606		0.005
Copper	<0.0019	602	<0.00065	0	<0.00034	0	0.23	4.06	0.0040	0	0.12	0	<0.0034	606	True	0.003
Iron	<0.20	602	<0.59	0	<0.53	0	5.3	4.06	0.17	0	2.8	0	<0.23	606	True	0.1
Lead	<0.00014	602	<0.00045	0	<0.00038	0	<0.11	4.06	0.00060	0	<0.018	0	<0.00088	606	True	0.00055
Manganese	<0.0060	602	<0.059	0	<0.033	0	0.66	4.06	0.050	0	2.4	0	<0.010	606		0.05
Mercury	<0.000020	602	<0.000028	0	<0.000022	0	<0.000010	4.06	0.000015	0	<0.00020	0	<0.000020	606		0.00005
Silver	<0.00025	602	<0.00051	0	<0.00051	0	<0.045	4.06	0.00040	0	<0.0041	0	<0.00055	606	True	0.00037
Zinc	<0.0023	602	<0.037	0	<0.044	0	<0.10	4.06	0.040	0	<0.12	0	<0.0030	606		0.025

No water discharges during mining, iron exceedance is due to ambient water quality

RAMSEY CREEK at RA 400
Postmining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<17	616	471	0	439	0	467	0	100	0	995	14	<39	629.5		100
Ammonia	<0.010	616	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	14	<0.20	629.5		TIN=1
Nitrate	0.080	616	<67	0	<0.73	0	5.1	0	1.3	0	26	14	<0.66	629.5		TIN=1
Antimony	<0.00025	616	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	14	<0.00091	629.5		0.0056
Arsenic	<0.00025	616	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	14	<0.00047	629.5		0.01
Cadmium	<0.000040	616	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	14	<0.000058	629.5		0.000097
Chromium	<0.00044	616	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	14	<0.00061	629.5		0.005
Copper	<0.0019	616	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	14	<0.0045	629.5	True	0.003
Iron	<0.20	616	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	14	<0.26	629.5	True	0.1
Lead	<0.00014	616	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	14	<0.00054	629.5		0.00055
Manganese	<0.0060	616	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	14	<0.059	629.5	True	0.05
Mercury	<0.000020	616	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	14	<0.000024	629.5		0.00005
Silver	<0.00025	616	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	14	<0.00034	629.5		0.00037
Zinc	<0.0023	616	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	14	<0.0049	629.5		0.025

RAMSEY CREEK at RA 600
Evaluation

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<12	647	471	15.9	439	0	467	2.1	100	0	995	0	<24	665		100
Ammonia	<0.054	647	<2.8	15.9	<0.10	0	<1.5	2.1	0.40	0	8.5	0	<0.12	665	True	TIN=1
Nitrate	0.082	647	<67	15.9	<0.73	0	5.1	2.1	1.3	0	26	0	<1.7	665	True	TIN=1
Antimony	<0.0030	647	<0.0028	15.9	<0.00087	0	0.020	2.1	0.0030	0	0.030	0	<0.0030	665		0.0056
Arsenic	<0.0030	647	<0.026	15.9	<0.0026	0	<0.047	2.1	0.0050	0	<0.010	0	<0.0037	665		0.01
Cadmium	<0.000022	647	<0.000063	15.9	<0.000081	0	0.0030	2.1	0.00010	0	<0.00087	0	<0.000032	665		0.000097
Chromium	<0.0010	647	<0.0015	15.9	<0.0015	0	<0.0020	2.1	0.0080	0	<0.0081	0	<0.0010	665		0.005
Copper	<0.0010	647	<0.00065	15.9	<0.00034	0	0.23	2.1	0.0040	0	0.12	0	<0.0017	665		0.003
Iron	<0.050	647	<0.59	15.9	<0.53	0	5.3	2.1	0.17	0	2.8	0	<0.079	665		0.1
Lead	<0.00012	647	<0.00045	15.9	<0.00038	0	<0.11	2.1	0.00060	0	<0.018	0	<0.00047	665		0.00055
Manganese	<0.0027	647	<0.059	15.9	<0.033	0	0.66	2.1	0.050	0	2.4	0	<0.0061	665		0.05
Mercury	<0.000030	647	<0.000028	15.9	<0.000022	0	<0.000010	2.1	0.000015	0	<0.00020	0	<0.000030	665		0.00005
Silver	<0.00020	647	<0.00051	15.9	<0.00051	0	<0.045	2.1	0.00040	0	<0.0041	0	<0.00035	665		0.00037
Zinc	<0.0050	647	<0.037	15.9	<0.044	0	<0.10	2.1	0.040	0	<0.12	0	<0.0061	665		0.025

Assumes only water to LAD area is mine and adit water, not waste rock runoff

RAMSEY CREEK at RA 600
Construction

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<12	638	471	16.74	439	0	467	1.26	100	0	995	0	<25	656		100
Ammonia	<0.054	638	<2.8	16.74	<0.10	0	<1.5	1.26	0.40	0	8.5	0	<0.13	656	True	TIN=1
Nitrate	0.082	638	<67	16.74	<0.73	0	5.1	1.26	1.3	0	26	0	<1.8	656	True	TIN=1
Antimony	<0.0030	638	<0.0028	16.74	<0.00087	0	0.020	1.26	0.0030	0	0.030	0	<0.0030	656		0.0056
Arsenic	<0.0030	638	<0.026	16.74	<0.0026	0	<0.047	1.26	0.0050	0	<0.010	0	<0.0037	656		0.01
Cadmium	<0.000022	638	<0.000063	16.74	<0.000081	0	0.0030	1.26	0.00010	0	<0.00087	0	<0.000029	656		0.000097
Chromium	<0.0010	638	<0.0015	16.74	<0.0015	0	<0.0020	1.26	0.0080	0	<0.0081	0	<0.0010	656		0.005
Copper	<0.0010	638	<0.00065	16.74	<0.00034	0	0.23	1.26	0.0040	0	0.12	0	<0.0014	656		0.003
Iron	<0.050	638	<0.59	16.74	<0.53	0	5.3	1.26	0.17	0	2.8	0	<0.074	656		0.1
Lead	<0.00012	638	<0.00045	16.74	<0.00038	0	<0.11	1.26	0.00060	0	<0.018	0	<0.00034	656		0.00055
Manganese	<0.0027	638	<0.059	16.74	<0.033	0	0.66	1.26	0.050	0	2.4	0	<0.0054	656		0.05
Mercury	<0.000030	638	<0.000028	16.74	<0.000022	0	<0.000010	1.26	0.000015	0	<0.00020	0	<0.000030	656		0.00005
Silver	<0.00020	638	<0.00051	16.74	<0.00051	0	<0.045	1.26	0.00040	0	<0.0041	0	<0.00029	656		0.00037
Zinc	<0.0050	638	<0.037	16.74	<0.044	0	<0.10	1.26	0.040	0	<0.12	0	<0.0060	656		0.025

Assumes only water to LAD area is mine and adit water (not TI water)

RAMSEY CREEK at RA 600
Mining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<12	629	471	0	439	0	467	5.2	100	0	995	0	<16	634		100
Ammonia	<0.054	629	<2.8	0	<0.10	0	<1.5	5.2	0.40	0	8.5	0	<0.066	634		TIN=1
Nitrate	0.082	629	<67	0	<0.73	0	5.1	5.2	1.3	0	26	0	<0.12	634		TIN=1
Antimony	<0.0030	629	<0.0028	0	<0.00087	0	0.020	5.2	0.0030	0	0.030	0	<0.0031	634		0.0056
Arsenic	<0.0030	629	<0.026	0	<0.0026	0	<0.047	5.2	0.0050	0	<0.010	0	<0.0034	634		0.01
Cadmium	<0.000022	629	<0.000063	0	<0.000081	0	0.0030	5.2	0.00010	0	<0.00087	0	<0.000046	634		0.000097
Chromium	<0.0010	629	<0.0015	0	<0.0015	0	<0.0020	5.2	0.0080	0	<0.0081	0	<0.0010	634		0.005
Copper	<0.0010	629	<0.00065	0	<0.00034	0	0.23	5.2	0.0040	0	0.12	0	<0.0029	634		0.003
Iron	<0.050	629	<0.59	0	<0.53	0	5.3	5.2	0.17	0	2.8	0	<0.093	634		0.1
Lead	<0.00012	629	<0.00045	0	<0.00038	0	<0.11	5.2	0.00060	0	<0.018	0	<0.0010	634	True	0.00055
Manganese	<0.0027	629	<0.059	0	<0.033	0	0.66	5.2	0.050	0	2.4	0	<0.0081	634		0.05
Mercury	<0.000030	629	<0.000028	0	<0.000022	0	<0.000010	5.2	0.000015	0	<0.00020	0	<0.000030	634		0.00005
Silver	<0.00020	629	<0.00051	0	<0.00051	0	<0.045	5.2	0.00040	0	<0.0041	0	<0.00057	634	True	0.00037
Zinc	<0.0050	629	<0.037	0	<0.044	0	<0.10	5.2	0.040	0	<0.12	0	<0.0058	634		0.025

No discharges during mining

RAMSEY CREEK at RA 600
Postmining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<12	643	471	0	439	0	467	0	100	0	995	18	<39	661		100
Ammonia	<0.054	643	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	18	<0.28	661	True	TIN=1
Nitrate	0.082	643	<67	0	<0.73	0	5.1	0	1.3	0	26	18	<0.79	661	True	TIN=1
Antimony	<0.0030	643	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	18	<0.0037	661		0.0056
Arsenic	<0.0030	643	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	18	<0.0032	661		0.01
Cadmium	<0.000022	643	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	18	<0.000045	661		0.000097
Chromium	<0.0010	643	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	18	<0.0012	661		0.005
Copper	<0.0010	643	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	18	<0.0042	661	True	0.003
Iron	<0.050	643	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	18	<0.12	661	True	0.1
Lead	<0.00012	643	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	18	<0.00061	661	True	0.00055
Manganese	<0.0027	643	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	18	<0.068	661	True	0.05
Mercury	<0.000030	643	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	18	<0.000035	661		0.00005
Silver	<0.00020	643	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	18	<0.00031	661		0.00037
Zinc	<0.0050	643	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	18	<0.0081	661		0.025

POORMAN CREEK at PM 1200
Evaluation

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<22	443	471	8	439	0	467	1	100	0	995	0	<31	452		100
Ammonia	<0.050	443	<2.8	8	<0.10	0	<1.5	1	0.40	0	8.5	0	<0.10	452	True	TIN=1
Nitrate	0.050	443	<67	8	<0.73	0	5.1	1	1.3	0	26	0	<1.2	452	True	TIN=1
Antimony	<0.0030	443	<0.0028	8	<0.00087	0	0.020	1	0.0030	0	0.030	0	<0.0030	452		0.0056
Arsenic	<0.0010	443	<0.026	8	<0.0026	0	<0.047	1	0.0050	0	<0.010	0	<0.0015	452		0.01
Cadmium	<0.000018	443	<0.000063	8	<0.000081	0	0.0030	1	0.00010	0	<0.00087	0	<0.000025	452		0.000097
Chromium	<0.0010	443	<0.0015	8	<0.0015	0	<0.0020	1	0.0080	0	<0.0081	0	<0.0010	452		0.005
Copper	<0.0010	443	<0.00065	8	<0.00034	0	0.23	1	0.0040	0	0.12	0	<0.0015	452		0.003
Iron	<0.032	443	<0.59	8	<0.53	0	5.3	1	0.17	0	2.8	0	<0.054	452		0.1
Lead	<0.000050	443	<0.00045	8	<0.00038	0	<0.11	1	0.00060	0	<0.018	0	<0.00030	452		0.00055
Manganese	<0.0010	443	<0.059	8	<0.033	0	0.66	1	0.050	0	2.4	0	<0.0035	452		0.05
Mercury	<0.000017	443	<0.000028	8	<0.000022	0	<0.000010	1	0.000015	0	<0.00020	0	<0.000017	452		0.00005
Silver	<0.00020	443	<0.00051	8	<0.00051	0	<0.045	1	0.00040	0	<0.0041	0	<0.00030	452		0.00037
Zinc	<0.0025	443	<0.037	8	<0.044	0	<0.10	1	0.040	0	<0.12	0	<0.0033	452		0.025

Using PM-1000 ambient wq data
Assumes only water to LAD area is mine and adit water, not waste rock runoff

<u>POORMAN CREEK at PM 1200</u>
Construction

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<22	443	471	8.37	439	0	467	0.63	100	0	995	0	<31	452		100
Ammonia	<0.050	443	<2.8	8.37	<0.10	0	<1.5	0.63	0.40	0	8.5	0	<0.10	452	True	TIN=1
Nitrate	0.050	443	<67	8.37	<0.73	0	5.1	0.63	1.3	0	26	0	<1.3	452	True	TIN=1
Antimony	<0.0030	443	<0.0028	8.37	<0.00087	0	0.020	0.63	0.0030	0	0.030	0	<0.0030	452		0.0056
Arsenic	<0.0010	443	<0.026	8.37	<0.0026	0	<0.047	0.63	0.0050	0	<0.010	0	<0.0015	452		0.01
Cadmium	<0.000018	443	<0.000063	8.37	<0.000081	0	0.0030	0.63	0.00010	0	<0.00087	0	<0.000023	452		0.000097
Chromium	<0.0010	443	<0.0015	8.37	<0.0015	0	<0.0020	0.63	0.0080	0	<0.0081	0	<0.0010	452		0.005
Copper	<0.0010	443	<0.00065	8.37	<0.00034	0	0.23	0.63	0.0040	0	0.12	0	<0.0013	452		0.003
Iron	<0.032	443	<0.59	8.37	<0.53	0	5.3	0.63	0.17	0	2.8	0	<0.050	452		0.1
Lead	<0.000050	443	<0.00045	8.37	<0.00038	0	<0.11	0.63	0.00060	0	<0.018	0	<0.00021	452		0.00055
Manganese	<0.0010	443	<0.059	8.37	<0.033	0	0.66	0.63	0.050	0	2.4	0	<0.0030	452		0.05
Mercury	<0.000017	443	<0.000028	8.37	<0.000022	0	<0.000010	0.63	0.000015	0	<0.00020	0	<0.000017	452		0.00005
Silver	<0.00020	443	<0.00051	8.37	<0.00051	0	<0.045	0.63	0.00040	0	<0.0041	0	<0.00027	452		0.00037
Zinc	<0.0025	443	<0.037	8.37	<0.044	0	<0.10	0.63	0.040	0	<0.12	0	<0.0033	452		0.025

Assumes only water to LAD area is mine and adit water (not TI water)

POORMAN CREEK at PM 1200
Mining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<22	438	471	0	439	0	467	2.6	100	0	995		<25	441		100
Ammonia	<0.050	438	<2.8	0	<0.10	0	<1.5	2.6	0.40	0	8.5	0	<0.059	441		TIN=1
Nitrate	0.050	438	<67	0	<0.73	0	5.1	2.6	1.3	0	26	0	<0.080	441		TIN=1
Antimony	<0.0030	438	<0.0028	0	<0.00087	0	0.020	2.6	0.0030	0	0.030	0	<0.0031	441		0.0056
Arsenic	<0.0010	438	<0.026	0	<0.0026	0	<0.047	2.6	0.0050	0	<0.010	0	<0.0013	441		0.01
Cadmium	<0.000018	438	<0.000063	0	<0.000081	0	0.0030	2.6	0.00010	0	<0.00087	0	<0.000036	441		0.000097
Chromium	<0.0010	438	<0.0015	0	<0.0015	0	<0.0020	2.6	0.0080	0	<0.0081	0	<0.0010	441		0.005
Copper	<0.0010	438	<0.00065	0	<0.00034	0	0.23	2.6	0.0040	0	0.12	0	<0.0024	441		0.003
Iron	<0.032	438	<0.59	0	<0.53	0	5.3	2.6	0.17	0	2.8	0	<0.063	441		0.1
Lead	<0.000050	438	<0.00045	0	<0.00038	0	<0.11	2.6	0.00060	0	<0.018	0	<0.00070	441	True	0.00055
Manganese	<0.0010	438	<0.059	0	<0.033	0	0.66	2.6	0.050	0	2.4	0	<0.0049	441		0.05
Mercury	<0.000017	438	<0.000028	0	<0.000022	0	<0.000010	2.6	0.000015	0	<0.00020	0	<0.000017	441		0.00005
Silver	<0.00020	438	<0.00051	0	<0.00051	0	<0.045	2.6	0.00040	0	<0.0041	0	<0.00046	441	True	0.00037
Zinc	<0.0025	438	<0.037	0	<0.044	0	<0.10	2.6	0.040	0	<0.12	0	<0.0031	441		0.025

No discharges during mining

POORMAN CREEK at PM 1200
Postmining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<22	443	471	0	439	0	467	0	100	0	995	9	<41	452		100
Ammonia	<0.050	443	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	9	<0.22	452		TIN=1
Nitrate	0.050	443	<67	0	<0.73	0	5.1	0	1.3	0	26	9	<0.57	452		TIN=1
Antimony	<0.0030	443	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	9	<0.0035	452		0.0056
Arsenic	<0.0010	443	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	9	<0.0012	452		0.01
Cadmium	<0.000018	443	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	9	<0.000035	452		0.000097
Chromium	<0.0010	443	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	9	<0.0011	452		0.005
Copper	<0.0010	443	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	9	<0.0034	452	True	0.003
Iron	<0.032	443	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	9	<0.087	452		0.1
Lead	<0.000050	443	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	9	<0.00041	452		0.00055
Manganese	<0.0010	443	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	9	<0.049	452		0.05
Mercury	<0.000017	443	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	9	<0.000021	452		0.00005
Silver	<0.00020	443	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	9	<0.00028	452		0.00037
Zinc	<0.0025	443	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	9	<0.0048	452		0.025

LIBBY CREEK at LB 300
Evaluation

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<24	530	471	0	439	0	467	0	100	133	995	0	<39	663		100
Ammonia	<0.050	530	<2.8	0	<0.10	0	<1.5	0	0.40	133	8.5	0	<0.12	663		TIN=1
Nitrate	0.12	530	<67	0	<0.73	0	5.1	0	1.3	133	26	0	<0.36	663		TIN=1
Antimony	<0.0030	530	<0.0028	0	<0.00087	0	0.020	0	0.0030	133	0.030	0	<0.0030	663		0.0056
Arsenic	<0.0010	530	<0.026	0	<0.0026	0	<0.047	0	0.0050	133	<0.010	0	<0.0018	663		0.01
Cadmium	<0.000060	530	<0.000063	0	<0.000081	0	0.0030	0	0.00010	133	<0.00087	0	<0.000068	663		0.000097
Chromium	<0.0010	530	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	133	<0.0081	0	<0.0024	663		0.005
Copper	<0.0010	530	<0.00065	0	<0.00034	0	0.23	0	0.0040	133	0.12	0	<0.0016	663		0.003
Iron	<0.018	530	<0.59	0	<0.53	0	5.3	0	0.17	133	2.8	0	<0.048	663		0.1
Lead	<0.00043	530	<0.00045	0	<0.00038	0	<0.11	0	0.00060	133	<0.018	0	<0.00046	663		0.00055
Manganese	<0.0019	530	<0.059	0	<0.033	0	0.66	0	0.050	133	2.4	0	<0.012	663		0.05
Mercury	<0.000017	530	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	133	<0.00020	0	<0.000017	663		0.00005
Silver	<0.00025	530	<0.00051	0	<0.00051	0	<0.045	0	0.00040	133	<0.0041	0	<0.00028	663		0.00037
Zinc	<0.0050	530	<0.037	0	<0.044	0	<0.10	0	0.040	133	<0.12	0	<0.012	663		0.025

Assumes 130 gpm to LAD areas, remainder to water treatment plant

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<24	530	471	0	439	0	467	0	100	263	995	0	<49	793		100
Ammonia	<0.050	530	<2.8	0	<0.10	0	<1.5	0	0.40	263	8.5	0	<0.17	793		TIN=1
Nitrate	0.12	530	<67	0	<0.73	0	5.1	0	1.3	263	26	0	<0.51	793		TIN=1
Antimony	<0.0030	530	<0.0028	0	<0.00087	0	0.020	0	0.0030	263	0.030	0	<0.0030	793		0.0056
Arsenic	<0.0010	530	<0.026	0	<0.0026	0	<0.047	0	0.0050	263	<0.010	0	<0.0023	793		0.01
Cadmium	<0.000060	530	<0.000063	0	<0.000081	0	0.0030	0	0.00010	263	<0.00087	0	<0.000073	793		0.000097
Chromium	<0.0010	530	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	263	<0.0081	0	<0.0033	793		0.005
Copper	<0.0010	530	<0.00065	0	<0.00034	0	0.23	0	0.0040	263	0.12	0	<0.0020	793		0.003
Iron	<0.018	530	<0.59	0	<0.53	0	5.3	0	0.17	263	2.8	0	<0.068	793		0.1
Lead	<0.00043	530	<0.00045	0	<0.00038	0	<0.11	0	0.00060	263	<0.018	0	<0.00049	793		0.00055
Manganese	<0.0019	530	<0.059	0	<0.033	0	0.66	0	0.050	263	2.4	0	<0.018	793		0.05
Mercury	<0.000017	530	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	263	<0.00020	0	<0.000016	793		0.00005
Silver	<0.00025	530	<0.00051	0	<0.00051	0	<0.045	0	0.00040	263	<0.0041	0	<0.00030	793		0.00037
Zinc	<0.0050	530	<0.037	0	<0.044	0	<0.10	0	0.040	263	<0.12	0	<0.017	793		0.025

LIBBY CREEK at LB 300
Construction

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<24	481	471	0	439	0	467	0	100	370	995	0	<57	851		100
Ammonia	<0.050	481	<2.8	0	<0.10	0	<1.5	0	0.40	370	8.5	0	<0.20	851		TIN=1
Nitrate	0.12	481	<67	0	<0.73	0	5.1	0	1.3	370	26	0	<0.63	851		TIN=1
Antimony	<0.0030	481	<0.0028	0	<0.00087	0	0.020	0	0.0030	370	0.030	0	<0.0030	851		0.0056
Arsenic	<0.0010	481	<0.026	0	<0.0026	0	<0.047	0	0.0050	370	<0.010	0	<0.0027	851		0.01
Cadmium	<0.000060	481	<0.000063	0	<0.000081	0	0.0030	0	0.00010	370	<0.00087	0	<0.000077	851		0.000097
Chromium	<0.0010	481	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	370	<0.0081	0	<0.0040	851		0.005
Copper	<0.0010	481	<0.00065	0	<0.00034	0	0.23	0	0.0040	370	0.12	0	<0.0023	851		0.003
Iron	<0.018	481	<0.59	0	<0.53	0	5.3	0	0.17	370	2.8	0	<0.084	851		0.1
Lead	<0.00043	481	<0.00045	0	<0.00038	0	<0.11	0	0.00060	370	<0.018	0	<0.00050	851		0.00055
Manganese	<0.0019	481	<0.059	0	<0.033	0	0.66	0	0.050	370	2.4	0	<0.023	851		0.05
Mercury	<0.000017	481	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	370	<0.00020	0	<0.000016	851		0.00005
Silver	<0.00025	481	<0.00051	0	<0.00051	0	<0.045	0	0.00040	370	<0.0041	0	<0.00032	851		0.00037
Zinc	<0.0050	481	<0.037	0	<0.044	0	<0.10	0	0.040	370	<0.12	0	<0.020	851		0.025

Assumes 130 gpm to LAD areas, rest to water treatment plant

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<24	481	471	0	439	0	467	0	100	500	995	0	<63	981		100
Ammonia	<0.050	481	<2.8	0	<0.10	0	<1.5	0	0.40	500	8.5	0	<0.23	981		TIN=1
Nitrate	0.12	481	<67	0	<0.73	0	5.1	0	1.3	500	26	0	<0.72	981		TIN=1
Antimony	<0.0030	481	<0.0028	0	<0.00087	0	0.020	0	0.0030	500	0.030	0	<0.0030	981		0.0056
Arsenic	<0.0010	481	<0.026	0	<0.0026	0	<0.047	0	0.0050	500	<0.010	0	<0.0030	981		0.01
Cadmium	<0.000060	481	<0.000063	0	<0.000081	0	0.0030	0	0.00010	500	<0.00087	0	<0.000080	981		0.000097
Chromium	<0.0010	481	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	500	<0.0081	0	<0.0046	981		0.005
Copper	<0.0010	481	<0.00065	0	<0.00034	0	0.23	0	0.0040	500	0.12	0	<0.0025	981		0.003
Iron	<0.018	481	<0.59	0	<0.53	0	5.3	0	0.17	500	2.8	0	<0.095	981		0.1
Lead	<0.00043	481	<0.00045	0	<0.00038	0	<0.11	0	0.00060	500	<0.018	0	<0.00052	981		0.00055
Manganese	<0.0019	481	<0.059	0	<0.033	0	0.66	0	0.050	500	2.4	0	<0.026	981		0.05
Mercury	<0.000017	481	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	500	<0.00020	0	<0.000016	981		0.00005
Silver	<0.00025	481	<0.00051	0	<0.00051	0	<0.045	0	0.00040	500	<0.0041	0	<0.00033	981		0.00037
Zinc	<0.0050	481	<0.037	0	<0.044	0	<0.10	0	0.040	500	<0.12	0	<0.023	981		0.025

<u>LIBBY CREEK at LB 300</u>
Mining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<24	449	471	0	439	0	467	0	100	0	995	0	<24	449		100
Ammonia	<0.050	449	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	0	<0.050	449		TIN=1
Nitrate	0.12	449	<67	0	<0.73	0	5.1	0	1.3	0	26	0	<0.12	449		TIN=1
Antimony	<0.0030	449	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	0	<0.0030	449		0.0056
Arsenic	<0.0010	449	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	0	<0.0010	449		0.01
Cadmium	<0.000060	449	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	0	<0.000060	449		0.000097
Chromium	<0.0010	449	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	0	<0.0010	449		0.005
Copper	<0.0010	449	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	0	<0.0010	449		0.003
Iron	<0.018	449	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	0	<0.018	449		0.1
Lead	<0.00043	449	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	0	<0.00043	449		0.00055
Manganese	<0.0019	449	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	0	<0.0019	449		0.05
Mercury	<0.000017	449	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	0	<0.000017	449		0.00005
Silver	<0.00025	449	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	0	<0.00025	449		0.00037
Zinc	<0.0050	449	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	0	<0.0050	449		0.025

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<24	449	471	0	439	0	467	0	100	0	995	0	<24	449		100
Ammonia	<0.050	449	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	0	<0.050	449		TIN=1
Nitrate	0.12	449	<67	0	<0.73	0	5.1	0	1.3	0	26	0	<0.12	449		TIN=1
Antimony	<0.0030	449	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	0	<0.0030	449		0.0056
Arsenic	<0.0010	449	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	0	<0.0010	449		0.01
Cadmium	<0.000060	449	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	0	<0.000060	449		0.000097
Chromium	<0.0010	449	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	0	<0.0010	449		0.005
Copper	<0.0010	449	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	0	<0.0010	449		0.003
Iron	<0.018	449	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	0	<0.018	449		0.1
Lead	<0.00043	449	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	0	<0.00043	449		0.00055
Manganese	<0.0019	449	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	0	<0.0019	449		0.05
Mercury	<0.000017	449	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	0	<0.000017	449		0.00005
Silver	<0.00025	449	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	0	<0.00025	449		0.00037
Zinc	<0.0050	449	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	0	<0.0050	449		0.025

No water to treatment during mining

LIBBY CREEK at LB 300
Postmining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<24	485	471	0	439	0	467	0	100	370	995	0	<57	855		100
Ammonia	<0.050	485	<2.8	0	<0.10	0	<1.5	0	0.40	370	8.5	0	<0.20	855		TIN=1
Nitrate	0.12	485	<67	0	<0.73	0	5.1	0	1.3	370	26	0	<0.63	855		TIN=1
Antimony	<0.0030	485	<0.0028	0	<0.00087	0	0.020	0	0.0030	370	0.030	0	<0.0030	855		0.0056
Arsenic	<0.0010	485	<0.026	0	<0.0026	0	<0.047	0	0.0050	370	<0.010	0	<0.0027	855		0.01
Cadmium	<0.000060	485	<0.000063	0	<0.000081	0	0.0030	0	0.00010	370	<0.00087	0	<0.00008	855		0.000097
Chromium	<0.0010	485	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	370	<0.0081	0	<0.0040	855		0.005
Copper	<0.0010	485	<0.00065	0	<0.00034	0	0.23	0	0.0040	370	0.12	0	<0.0023	855		0.003
Iron	<0.018	485	<0.59	0	<0.53	0	5.3	0	0.17	370	2.8	0	<0.084	855		0.1
Lead	<0.00043	485	<0.00045	0	<0.00038	0	<0.11	0	0.00060	370	<0.018	0	<0.00050	855		0.00055
Manganese	<0.0019	485	<0.059	0	<0.033	0	0.66	0	0.050	370	2.4	0	<0.023	855		0.05
Mercury	<0.000017	485	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	370	<0.00020	0	<0.000016	855		0.00005
Silver	<0.00025	485	<0.00051	0	<0.00051	0	<0.045	0	0.00040	370	<0.0041	0	<0.00031	855		0.00037
Zinc	<0.0050	485	<0.037	0	<0.044	0	<0.10	0	0.040	370	<0.12	0	<0.020	855		0.025

Assumes 130 gpm to LAD Areas, 370 gpm to Water Treatment Plant

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<24	485	471	0	439	0	467	0	100	500	995	0	<63	985		100
Ammonia	<0.050	485	<2.8	0	<0.10	0	<1.5	0	0.40	500	8.5	0	<0.23	985		TIN=1
Nitrate	0.12	485	<67	0	<0.73	0	5.1	0	1.3	500	26	0	<0.72	985		TIN=1
Antimony	<0.0030	485	<0.0028	0	<0.00087	0	0.020	0	0.0030	500	0.030	0	<0.0030	985		0.0056
Arsenic	<0.0010	485	<0.026	0	<0.0026	0	<0.047	0	0.0050	500	<0.010	0	<0.0030	985		0.01
Cadmium	<0.000060	485	<0.000063	0	<0.000081	0	0.0030	0	0.00010	500	<0.00087	0	<0.000080	985		0.000097
Chromium	<0.0010	485	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	500	<0.0081	0	<0.0046	985		0.005
Copper	<0.0010	485	<0.00065	0	<0.00034	0	0.23	0	0.0040	500	0.12	0	<0.0025	985		0.003
Iron	<0.018	485	<0.59	0	<0.53	0	5.3	0	0.17	500	2.8	0	<0.095	985		0.1
Lead	<0.00043	485	<0.00045	0	<0.00038	0	<0.11	0	0.00060	500	<0.018	0	<0.00052	985		0.00055
Manganese	<0.0019	485	<0.059	0	<0.033	0	0.66	0	0.050	500	2.4	0	<0.026	985		0.05
Mercury	<0.000017	485	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	500	<0.00020	0	<0.000016	985		0.00005
Silver	<0.00025	485	<0.00051	0	<0.00051	0	<0.045	0	0.00040	500	<0.0041	0	<0.00033	985		0.00037
Zinc	<0.0050	485	<0.037	0	<0.044	0	<0.10	0	0.040	500	<0.12	0	<0.023	985		0.025

LIBBY CREEK at LB 800
Evaluation

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	19	2175	471	20.35	439	0	467	2.65	100	133	995	0	28	2331		100
Ammonia	<0.074	2175	<2.8	20.35	<0.10	0	<1.5	2.65	0.40	133	8.5	0	<0.12	2331		TIN=1
Nitrate	0.040	2175	<67	20.35	<0.73	0	5.1	2.65	1.3	133	26	0	0.70	2331		TIN=1
Antimony	<0.0016	2175	<0.0028	20.35	<0.00087	0	0.020	2.65	0.0030	133	0.030	0	<0.0017	2331		0.0056
Arsenic	<0.00026	2175	<0.026	20.35	<0.0026	0	<0.047	2.65	0.0050	133	<0.010	0	<0.00081	2331		0.01
Cadmium	<0.000013	2175	<0.000063	20.35	<0.000081	0	0.0030	2.65	0.00010	133	<0.00087	0	<0.000022	2331		0.000097
Chromium	<0.0023	2175	<0.0015	20.35	<0.0015	0	<0.0020	2.65	0.0080	133	<0.0081	0	<0.0026	2331		0.005
Copper	<0.00052	2175	<0.00065	20.35	<0.00034	0	0.23	2.65	0.0040	133	0.12	0	<0.0010	2331		0.003
Iron	<0.019	2175	<0.59	20.35	<0.53	0	5.3	2.65	0.17	133	2.8	0	<0.039	2331		0.1
Lead	<0.000050	2175	<0.00045	20.35	<0.00038	0	<0.11	2.65	0.00060	133	<0.018	0	<0.00021	2331		0.00055
Manganese	<0.0013	2175	<0.059	20.35	<0.033	0	0.66	2.65	0.050	133	2.4	0	<0.0053	2331		0.05
Mercury	<0.000017	2175	<0.000028	20.35	<0.000022	0	<0.000010	2.65	0.000015	133	<0.00020	0	<0.000017	2331		0.00005
Silver	<0.00023	2175	<0.00051	20.35	<0.00051	0	<0.045	2.65	0.00040	133	<0.0041	0	<0.00029	2331		0.00037
Zinc	<0.0024	2175	<0.037	20.35	<0.044	0	<0.10	2.65	0.040	133	<0.12	0	<0.0050	2331		0.025

For metals, used LB-1000 concentrations

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	19	2175	471	0	439	0	467	0	100	263	995	0	28	2438		100
Ammonia	<0.074	2175	<2.8	0	<0.10	0	<1.5	0	0.40	263	8.5	0	<0.11	2438		TIN=1
Nitrate	0.040	2175	<67	0	<0.73	0	5.1	0	1.3	263	26	0	0.18	2438		TIN=1
Antimony	<0.0016	2175	<0.0028	0	<0.00087	0	0.020	0	0.0030	263	0.030	0	<0.0018	2438		0.0056
Arsenic	<0.00026	2175	<0.026	0	<0.0026	0	<0.047	0	0.0050	263	<0.010	0	<0.00077	2438		0.01
Cadmium	<0.000013	2175	<0.000063	0	<0.000081	0	0.0030	0	0.00010	263	<0.00087	0	<0.000022	2438		0.000097
Chromium	<0.0023	2175	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	263	<0.0081	0	<0.0029	2438		0.005
Copper	<0.00052	2175	<0.00065	0	<0.00034	0	0.23	0	0.0040	263	0.12	0	<0.00090	2438		0.003
Iron	<0.019	2175	<0.59	0	<0.53	0	5.3	0	0.17	263	2.8	0	<0.035	2438		0.1
Lead	<0.000050	2175	<0.00045	0	<0.00038	0	<0.11	0	0.00060	263	<0.018	0	<0.00011	2438		0.00055
Manganese	<0.0013	2175	<0.059	0	<0.033	0	0.66	0	0.050	263	2.4	0	<0.007	2438		0.05
Mercury	<0.000017	2175	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	263	<0.00020	0	<0.000017	2438		0.00005
Silver	<0.00023	2175	<0.00051	0	<0.00051	0	<0.045	0	0.00040	263	<0.0041	0	<0.00025	2438		0.00037
Zinc	<0.0024	2175	<0.037	0	<0.044	0	<0.10	0	0.040	263	<0.12	0	<0.0065	2438		0.025

Alternative 4 would be same as Alternative 3

LIBBY CREEK at LB 800

Construction

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	19	2117	471	21.4	439	0	467	1.6	100	370	995	0	35	2510		100
Ammonia	<0.074	2117	<2.8	21.4	<0.10	0	<1.5	1.6	0.40	370	8.5	0	<0.15	2510		TIN=1
Nitrate	0.040	2117	<67	21.4	<0.73	0	5.1	1.6	1.3	370	26	0	0.80	2510		TIN=1
Antimony	<0.0016	2117	<0.0028	21.4	<0.00087	0	0.020	1.6	0.0030	370	0.030	0	<0.0018	2510		0.0056
Arsenic	<0.00026	2117	<0.026	21.4	<0.0026	0	<0.047	1.6	0.0050	370	<0.010	0	<0.0012	2510		0.01
Cadmium	<0.000013	2117	<0.000063	21.4	<0.000081	0	0.0030	1.6	0.00010	370	<0.00087	0	<0.000028	2510		0.000097
Chromium	<0.0023	2117	<0.0015	21.4	<0.0015	0	<0.0020	1.6	0.0080	370	<0.0081	0	<0.0031	2510		0.005
Copper	<0.00052	2117	<0.00065	21.4	<0.00034	0	0.23	1.6	0.0040	370	0.12	0	<0.0012	2510		0.003
Iron	<0.019	2117	<0.59	21.4	<0.53	0	5.3	1.6	0.17	370	2.8	0	<0.049	2510		0.1
Lead	<0.000050	2117	<0.00045	21.4	<0.00038	0	<0.11	1.6	0.00060	370	<0.018	0	<0.00020	2510		0.00055
Manganese	<0.0013	2117	<0.059	21.4	<0.033	0	0.66	1.6	0.050	370	2.4	0	<0.009	2510		0.05
Mercury	<0.000017	2117	<0.000028	21.4	<0.000022	0	<0.000010	1.6	0.000015	370	<0.00020	0	<0.000017	2510		0.00005
Silver	<0.00023	2117	<0.00051	21.4	<0.00051	0	<0.045	1.6	0.00040	370	<0.0041	0	<0.00029	2510		0.00037
Zinc	<0.0024	2117	<0.037	21.4	<0.044	0	<0.10	1.6	0.040	370	<0.12	0	<0.0083	2510		0.025

For metals, used LB-1000 concentrations

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	19	2117	471	0	439	0	467	0	100	500	995	0	34	2617		100
Ammonia	<0.074	2117	<2.8	0	<0.10	0	<1.5	0	0.40	500	8.5	0	<0.14	2617		TIN=1
Nitrate	0.040	2117	<67	0	<0.73	0	5.1	0	1.3	500	26	0	0.28	2617		TIN=1
Antimony	<0.0016	2117	<0.0028	0	<0.00087	0	0.020	0	0.0030	500	0.030	0	<0.0019	2617		0.0056
Arsenic	<0.00026	2117	<0.026	0	<0.0026	0	<0.047	0	0.0050	500	<0.010	0	<0.0012	2617		0.01
Cadmium	<0.000013	2117	<0.000063	0	<0.000081	0	0.0030	0	0.00010	500	<0.00087	0	<0.000030	2617		0.000097
Chromium	<0.0023	2117	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	500	<0.0081	0	<0.0034	2617		0.005
Copper	<0.00052	2117	<0.00065	0	<0.00034	0	0.23	0	0.0040	500	0.12	0	<0.0012	2617		0.003
Iron	<0.019	2117	<0.59	0	<0.53	0	5.3	0	0.17	500	2.8	0	<0.048	2617		0.1
Lead	<0.000050	2117	<0.00045	0	<0.00038	0	<0.11	0	0.00060	500	<0.018	0	<0.00016	2617		0.00055
Manganese	<0.0013	2117	<0.059	0	<0.033	0	0.66	0	0.050	500	2.4	0	<0.011	2617		0.05
Mercury	<0.000017	2117	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	500	<0.00020	0	<0.000017	2617		0.00005
Silver	<0.00023	2117	<0.00051	0	<0.00051	0	<0.045	0	0.00040	500	<0.0041	0	<0.00026	2617		0.00037
Zinc	<0.0024	2117	<0.037	0	<0.044	0	<0.10	0	0.040	500	<0.12	0	<0.0096	2617		0.025

Alternative 4 would be same as Alternative 3

LIBBY CREEK at LB 800
Mining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	19	2076	471	0	439	0	467	0	100	0	995	0	19	2076		100
Ammonia	<0.074	2076	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	0	<0.074	2076		TIN=1
Nitrate	0.040	2076	<67	0	<0.73	0	5.1	0	1.3	0	26	0	<0.040	2076		TIN=1
Antimony	<0.0016	2076	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	0	<0.0016	2076		0.0056
Arsenic	<0.00026	2076	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	0	<0.00026	2076		0.01
Cadmium	<0.000013	2076	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	0	<0.000013	2076		0.000097
Chromium	<0.0023	2076	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	0	<0.0023	2076		0.005
Copper	<0.00052	2076	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	0	<0.00052	2076		0.003
Iron	<0.019	2076	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	0	<0.019	2076		0.1
Lead	<0.000050	2076	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	0	<0.000050	2076		0.00055
Manganese	<0.0013	2076	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	0	<0.0013	2076		0.05
Mercury	<0.000017	2076	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	0	<0.000017	2076		0.00005
Silver	<0.00023	2076	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	0	<0.00023	2076		0.00037
Zinc	<0.0024	2076	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	0	<0.0024	2076		0.025

No water discharges during mining

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	19	2051	471	0	439	0	467	0	100	0	995	0	19	2051		100
Ammonia	<0.074	2051	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	0	<0.074	2051		TIN=1
Nitrate	0.040	2051	<67	0	<0.73	0	5.1	0	1.3	0	26	0	<0.040	2051		TIN=1
Antimony	<0.0016	2051	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	0	<0.0016	2051		0.0056
Arsenic	<0.00026	2051	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	0	<0.00026	2051		0.01
Cadmium	<0.000013	2051	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	0	<0.000013	2051		0.000097
Chromium	<0.0023	2051	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	0	<0.0023	2051		0.005
Copper	<0.00052	2051	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	0	<0.00052	2051		0.003
Iron	<0.019	2051	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	0	<0.019	2051		0.1
Lead	<0.000050	2051	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	0	<0.000050	2051		0.00055
Manganese	<0.0013	2051	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	0	<0.0013	2051		0.05
Mercury	<0.000017	2051	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	0	<0.000017	2051		0.00005
Silver	<0.00023	2051	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	0	<0.00023	2051		0.00037
Zinc	<0.0024	2051	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	0	<0.0024	2051		0.025

Alternative 4 would be the same as Alternative 3 except that the flow rate at LB-800 would be 2,076 gpm

LIBBY CREEK at LB 800
Postmining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	19	2132	471	0	439	0	467	0	100	370	995	23	40	2525		100
Ammonia	<0.074	2132	<2.8	0	<0.10	0	<1.5	0	0.40	370	8.5	23	<0.20	2525		TIN=1
Nitrate	0.040	2132	<67	0	<0.73	0	5.1	0	1.3	370	26	23	0.46	2525		TIN=1
Antimony	<0.0016	2132	<0.0028	0	<0.00087	0	0.020	0	0.0030	370	0.030	23	<0.0021	2525		0.0056
Arsenic	<0.00026	2132	<0.026	0	<0.0026	0	<0.047	0	0.0050	370	<0.010	23	<0.0010	2525		0.01
Cadmium	<0.000013	2132	<0.000063	0	<0.000081	0	0.0030	0	0.00010	370	<0.00087	23	<0.000034	2525		0.000097
Chromium	<0.0023	2132	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	370	<0.0081	23	<0.0032	2525		0.005
Copper	<0.00052	2132	<0.00065	0	<0.00034	0	0.23	0	0.0040	370	0.12	23	<0.0021	2525		0.003
Iron	<0.019	2132	<0.59	0	<0.53	0	5.3	0	0.17	370	2.8	23	<0.066	2525		0.1
Lead	<0.000050	2132	<0.00045	0	<0.00038	0	<0.11	0	0.00060	370	<0.018	23	<0.00029	2525		0.00055
Manganese	<0.0013	2132	<0.059	0	<0.033	0	0.66	0	0.050	370	2.4	23	<0.030	2525		0.05
Mercury	<0.000017	2132	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	370	<0.00020	23	<0.000018	2525		0.00005
Silver	<0.00023	2132	<0.00051	0	<0.00051	0	<0.045	0	0.00040	370	<0.0041	23	<0.00029	2525		0.00037
Zinc	<0.0024	2132	<0.037	0	<0.044	0	<0.10	0	0.040	370	<0.12	23	<0.0090	2525		0.025

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	19	2107	471	0	439	0	467	0	100	500	995	0	35	2607		100
Ammonia	<0.074	2107	<2.8	0	<0.10	0	<1.5	0	0.40	500	8.5	0	<0.14	2607		TIN=1
Nitrate	0.040	2107	<67	0	<0.73	0	5.1	0	1.3	500	26	0	0.28	2607		TIN=1
Antimony	<0.0016	2107	<0.0028	0	<0.00087	0	0.020	0	0.0030	500	0.030	0	<0.0019	2607		0.0056
Arsenic	<0.00026	2107	<0.026	0	<0.0026	0	<0.047	0	0.0050	500	<0.010	0	<0.0012	2607		0.01
Cadmium	<0.000013	2107	<0.000063	0	<0.000081	0	0.0030	0	0.00010	500	<0.00087	0	<0.000030	2607		0.000097
Chromium	<0.0023	2107	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	500	<0.0081	0	<0.0034	2607		0.005
Copper	<0.00052	2107	<0.00065	0	<0.00034	0	0.23	0	0.0040	500	0.12	0	<0.0012	2607		0.003
Iron	<0.019	2107	<0.59	0	<0.53	0	5.3	0	0.17	500	2.8	0	<0.048	2607		0.1
Lead	<0.000050	2107	<0.00045	0	<0.00038	0	<0.11	0	0.00060	500	<0.018	0	<0.00016	2607		0.00055
Manganese	<0.0013	2107	<0.059	0	<0.033	0	0.66	0	0.050	500	2.4	0	<0.011	2607		0.05
Mercury	<0.000017	2107	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	500	<0.00020	0	<0.000017	2607		0.00005
Silver	<0.00023	2107	<0.00051	0	<0.00051	0	<0.045	0	0.00040	500	<0.0041	0	<0.00026	2607		0.00037
Zinc	<0.0024	2107	<0.037	0	<0.044	0	<0.10	0	0.040	500	<0.12	0	<0.0096	2607		0.025

Alternative 4 would be same as Alternative 3 except that the flow rate at LB-800 would be 2,132 gpm

LIBBY CREEK at LB 1000
Evaluation

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<28	2918	471	28.3	439	0	467	3.7	100	133	995	0	<36	3083		100
Ammonia	<0.035	2918	<2.8	28.3	<0.10	0	<1.5	3.7	0.40	133	8.5	0	<0.08	3083		TIN=1
Nitrate	0.030	2918	<67	28.3	<0.73	0	5.1	3.7	1.3	133	26	0	0.71	3083		TIN=1
Antimony	<0.0016	2918	<0.0028	28.3	<0.00087	0	0.020	3.7	0.0030	133	0.030	0	<0.0017	3083		0.0056
Arsenic	<0.00026	2918	<0.026	28.3	<0.0026	0	<0.047	3.7	0.0050	133	<0.010	0	<0.00076	3083		0.01
Cadmium	<0.000013	2918	<0.000063	28.3	<0.000081	0	0.0030	3.7	0.00010	133	<0.00087	0	<0.000021	3083		0.000097
Chromium	<0.0023	2918	<0.0015	28.3	<0.0015	0	<0.0020	3.7	0.0080	133	<0.0081	0	<0.0025	3083		0.005
Copper	<0.00052	2918	<0.00065	28.3	<0.00034	0	0.23	3.7	0.0040	133	0.12	0	<0.00095	3083		0.003
Iron	<0.019	2918	<0.59	28.3	<0.53	0	5.3	3.7	0.17	133	2.8	0	<0.037	3083		0.1
Lead	<0.000050	2918	<0.00045	28.3	<0.00038	0	<0.11	3.7	0.00060	133	<0.018	0	<0.00021	3083		0.00055
Manganese	<0.0013	2918	<0.059	28.3	<0.033	0	0.66	3.7	0.050	133	2.4	0	<0.0047	3083		0.05
Mercury	<0.000017	2918	<0.000028	28.3	<0.000022	0	<0.000010	3.7	0.000015	133	<0.00020	0	<0.000017	3083		0.00005
Silver	<0.00023	2918	<0.00051	28.3	<0.00051	0	<0.045	3.7	0.00040	133	<0.0041	0	<0.00029	3083		0.00037
Zinc	<0.0024	2918	<0.037	28.3	<0.044	0	<0.10	3.7	0.040	133	<0.12	0	<0.0045	3083		0.025

Alternative 3

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<28	2918	471	0	439	0	467	0	100	263	995	0	<34	3181		100
Ammonia	<0.035	2918	<2.8	0	<0.10	0	<1.5	0	0.40	263	8.5	0	<0.07	3181		TIN=1
Nitrate	0.030	2918	<67	0	<0.73	0	5.1	0	1.3	263	26	0	0.14	3181		TIN=1
Antimony	<0.0016	2918	<0.0028	0	<0.00087	0	0.020	0	0.0030	263	0.030	0	<0.0017	3181		0.0056
Arsenic	<0.00026	2918	<0.026	0	<0.0026	0	<0.047	0	0.0050	263	<0.010	0	<0.00065	3181		0.01
Cadmium	<0.000013	2918	<0.000063	0	<0.000081	0	0.0470	0	0.00010	263	<0.00087	0	<0.000020	3181		0.000097
Chromium	<0.0023	2918	<0.0015	0	<0.0015	0	<0.0030	0	0.0080	263	<0.0081	0	<0.0028	3181		0.005
Copper	<0.00052	2918	<0.00065	0	<0.00034	0	0.23	0	0.0040	263	0.12	0	<0.00081	3181		0.003
Iron	<0.019	2918	<0.59	0	<0.53	0	5.3	0	0.17	263	2.8	0	<0.031	3181		0.1
Lead	<0.000050	2918	<0.00045	0	<0.00038	0	<0.11	0	0.00060	263	<0.018	0	<0.00010	3181		0.00055
Manganese	<0.0013	2918	<0.059	0	<0.033	0	0.66	0	0.050	263	2.4	0	<0.0053	3181		0.05
Mercury	<0.000017	2918	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	263	<0.00020	0	<0.000017	3181		0.00005
Silver	<0.00023	2918	<0.00051	0	<0.00051	0	<0.045	0	0.00040	263	<0.0041	0	<0.00024	3181		0.00037
Zinc	<0.0024	2918	<0.037	0	<0.044	0	<0.10	0	0.040	263	<0.12	0	<0.0055	3181		0.025

Alternative 4 would be same as Alternative 3

LIBBY CREEK at LB 1000
Construction

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<28	2860	471	29.8	439	0	467	2.2	100	370	995	0	<41	3262		100
Ammonia	<0.035	2860	<2.8	29.8	<0.10	0	<1.5	2.2	0.40	370	8.5	0	<0.10	3262		TIN=1
Nitrate	0.030	2860	<67	29.8	<0.73	0	5.1	2.2	1.3	370	26	0	0.79	3262		TIN=1
Antimony	<0.0016	2860	<0.0028	29.8	<0.00087	0	0.020	2.2	0.0030	370	0.030	0	<0.0018	3262		0.0056
Arsenic	<0.00026	2860	<0.026	29.8	<0.0026	0	<0.047	2.2	0.0050	370	<0.010	0	<0.0011	3262		0.01
Cadmium	<0.000013	2860	<0.000063	29.8	<0.000081	0	0.0030	2.2	0.00010	370	<0.00087	0	<0.000025	3262		0.000097
Chromium	<0.0023	2860	<0.0015	29.8	<0.0015	0	<0.0020	2.2	0.0080	370	<0.0081	0	<0.0029	3262		0.005
Copper	<0.00052	2860	<0.00065	29.8	<0.00034	0	0.23	2.2	0.0040	370	0.12	0	<0.0011	3262		0.003
Iron	<0.019	2860	<0.59	29.8	<0.53	0	5.3	2.2	0.17	370	2.8	0	<0.045	3262		0.1
Lead	<0.000050	2860	<0.00045	29.8	<0.00038	0	<0.11	2.2	0.00060	370	<0.018	0	<0.00019	3262		0.00055
Manganese	<0.0013	2860	<0.059	29.8	<0.033	0	0.66	2.2	0.050	370	2.4	0	<0.008	3262		0.05
Mercury	<0.000017	2860	<0.000028	29.8	<0.000022	0	<0.000010	2.2	0.000015	370	<0.00020	0	<0.000017	3262		0.00005
Silver	<0.00023	2860	<0.00051	29.8	<0.00051	0	<0.045	2.2	0.00040	370	<0.0041	0	<0.00028	3262		0.00037
Zinc	<0.0024	2860	<0.037	29.8	<0.044	0	<0.10	2.2	0.040	370	<0.12	0	<0.0070	3262		0.025

Alternative 3

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<28	2860	471	0	439	0	467	0	100	500	995	0	<39	3360		100
Ammonia	<0.035	2860	<2.8	0	<0.10	0	<1.5	0	0.40	500	8.5	0	<0.09	3360		TIN=1
Nitrate	0.030	2860	<67	0	<0.73	0	5.1	0	1.3	500	26	0	0.22	3360		TIN=1
Antimony	<0.0016	2860	<0.0028	0	<0.00087	0	0.020	0	0.0030	500	0.030	0	<0.0018	3360		0.0056
Arsenic	<0.00026	2860	<0.026	0	<0.0026	0	<0.047	0	0.0050	500	<0.010	0	<0.0010	3360		0.01
Cadmium	<0.000013	2860	<0.000063	0	<0.000081	0	0.0030	0	0.00010	500	<0.00087	0	<0.000026	3360		0.000097
Chromium	<0.0023	2860	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	500	<0.0081	0	<0.0031	3360		0.005
Copper	<0.00052	2860	<0.00065	0	<0.00034	0	0.23	0	0.0040	500	0.12	0	<0.0010	3360		0.003
Iron	<0.019	2860	<0.59	0	<0.53	0	5.3	0	0.17	500	2.8	0	<0.041	3360		0.1
Lead	<0.000050	2860	<0.00045	0	<0.00038	0	<0.11	0	0.00060	500	<0.018	0	<0.00013	3360		0.00055
Manganese	<0.0013	2860	<0.059	0	<0.033	0	0.66	0	0.050	500	2.4	0	<0.009	3360		0.05
Mercury	<0.000017	2860	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	500	<0.00020	0	<0.000017	3360		0.00005
Silver	<0.00023	2860	<0.00051	0	<0.00051	0	<0.045	0	0.00040	500	<0.0041	0	<0.00026	3360		0.00037
Zinc	<0.0024	2860	<0.037	0	<0.044	0	<0.10	0	0.040	500	<0.12	0	<0.0080	3360		0.025

Alternative 4 would be the same as Alternative 3

LIBBY CREEK at LB 1000
Mining

Alternatives 3

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<28	2691	471	0	439	0	467	0	100	0	995	0	<28	2691		100
Ammonia	<0.035	2691	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	0	<0.04	2691		TIN=1
Nitrate	0.030	2691	<67	0	<0.73	0	5.1	0	1.3	0	26	0	<0.030	2691		TIN=1
Antimony	<0.0016	2691	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	0	<0.0016	2691		0.0056
Arsenic	<0.00026	2691	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	0	<0.00026	2691		0.01
Cadmium	<0.000013	2691	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	0	<0.000013	2691		0.000097
Chromium	<0.0023	2691	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	0	<0.0023	2691		0.005
Copper	<0.00052	2691	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	0	<0.00052	2691		0.003
Iron	<0.019	2691	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	0	<0.019	2691		0.1
Lead	<0.000050	2691	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	0	<0.000050	2691		0.00055
Manganese	<0.0013	2691	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	0	<0.0013	2691		0.05
Mercury	<0.000017	2691	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	0	<0.000017	2691		0.00005
Silver	<0.00023	2691	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	0	<0.00023	2691		0.00037
Zinc	<0.0024	2691	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	0	<0.0024	2691		0.025

No water discharges during mining
(Streamflow at LB-1000 would be 2,814 gpm for Alternatives 2 and 4)

<u>LIBBY CREEK at LB 1000</u>
Postmining

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<28	2875	471	0	439	0	467	0	100	370	995	32	<46	3277		100
Ammonia	<0.035	2875	<2.8	0	<0.10	0	<1.5	0	0.40	370	8.5	32	<0.16	3277		TIN=1
Nitrate	0.03	2875	<67	0	<0.73	0	5.1	0	1.3	370	26	32	0.43	3277		TIN=1
Antimony	<0.0016	2875	<0.0028	0	<0.00087	0	0.020	0	0.0030	370	0.030	32	<0.0020	3277		0.0056
Arsenic	<0.00026	2875	<0.026	0	<0.0026	0	<0.047	0	0.0050	370	<0.010	32	<0.00089	3277		0.01
Cadmium	<0.000013	2875	<0.000063	0	<0.000081	0	0.0030	0	0.00010	370	<0.00087	32	<0.000031	3277		0.000097
Chromium	<0.0023	2875	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	370	<0.0081	32	<0.0030	3277		0.005
Copper	<0.00052	2875	<0.00065	0	<0.00034	0	0.23	0	0.0040	370	0.12	32	<0.0021	3277		0.003
Iron	<0.019	2875	<0.59	0	<0.53	0	5.3	0	0.17	370	2.8	32	<0.063	3277		0.1
Lead	<0.00005	2875	<0.00045	0	<0.00038	0	<0.11	0	0.00060	370	<0.018	32	<0.00029	3277		0.00055
Manganese	<0.0013	2875	<0.059	0	<0.033	0	0.66	0	0.050	370	2.4	32	<0.030	3277		0.05
Mercury	<0.000017	2875	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	370	<0.00020	32	<0.000019	3277		0.00005
Silver	<0.00023	2875	<0.00051	0	<0.00051	0	<0.045	0	0.00040	370	<0.0041	32	<0.00029	3277		0.00037
Zinc	<0.0024	2875	<0.037	0	<0.044	0	<0.10	0	0.040	370	<0.12	32	<0.0078	3277		0.025

Alternative 3

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	<28	2752	471	0	439	0	467	0	100	500	995	0	<39	3252		100
Ammonia	<0.035	2752	<2.8	0	<0.10	0	<1.5	0	0.40	500	8.5	0	<0.09	3252		TIN=1
Nitrate	0.030	2752	<67	0	<0.73	0	5.1	0	1.3	500	26	0	0.23	3252		TIN=1
Antimony	<0.0016	2752	<0.0028	0	<0.00087	0	0.020	0	0.0030	500	0.030	0	<0.0018	3252		0.0056
Arsenic	<0.00026	2752	<0.026	0	<0.0026	0	<0.047	0	0.0050	500	<0.010	0	<0.0010	3252		0.01
Cadmium	<0.000013	2752	<0.000063	0	<0.000081	0	0.0030	0	0.00010	500	<0.00087	0	<0.000026	3252		0.000097
Chromium	<0.0023	2752	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	500	<0.0081	0	<0.0032	3252		0.005
Copper	<0.00052	2752	<0.00065	0	<0.00034	0	0.23	0	0.0040	500	0.12	0	<0.0011	3252		0.003
Iron	<0.019	2752	<0.59	0	<0.53	0	5.3	0	0.17	500	2.8	0	<0.042	3252		0.1
Lead	<0.000050	2752	<0.00045	0	<0.00038	0	<0.11	0	0.00060	500	<0.018	0	<0.00013	3252		0.00055
Manganese	<0.0013	2752	<0.059	0	<0.033	0	0.66	0	0.050	500	2.4	0	<0.009	3252		0.05
Mercury	<0.000017	2752	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	500	<0.00020	0	<0.000017	3252		0.00005
Silver	<0.00023	2752	<0.00051	0	<0.00051	0	<0.045	0	0.00040	500	<0.0041	0	<0.00026	3252		0.00037
Zinc	<0.0024	2752	<0.037	0	<0.044	0	<0.10	0	0.040	500	<0.12	0	<0.0082	3252		0.025

Alternative 4 would be the same as Alternative 3 except that the flow rate at LB-1000 would be 2,875 gpm and predicted concentrations less

LIBBY CREEK at LB 2000
Evaluation

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	29	3237	471	28.3	439	0	467	3.7	100	133	995	0	36	3402		100
Ammonia	<0.050	3237	<2.8	28.3	<0.10	0	<1.5	3.7	0.40	133	8.5	0	<0.088	3402		TIN=1
Nitrate	<0.044	3237	<67	28.3	<0.73	0	5.1	3.7	1.3	133	26	0	0.66	3402		TIN=1
Antimony	<0.0016	3237	<0.0028	28.3	<0.00087	0	0.020	3.7	0.0030	133	0.030	0	<0.0017	3402		0.0056
Arsenic	<0.00033	3237	<0.026	28.3	<0.0026	0	<0.047	3.7	0.0050	133	<0.010	0	<0.00078	3402		0.01
Cadmium	<0.000041	3237	<0.000063	28.3	<0.000081	0	0.0030	3.7	0.00010	133	<0.00087	0	<0.000047	3402		0.000097
Chromium	<0.0021	3237	<0.0015	28.3	<0.0015	0	<0.0020	3.7	0.0080	133	<0.0081	0	<0.0023	3402		0.005
Copper	<0.00038	3237	<0.00065	28.3	<0.00034	0	0.23	3.7	0.0040	133	0.12	0	<0.00077	3402		0.003
Iron	<0.037	3237	<0.59	28.3	<0.53	0	5.3	3.7	0.17	133	2.8	0	<0.053	3402		0.1
Lead	<0.000074	3237	<0.00045	28.3	<0.00038	0	<0.11	3.7	0.00060	133	<0.018	0	<0.00022	3402		0.00055
Manganese	<0.0014	3237	<0.059	28.3	<0.033	0	0.66	3.7	0.050	133	2.4	0	<0.0045	3402		0.05
Mercury	<0.000017	3237	<0.000028	28.3	<0.000022	0	<0.000010	3.7	0.000015	133	<0.00020	0	<0.000017	3402		0.00005
Silver	<0.00023	3237	<0.00051	28.3	<0.00051	0	<0.045	3.7	0.00040	133	<0.0041	0	<0.00029	3402		0.00037
Zinc	<0.0020	3237	<0.037	28.3	<0.044	0	<0.10	3.7	0.040	133	<0.12	0	<0.0039	3402		0.025

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	29	3237	471	0	439	0	467	0	100	263	995	0	34	3500		100
Ammonia	<0.050	3237	<2.8	0	<0.10	0	<1.5	0	0.40	263	8.5	0	<0.076	3500		TIN=1
Nitrate	<0.044	3237	<67	0	<0.73	0	5.1	0	1.3	263	26	0	0.14	3500		TIN=1
Antimony	<0.0016	3237	<0.0028	0	<0.00087	0	0.020	0	0.0030	263	0.030	0	<0.0017	3500		0.0056
Arsenic	<0.00033	3237	<0.026	0	<0.0026	0	<0.047	0	0.0050	263	<0.010	0	<0.00068	3500		0.01
Cadmium	<0.000041	3237	<0.000063	0	<0.000081	0	0.0030	0	0.00010	263	<0.00087	0	<0.000045	3500		0.000097
Chromium	<0.0021	3237	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	263	<0.0081	0	<0.0025	3500		0.005
Copper	<0.00038	3237	<0.00065	0	<0.00034	0	0.23	0	0.0040	263	0.12	0	<0.00065	3500		0.003
Iron	<0.037	3237	<0.59	0	<0.53	0	5.3	0	0.17	263	2.8	0	<0.047	3500		0.1
Lead	<0.000074	3237	<0.00045	0	<0.00038	0	<0.11	0	0.00060	263	<0.018	0	<0.00011	3500		0.00055
Manganese	<0.0014	3237	<0.059	0	<0.033	0	0.66	0	0.050	263	2.4	0	<0.0051	3500		0.05
Mercury	<0.000017	3237	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	263	<0.00020	0	<0.000017	3500		0.00005
Silver	<0.00023	3237	<0.00051	0	<0.00051	0	<0.045	0	0.00040	263	<0.0041	0	<0.00024	3500		0.00037
Zinc	<0.0020	3237	<0.037	0	<0.044	0	<0.10	0	0.040	263	<0.12	0	<0.0049	3500		0.025

LIBBY CREEK at LB 2000
Construction

Alternative 2

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	29	3170	471	29.8	439	0	467	2.2	100	475	995	0	42	3677		100
Ammonia	<0.050	3170	<2.8	29.8	<0.10	0	<1.5	2.2	0.40	475	8.5	0	<0.12	3677		TIN=1
Nitrate	<0.044	3170	<67	29.8	<0.73	0	5.1	2.2	1.3	475	26	0	0.75	3677		TIN=1
Antimony	<0.0016	3170	<0.0028	29.8	<0.00087	0	0.020	2.2	0.0030	475	0.030	0	<0.0018	3677		0.0056
Arsenic	<0.00033	3170	<0.026	29.8	<0.0026	0	<0.047	2.2	0.0050	475	<0.010	0	<0.0012	3677		0.01
Cadmium	<0.000041	3170	<0.000063	29.8	<0.000081	0	0.0030	2.2	0.00010	475	<0.00087	0	<0.000051	3677		0.000097
Chromium	<0.0021	3170	<0.0015	29.8	<0.0015	0	<0.0020	2.2	0.0080	475	<0.0081	0	<0.0029	3677		0.005
Copper	<0.00038	3170	<0.00065	29.8	<0.00034	0	0.23	2.2	0.0040	475	0.12	0	<0.0010	3677		0.003
Iron	<0.037	3170	<0.59	29.8	<0.53	0	5.3	2.2	0.17	475	2.8	0	<0.062	3677		0.1
Lead	<0.000074	3170	<0.00045	29.8	<0.00038	0	<0.11	2.2	0.00060	475	<0.018	0	<0.00021	3677		0.00055
Manganese	<0.0014	3170	<0.059	29.8	<0.033	0	0.66	2.2	0.050	475	2.4	0	<0.009	3677		0.05
Mercury	<0.000017	3170	<0.000028	29.8	<0.000022	0	<0.000010	2.2	0.000015	475	<0.00020	0	<0.000017	3677		0.00005
Silver	<0.00023	3170	<0.00051	29.8	<0.00051	0	<0.045	2.2	0.00040	475	<0.0041	0	<0.00028	3677		0.00037
Zinc	<0.0020	3170	<0.037	29.8	<0.044	0	<0.10	2.2	0.040	475	<0.12	0	<0.0073	3677		0.025

Alternatives 3 and 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	29	3170	471	0	439	0	467	0	100	500	995	0	39	3670		100
Ammonia	<0.050	3170	<2.8	0	<0.10	0	<1.5	0	0.40	500	8.5	0	<0.10	3670		TIN=1
Nitrate	<0.044	3170	<67	0	<0.73	0	5.1	0	1.3	500	26	0	0.22	3670		TIN=1
Antimony	<0.0016	3170	<0.0028	0	<0.00087	0	0.020	0	0.0030	500	0.030	0	<0.0018	3670		0.0056
Arsenic	<0.00033	3170	<0.026	0	<0.0026	0	<0.047	0	0.0050	500	<0.010	0	<0.0010	3670		0.01
Cadmium	<0.000041	3170	<0.000063	0	<0.000081	0	0.0030	0	0.00010	500	<0.00087	0	<0.000049	3670		0.000097
Chromium	<0.0021	3170	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	500	<0.0081	0	<0.0029	3670		0.005
Copper	<0.00038	3170	<0.00065	0	<0.00034	0	0.23	0	0.0040	500	0.12	0	<0.00087	3670		0.003
Iron	<0.037	3170	<0.59	0	<0.53	0	5.3	0	0.17	500	2.8	0	<0.055	3670		0.1
Lead	<0.000074	3170	<0.00045	0	<0.00038	0	<0.11	0	0.00060	500	<0.018	0	<0.00015	3670		0.00055
Manganese	<0.0014	3170	<0.059	0	<0.033	0	0.66	0	0.050	500	2.4	0	<0.008	3670		0.05
Mercury	<0.000017	3170	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	500	<0.00020	0	<0.000017	3670		0.00005
Silver	<0.00023	3170	<0.00051	0	<0.00051	0	<0.045	0	0.00040	500	<0.0041	0	<0.00025	3670		0.00037
Zinc	<0.0020	3170	<0.037	0	<0.044	0	<0.10	0	0.040	500	<0.12	0	<0.0072	3670		0.025

LIBBY CREEK at LB 2000
Mining

Alternatives 2, 3, 4

	Existing Water Quality		Representative adit water from LAD percolation (construction)		Representative adit water from LAD percolation (mining)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	29	2878	471	0	439	0	467	0	100	0	995	0	29	2878		100
Ammonia	<0.050	2878	<2.8	0	<0.10	0	<1.5	0	0.40	0	8.5	0	<0.050	2878		TIN=1
Nitrate	<0.044	2878	<67	0	<0.73	0	5.1	0	1.3	0	26	0	<0.044	2878		TIN=1
Antimony	<0.0016	2878	<0.0028	0	<0.00087	0	0.020	0	0.0030	0	0.030	0	<0.0016	2878		0.0056
Arsenic	<0.00033	2878	<0.026	0	<0.0026	0	<0.047	0	0.0050	0	<0.010	0	<0.00033	2878		0.01
Cadmium	<0.000041	2878	<0.000063	0	<0.000081	0	0.0030	0	0.00010	0	<0.00087	0	<0.000041	2878		0.000097
Chromium	<0.0021	2878	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	0	<0.0081	0	<0.0021	2878		0.005
Copper	<0.00038	2878	<0.00065	0	<0.00034	0	0.23	0	0.0040	0	0.12	0	<0.00038	2878		0.003
Iron	<0.037	2878	<0.59	0	<0.53	0	5.3	0	0.17	0	2.8	0	<0.037	2878		0.1
Lead	<0.000074	2878	<0.00045	0	<0.00038	0	<0.11	0	0.00060	0	<0.018	0	<0.000074	2878		0.00055
Manganese	<0.0014	2878	<0.059	0	<0.033	0	0.66	0	0.050	0	2.4	0	<0.0014	2878		0.05
Mercury	<0.000017	2878	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	0	<0.00020	0	<0.000017	2878		0.00005
Silver	<0.00023	2878	<0.00051	0	<0.00051	0	<0.045	0	0.00040	0	<0.0041	0	<0.00023	2878		0.00037
Zinc	<0.0020	2878	<0.037	0	<0.044	0	<0.10	0	0.040	0	<0.12	0	<0.0020	2878		0.025

No water discharges during mining

LIBBY CREEK at LB 2000
Postmining

Alternative 2

Parameter	Existing Water Quality Conc. (mg/l)	Existing Water Quality Flow (gpm)	Representative adit water from LAD percolation (construction) Conc. (mg/l)	Flow (gpm)	Representative adit water from LAD percolation (mining) Conc. (mg/l)	Flow (gpm)	Representative mine water from LAD percolation Conc. (mg/l)	Flow (gpm)	Representative Water Treatment Plant effluent Conc. (mg/l)	Flow (gpm)	Representative tailings water from LAD percolation Conc. (mg/l)	Flow (gpm)	Projected final mixing concentration Conc. (mg/l)	Flow (gpm)	Exceedance	Surface Water Standard or BHES Order Limit (mg/L)
TDS	29	2950	471	0	439	0	467	0	100	370	995	32	46	3352		100
Ammonia	<0.050	2950	<2.8	0	<0.10	0	<1.5	0	0.40	370	8.5	32	<0.17	3352		TIN=1
Nitrate	<0.044	2950	<67	0	<0.73	0	5.1	0	1.3	370	26	32	0.43	3352		TIN=1
Antimony	<0.0016	2950	<0.0028	0	<0.00087	0	0.020	0	0.0030	370	0.030	32	<0.0020	3352		0.0056
Arsenic	<0.00033	2950	<0.026	0	<0.0026	0	<0.047	0	0.0050	370	<0.010	32	<0.00094	3352		0.01
Cadmium	<0.000041	2950	<0.000063	0	<0.000081	0	0.0030	0	0.00010	370	<0.00087	32	<0.000055	3352		0.000097
Chromium	<0.0021	2950	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	370	<0.0081	32	<0.0028	3352		0.005
Copper	<0.00038	2950	<0.00065	0	<0.00034	0	0.23	0	0.0040	370	0.12	32	<0.0019	3352		0.003
Iron	<0.037	2950	<0.59	0	<0.53	0	5.3	0	0.17	370	2.8	32	<0.078	3352		0.1
Lead	<0.000074	2950	<0.00045	0	<0.00038	0	<0.11	0	0.00060	370	<0.018	32	<0.00030	3352		0.00055
Manganese	<0.0014	2950	<0.059	0	<0.033	0	0.66	0	0.050	370	2.4	32	<0.030	3352		0.05
Mercury	<0.000017	2950	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	370	<0.00020	32	<0.000019	3352		0.00005
Silver	<0.00023	2950	<0.00051	0	<0.00051	0	<0.045	0	0.00040	370	<0.0041	32	<0.00029	3352		0.00037
Zinc	<0.0020	2950	<0.037	0	<0.044	0	<0.10	0	0.040	370	<0.12	32	<0.0073	3352		0.025

Alternatives 3 and 4

Parameter	Existing Water Quality Conc. (mg/l)	Existing Water Quality Flow (gpm)	Representative adit water from LAD percolation (construction) Conc. (mg/l)	Flow (gpm)	Representative adit water from LAD percolation (mining) Conc. (mg/l)	Flow (gpm)	Representative mine water from LAD percolation Conc. (mg/l)	Flow (gpm)	Representative Water Treatment Plant effluent Conc. (mg/l)	Flow (gpm)	Representative tailings water from LAD percolation Conc. (mg/l)	Flow (gpm)	Projected final mixing concentration Conc. (mg/l)	Flow (gpm)	Exceedance	Surface Water Standard or BHES Order Limit (mg/L)
TDS	29	2950	471	0	439	0	467	0	100	500	995	0	39	3450		100
Ammonia	<0.050	2950	<2.8	0	<0.10	0	<1.5	0	0.40	500	8.5	0	<0.10	3450		TIN=1
Nitrate	<0.044	2950	<67	0	<0.73	0	5.1	0	1.3	500	26	0	0.23	3450		TIN=1
Antimony	<0.0016	2950	<0.0028	0	<0.00087	0	0.020	0	0.0030	500	0.030	0	<0.0018	3450		0.0056
Arsenic	<0.00033	2950	<0.026	0	<0.0026	0	<0.047	0	0.0050	500	<0.010	0	<0.0010	3450		0.01
Cadmium	<0.000041	2950	<0.000063	0	<0.000081	0	0.0030	0	0.00010	500	<0.00087	0	<0.000050	3450		0.000097
Chromium	<0.0021	2950	<0.0015	0	<0.0015	0	<0.0020	0	0.0080	500	<0.0081	0	<0.0030	3450		0.005
Copper	<0.00038	2950	<0.00065	0	<0.00034	0	0.23	0	0.0040	500	0.12	0	<0.00090	3450		0.003
Iron	<0.037	2950	<0.59	0	<0.53	0	5.3	0	0.17	500	2.8	0	<0.056	3450		0.1
Lead	<0.000074	2950	<0.00045	0	<0.00038	0	<0.11	0	0.00060	500	<0.018	0	<0.00015	3450		0.00055
Manganese	<0.0014	2950	<0.059	0	<0.033	0	0.66	0	0.050	500	2.4	0	<0.008	3450		0.05
Mercury	<0.000017	2950	<0.000028	0	<0.000022	0	<0.000010	0	0.000015	500	<0.00020	0	<0.000017	3450		0.00005
Silver	<0.00023	2950	<0.00051	0	<0.00051	0	<0.045	0	0.00040	500	<0.0041	0	<0.00025	3450		0.00037
Zinc	<0.0020	2950	<0.037	0	<0.044	0	<0.10	0	0.040	500	<0.12	0	<0.0075	3450		0.025

LAD--Evaluation

Alternative 2

Mass Balance Calculations for groundwater below LAD Areas

	Existing Groundwater Conditions		Representative Adit Water Input from LAD Percolation (construction)		Projected Final Mixing Concentration		Exceedance	Groundwater Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	(mg/L)		(mg/L)
TDS	63	31	471	32	270	63	True	200
Nitrate	0.060	31	<67	32	<34	63	True	10
Antimony	<0.0030	31	<0.0026	32	<0.0028	63		0.006
Arsenic	<0.0030	31	<0.022	32	<0.013	63	True	0.01
Cadmium	<0.00010	31	<0.000033	32	<0.000066	63		0.005
Chromium	<0.0010	31	<0.0011	32	<0.0011	63		0.02
Copper	<0.0010	31	<0.00045	32	<0.00072	63		0.1
Iron	<0.052	31	<0.039	32	<0.045	63		0.2
Lead	<0.00034	31	<0.00035	32	<0.00035	63		0.015
Manganese	<0.081	31	<0.029	32	<0.055	63	True	0.05
Mercury	<0.000020	31	<0.000041	32	<0.000031	63		0.002
Silver	<0.00050	31	<0.00051	32	<0.00051	63		0.1
Zinc	<0.010	31	<0.026	32	<0.018	63		0.1

Manganese exceedance is due to ambient dissolved Mn concentration

LAD--Construction

Alternative 2

Mass Balance Calculations for groundwater below LAD Areas

	Existing Groundwater Conditions		Representative Adit Water Input from LAD Percolation (construction)		Projected Final Mixing Concentration		Exceedance	Groundwater Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	(mg/L)		(mg/L)
TDS	63	31	471	32	270	63	True	200
Nitrate	0.060	31	<67	32	<34	63	True	10
Antimony	<0.0030	31	<0.0026	32	<0.0028	63		0.006
Arsenic	<0.0030	31	<0.022	32	<0.013	63	True	0.01
Cadmium	<0.00010	31	<0.000033	32	<0.000066	63		0.005
Chromium	<0.0010	31	<0.0011	32	<0.0011	63		0.02
Copper	<0.0010	31	<0.00045	32	<0.00072	63		0.1
Iron	<0.052	31	<0.039	32	<0.045	63		0.2
Lead	<0.00034	31	<0.00035	32	<0.00035	63		0.015
Manganese	<0.081	31	<0.029	32	<0.055	63	True	0.05
Mercury	<0.000020	31	<0.000041	32	<0.000031	63		0.002
Silver	<0.00050	31	<0.00051	32	<0.00051	63		0.1
Zinc	<0.010	31	<0.026	32	<0.018	63		0.1

Manganese exceedance is due to ambient dissolved Mn concentration

LAD--Mining

Alternative 2

Mass Balance Calculations for groundwater below LAD Areas

	Existing Groundwater Conditions		Representative Adit Water Input from LAD Percolation (operational)		Representative Mine Water Input from LAD Percolation (operational)		Projected Final Mixing Concen.		Exceedance	Groundwater Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	63	31	439	0	467	0	63	31		200
Nitrate	0.060	31	<0.73	0	5.1	0	<0.060	31		10
Antimony	<0.0030	31	<0.0010	0	<0.018	0	<0.0030	31		0.006
Arsenic	<0.0030	31	<0.0019	0	<0.0053	0	<0.0030	31		0.01
Cadmium	<0.00010	31	<0.000081	0	<0.0030	0	<0.00010	31		0.005
Chromium	<0.0010	31	<0.00081	0	<0.0020	0	<0.0010	31		0.02
Copper	<0.0010	31	<0.00041	0	0.017	0	<0.0010	31		0.1
Iron	<0.052	31	<0.035	0	<0.037	0	<0.052	31		0.2
Lead	<0.00034	31	<0.00011	0	<0.0045	0	<0.00034	31		0.015
Manganese	<0.081	31	<0.028	0	0.80	0	<0.081	31		0.05
Mercury	<0.000020	31	<0.000033	0	<0.000010	0	<0.000020	31		0.002
Silver	<0.00050	31	<0.00051	0	<0.0061	0	<0.00050	31		0.1
Zinc	<0.010	31	<0.026	0	<0.044	0	<0.010	31		0.1

No discharge during mining

LAD--Post-Mining

Alternative 2

Mass Balance Calculations for groundwater below LAD Areas

	Existing Groundwater Conditions		Representative Tailing Water Input from LAD Percolation (post-mining)		Projected Final Mixing Concen.		Exceedance	Groundwater Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	63	31	995	32	536	63	True	200
Nitrate	0.060	31	26	32	13	63	True	10
Antimony	<0.0030	31	0.030	32	<0.017	63	True	0.006
Arsenic	<0.0030	31	<0.0043	32	<0.0037	63		0.01
Cadmium	<0.00010	31	<0.0020	32	<0.0011	63		0.005
Chromium	<0.0010	31	<0.0020	32	<0.0015	63		0.02
Copper	<0.0010	31	0.010	32	<0.0055	63		0.1
Iron	<0.052	31	<0.14	32	<0.097	63		0.2
Lead	<0.00034	31	<0.0010	32	<0.00068	63		0.015
Manganese	<0.081	31	2.0	32	<1.1	63	True	0.05
Mercury	<0.000020	31	<0.00011	32	<0.000066	63		0.002
Silver	<0.00050	31	<0.0010	32	<0.00075	63		0.1
Zinc	<0.010	31	<0.037	32	<0.024	63		0.1

Tailings Impoundment--Mining
Little Cherry Creek Impoundment Area Well Data Used for Existing Conditions

Alternatives 2 & 4
Mass Balance Calculations for groundwater below TI

	Existing Groundwater Conditions		Representative Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Groundwater Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	60	35	245	25	137	60		200
Nitrate	0.070	35	13	25	5.5	60		10
Antimony	<0.0030	35	0.015	25	<0.0080	60	True	0.006
Arsenic	<0.0030	35	<0.0021	25	<0.0026	60		0.01
Cadmium	<0.00010	35	<0.00098	25	<0.00047	60		0.005
Chromium	<0.00074	35	<0.0010	25	<0.00085	60		0.02
Copper	<0.0012	35	0.024	25	<0.011	60		0.1
Iron	<0.010	35	<0.067	25	<0.034	60		0.2
Lead	<0.00028	35	<0.0025	25	<0.0012	60		0.015
Manganese	<0.077	35	0.54	25	<0.27	60	True	0.05
Mercury	<0.000030	35	<0.000055	25	<0.000040	60		0.002
Silver	<0.00050	35	<0.00050	25	<0.00050	60		0.1
Zinc	<0.0064	35	<0.010	25	<0.0079	60		0.1

Poorman Impoundment Area Well Data Used for Existing Conditions
Alternative 3
Mass Balance Calculations for groundwater below TI

	Existing Groundwater Conditions		Representative Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Groundwater Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	60	41	245	25	130	66		200
Nitrate	0.070	41	13	25	5.0	66		10
Antimony	<0.0030	41	0.015	25	<0.0075	66	True	0.006
Arsenic	<0.0030	41	<0.0021	25	<0.0027	66		0.01
Cadmium	<0.00010	41	<0.00098	25	<0.00043	66		0.005
Chromium	<0.00074	41	<0.0010	25	<0.00084	66		0.02
Copper	<0.0012	41	0.024	25	<0.0098	66		0.1
Iron	<0.010	41	<0.067	25	<0.032	66		0.2
Lead	<0.00028	41	<0.0025	25	<0.0011	66		0.015
Manganese	<0.077	41	0.54	25	<0.25	66	True	0.05
Mercury	<0.000030	41	<0.000055	25	<0.000039	66		0.002
Silver	<0.00050	41	<0.00050	25	<0.00050	66		0.1
Zinc	<0.0064	41	<0.010	25	<0.0078	66		0.1

Tailings Impoundment--Post-Closure
Little Cherry Creek Impoundment Area Well Data Used for Existing Conditions

Alternatives 2 & 4
Mass Balance Calculations for groundwater below TI

	Existing Groundwater Conditions		Representative Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Groundwater Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	60	35	245	5	83	40		200
Nitrate	0.070	35	13	5	1.7	40		10
Antimony	<0.0030	35	0.015	5	<0.0045	40		0.006
Arsenic	<0.0030	35	<0.0021	5	<0.0029	40		0.01
Cadmium	<0.00010	35	<0.00098	5	<0.00021	40		0.005
Chromium	<0.00074	35	<0.0010	5	<0.00077	40		0.02
Copper	<0.0012	35	0.024	5	<0.0041	40		0.1
Iron	<0.010	35	<0.067	5	<0.017	40		0.2
Lead	<0.00028	35	<0.0025	5	<0.00056	40		0.015
Manganese	<0.077	35	0.54	5	<0.13	40	True	0.05
Mercury	<0.000030	35	<0.000055	5	<0.000033	40		0.002
Silver	<0.00050	35	<0.00050	5	<0.00050	40		0.1
Zinc	<0.0064	35	<0.010	5	<0.0069	40		0.1

Poorman Impoundment Area Well Data Used for Existing Conditions
Alternative 3
Mass Balance Calculations for groundwater below TI

	Existing Groundwater Conditions		Representative Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Groundwater Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)		(mg/L)
TDS	60	41	245	5	80	46		200
Nitrate	0.070	41	13	5	1.5	46		10
Antimony	<0.0030	41	0.015	5	<0.0043	46		0.006
Arsenic	<0.0030	41	<0.0021	5	<0.0029	46		0.01
Cadmium	<0.00010	41	<0.00098	5	<0.00020	46		0.005
Chromium	<0.00074	41	<0.0010	5	<0.00077	46		0.02
Copper	<0.0012	41	0.024	5	<0.0037	46		0.1
Iron	<0.010	41	<0.067	5	<0.016	46		0.2
Lead	<0.00028	41	<0.0025	5	<0.00052	46		0.015
Manganese	<0.077	41	0.54	5	<0.13	46	True	0.05
Mercury	<0.000030	41	<0.000055	5	<0.000033	46		0.002
Silver	<0.00050	41	<0.00050	5	<0.00050	46		0.1
Zinc	<0.0064	41	<0.010	5	<0.0068	46		0.1

Appendix H—Various Streamflow Analyses

Water Yield Discussion for Montanore Mine Alternatives and Transmission Line Alternatives

The Kootenai National Forest Plan contains water yield guidelines based on instream resource values (Guidelines for Calculating Water Yield Increases, Appendix 18, KNF Plan). Because the greatest risk of degrading channel function occurs during high flow periods, it is the increase in magnitude and duration of peak flows that concerns land managers the most. Timber harvest often alters normal streamflow dynamics, particularly the volume of peak flows (maximum volume of water in the stream) and baseflows (the volume of water in the stream representing the groundwater contribution). The degree these parameters change depend on the road density, percentage of total tree cover removed from the watershed, and the amount of soil disturbance caused by the harvest, among other things. For example, if harvest activities remove a high percentage of tree cover and cause light soil disturbance and compaction, rain falling on the soil will infiltrate normally. However, due to the loss of tree cover, evapotranspiration (the loss of water by plants to the atmosphere) will be much lower than before. Thus, the combination of normal water infiltration into the soil and decreased uptake of water by tree cover results in higher stream flows. In general, timber harvest on a watershed scale results in water moving more quickly through the watershed because of decreased soil infiltration and evapotranspiration. The creation of openings in a forested canopy tends to increase snow deposition (Christner and Harr 1982) and wind speeds (Chamberlin 1982). An increase in wind speeds could increase the rate of snowmelt during cloudy and rainy conditions, resulting in greater streamflow (Harr 1981).

Direct and Indirect Effects to Water Yield

Water yield increases due to timber harvest activities are a function of canopy reduction and miles of road constructed. Hydrologic responses to these activities will depend on the natural characteristics of the watershed. They can include increases in snowpack depth, melting rates, surface runoff, subsurface flow interception and landform energy aspects. Rain-on-snow events can occur in the project area drainages.

Water yield estimates for analysis area streams were determined using the KNF beta version of the Equivalent Clearcut Acres Calculator (ECAC). The ECAC Model was designed as a quick-analysis tool to enable watershed professionals to estimate the potential effects of forest management (harvest and roading). The utility of the model is that it offers a quick and consistent method of providing information on past and proposed management activities. The values generated by the model are used, in concert with other water resource information, to interpret the potential effects to a stream channel as a result of implementing a proposed land management activity. Values generated by the model are not to be considered as an absolute measure against verifiable standards, nor by themselves provide an answer as to the effects of implementing the proposed land management activity.

The ECAC process is a GIS interface between management activity databases (Oracle and TSMRS) that allows watershed specialists to model (estimate) the current equivalent clearcut acres (ECA) within a watershed of interest. The model calculates disturbances based on the “ECA” (Equivalent Clearcut Acre) procedure. For example, a 100-acre harvest area with 100 percent canopy removal would equate to 100 ECAs; a 100-acre harvest with a 52% crown removal would equate to 44 ECAs. The ECAC model calculates ECA for a specified watershed based on the most recent management activities with the greatest crown removal associated with roads, timber harvest, and land conversion from a timbered to a permanently cleared state. The

ECAC model does not model peak flows or sediment production and transport. Watershed specialists must use additional models, indices, measures, monitoring, site-specific data, and professional experience to analyze those watershed effects.

The ECAC Model was not designed to develop estimates of flow. The development of flow estimates from ECAC output generally involves separating watersheds by size class and precipitation regime that had already been run through the R1-WATSED model (also an ECA based program) and comparing their results with the above mentioned ECAC process to look at water yield estimates. This procedure has allowed a more simplified analysis path based for ECAs to generate water yield estimates that have been validated by comparison with the R1-WATSED model output. Regression equations created from R1-WATSED outputs are used to determine the number of ECAs required to generate a 1% increase in peak flows and also the number of ECAs that recover each year in a watershed. Copies of the regression equations are included in the project file.

In an analysis of effects of forest harvest activities on peak flows and channel morphology in the Pacific Northwest, Grant *et al.* (2008) identified a detection limit for changes in peak flow measurements of about ±10 percent. They indicated percentage changes in peak flow that fall in this range are within the error of peak flow measurement and cannot be ascribed as an effect.

Data for the proposed Montanore Project mine alternatives and the proposed transmission line alternatives were analyzed using the ECAC model and the results are displayed below in Tables H-1, H-2, and H-3. In general, none of the transmission line alternatives would result in a measurable increase in peak flows to any watershed. For the mine alternatives (besides Little Cherry Creek – see discussion below), only Alternative 2 in the Ramsey Creek watershed approaches an increase in water yield (8.1%) that might be measurable compared to existing conditions.

Table H-1. Projected Water Yield Increase by Mine Alternative.

Drainage	Existing		Alt 2		Alt 3		Alt 4	
	ECAs*	PFI**	ECAs	PFI	ECAs	PFI	ECAs	PFI
Bear	610	4.1	172	1.1	18	0.1	169	1.1
Big Cherry	5,145	3.0	58	<0.1	58	<0.1	58	<0.1
Getner	347	13.3	3	<0.1	3	<0.1	3	<0.1
Little Cherry‡	387	32.2	1,252	104	328	27.3	1,069	89.1
Poorman	216	5.4	214	5.3	182	4.6	132	3.3
Ramsey	166	3.6	373	8.1	274	5.9	274	5.9
Rock	1,376	3.0	1	0.0	1	0.0	1	0.0
Upper Libby†	4,038	3.2	2,014	1.6	805	0.6	1,647	1.3
Libby Total	28,467	4.1	2,072	0.3	863	0.1	1,705	0.2

Note: These values do not include the various transmission line alternatives.
†The Upper Libby Creek watershed boundary is the bridge where Libby Creek is crossed by U.S. 2.
‡In all alternatives, the majority of the disturbance acres in the Little Cherry Creek watershed would be altered for the construction of a tailings impoundment. These acres would not discharge water to the lower section of Little Cherry Creek. This will result in a much lower PFI (similar to existing) to the lower section of Little Cherry Creek than what is displayed.
*ECA= Equivalent Clearcut Acres, ** PFI= Percent Peak Flow Increase

The projected impacts to water yield in Little Cherry Creek are for the unaltered basin. Because Alternatives 2 and 4 include the construction of a tailings impoundment in the watershed (Alternative 3 includes the construction of an impoundment in the Poorman Creek watershed but the outlet for this impoundment would also be directed towards Little Cherry Creek after closure), the majority of the watershed would be captured within the tailings impoundment and the water would be used in the milling process for the mine. For this reason, the values shown in Tables H-1 and H-2 for Little Cherry Creek do not represent what the actual condition would be on the ground.

It is assumed that the diversion channel that would drain the upper portion of the Little Cherry Creek watershed would be sized correctly to remain in a stable, functional condition. Based on the proposed project design for the tailings impoundments after closure, the impoundment area would act as a sink for the water it captures until the water reaches a level where it would then begin to flow down a lined channel off the impoundment surface towards the new diversion channel in Alternatives 2 and 4 (or Little Cherry Creek in Alternative 3). This process would have a dampening effect on flows from the impoundment area and there would be no impact to peak flows in the Little Cherry system because of runoff from the impoundment surface area.

Table H-2. Projected Total (Existing plus Proposed) Mine Related Water Yield Increase by Alternative.

Drainage	Alt 2		Alt 3		Alt 4	
	ECAs*	PFI**	ECAs	PFI	ECAs	PFI
Bear	782	5.2	628	4.2	779	5.2
Big Cherry	5,203	3.0	5,203	3.0	5,203	3.0
Getner	350	13.4	350	13.4	350	13.4
Little Cherry‡	1,639	136.2	715	59.5	1,456	121.3
Poorman	430	10.7	398	10.0	348	8.7
Ramsey	539	11.7	440	9.5	440	9.5
Rock	1,377	3.0	1,377	3.0	1,377	3.0
Upper Libby†	6,052	4.8	4,843	3.8	5,685	4.5
Libby Total	30,539	4.4	29,330	4.2	30,172	4.3

Note: These values do not include the various transmission line alternatives.
†The Upper Libby Creek watershed boundary is the bridge where Libby Creek is crossed by U.S. 2.
‡In all alternatives, the majority of the disturbance acres in the Little Cherry Creek watershed would be altered for the construction of a tailings impoundment. These acres would not discharge water to the lower section of Little Cherry Creek. This will result in a much lower PFI (similar to existing) to the lower section of Little Cherry Creek than what is displayed.

*ECA= Equivalent Clearcut Acres, ** PFI= Percent Peak Flow Increase

Depending on which mine alternative is chosen and which transmission line alignment alternative is chosen the total mine related impact to water yield will need to be added from Tables H-2 and H-3 for the selected watersheds. The combination of Alternative 2 and Alternative B would have the highest probability of resulting in a measurable impact to Ramsey Creek (11.7 + 0.5 = 12.2 percent increase in peak flows). Not withstanding the previous discussion about impacts to Little Cherry Creek, the remaining mine and transmission line alternatives all fall within unmeasurable mine related effects to water yields for all reviewed watersheds. Reviewing the data in tables H-1 and H-2, the mine related water yield increase would reach a measurable level in Ramsey and Poorman (Alt 2 only) creeks, but none of the transmission line alternatives affect the Poorman drainage, so the impacts would not be greater than those displayed in Tables H-1 and H-2.

Table H-3. Projected Water Yield Increase by Transmission Line Alternative.

Drainage	Alt B		Alt C-R		Alt D-R		Alt E-R	
	ECAs	PFI	ECAs	PFI	ECAs	PFI	ECAs	PFI
Howard	16	1.1	20	1.4	59	4.2	59	4.2
Ramsey	24	0.5	0	0	0	0	0	0
Midas	36	0.9	40	1.0	0	0	0	0
Miller	104	0.6	115	0.7	122	0.7	21	0.1
Fisher Tribs‡	11	n/a	64	n/a	63	n/a	63	n/a
West Fisher	0	0	49	.07	68	.09	186	0.3
Upper Libby†	17	.01	13	.01	13	.01	13	.01
Fisher Total	199	.01	199	.01	201	.01	290	.02

‡Fisher River tributaries include Hunter, Sedlak and a small side drainage. These areas do not have stream channels with direct connections to the Fisher River. These areas were all combined in the Fisher Total value.
†The Upper Libby Creek watershed boundary is where Libby Creek is crossed by U.S. 2.

*ECA= Equivalent Clearcut Acres, ** PFI= Percent Peak Flow Increase

Cumulative Effects to Water Yield

Fisher River Watershed

An analysis for cumulative effects that includes activities beyond those associated with the proposed mine was completed in the *Miller-West Fisher EIS* (KNF, 2009). A summary of that analysis is included here. Please see that document for a complete review of the analysis. The analysis included the following activities:

- Private Timber Company timber harvest (PCTC)
- Forest-Wide Fuels EA burn units
- Miller Creek Wildlife Habitat Improvement Burn Units
- Montanore and Libby Adit Projects
- Green Mountain Fuel Reduction Units
- Rock Creek Mine Project
- Bear Lakes Estate Access
- Wayup and Forth of July Mines Access
- Other small activities such as Outfitter and Guide Use and Monitoring Activities.

The activities listed above for cumulative effects were analyzed in combination with the Alternative 6 activities from the Miller West Fisher EIS. The results of those combined activities are displayed below for the larger Fisher River watershed and assume that PCTC and the approved USFS timber sales would have been completed in 2010. The analysis used the E-R transmission line route, and because of potential impacts to Miller Creek Alt D-R was also included for analysis for that basin and is displayed in the table below

Miller West Fisher EIS Cumulative Water Yield Results - Alternative 6 (2009)

DRAINAGE	WATERSHED SIZE (ACRES)	ECA (ACRES)	CUMMULATIVE WATER YIELD INCREASE (%)	ROAD DENSITY (MILES/MI^2)
Miller Creek	7,563	2,275	13.4 (14.1 D-R)	2.56
West Fisher Creek	28,950	3,122	4.5	2.25
Silver Butte Creek	29,934	1,157	1.6	1.07
Fisher River	250,551	64,927	5.0	4.2

Watershed Condition Discussion

The cumulative effects associated with the Fisher River basin have been lumped into one year (2009). Because the proposed harvest actually extends to the year 2020, the amount of recovering ECA's in that time period will more than offset the additional harvest acres from the PCTC activities. Even with all the ECA's being lumped into one year, the resulting increase is just 0.7%. This level of water yield increase would be very difficult to separate from the amount of natural variability in the system and should be considered insignificant in the Fisher basin.

Hydrology/ Geomorphology

The paper by Grant (2008) discussed above suggests that when the cumulative impacts to a watershed result in an increase in water yield above 10 percent that the change would be measurable in that watershed. Water yield changes below that level fall into a zone of natural variability and would be very difficult to separate from activity related changes and natural changes. The Kootenai Forest Plan has an allowable peak flow increase level of 15 percent.

The majority of the geomorphic channel types in Miller Creek are sensitive to increases in peak flow levels. It is not expected that the projected peak flow increases in West Fisher, Silver Butte and the Fisher River will cause a change in the existing channel stability. The projected cumulative peak flow increase if Alt D-R is chosen of 14.1% in Miller Creek would remain below the recommended allowable peak flow increase of 15%, and would meet Forest Plan standards. It is expected that the projected water yield increase would not result in a degraded condition based on field reviews and past stream monitoring. The projected portion of the increase in peak flow from the Montanore project transmission line in the Miller Creek basin is 0.7 percent above the projected existing condition, which would still be below the Forest Plan recommended allowable peak flow increase of 15%.

Libby Creek Watershed

A cumulative analysis for water yields in the entire Libby Creek watershed was completed in 2004 for the Treasure Interface EA. That analysis has been updated using existing data supplied by the USFS. Exact acreages of private harvest in the basin were not available, but average harvest rates have been used to update the prior cumulative effects analysis for water yields in the larger Libby Creek watershed.

Treasure Interface Cumulative Water Yield Results - 2004					
Drainage	**Acres**	**Predicted PFI***	**ECA*** USFS**	**ECA other**	**Road Miles**
Prospect	4,005	25.5	340	806	14
Big Cherry*	23,538	4.7	804	1,640	40
Libby	150,017	4.1	18,032	10,435	661

* That portion of Big Cherry Creek from Libby creek up to, and including Granite Creek
** PFI = Peakflow Increase (%), ***ECA = Equivalent Clearcut Acres

It is assumed that 400 acres per year of harvest for the last 8 years equals 3,200 acres of new harvest. Prior analyses (Libby NFMA) have shown that approximately 440 acres of vegetative recovery occur each year. This equates to 3,520 acres of recovery in the past 8 years. Overall, the updated analysis would suggest that there has been an equal amount of harvest and recovery, and the values from the Treasure Interface EA for the entire Libby Creek watershed (which are displayed in Tables H1 and H2) remain valid for reviewing cumulative impacts in this watershed.

Water yield increases like the ones seen in the Libby Creek watershed fall into a zone of natural variability and would be very difficult to separate any activity related changes compared to natural changes (Grant 2008). The Kootenai Forest Plan has an allowable peak flow increase level of 15 percent.

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January 4, 2010

To: Montanore Mine Project EIS

From: Jack Denman, Richard Trenholme, ERO Resources Corporation

Re: Montanore Tailings Impoundment Watershed Analysis

This memorandum presents the findings of an analysis of the changes to watershed boundaries resulting from the various tailings impoundment locations for each of the three alternatives (Alternatives 2, 3, and 4) for the Montanore Project. The purpose of the analysis is to assess changes in watershed areas as an indicator of possible streamflow changes.

The primary assumption of this analysis is that watershed area, as a direct measure of catchment area, is directly related to streamflow of the receiving stream in each watershed. Additional assumptions are:

1. Differences in precipitation and runoff due to elevation, soil type, vegetative cover, slope, aspect or other physical, biological, or geologic characteristics of the watershed are negligible across the analysis area. Within the small watersheds of the tailings impoundment sites, differences in elevation are slight.
2. All surface runoff in contact with tailings during operational periods would be intercepted and pumped to the mill for use.
3. The South Saddle Dam and Main Dam (Alternatives 2 and 4) and the Main Dam and Seepage Collection Dam (Alternative 3) would be constructed of tailings, and surface runoff would be pumped to mill.
4. The North Saddle Dam and Diversion Dam (Alternatives 2 and 4) and the Saddle Dam (Alternative 3) would be constructed of local soil and rock, not tailings, and surface runoff would be managed as stormwater and flow into nearby streams.
5. Surface runoff associated with soil stockpiles located across existing watersheds would remain within the respective existing watershed.
6. Surface runoff from the borrow areas outside of the impoundment footprint in Alternatives 2 and 4 would be channeled to Bear Creek during operations and graded to flow into the tailings impoundment upon closure.
7. Seepage collection dams would be removed as part of mine closure.

Watershed Calculations

For the purpose of this analysis, the existing proposed footprints for the three tailings impoundments and associated facilities were plotted over the Hydrographic Unit boundaries. The boundaries were a GIS coverage provided by the Kootenai National Forest (KNF). ERO altered one hydrographic unit, the Libby Creek Upper Tributary, from that provided by the KNF. The altered unit is between Little Cherry Creek and Poorman Creek, and is the unit in which most of the Poorman Tailings Impoundment in Alternative 3 would be located. ERO altered the boundary based on studies of the Diversion Channel and the Poorman Impoundment Site. Kline (2005) reported that the USGS topographic map indicates the diverted stream (between National Forest Service (NFS) roads #6212 and #5181) would flow to the southeast. The field survey revealed that the stream would flow to the northeast and discharge to Libby Creek 1,900 feet downstream of the location indicated on the topographic map. Geomatrix (2006) labeled this stream Channel A. Kline (2005) reported that a closed spur of NFS road #5181 has a culvert to convey the diverted stream and another culvert 1,157 feet to the south. The diverted stream would not naturally flow to the south culvert. According to Kline (2005), it was often difficult to judge where water would flow downgradient of NFS road #5181. Geomatrix (2006) described this south channel as Channel B. In a wetland delineation of the Poorman Impoundment Site, Geomatrix (2007) identified four channels between Little Cherry Creek and Poorman Creek. MMC proposes to divert flows up to about 20 cfs into Channel A, and higher flows into both channels (Geomatrix 2007). Based on these reports and air photo-interpretation, ERO delineated a watershed for Channel A, and a separate watershed for Channel B and the other two channels. The watershed for Channel A is labeled Channel A for this analysis; the watershed for Channel B and the other two channels is labeled Channel BCD.

Each impoundment feature and associated “sub-watershed” was mapped as a polygon using ArcGIS. The mapping enabled an impact area to be calculated for each feature by watershed. For example, precipitation intercepted by the impoundment surface, Main Dam, South Saddle Dam, and Seepage Collection Dam in Alternatives 2 and 4 would be intercepted and sent to the mill. For Alternative 2, this sub-watershed is labeled LCC-2. Likewise, precipitation upstream of the Diversion Dam in Alternative 2 would be diverted into Channel A. This sub-watershed is labeled LCC-5. For purposes of analysis, it was assumed all water upstream of the Diversion Dam in Alternatives 2 and 4 would be diverted into Channel A. This assumption would accurately reflect relative change except during high flow periods, when some flow would flow to Channel B in the Channel BCD watershed. Changes to all watersheds were either added or subtracted from the existing watershed area, depending on whether the change would add watershed area, and therefore “water” to the watershed, or remove it. Total watershed areas were calculated from the location on the receiving stream that would receive diverted “watershed area.” As a quality control check, the summation of all diversion areas equal to zero was checked for each scenario to ensure that areas were not counted twice. Finally, percent change in the watershed was calculated for each measurement location of receiving streams to qualitatively estimate potential changes in flow associated with the diversions. Calculations for all three alternatives were performed, for both operational periods and post-closure based on the general conditions of operation and closure discussed in this memorandum.

Watershed Analysis – Alternative 2

Changes to watershed areas during Alternative 2 operations are shown on Figure 1. Surface runoff from the west face of the Diversion Dam and the Little Cherry Creek watershed upstream of the tailings impoundment (LCC-5) would be diverted to Channel A via the engineered diversion channel. This diversion would become the "new" Little Cherry Creek. The watershed of Channel A would increase during operations from 237 acres to 974 acres. Some high flows would be directed into Channel B. During operations, all surface water in contact with tailings and within the sub-watershed of the Seepage Collection Dam (LCC-2, CHA-2, and BC-1) would be pumped to the mill. These diversions would reduce the watershed of the former Little Cherry Creek from 1,682 acres to 225 acres. The watersheds of two locations in Bear Creek would increase slightly (Table 1). Surface runoff from the borrow area uphill from the tailings impoundment (LCC-4) would be diverted around the Diversion Dam, ultimately into Channel A. Surface runoff from the north face of the North Saddle Dam (LCC-3) would be treated as storm runoff and diverted to Bear Creek.

Alternative 2 post-closure changes to watershed areas are shown on Figure 2. The surface of the tailings impoundment would be graded so that drainage west of the Main Dam crest and north of the South Saddle Dam crest would flow toward Bear Creek. The diversion channel that allowed drainage from the borrow area (LCC-4) would be removed to allow flow into the tailings impoundment and north to Bear Creek with the tailings impoundment surface flow (LCC-6). The watershed area in Bear Creek would increase by 560 acres.

The Seepage Collection Dam would be removed and the former Little Cherry Creek watershed would extend west to the crest of the Main Dam. Runoff east of the Main Dam crest would remain in the former Little Cherry Creek watershed (LCC-8). Similarly, surface runoff upstream of the Diversion Dam face (LCC-7) and south of the South Saddle Dam face (CHA-13) would remain in the Channel A watershed upon closure. After closure, Channel A would have a watershed 678 acres larger than its current 237 acres (Table 1). The Libby Creek watershed at the confluence of Channel A would have a slightly larger watershed (678 acre or 3 percent). Between the confluence of the former Little Cherry Creek and Bear Creek, the Libby Creek watershed would have a slightly smaller watershed (560 acres or 2 percent) compared to existing areas. The Libby Creek watershed above the confluence with Bear Creek, would remain unchanged (Table 1).

Table 1. Changes in Watershed Areas during Operations and Closure, Alternative 2.

	Bear Creek		Former Little Cherry Creek	Channel A	Libby Creek		
Measurement Location	BC-7208	BC-8281	LCC-1682	CHA-A-237	LC-23245	LC-25637	LC-35853
Existing Watershed Area (ac.)	7,208	8,281	1,682	237	23,245	25,637	35,853
Operations							
Change in Watershed (ac.)	8	2	-1,457	737	737	-720	-720
New Watershed Area (ac.)	7,217	8,283	225	974	23,982	24,917	35,135
% Change	<1%	<1%	-87%	311%	3%	-3%	-2%
Closure							
Change in Watershed (ac.)	560	560	-1,238	678	678	-560	0
New Watershed Area (ac.)	7,768	8,841	445	915	23,923	25,077	35,853
% Change	8%	7%	-74%	286%	3%	-2%	0%

Watershed Analysis – Alternative 3

Alternative 3 operational changes to the existing watersheds are shown in Figure 3. During operations, surface runoff from below the access road, in contact with tailings, the Main Dam face, and within the Seepage Collection Dam sub-watershed (CHBD-b2a, CHBD-3b, CHA-4, CHBD-1, LC-3, LC-4, LCC-9, LCC-10, and LCC-11), would be diverted to the mill. Surface runoff from the Saddle Dam face (CHA-5) would be diverted to Little Cherry Creek. Surface runoff from the western watershed boundary of Channels BCD to the access road would be diverted as storm water based on a topographic divide between Channels C and D, with runoff from the northern sub-watershed (CHA-6 and CHBD-3a) diverted to Little Cherry Creek; and runoff from the southern sub-watershed (CHBD-2a) diverted to Poorman Creek. Runoff from the southern portion of the Channel BCD watershed (CHBD-4) would be diverted to Libby Creek because of topographic isolation from the remaining Channel BCD watershed by the Main Dam. These diversions would reduce the watershed of Channel BCD from 759 acres to 100 acres. The watersheds of Poorman Creek and Little Cherry Creek would increase during operation by 112 and 53 acres, respectively (Table 2). The Libby Creek watershed between Poorman Creek and Channels BCD would increase slightly (132 acres or <1 percent), and decrease slightly between Channels BCD and the confluence of Channel A and Libby Creek (744 acres or 3 percent).

Alternative 3 post-closure changes to existing watersheds are shown on Figure 4. After closure, the surface of the tailings impoundment would be graded to allow surface runoff from the impoundment to flow toward Little Cherry Creek. A portion of the northern face of the Main Dam (CHA-12) would flow into the Little Cherry Creek drainage because of the elevation of the final dam face. The drainage channel that allowed surface runoff from the western portion of the Channel BCD watershed to flow to Poorman Creek (during operations) would be removed and graded to allow all surface drainage to flow toward Little Cherry Creek (CHBD-6, CHBD-8, and CHA-8). These changes would increase the watershed of Little Cherry Creek from 1,457 to 2,101 acres. The Poorman Creek watershed would remain unchanged at closure/post-closure, compared to the pre-operation size of the watershed.

Surface runoff from the face of the Main Dam would remain in the respective watersheds of final construction (sub-watersheds CHA-7, CHBD-5, CHBD-7, LCC-9, LCC-10 and LC-3). The Seepage Collection Dam would be removed prior to post-closure. Surface runoff from the south face of the Main Dam (CHBD-7) and the southern extent of the Channel BCD watershed (CHBD-4) would flow to Libby Creek because of the topographic isolation described above during operations. The Libby Creek watershed above the confluence with Little Cherry Creek, would remain unchanged (Table 2).

Table 2. Changes in Watershed Areas during Operations and Closure, Alternative 3.

	Poorman Creek	Little Cherry Creek		Channel A	Channel BCD	Libby Creek		
Measurement Location	PC-3651	LCC-940	LCC-1457	CHA-A-237	CHA-BCD-759	LC-21482	LC-23245	LC-25637
Existing Watershed Area (ac.)	3,651	940	1,457	237	759	21,482	23,245	25,637
Operations				-207	-659	132	-744	-689
Change in Watershed (ac.)	112	53	55	30	100	21,614	22,501	24,948
New Watershed Area (ac.)	3,763	993	1,512	-87%	-87%	0.61%	-3%	-3%
% Change	3%	6%	4%	237	759	21,482	23,245	25,637
Closure								
Change in Watershed (ac.)	0	633	644	-157	-561	74	-644	0
New Watershed Area (ac.)	3,651	1,573	2,101	80	198	21,556	22,601	25,637
% Change	0%	67%	44%	-66%	-74%	<1%	-3%	0%

Watershed Analysis – Alternative 4

Alternative 4 operational changes to existing watersheds are shown in Figure 5. Surface water drainage during operations is similar to Alternative 2, with all surface runoff in contact with tailings to be pumped to the mill (LCC-14, CHA-2, and BC-1). Surface runoff from the North Saddle Dam face (LCC-3) would flow to Bear Creek. The watershed of Bear Creek would increase by about 2 to 8 acres (Table 3). A diversion ditch at the base of the borrow area (LCC-15) would divert surface runoff as stormwater to the diversion dam. Surface runoff from the Little Cherry Creek watershed above the Diversion Dam (LCC-13) and the soil borrow area (LCC-15) would be conveyed to Channel A. Tailings runoff diversion to the mill and Channel A diversions would reduce the watershed of Little Cherry Creek by 1,457 acres and increase the watershed of Channel A by 737 acres.

Alternative 4 changes to existing watersheds after closure are shown in Figure 6. The primary difference between Alternatives 2 and 4 is in closure. In Alternative 4, the Tailings Impoundment would be sloped to allow drainage to the southwest, around the

Diversion Dam. The diversion ditch at the base of the borrow area would allow flow to the Tailings Impoundment and subsequently to Channel A. Flows from the Tailings Impoundment (LCC-15 and LCC-16), and from the Little Cherry Creek watershed above the Diversion Dam (LCC-18), would be diverted to Channel A. The Seepage Collection Dam would be removed prior to closure. Surface flow from the dam faces would flow downhill to the receiving watershed, post-closure. These changes would decrease the watershed of Little Cherry Creek by 1,242 acres. The Channel A watershed would increase by 1,234 acres. The Libby Creek watershed, above the confluence with Bear Creek, would remain unchanged (Table 3).

Table 3. Changes in Watershed Areas during Operations and Closure, Alternative 4.

	Bear Creek		**Little Cherry Creek**		**Channel A**	**Libby Creek**		
Measurement Location	BC-7208	BC-8281	LCC-1457	LCC-1682	CHA-A-237	LC-23245	LC-25637	LC-35,853
Existing Watershed Area (ac.)	7,208	8,281	1,457	1,682	237	23,245	25,637	35,853
Operations								
Change in Watershed (ac.)	8	2	-1,457	-1,457	737	737	-720	-720
New Watershed Area (ac.)	7,216	8,283	0	225	974	23,982	25,242	35,102
% Change	<1%	<1%	-100%	-87%	311%	3%	-3%	-2%
Closure								
Change in Watershed (ac.)	8	8	-1,242	-1,242	1,234	1,234	-8	0
New Watershed Area (ac.)	7,216	8,289	215	440	1,470	24,478	25,629	35,853
% Change	<1%	<1%	-85%	-74%	520%	5%	<1%	0%

References

Geomatrix Consultants, Inc. 2006. Analysis of conceptual tailings impoundment diversion drainage alternatives, Montanore Mine Project. Submitted to the KNF and the DEQ. p. 41 plus appendices.

Geomatrix Consultants, Inc. 2009. Survey of wetlands, sensitive plants, and amphibian/reptiles in alternative sites for tailings impoundment, plant facility and mine tunnel, Montanore Mine Project. Prepared for Montanore Minerals Corp. p. 15 plus appendices.

Kline Environmental Research, LLC. 2005. Montanore Project: Fish habitat potential in the Little Cherry Creek tailings impoundment diversion. Submitted to the KNF and the DEQ. p. 20 plus appendices.

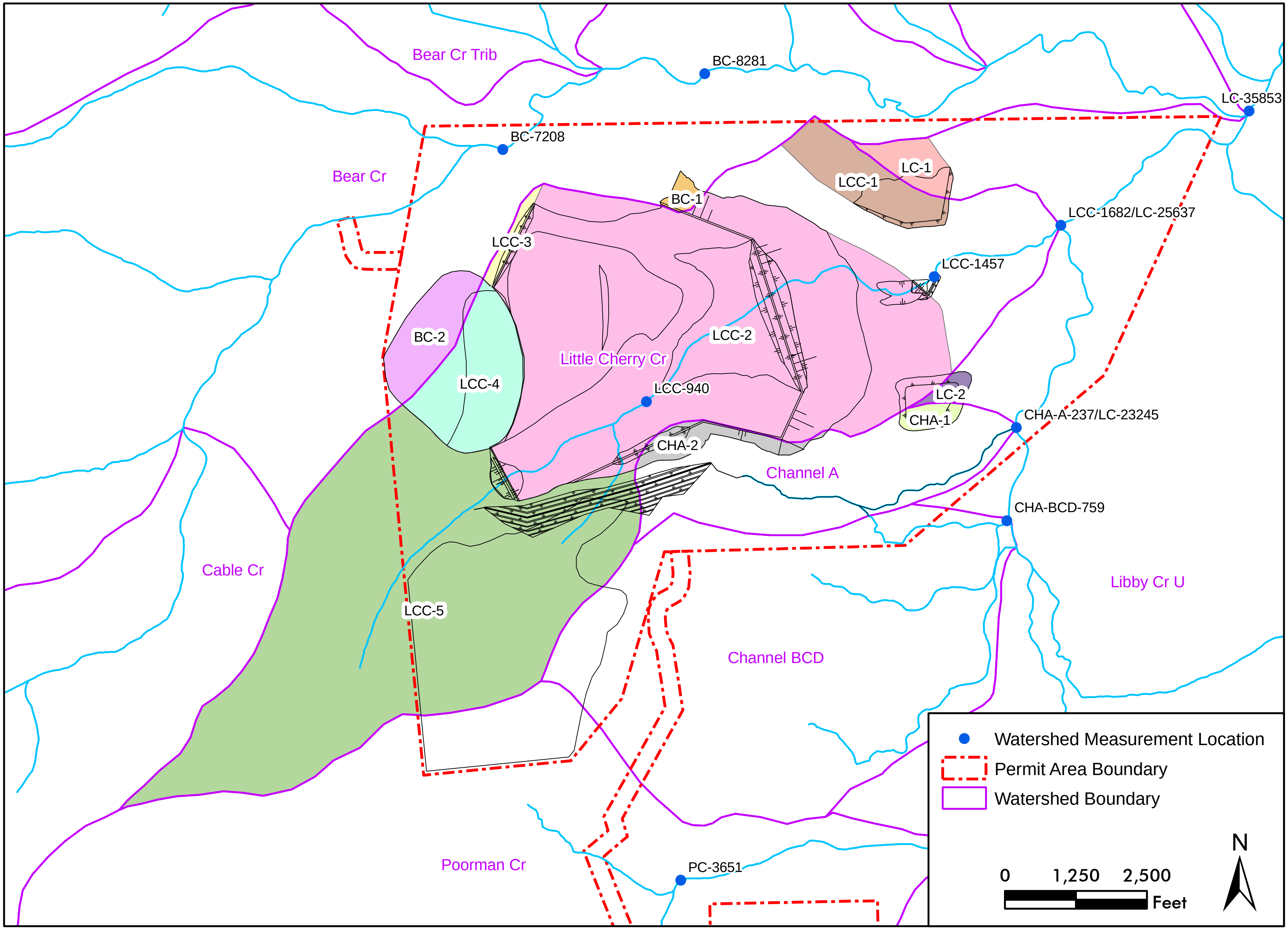

Figure 1. Watershed Analysis, Alternative 2 Operations

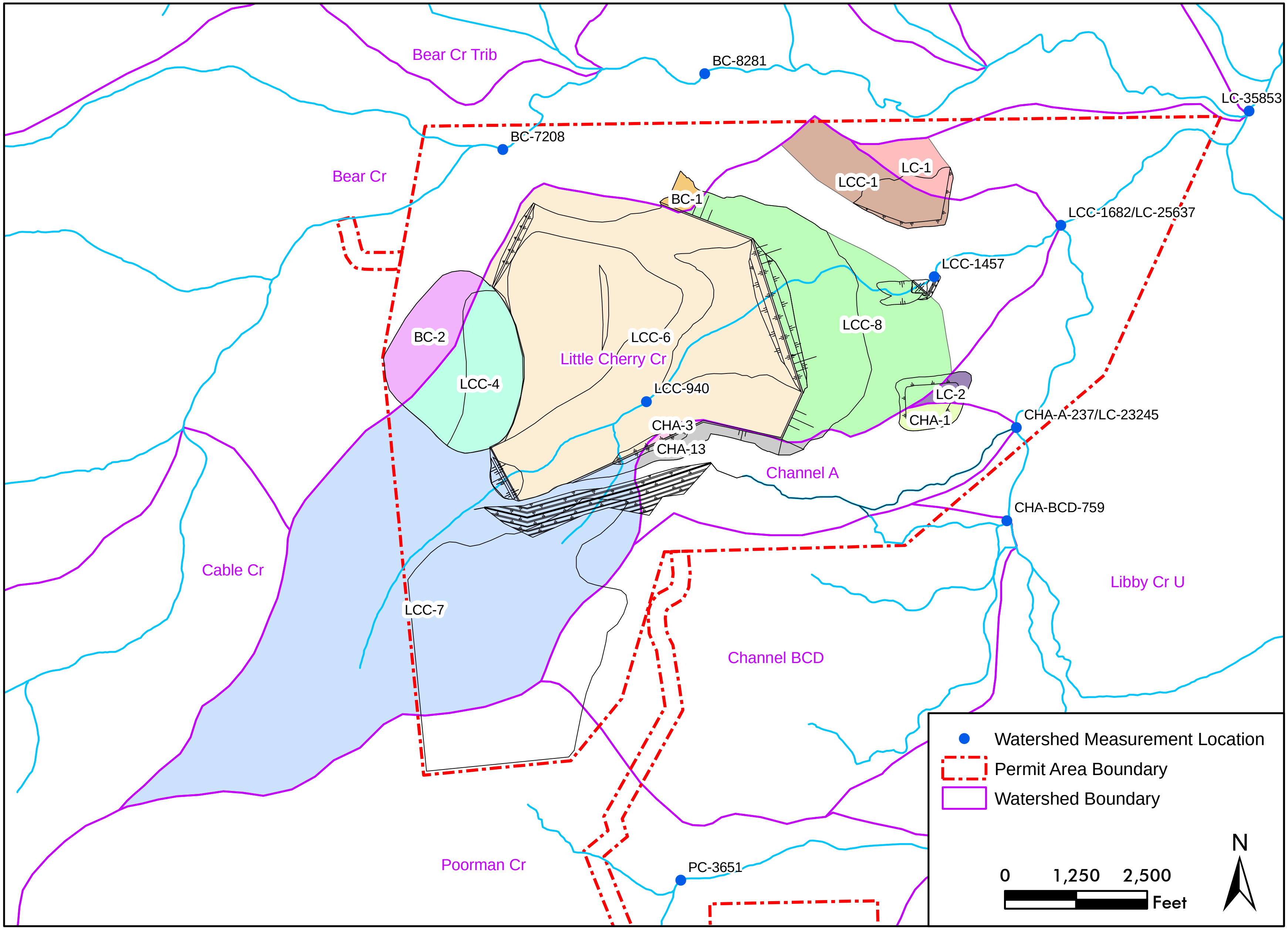

Figure 2. Watershed Analysis, Alternative 2 Closure

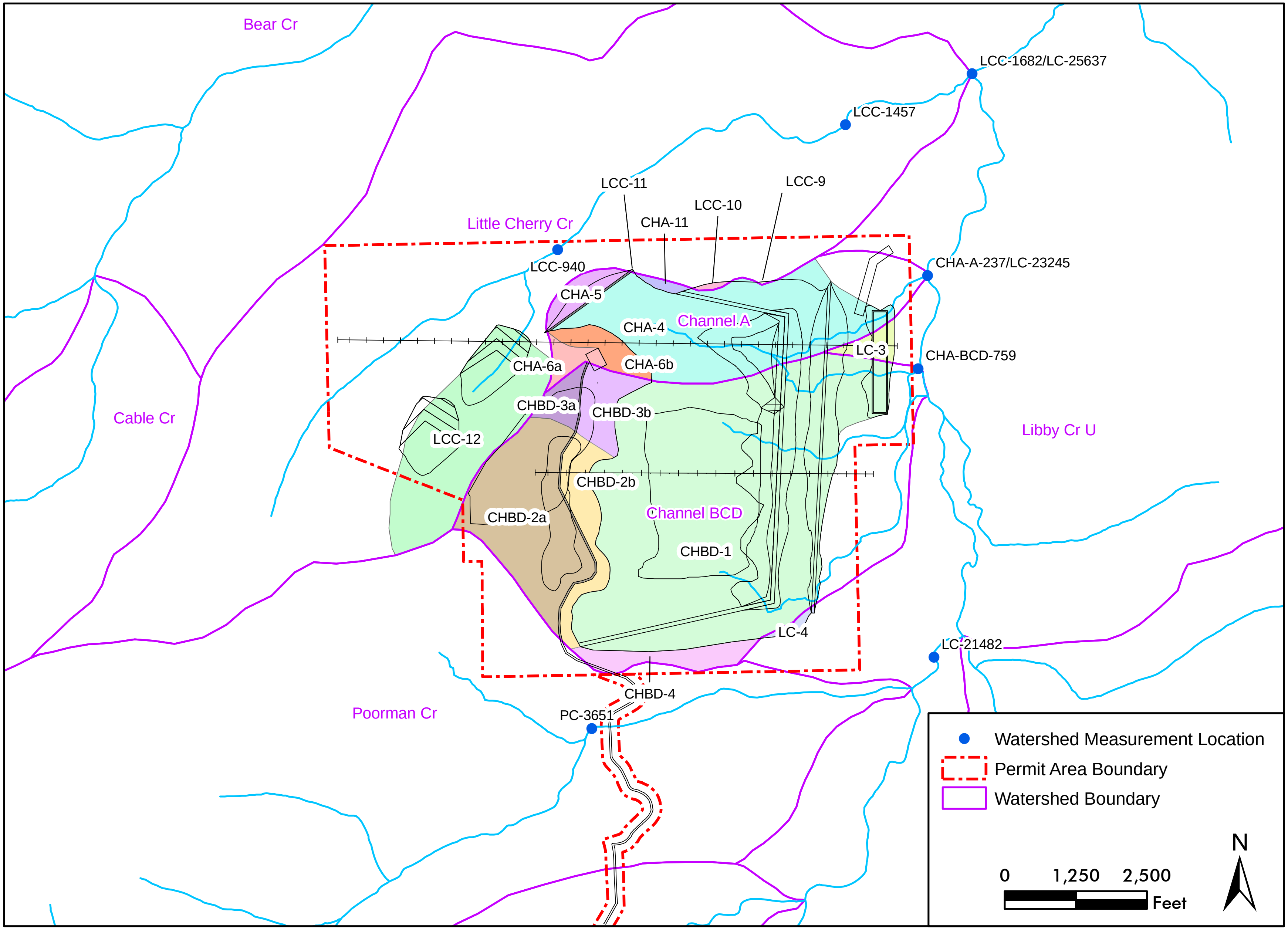

Figure 3. Watershed Analysis, Alternative 3 Operations

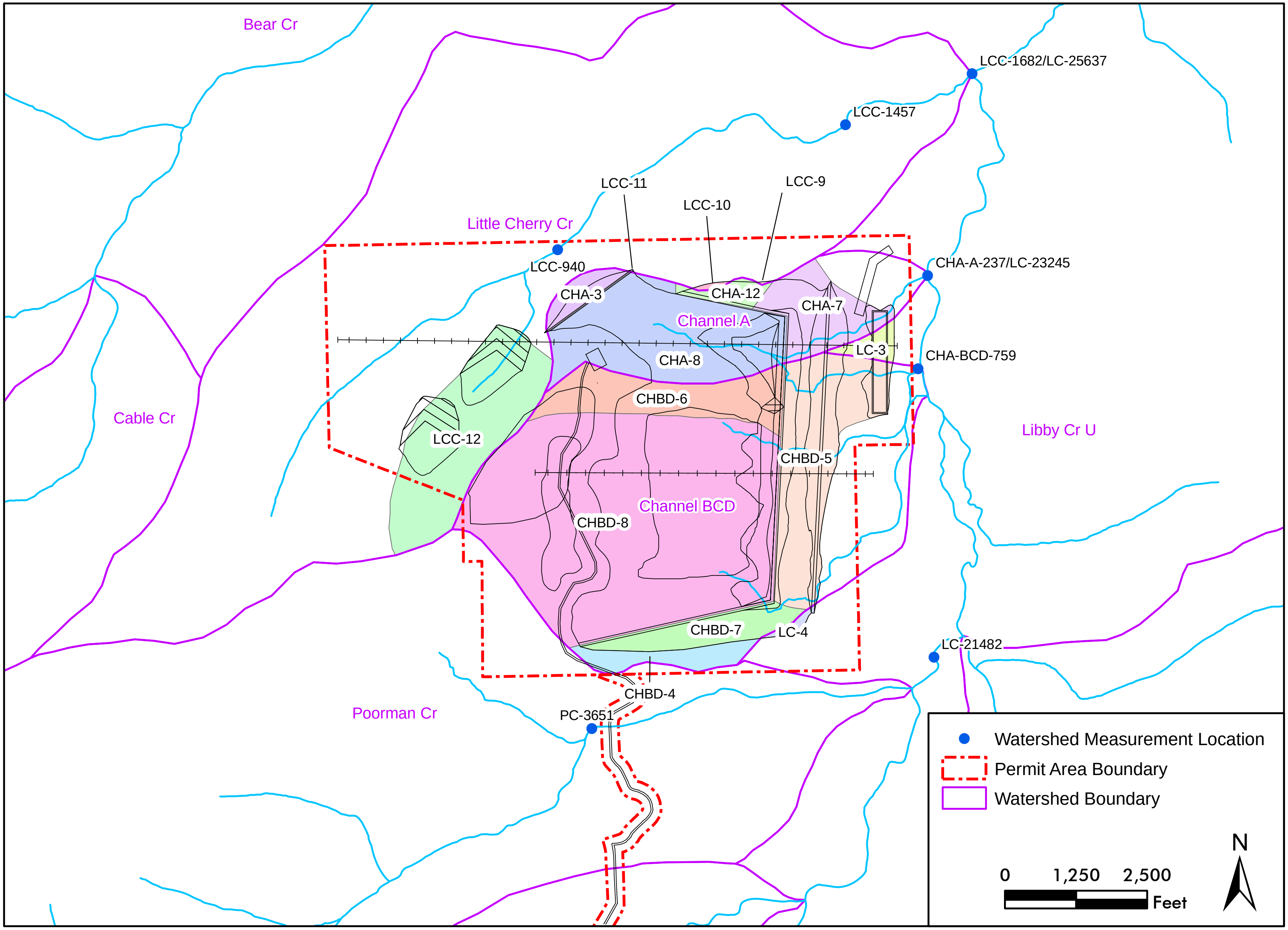

Figure 4. Watershed Analysis, Alternative 3 Closure

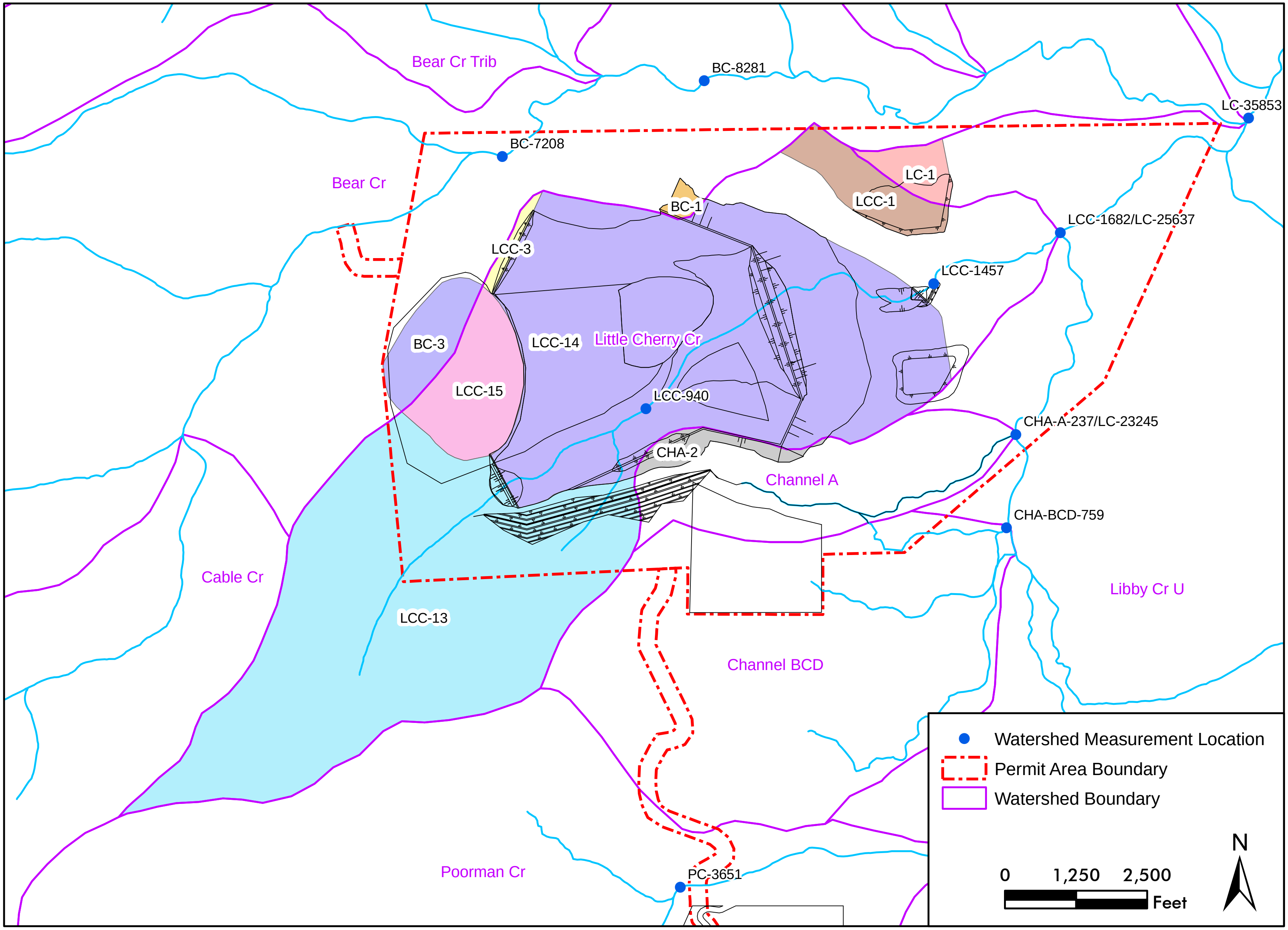

Figure 5. Watershed Analysis, Alternative 4 Operations

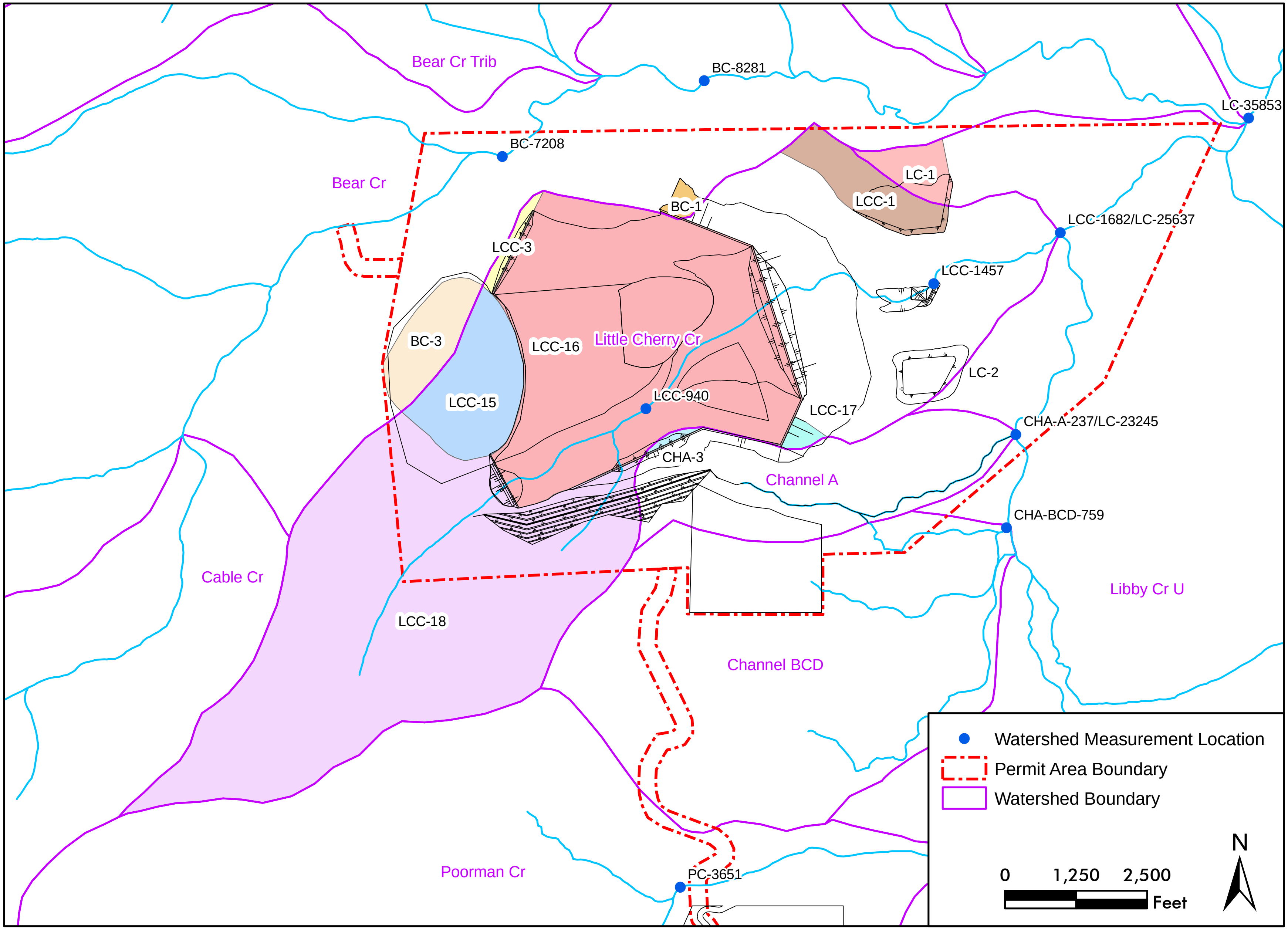

Figure 6. Watershed Analysis, Alternative 4 Closure

Appendix I—Visual Simulations

Figure I-1. Visual Simulation of the Little Cherry Creek Impoundment Looking West from the Scenic Overlook on NFS Road #4776

Figure I-2. Visual Simulation of the Poorman Impoundment Looking West from the Scenic Overlook on NFS Road #4776

Figure I-3. Existing View Looking Southeast from Howard Lake

Figure I-4. Visual Simulation of the Miller Creek or West Fisher Creek Transmission Line Alignments Looking Southeast from Howard Lake

Appendix J— Montanore 230-kV Transmission Line Minimal Impact Standard Assessment

Appendix J
Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Altternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
Circular MFSA-2, section 3.2(d)(1)(d)(i) through (xi)														
i. National wilderness areas	N/A	N/A	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	none	No direct effect on wilderness attributes	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	none	No direct effect on wilderness attributes
ii. National primitive areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
iii. National wildlife refuges and ranges	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
iv. State wildlife management areas and wildlife habitat protection areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
v. National parks and monuments	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
vi. State parks	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
vii. National recreation areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
viii. Designated or eligible national wild and scenic rivers system	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
ix. Roadless areas over 5,000 acres	acres in clearing width/ low, moderate, high effect	Miles of new and high upgrade roads	2, moderate effect	0.1	none	moderate effect	No effect	No effect	No effect	No effect	No effect	No effect	Avoidance of IRAs	No effect
x. Rugged topography (areas with slopes >30%)	miles of centerline/ low, moderate, high effect	Acres/ low, moderate, high effect	7.4	16.5	none	moderate effect	6.9	3.4	6.1	6.9	4.4	2.1	Helicopter use for vegetation clearing and structure construction adjacent to grizzly bear core habitat to decrease number of access roads	Minor effect
xi. Specially managed buffer areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
Circular MFSA-2, section 3.4(1)(b) through (w)														
b. state or federal waterfowl production areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
c. Designated natural areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect

Appendix J
Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Altternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
d. Critical habitat for federal T&E species														
Bull trout	# structures within 1 mile of bull trout critical habitat	acres new and high-upgrade road disturbance within 1 mile of bull trout critical habitat	38	18.1	Implementation of Storm Water Pollution Prevention Plan and structural and nonstructural BMPs. Construction of stream crossings per KNF and DEQ requirements; minimization of disturbance on active floodplains; curtailement of construction activities during heavy rains. Additional measures described under "severe erosion risk" below.	May affect, and likely to adversely affect bull trout critical habitat.	28	6.7	25	6.7	65	10.5	In addition to measures described for Alternative B: re-routing to avoid highly erosive soils; use of H-frame poles, allowing longer spans and fewer structures and access roads; helicopter construction in grizzly bear core habitat to decrease number of access roads; placement of NFS road #4725 into long-term intermittent stored status; where feasible, location of structures outside of riparian areas; new culverts to allow fish passage; stream-crossing structures designed to withstand a 100-year flow event; completion of habitat inventory and development of instream structures in Libby Creek. Additional measures described under "severe erosion risk" below.	May affect, and likely to adversely affect bull trout critical habitat.
e. Seasonally occupied habitat for federal and state T&E species														
grizzly bear habitat physically removed	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	26	N/A	Protection of grizzly bear habitat through acquisition of or conservation easements on 2,826 acres of non-Forest System lands. Closure of NFS road #4724 from April 1 to June 30.	May affect, and likely to adversely affect grizzly bear	35	N/A	4	N/A	4	N/A	Protection of grizzly bear habitat through acquisition of or conservation easements on 24 to 28 acres of habitat on non-Forest System lands. Creation of grizzly bear core habitat through yearlong access changes through the installation of barriers or gates in several roads.	May affect, and likely to adversely affect grizzly bear
Additional temporary displacement effects on grizzly bears due to helicopter use in currently affected habitat	acres in areas where influence zones of existing disturbance and new disturbance overlap	N/A - all roads included in heli. const. influence zone	14,727	N/A	Same as above	May affect, and likely to adversely affect grizzly bear	12,023	N/A	10,847	N/A	12,952	N/A	Habitat enhancement, acquistion, or conservation easement for temporary displacement effects.	May affect, and likely to adversely affect grizzly bear
New temporary displacement effects on grizzly bears due to helicopter use in currently undisturbed habitat	acres in influence zone of new disturbance only	N/A - all roads included in heli. const. influence zone	5,067	N/A	Same as above	May affect, and likely to adversely affect grizzly bear	5,372	N/A	6,360	N/A	5,748	N/A	Habitat enhancement, acquistion, or conservation easement for temporary displacement effects.	

Appendix J
Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Altternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
clearing of lynx overall habitat	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	85	N/A	Potential benefits to lynx from land acquisitions for grizzly bear and big game mitigation.	May affect, and likely to adversely affect Canada lynx	62	N/A	108	N/A	87	N/A	Potential benefits to lynx from land acquisitions for grizzly bear and big game mitigation.	May affect, and likely to adversely affect Canada lynx
clearing of multi-story mature or late succession forest lynx habitat	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	48	N/A	Potential benefits to lynx from land acquisitions for grizzly bear and big game mitigation.	May affect, and likely to adversely affect Canada lynx	38	N/A	90	N/A	66	N/A	Potential benefits to lynx from land acquisitions for grizzly bear and big game mitigation.	May affect, and likely to adversely affect Canada lynx
occupied bull trout habitat	acres in clearing width and width of new and high-upgrade roads in watersheds with occupied bull trout habitat	Included in clearing width impacts	182	N/A	Same as bull trout critical habitat above.	May affect, and likely to adversely affect bull trout	101	N/A	70	N/A	172	N/A	Same as bull trout critical habitat above.	May affect, and likely to adversely affect bull trout
f. National historic landmarks, districts, or sites	# of sites	Included in transmission line analysis buffer	0	N/A	N/A	No effect	0	N/A	0	N/A	0	N/A	N/A	No effect
g. Eligible or recommended eligible historic landmarks, districts, or sites	# of sites	Included in transmission line analysis buffer	5	N/A	Review and consultation with the SHPO to receive consensus determinations and to develop a plan of action for site 24LN1818. Additional fieldwork may be necessary prior to SHPO consultation.	Because there would be no direct effects, a determination of no adverse effect may be achieved through SHPO consultation.	3	N/A	4	N/A	7	N/A	Review and consultation with the SHPO to receive consensus determinations and to develop a plan of action for site 24LN1818. Additional fieldwork may be necessary prior to SHPO consultation.	Because there would be no direct effects, a determination of no adverse effect may be achieved through SHPO consultation.
h. Municipal watersheds	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
i. FWP Class I or II streams or rivers	acres in clearing width within watershed of affected streams	Acres of roads within watershed of affected streams	106.9	7.3	Same as described above for "occupied bull trout habitat" and below for "severe erosion risk".	Minor increases in sediment	72.4	0.3	46.8	0.5	46.8	0.5	Same as described above for "occupied bull trout habitat" and below for "severe erosion risk".	Minor effects
j. 303(d) listed impaired streams	acres in clearing width within watershed of affected streams	Acres of roads within watershed of affected streams	96.7	4.1	Same as described above for "occupied bull trout habitat"and below for "severe erosion risk".	Minor increases in sediment	32.1	0.3	32.4	0.3	32.4	0.3	Same as described above for "occupied bull trout habitat"and below for "severe erosion risk".	Minor effects

Appendix J
Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Altternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
k. Highly erodible soils/reclamation constraints														
Severe erosion risk	miles of centerline	Acres of roads	6.7	8.9	Erosion and sediment control BMPs; interim reclamation (replacing soil where it was removed and reseeding) of access roads ; immediate stabilization of cut-and-fill slopes; seeding, application of fertilizer, and stabilization of road cut-and-fill slopes and other disturbances along roads as soon as final grades post-construction grades are achieved; at the end of operations, decommissioning of new roads and reclamation of most other currently existing roads to pre-operational conditions; ripping of compacted soils prior to soil placement, and disking and harrowing of seedbeds.	Minor losses of soil until re-establishment of vegetation.	2.0	3.1	1.5	2.6	3.4	6.4	In addition to measures described for Alternative B: development and implementation of a Road Management Plan; where feasible, soil salvage in 2 lifts; after removal of transmission line, soil salvage before reclamation of decomissioned roads. Additional measures described above for "bull trout occupied habitat".	Minor losses of soil until re establishment of vegetation.
High sediment delivery	miles of centerline	Acres of roads	5.1	6.3	Same as for erosion risk above	Minor contributions of sediment until re-establishment of vegetation	0.3	0.5	0.3	0.5	0.3	0.5	Same as for erosion risk above	Minor contributions of sediment until re-establishment of vegetation
l. Compatibility with visual management plans/regulations														
Compatibility with visual management plans	Yes/No	Yes/No	Yes	Yes	Forest Plan amendment	In compliance	Yes	Yes	Yes	Yes	Yes	Yes	Forest Plan amendment	In compliance
Indirect visual impacts to the CMW	Acres within CWA from which transmission line can be seen	N/A	1,630	N/A	none	No effect on wilderness attributes	1,480	N/A	1360	N/A	1,380	N/A	none	No effect on wilderness attributes
m. Winter habitat for elk, deer, moose, pronghorn, or bighorn sheep														
elk	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	124	N/A	Potential benefits to elk from land acquisitions and road access changes for grizzly bear and big game mitigation. As described in the Environmental Specifications, transmission line construction and associated motorized travel would be prohibited from December 1 to April 30. Exemptions to these timing restrictions may be granted by DEQ and FS in writing if MMC can clearly demonstrate that no significant environmental impacts would occur as a result.	Minor effects	156	N/A	124	N/A	99	N/A	Potential benefits to elk from land acquisitions and road access changes for grizzly bear and big game mitigation. As described in the Environmental Specifications, transmission line construction and associated motorized travel would be prohibited from December 1 to April 30. Exemptions to these timing restrictions may be granted by DEQ and FS in writing if MMC can clearly demonstrate that no significant environmental impacts will occur as a result.	Minor effects
white-tailed deer	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	149	N/A	Same as described above for elk	Minor effects	161	N/A	143	N/A	183	N/A	Same as described above for elk	Minor effects

Appendix J
Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Altternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
moose	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	235	N/A	Same as described above for elk	Minor effects	263	N/A	265	N/A	292	N/A	Same as described above for elk	Minor effects
n. Elk security areas	Acres of security habitat in clearing width	Included in clearing width impacts	84	N/A	Security habitat maybe created through additional road access changes that may occur on land acquired as part of the grizzly bear mitigation.	Minor effects	59	N/A	10.6	N/A	No effect	N/A	Creation of security habitat through yearlong access changes through the installation of barriers or gates in several National Forest System roads. Additional security habitat may also be created through additional road access changes that may occur on land acquired as part of the grizzly bear mitigation.	Minor effects
o. Occupied mountain goat habitat														
habitat physically impacted	acres in clearing width	Included in clearing width impacts	47	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear and big game mitigation.	Minor effects	0	N/A	0	N/A	0	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear and big game mitigation.	Minor effects
construction displacement effects	acres in 1-mile helicopter influence zone	N/A - all roads included in heli. const. influence zone	3,162	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear and big game mitigation.	Minor effects	632	N/A	654	N/A	654	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear and big game mitigation.	Minor effects
p. Sage and sharp-tailed grouse breeding areas and winter range	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
q. High waterfowl population areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
r. Areas of unusual scientific, educational, or recreational signficance	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
s. Areas with high probability of including significant paleontological resources	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
t. Sites with religious or heritage significance/value to Indians	# sites	#sites	No sites identified	No sites identified	Ongoing tribal consultation	To be determined during consultation	No sites identified	No sites identified	No sites identified	No sites identified	No sites identified	No sites identified	Ongoing tribal consultation	To be determined during consultation
u. Water bodies	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
v. Potable surface water supplies	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
w. Active faults (for substation)	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect

Appendix K—Water Quality Data

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
BC-100	Field Conductivity	73	2	2	0	0.0%	41	105
BC-100	Field pH	6.9	2	2	0	0.0%	6.8	7
BC-100	Field Temp	6.8	2	2	0	0.0%	5.5	8
BC-100	Flow	1.9	2	2	0	0.0%	1.8	1.9
BC-100	Lab pH	7.6	2	2	0	0.0%	7.5	7.6
BC-100	Lab SC	79	2	2	0	0.0%	40	118
BC-100	TDS	50	2	2	0	0.0%	29	70
BC-100	TSS	< 1	2	0	2	100.0%		
BC-100	Turbidity	0.21	2	2	0	0.0%	0.11	0.31
BC-100	Alkalinity, Bicarbonate as HCO3	49	2	2	0	0.0%	24	73
BC-100	Alkalinity, Total as CaCO3	40	2	2	0	0.0%	20	60
BC-100	Calcium, as Ca Total	11	2	2	0	0.0%	6	15
BC-100	Chloride, as Cl	< 1	2	0	2	100.0%		
BC-100	Fluoride, as F	< 0.05	2	0	2	100.0%		
BC-100	Hardness, as CaCO3	< 33	2	1	1	50.0%	50	50
BC-100	Magnesium, as Mg Total	< 2	2	1	1	50.0%	3	3
BC-100	Potassium, as K Total	< 1	2	1	1	50.0%	1	1
BC-100	Sodium, as Na Total	< 1	2	1	1	50.0%	1	1
BC-100	Sulfate, as SO4	1.5	2	2	0	0.0%	1	2
BC-100	Ammonia	< 0.06	2	1	1	50.0%	0.07	0.07
BC-100	Nitrate	0.15	2	2	0	0.0%	0.07	0.23
BC-100	Nitrate + Nitrite, as N	0.15	2	2	0	0.0%	0.07	0.23
BC-100	OrthoPhosphorus	< 0.007	2	1	1	50.0%	0.009	0.009
BC-100	TKN	< 0.2	2	0	2	100.0%		
BC-100	Total Phosphorus	0.008	2	2	0	0.0%	0.007	0.009
BC-500	Dissolved Oxygen	13	3	3	0	0.0%	11	13
BC-500	Field Conductivity	61	19	19	0	0.0%	34	95
BC-500	Field pH	7.4	18	18	0	0.0%	5.1	7.8
BC-500	Field Temp	5	19	19	0	0.0%	0	14
BC-500	Flow	8.4	18	18	0	0.0%	2.8	110
BC-500	Lab pH	7.2	18	18	0	0.0%	5.9	7.8
BC-500	Lab SC	69	19	19	0	0.0%	36	87
BC-500	TDS	40	19	19	0	0.0%	14	54
BC-500	TSS	< 1	18	4	14	77.8%	0.49	34
BC-500	Turbidity	< 0.2	19	14	5	26.3%	0.09	0.4
BC-500	Alkalinity, Bicarbonate as HCO3	41	19	19	0	0.0%	20	58
BC-500	Alkalinity, Total as CaCO3	35	19	19	0	0.0%	17	47
BC-500	Calcium, as Ca Dissolved	11	7	7	0	0.0%	4.8	13
BC-500	Calcium, as Ca Total	9.3	12	12	0	0.0%	0.2	12
BC-500	Chloride, as Cl	< 0.92	19	6	13	68.4%	0.21	1
BC-500	Fluoride, as F	< 0.05	6	0	6	100.0%		
BC-500	Hardness, as CaCO3	34	19	19	0	0.0%	1	43
BC-500	Magnesium, as Mg Dissolved	2.2	7	7	0	0.0%	1.4	2.5
BC-500	Magnesium, as Mg Total	< 1.7	12	11	1	8.3%	1	2.6
BC-500	Potassium, as K Dissolved	< 0.79	6	2	4	66.7%	0.34	0.38
BC-500	Potassium, as K Total	< 0.68	12	5	7	58.3%	0.2	0.3
BC-500	Sodium, as Na Dissolved	< 0.94	7	3	4	57.1%	0.69	1
BC-500	Sodium, as Na Total	< 0.93	12	7	5	41.7%	0.4	2
BC-500	Sulfate, as SO4	< 2.2	19	16	3	15.8%	1	5
BC-500	Ammonia	< 0.054	19	7	12	63.2%	0.01	0.35
BC-500	Nitrate	0.15	19	19	0	0.0%	0.05	0.62
BC-500	Nitrate + Nitrite, as N	0.15	17	17	0	0.0%	0.05	0.62
BC-500	Nitrite	< 0.01	10	0	10	100.0%		
BC-500	OrthoPhosphorus	< 0.0043	19	6	13	68.4%	0.0008	0.015
BC-500	TKN	< 0.28	18	8	10	55.6%	0.05	2
BC-500	Total Inorganic Nitrogen	0.17	8	8	0	0.0%	0.07	0.46
BC-500	Total Phosphorus	< 0.0072	19	11	8	42.1%	0.002	0.022
BC-500	Aluminum, as Al Dissolved	0.0091	3	3	0	0.0%	0.004	0.063
BC-500	Aluminum, as Al Total	< 0.016	8	3	5	62.5%	0.0041	0.029
BC-500	Antimony, as Sb Dissolved	< 0.003	7	1	6	85.7%	0.000055	0.000055
BC-500	Antimony, as Sb Total	< 0.003	8	1	7	87.5%	0.00013	0.00013
BC-500	Arsenic, as As Dissolved	< 0.0004	7	3	4	57.1%	0.00037	0.00046
BC-500	Arsenic, as As Total	< 0.00042	8	3	5	62.5%	0.0003	0.00055
BC-500	Barium, as Ba Dissolved	< 0.007	7	6	1	14.3%	0.006	0.0083
BC-500	Barium, as Ba Total	< 0.0071	8	7	1	12.5%	0.0044	0.014
BC-500	Beryllium, as Be Dissolved	< 0.001	7	1	6	85.7%	0.000035	0.000035
BC-500	Beryllium, as Be Total	< 0.001	8	0	8	100.0%		
BC-500	Cadmium, as Cd Dissolved	< 0.000028	3	2	1	33.3%	0.000018	0.000026
BC-500	Cadmium, as Cd Total	< 0.00003	3	2	1	33.3%	0.000018	0.000033
BC-500	Chromium, as Cr Dissolved	< 0.004	7	1	6	85.7%	0.00034	0.00034
BC-500	Chromium, as Cr Total	< 0.004	8	2	6	75.0%	0.0002	0.00055
BC-500	Copper, as Cu Dissolved	< 0.001	7	1	6	85.7%	0.00037	0.00037
BC-500	Copper, as Cu Total	< 0.001	8	1	7	87.5%	0.002	0.002
BC-500	Iron, as Fe Dissolved	< 0.05	7	2	5	71.4%	0.0022	0.04
BC-500	Iron, as Fe Total	< 0.05	8	2	6	75.0%	0.0027	0.025

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
BC-500	Lead, as Pb Dissolved	< 0.000082	6	2	4	66.7%	0.000076	0.00011
BC-500	Lead, as Pb Total	< 0.000079	7	4	3	42.9%	0.00006	0.00011
BC-500	Manganese, as Mn Dissolved	< 0.00052	7	3	4	57.1%	0.0003	0.00086
BC-500	Manganese, as Mn Total	< 0.00095	8	3	5	62.5%	0.00026	0.0013
BC-500	Mercury, as Hg Dissolved	< 0.00002	7	1	6	85.7%	0.000075	0.000075
BC-500	Mercury, as Hg Total	< 0.00002	8	0	8	100.0%		
BC-500	Nickel, as Ni Dissolved	< 0.01	7	0	7	100.0%		
BC-500	Nickel, as Ni Total	< 0.01	8	0	8	100.0%		
BC-500	Selenium, as Se Dissolved	< 0.001	7	1	6	85.7%	0.00018	0.00018
BC-500	Selenium, as Se Total	< 0.001	8	0	8	100.0%		
BC-500	Silver, as Ag Dissolved	< 0.0002	7	0	7	100.0%		
BC-500	Silver, as Ag Total	< 0.0002	8	1	7	87.5%	0.00026	0.00026
BC-500	Thallium, as Tl Dissolved	< 0.0002	4	0	4	100.0%		
BC-500	Thallium, as Tl Total	< 0.0002	5	0	5	100.0%		
BC-500	Zinc, as Zn Dissolved	< 0.0031	7	3	4	57.1%	0.0021	0.009
BC-500	Zinc, as Zn Total	< 0.002	8	2	6	75.0%	0.0017	0.0043
EFBR-300	Field Temp	2	1	1	0	0.0%	2	2
EFBR-300	Lab pH	7.6	1	1	0	0.0%	7.6	7.6
EFBR-300	Lab SC	42	1	1	0	0.0%	42	42
EFBR-300	TDS	51	1	1	0	0.0%	51	51
EFBR-300	TSS	< 1	1	0	1	100.0%		
EFBR-300	Turbidity	0.46	1	1	0	0.0%	0.46	0.46
EFBR-300	Alkalinity, Bicarbonate as HCO3	22	1	1	0	0.0%	22	22
EFBR-300	Alkalinity, Total as CaCO3	18	1	1	0	0.0%	18	18
EFBR-300	Calcium, as Ca Total	6	1	1	0	0.0%	6	6
EFBR-300	Chloride, as Cl	2	1	1	0	0.0%	2	2
EFBR-300	Fluoride, as F	< 0.1	1	0	1	100.0%		
EFBR-300	Hardness, as CaCO3	19	1	1	0	0.0%	19	19
EFBR-300	Magnesium, as Mg Total	1	1	1	0	0.0%	1	1
EFBR-300	Potassium, as K Total	< 1	1	0	1	100.0%		
EFBR-300	Sodium, as Na Total	< 1	1	0	1	100.0%		
EFBR-300	Sulfate, as SO4	< 5	1	0	1	100.0%		
EFBR-300	Ammonia	0.05	1	1	0	0.0%	0.05	0.05
EFBR-300	Nitrate	0.16	1	1	0	0.0%	0.16	0.16
EFBR-300	Nitrate + Nitrite, as N	0.16	1	1	0	0.0%	0.16	0.16
EFBR-300	Nitrite	< 0.01	1	0	1	100.0%		
EFBR-300	OrthoPhosphorus	0.009	1	1	0	0.0%	0.009	0.009
EFBR-300	TKN	< 0.2	1	0	1	100.0%		
EFBR-300	Total Phosphorus	0.014	1	1	0	0.0%	0.014	0.014
EFBR-300	Aluminum, as Al Total	< 0.05	1	0	1	100.0%		
EFBR-300	Antimony, as Sb Total	< 0.003	1	0	1	100.0%		
EFBR-300	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
EFBR-300	Barium, as Ba Total	0.015	1	1	0	0.0%	0.015	0.015
EFBR-300	Beryllium, as Be Total	< 0.001	1	0	1	100.0%		
EFBR-300	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
EFBR-300	Copper, as Cu Total	< 0.001	1	0	1	100.0%		
EFBR-300	Iron, as Fe Total	0.01	1	1	0	0.0%	0.01	0.01
EFBR-300	Manganese, as Mn Total	< 0.005	1	0	1	100.0%		
EFBR-300	Selenium, as Se Total	< 0.001	1	0	1	100.0%		
EFBR-300	Silver, as Ag Total	< 0.0003	1	0	1	100.0%		
EFBR-300	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
EFBR-500	Field Temp	2	1	1	0	0.0%	2	2
EFBR-500	Lab pH	7.7	1	1	0	0.0%	7.7	7.7
EFBR-500	Lab SC	53	1	1	0	0.0%	53	53
EFBR-500	TDS	49	1	1	0	0.0%	49	49
EFBR-500	TSS	< 1	1	0	1	100.0%		
EFBR-500	Turbidity	0.34	1	1	0	0.0%	0.34	0.34
EFBR-500	Alkalinity, Bicarbonate as HCO3	31	1	1	0	0.0%	31	31
EFBR-500	Alkalinity, Total as CaCO3	26	1	1	0	0.0%	26	26
EFBR-500	Calcium, as Ca Total	7	1	1	0	0.0%	7	7
EFBR-500	Chloride, as Cl	7	1	1	0	0.0%	7	7
EFBR-500	Fluoride, as F	< 0.1	1	0	1	100.0%		
EFBR-500	Hardness, as CaCO3	26	1	1	0	0.0%	26	26
EFBR-500	Magnesium, as Mg Total	2	1	1	0	0.0%	2	2
EFBR-500	Potassium, as K Total	< 1	1	0	1	100.0%		
EFBR-500	Sodium, as Na Total	< 1	1	0	1	100.0%		
EFBR-500	Sulfate, as SO4	< 5	1	0	1	100.0%		
EFBR-500	Ammonia	< 0.05	1	0	1	100.0%		
EFBR-500	Nitrate	0.13	1	1	0	0.0%	0.13	0.13
EFBR-500	Nitrate + Nitrite, as N	0.13	1	1	0	0.0%	0.13	0.13
EFBR-500	Nitrite	< 0.01	1	0	1	100.0%		
EFBR-500	OrthoPhosphorus	0.008	1	1	0	0.0%	0.008	0.008
EFBR-500	TKN	< 0.2	1	0	1	100.0%		
EFBR-500	Total Phosphorus	0.01	1	1	0	0.0%	0.01	0.01
EFBR-500	Aluminum, as Al Total	< 0.05	1	0	1	100.0%		

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
EFBR-500	Antimony, as Sb Total	< 0.003	1	0	1	100.0%		
EFBR-500	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
EFBR-500	Barium, as Ba Total	0.017	1	1	0	0.0%	0.017	0.017
EFBR-500	Beryllium, as Be Total	< 0.001	1	0	1	100.0%		
EFBR-500	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
EFBR-500	Copper, as Cu Total	< 0.001	1	0	1	100.0%		
EFBR-500	Iron, as Fe Total	0.01	1	1	0	0.0%	0.01	0.01
EFBR-500	Manganese, as Mn Total	< 0.005	1	0	1	100.0%		
EFBR-500	Selenium, as Se Total	< 0.001	1	0	1	100.0%		
EFBR-500	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
EFRC-100	Flow	0.34	1	1	0	0.0%	0.34	0.34
EFRC-100	Lab pH	7.5	1	1	0	0.0%	7.5	7.5
EFRC-100	Lab SC	10	1	1	0	0.0%	10	10
EFRC-100	TDS	< 10	1	0	1	100.0%		
EFRC-100	TSS	< 10	1	0	1	100.0%		
EFRC-100	Alkalinity, Bicarbonate as HCO3	6	1	1	0	0.0%	6	6
EFRC-100	Alkalinity, Total as CaCO3	5	1	1	0	0.0%	5	5
EFRC-100	Calcium, as Ca Dissolved	1	1	1	0	0.0%	1	1
EFRC-100	Chloride, as Cl	< 1	1	0	1	100.0%		
EFRC-100	Magnesium, as Mg Dissolved	< 1	1	0	1	100.0%		
EFRC-100	Potassium, as K Dissolved	< 1	1	0	1	100.0%		
EFRC-100	Sodium, as Na Dissolved	< 1	1	0	1	100.0%		
EFRC-100	Sulfate, as SO4	< 1	1	0	1	100.0%		
EFRC-100	Ammonia	< 0.1	1	0	1	100.0%		
EFRC-100	Nitrate + Nitrite, as N	< 0.05	1	0	1	100.0%		
EFRC-100	OrthoPhosphorus	< 0.01	1	0	1	100.0%		
EFRC-100	TKN	< 0.5	1	0	1	100.0%		
EFRC-100	Total Phosphorus	< 0.01	1	0	1	100.0%		
EFRC-200	Field Conductivity	6	2	2	0	0.0%	5	7
EFRC-200	Field pH	6.4	2	2	0	0.0%	6.3	6.4
EFRC-200	Field Temp	9.5	2	2	0	0.0%	6	13
EFRC-200	Flow	0.47	3	3	0	0.0%	0	6.1
EFRC-200	Lab pH	6.4	3	3	0	0.0%	6.3	6.6
EFRC-200	Lab SC	8	3	3	0	0.0%	7	9
EFRC-200	TDS	< 9	3	2	1	33.3%	8	9
EFRC-200	TSS	< 4	3	0	3	100.0%		
EFRC-200	Turbidity	0.41	2	2	0	0.0%	0.37	0.44
EFRC-200	Alkalinity, Bicarbonate as HCO3	5	3	3	0	0.0%	5	6
EFRC-200	Alkalinity, Total as CaCO3	< 4.3	3	2	1	33.3%	4	5
EFRC-200	Calcium, as Ca Dissolved	< 1	1	0	1	100.0%		
EFRC-200	Calcium, as Ca Total	< 1	2	0	2	100.0%		
EFRC-200	Chloride, as Cl	< 1	3	0	3	100.0%		
EFRC-200	Fluoride, as F	< 0.05	2	0	2	100.0%		
EFRC-200	Hardness, as CaCO3	< 6	2	0	2	100.0%		
EFRC-200	Magnesium, as Mg Dissolved	< 1	1	0	1	100.0%		
EFRC-200	Magnesium, as Mg Total	< 1	2	0	2	100.0%		
EFRC-200	Potassium, as K Dissolved	< 1	1	0	1	100.0%		
EFRC-200	Potassium, as K Total	< 1.5	2	1	1	50.0%	2	2
EFRC-200	Sodium, as Na Dissolved	< 1	1	0	1	100.0%		
EFRC-200	Sodium, as Na Total	< 1	2	1	1	50.0%	1	1
EFRC-200	Sulfate, as SO4	< 1	3	0	3	100.0%		
EFRC-200	Ammonia	< 0.073	3	1	2	66.7%	0.07	0.07
EFRC-200	Nitrate	< 0.02	2	1	1	50.0%	0.03	0.03
EFRC-200	Nitrate + Nitrite, as N	< 0.03	3	1	2	66.7%	0.03	0.03
EFRC-200	OrthoPhosphorus	< 0.0067	3	1	2	66.7%	0.005	0.005
EFRC-200	TKN	< 0.3	3	1	2	66.7%	0.2	0.2
EFRC-200	Total Phosphorus	< 0.0073	3	2	1	33.3%	0.005	0.007
EFRC-300	Field Conductivity	15	2	2	0	0.0%	12	18
EFRC-300	Field pH	6.7	2	2	0	0.0%	6.7	6.7
EFRC-300	Field Temp	8.5	2	2	0	0.0%	8	9
EFRC-300	Flow	3.5	2	2	0	0.0%	0.4	6.5
EFRC-300	Lab pH	6.7	2	2	0	0.0%	6.5	6.8
EFRC-300	Lab SC	20	2	2	0	0.0%	11	28
EFRC-300	TDS	18	2	2	0	0.0%	17	19
EFRC-300	TSS	< 1	2	1	1	50.0%	1	1
EFRC-300	Turbidity	< 0.17	2	1	1	50.0%	0.23	0.23
EFRC-300	Alkalinity, Bicarbonate as HCO3	11	2	2	0	0.0%	6	16
EFRC-300	Alkalinity, Total as CaCO3	9	2	2	0	0.0%	5	13
EFRC-300	Calcium, as Ca Total	1	2	2	0	0.0%	1	1
EFRC-300	Chloride, as Cl	< 1	2	0	2	100.0%		
EFRC-300	Fluoride, as F	< 0.05	2	0	2	100.0%		
EFRC-300	Hardness, as CaCO3	< 3	2	0	2	100.0%		
EFRC-300	Magnesium, as Mg Total	< 1	2	0	2	100.0%		
EFRC-300	Potassium, as K Total	< 1.5	2	1	1	50.0%	2	2
EFRC-300	Sodium, as Na Total	< 1	2	1	1	50.0%	1	1

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
EFRC-300	Sulfate, as SO4	1.5	2	2	0	0.0%	1	2
EFRC-300	Ammonia	< 0.06	2	1	1	50.0%	0.07	0.07
EFRC-300	Nitrate	0.075	2	2	0	0.0%	0.04	0.11
EFRC-300	Nitrate + Nitrite, as N	0.075	2	2	0	0.0%	0.04	0.11
EFRC-300	OrthoPhosphorus	< 0.005	2	0	2	100.0%		
EFRC-300	TKN	< 0.2	2	0	2	100.0%		
EFRC-300	Total Phosphorus	0.006	2	2	0	0.0%	0.005	0.007
EFRC-400	Field Conductivity	16	2	2	0	0.0%	15	16
EFRC-400	Field pH	6.6	2	2	0	0.0%	6.6	6.6
EFRC-400	Field Temp	11	2	2	0	0.0%	7	15
EFRC-400	Flow	12	2	2	0	0.0%	1.9	21
EFRC-400	Lab pH	6.5	2	2	0	0.0%	6.2	6.7
EFRC-400	Lab SC	16	2	2	0	0.0%	12	19
EFRC-400	TDS	16	2	2	0	0.0%	13	19
EFRC-400	TSS	1	2	2	0	0.0%	1	1
EFRC-400	Turbidity	0.44	2	2	0	0.0%	0.4	0.48
EFRC-400	Alkalinity, Bicarbonate as HCO3	10	2	2	0	0.0%	7	13
EFRC-400	Alkalinity, Total as CaCO3	8.5	2	2	0	0.0%	6	11
EFRC-400	Calcium, as Ca Total	< 1.5	2	1	1	50.0%	2	2
EFRC-400	Chloride, as Cl	< 1	2	0	2	100.0%		
EFRC-400	Fluoride, as F	< 0.05	2	1	1	50.0%	0.05	0.05
EFRC-400	Hardness, as CaCO3	< 5.5	2	0	2	100.0%		
EFRC-400	Magnesium, as Mg Total	< 1	2	0	2	100.0%		
EFRC-400	Potassium, as K Total	< 1	2	1	1	50.0%	1	1
EFRC-400	Sodium, as Na Total	< 1	2	0	2	100.0%		
EFRC-400	Sulfate, as SO4	< 1	2	1	1	50.0%	1	1
EFRC-400	Ammonia	< 0.06	2	1	1	50.0%	0.07	0.07
EFRC-400	Nitrate	< 0.03	2	1	1	50.0%	0.05	0.05
EFRC-400	Nitrate + Nitrite, as N	< 0.03	2	1	1	50.0%	0.05	0.05
EFRC-400	OrthoPhosphorus	0.0055	2	2	0	0.0%	0.005	0.006
EFRC-400	TKN	< 0.25	2	1	1	50.0%	0.3	0.3
EFRC-400	Total Phosphorus	0.008	2	2	0	0.0%	0.007	0.009
EFRC-800	Field Conductivity	14	2	2	0	0.0%	12	15
EFRC-800	Field pH	6.8	2	2	0	0.0%	6.5	7
EFRC-800	Field Temp	10	2	2	0	0.0%	8	12
EFRC-800	Flow	13	2	2	0	0.0%	0.3	26
EFRC-800	Lab pH	6.7	2	2	0	0.0%	6.5	6.9
EFRC-800	Lab SC	14	2	2	0	0.0%	11	16
EFRC-800	TDS	16	2	2	0	0.0%	13	19
EFRC-800	TSS	< 1	2	1	1	50.0%	1	1
EFRC-800	Turbidity	< 0.13	2	1	1	50.0%	0.15	0.15
EFRC-800	Alkalinity, Bicarbonate as HCO3	8.5	2	2	0	0.0%	7	10
EFRC-800	Alkalinity, Total as CaCO3	7	2	2	0	0.0%	6	8
EFRC-800	Calcium, as Ca Total	< 1	2	1	1	50.0%	1	1
EFRC-800	Chloride, as Cl	< 1	2	0	2	100.0%		
EFRC-800	Fluoride, as F	< 0.05	2	0	2	100.0%		
EFRC-800	Hardness, as CaCO3	< 4.5	2	0	2	100.0%		
EFRC-800	Magnesium, as Mg Total	< 1	2	0	2	100.0%		
EFRC-800	Potassium, as K Total	< 1.5	2	1	1	50.0%	2	2
EFRC-800	Sodium, as Na Total	< 1	2	1	1	50.0%	1	1
EFRC-800	Sulfate, as SO4	1.5	2	2	0	0.0%	1	2
EFRC-800	Ammonia	< 0.05	2	0	2	100.0%		
EFRC-800	Nitrate	0.04	2	2	0	0.0%	0.02	0.06
EFRC-800	Nitrate + Nitrite, as N	0.04	2	2	0	0.0%	0.02	0.06
EFRC-800	OrthoPhosphorus	< 0.006	2	1	1	50.0%	0.007	0.007
EFRC-800	TKN	< 0.2	2	0	2	100.0%		
EFRC-800	Total Phosphorus	0.009	2	2	0	0.0%	0.009	0.009
LB-100	Field Conductivity	11	2	2	0	0.0%	8	13
LB-100	Field pH	7.1	2	2	0	0.0%	6.8	7.3
LB-100	Field Temp	6.8	2	2	0	0.0%	5.5	8
LB-100	Flow	17	2	2	0	0.0%	1.1	33
LB-100	Lab pH	6.7	2	2	0	0.0%	6.4	6.9
LB-100	Lab SC	12	2	2	0	0.0%	10	13
LB-100	TDS	8	2	2	0	0.0%	4	12
LB-100	TSS	< 1.5	2	1	1	50.0%	2	2
LB-100	Turbidity	< 0.25	2	1	1	50.0%	0.4	0.4
LB-100	Alkalinity, Bicarbonate as HCO3	6	2	2	0	0.0%	6	6
LB-100	Alkalinity, Total as CaCO3	5	2	2	0	0.0%	5	5
LB-100	Calcium, as Ca Total	< 1	2	1	1	50.0%	1	1
LB-100	Chloride, as Cl	< 1	2	0	2	100.0%		
LB-100	Fluoride, as F	< 0.055	2	1	1	50.0%	0.06	0.06
LB-100	Hardness, as CaCO3	< 4.5	2	0	2	100.0%		
LB-100	Magnesium, as Mg Total	< 1	2	0	2	100.0%		
LB-100	Potassium, as K Total	< 1	2	1	1	50.0%	1	1
LB-100	Sodium, as Na Total	< 1	2	0	2	100.0%		

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-100	Sulfate, as SO4	1.5	2	2	0	0.0%	1	2
LB-100	Ammonia	< 0.05	2	0	2	100.0%		
LB-100	Nitrate	0.16	2	2	0	0.0%	0.12	0.19
LB-100	Nitrate + Nitrite, as N	0.16	2	2	0	0.0%	0.12	0.19
LB-100	OrthoPhosphorus	< 0.005	2	0	2	100.0%		
LB-100	TKN	< 0.2	2	0	2	100.0%		
LB-100	Total Phosphorus	< 0.005	2	0	2	100.0%		
LB-200	Dissolved Oxygen	13	22	22	0	0.0%	9.9	14
LB-200	Field Conductivity	15	77	77	0	0.0%	3	27
LB-200	Field pH	6.9	83	83	0	0.0%	5	8.5
LB-200	Field Temp	4	96	96	0	0.0%	0	23
LB-200	Flow	9	58	58	0	0.0%	0.77	113
LB-200	Lab pH	6.5	82	82	0	0.0%	5.2	7.6
LB-200	Lab SC	< 14	85	84	1	1.2%	7	42
LB-200	TDS	< 12	88	67	21	23.9%	1	39
LB-200	TSS	< 1	88	10	78	88.6%	0.49	2
LB-200	Turbidity	< 0.24	87	61	26	29.9%	0.05	2.9
LB-200	Alkalinity, Bicarbonate as HCO3	< 4.6	86	78	8	9.3%	1	28
LB-200	Alkalinity, Total as CaCO3	4	87	87	0	0.0%	1	28
LB-200	Calcium, as Ca Dissolved	1.3	27	27	0	0.0%	0.7	18
LB-200	Calcium, as Ca Total	< 1.3	71	54	17	23.9%	0.8	18
LB-200	Chloride, as Cl	< 1	88	23	65	73.9%	0.087	15
LB-200	Fluoride, as F	< 0.05	52	5	47	90.4%	0.05	0.06
LB-200	Hardness, as CaCO3	< 4.3	85	59	26	30.6%	1	8
LB-200	Magnesium, as Mg Dissolved	< 0.51	27	24	3	11.1%	0.2	4.1
LB-200	Magnesium, as Mg Total	< 0.78	71	26	45	63.4%	0.1	4.1
LB-200	Potassium, as K Dissolved	< 0.51	25	15	10	40.0%	0.11	0.39
LB-200	Potassium, as K Total	< 1	70	20	50	71.4%	0.1	1
LB-200	Sodium, as Na Dissolved	< 1.2	27	18	9	33.3%	0.33	13
LB-200	Sodium, as Na Total	< 1.2	71	38	33	46.5%	0.1	13
LB-200	Sulfate, as SO4	< 2.2	87	57	30	34.5%	0.68	7
LB-200	Ammonia	< 0.05	92	19	73	79.4%	0.01	0.15
LB-200	Nitrate	< 0.19	92	91	1	1.1%	0.01	1.7
LB-200	Nitrate + Nitrite, as N	0.15	79	79	0	0.0%	0.01	0.52
LB-200	Nitrite	< 0.01	39	6	33	84.6%	0.001	0.27
LB-200	OrthoPhosphorus	< 0.005	87	25	62	71.3%	0.0005	0.074
LB-200	TKN	< 0.27	86	31	55	64.0%	0.2	1.3
LB-200	Total Inorganic Nitrogen	< 0.19	19	18	1	5.3%	0.05	1
LB-200	Total Phosphorus	< 0.0095	86	46	40	46.5%	0.0017	0.12
LB-200	Aluminum, as Al Dissolved	< 0.013	24	16	8	33.3%	0.0065	0.032
LB-200	Aluminum, as Al Total	< 0.017	34	17	17	50.0%	0.0091	0.039
LB-200	Antimony, as Sb Dissolved	< 0.003	30	2	28	93.3%	0.000054	0.000076
LB-200	Antimony, as Sb Total	< 0.003	34	1	33	97.1%	0.000051	0.000051
LB-200	Arsenic, as As Dissolved	< 0.00031	30	10	20	66.7%	0.00023	0.00042
LB-200	Arsenic, as As Total	< 0.00028	34	11	23	67.7%	0.000087	0.0004
LB-200	Barium, as Ba Dissolved	< 0.0024	30	13	17	56.7%	0.0017	0.006
LB-200	Barium, as Ba Total	< 0.0022	34	13	21	61.8%	0.00046	0.006
LB-200	Beryllium, as Be Dissolved	< 0.001	30	1	29	96.7%	0.000054	0.000054
LB-200	Beryllium, as Be Total	< 0.001	34	1	33	97.1%	0.000032	0.000032
LB-200	Cadmium, as Cd Dissolved	< 0.00006	24	3	21	87.5%	0.000023	0.000028
LB-200	Cadmium, as Cd Total	< 0.00008	27	4	23	85.2%	0.000017	0.0001
LB-200	Chromium, as Cr Dissolved	< 0.001	29	4	25	86.2%	0.00021	0.00028
LB-200	Chromium, as Cr Total	< 0.001	34	4	30	88.2%	0.00021	0.00031
LB-200	Copper, as Cu Dissolved	< 0.001	30	5	25	83.3%	0.00028	0.0011
LB-200	Copper, as Cu Total	< 0.001	34	8	26	76.5%	0.00025	0.002
LB-200	Iron, as Fe Dissolved	< 0.013	30	8	22	73.3%	0.0024	0.014
LB-200	Iron, as Fe Total	< 0.0083	34	12	22	64.7%	0.0034	0.021
LB-200	Lead, as Pb Dissolved	< 0.00041	29	9	20	69.0%	0.000054	0.004
LB-200	Lead, as Pb Total	< 0.00051	32	16	16	50.0%	0.00005	0.005
LB-200	Manganese, as Mn Dissolved	< 0.00089	28	10	18	64.3%	0.00041	0.0015
LB-200	Manganese, as Mn Total	< 0.0009	34	11	23	67.7%	0.00037	0.002
LB-200	Mercury, as Hg Dissolved	< 0.000025	17	7	10	58.8%	0.000016	0.000072
LB-200	Mercury, as Hg Total	< 0.000021	21	8	13	61.9%	0.000015	0.000067
LB-200	Nickel, as Ni Dissolved	< 0.01	30	7	23	76.7%	0.00026	0.00067
LB-200	Nickel, as Ni Total	< 0.01	34	2	32	94.1%	0.00026	0.00067
LB-200	Selenium, as Se Dissolved	< 0.001	30	2	28	93.3%	0.00016	0.00017
LB-200	Selenium, as Se Total	< 0.001	34	1	33	97.1%	0.00014	0.00014
LB-200	Silver, as Ag Dissolved	< 0.00025	18	1	17	94.4%	0.00074	0.00074
LB-200	Silver, as Ag Total	< 0.00025	19	1	18	94.7%	0.0004	0.0004
LB-200	Thallium, as Tl Dissolved	< 0.0002	18	0	18	100.0%		
LB-200	Thallium, as Tl Total	< 0.0002	22	0	22	100.0%		
LB-200	Zinc, as Zn Dissolved	< 0.0025	28	7	21	75.0%	0.00093	0.0079
LB-200	Zinc, as Zn Total	< 0.0025	34	10	24	70.6%	0.0012	0.004
LB-250	Field Temp	2	1	1	0	0.0%	2	2
LB-250	Lab pH	7	1	1	0	0.0%	7	7

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-250	Lab SC	16	1	1	0	0.0%	16	16
LB-250	TDS	34	1	1	0	0.0%	34	34
LB-250	TSS	3	1	1	0	0.0%	3	3
LB-250	Turbidity	< 0.2	1	0	1	100.0%		
LB-250	Alkalinity, Bicarbonate as HCO3	7	1	1	0	0.0%	7	7
LB-250	Alkalinity, Total as CaCO3	5	1	1	0	0.0%	5	5
LB-250	Calcium, as Ca Total	2	1	1	0	0.0%	2	2
LB-250	Chloride, as Cl	< 1	1	0	1	100.0%		
LB-250	Fluoride, as F	< 0.1	1	0	1	100.0%		
LB-250	Hardness, as CaCO3	< 7	1	0	1	100.0%		
LB-250	Magnesium, as Mg Total	< 1	1	0	1	100.0%		
LB-250	Potassium, as K Total	< 1	1	0	1	100.0%		
LB-250	Sodium, as Na Total	< 1	1	0	1	100.0%		
LB-250	Sulfate, as SO4	< 5	1	0	1	100.0%		
LB-250	Ammonia	< 0.05	1	0	1	100.0%		
LB-250	Nitrate	0.08	1	1	0	0.0%	0.08	0.08
LB-250	Nitrate + Nitrite, as N	0.08	1	1	0	0.0%	0.08	0.08
LB-250	Nitrite	< 0.01	1	0	1	100.0%		
LB-250	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
LB-250	TKN	0.2	1	1	0	0.0%	0.2	0.2
LB-250	Total Phosphorus	0.017	1	1	0	0.0%	0.017	0.017
LB-250	Aluminum, as Al Total	< 0.03	1	0	1	100.0%		
LB-250	Antimony, as Sb Total	< 0.003	1	0	1	100.0%		
LB-250	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
LB-250	Barium, as Ba Total	< 0.005	1	0	1	100.0%		
LB-250	Beryllium, as Be Total	< 0.001	1	0	1	100.0%		
LB-250	Cadmium, as Cd Total	< 0.00008	1	0	1	100.0%		
LB-250	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
LB-250	Copper, as Cu Total	0.002	1	1	0	0.0%	0.002	0.002
LB-250	Iron, as Fe Total	0.02	1	1	0	0.0%	0.02	0.02
LB-250	Lead, as Pb Total	< 0.00005	1	0	1	100.0%		
LB-250	Manganese, as Mn Total	< 0.005	1	0	1	100.0%		
LB-250	Mercury, as Hg Total	< 0.00001	1	0	1	100.0%		
LB-250	Nickel, as Ni Total	< 0.01	1	0	1	100.0%		
LB-250	Selenium, as Se Total	< 0.001	1	0	1	100.0%		
LB-250	Thallium, as Tl Total	< 0.0002	1	0	1	100.0%		
LB-250	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
LB-300	Dissolved Oxygen	12	29	29	0	0.0%	0.1	13
LB-300	Field Conductivity	19	42	42	0	0.0%	11	32
LB-300	Field pH	6.9	119	119	0	0.0%	5	8.5
LB-300	Field Temp	4	149	149	0	0.0%	1	20
LB-300	Flow	11	67	67	0	0.0%	1.6	148
LB-300	Lab pH	6.6	110	110	0	0.0%	5	7.6
LB-300	Lab SC	< 21	46	45	1	2.2%	11	45
LB-300	TDS	< 24	48	35	13	27.1%	7	330
LB-300	TSS	< 1	96	25	71	74.0%	0.5	2.4
LB-300	Turbidity	< 0.28	96	68	28	29.2%	0.05	3.3
LB-300	Alkalinity, Bicarbonate as HCO3	< 5.5	94	86	8	8.5%	1	21
LB-300	Alkalinity, Total as CaCO3	5	96	96	0	0.0%	1	21
LB-300	Calcium, as Ca Dissolved	1.9	29	29	0	0.0%	0.9	3.3
LB-300	Calcium, as Ca Total	< 1.7	28	25	3	10.7%	1	2.7
LB-300	Chloride, as Cl	< 1.1	96	31	65	67.7%	0.11	9
LB-300	Fluoride, as F	< 0.05	57	3	54	94.7%	0.11	0.14
LB-300	Hardness, as CaCO3	< 6.3	45	35	10	22.2%	3	15
LB-300	Magnesium, as Mg Dissolved	< 0.55	29	25	4	13.8%	0.2	1
LB-300	Magnesium, as Mg Total	< 0.82	77	30	47	61.0%	0.3	2
LB-300	Potassium, as K Dissolved	< 0.54	24	14	10	41.7%	0.12	0.36
LB-300	Potassium, as K Total	< 1	76	22	54	71.1%	0.1	0.7
LB-300	Sodium, as Na Dissolved	< 0.97	29	22	7	24.1%	0.44	1.9
LB-300	Sodium, as Na Total	< 0.97	28	21	7	25.0%	0.53	2
LB-300	Sulfate, as SO4	< 3	47	34	13	27.7%	1	9
LB-300	Ammonia	< 0.05	47	8	39	83.0%	0.01	0.16
LB-300	Nitrate	0.12	42	42	0	0.0%	0.007	0.67
LB-300	Nitrate + Nitrite, as N	0.11	30	30	0	0.0%	0.03	0.56
LB-300	Nitrite	< 0.01	39	6	33	84.6%	0.001	1.4
LB-300	OrthoPhosphorus	< 0.013	92	29	63	68.5%	0.0007	0.05
LB-300	TKN	< 0.27	46	20	26	56.5%	0.18	0.96
LB-300	Total Inorganic Nitrogen	< 0.16	21	18	3	14.3%	0.03	0.75
LB-300	Total Phosphorus	< 0.015	90	53	37	41.1%	0.0012	0.08
LB-300	Aluminum, as Al Dissolved	< 0.01	27	19	8	29.6%	0.0047	0.033
LB-300	Aluminum, as Al Total	< 0.033	44	20	24	54.6%	0.0069	0.77
LB-300	Antimony, as Sb Dissolved	< 0.003	33	2	31	93.9%	0.000063	0.0001
LB-300	Antimony, as Sb Total	< 0.003	42	1	41	97.6%	0.000074	0.000074
LB-300	Arsenic, as As Dissolved	< 0.00029	33	14	19	57.6%	0.0002	0.00039
LB-300	Arsenic, as As Total	< 0.001	44	13	31	70.5%	0.00025	0.00053

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-300	Barium, as Ba Dissolved	< 0.0026	32	15	17	53.1%	0.0017	0.0042
LB-300	Barium, as Ba Total	< 0.0031	41	18	23	56.1%	0.0017	0.016
LB-300	Beryllium, as Be Dissolved	< 0.001	33	1	32	97.0%	0.000022	0.000022
LB-300	Beryllium, as Be Total	< 0.001	41	0	41	100.0%		
LB-300	Cadmium, as Cd Dissolved	< 0.00006	24	3	21	87.5%	0.000013	0.000034
LB-300	Cadmium, as Cd Total	< 0.00006	30	5	25	83.3%	0.000007	0.00012
LB-300	Chromium, as Cr Dissolved	< 0.001	32	4	28	87.5%	0.00018	0.00027
LB-300	Chromium, as Cr Total	< 0.001	44	6	38	86.4%	0.00016	0.001
LB-300	Copper, as Cu Dissolved	< 0.001	33	9	24	72.7%	0.00025	0.002
LB-300	Copper, as Cu Total	< 0.001	44	8	36	81.8%	0.00025	0.003
LB-300	Iron, as Fe Dissolved	< 0.0092	32	11	21	65.6%	0.0015	0.035
LB-300	Iron, as Fe Total	< 0.018	44	16	28	63.6%	0.0033	0.094
LB-300	Lead, as Pb Dissolved	< 0.00043	31	10	21	67.7%	0.000067	0.004
LB-300	Lead, as Pb Total	< 0.00043	37	15	22	59.5%	0.000033	0.005
LB-300	Manganese, as Mn Dissolved	< 0.0024	33	16	17	51.5%	0.00049	0.0063
LB-300	Manganese, as Mn Total	< 0.0019	44	15	29	65.9%	0.00023	0.0081
LB-300	Mercury, as Hg Dissolved	< 0.00002	16	4	12	75.0%	0.000023	0.00004
LB-300	Mercury, as Hg Total	< 0.000017	25	9	16	64.0%	3.5E-07	0.00016
LB-300	Nickel, as Ni Dissolved	< 0.01	33	3	30	90.9%	0.00027	0.00034
LB-300	Nickel, as Ni Total	< 0.01	38	5	33	86.8%	0.00026	0.01
LB-300	Selenium, as Se Dissolved	< 0.001	33	2	31	93.9%	0.00015	0.00016
LB-300	Selenium, as Se Total	< 0.001	41	1	40	97.6%	0.00014	0.00014
LB-300	Silver, as Ag Dissolved	< 0.00025	20	0	20	100.0%		
LB-300	Silver, as Ag Total	< 0.00025	26	0	26	100.0%		
LB-300	Thallium, as Tl Dissolved	< 0.0002	18	0	18	100.0%		
LB-300	Thallium, as Tl Total	< 0.0002	22	0	22	100.0%		
LB-300	Zinc, as Zn Dissolved	< 0.0032	32	9	23	71.9%	0.00095	0.0084
LB-300	Zinc, as Zn Total	< 0.005	43	11	32	74.4%	0.0013	0.0066
LB-500	Dissolved Oxygen	12	43	43	0	0.0%	5.5	16
LB-500	Field Conductivity	19	63	63	0	0.0%	6	36
LB-500	Field pH	7.1	89	89	0	0.0%	4.8	8.5
LB-500	Field Temp	4	89	89	0	0.0%	0	18
LB-500	Flow	7.4	59	59	0	0.0%	0.47	174
LB-500	Lab pH	6.7	42	42	0	0.0%	5.2	7.4
LB-500	Lab SC	18	39	39	0	0.0%	11	26
LB-500	TDS	< 15	39	35	4	10.3%	4	34
LB-500	TSS	< 1	91	21	70	76.9%	0	5.6
LB-500	Turbidity	< 0.34	44	33	11	25.0%	0.05	1.9
LB-500	Alkalinity, Bicarbonate as HCO3	< 7.3	41	39	2	4.9%	2	26
LB-500	Alkalinity, Total as CaCO3	6	42	42	0	0.0%	2	21
LB-500	Calcium, as Ca Dissolved	2	22	22	0	0.0%	0.9	11
LB-500	Calcium, as Ca Total	< 1.2	21	8	13	61.9%	1	2.2
LB-500	Chloride, as Cl	< 1	44	11	33	75.0%	0.1	1
LB-500	Fluoride, as F	< 0.05	23	3	20	87.0%	0.01	0.03
LB-500	Hardness, as CaCO3	< 5.1	36	25	11	30.6%	0	38
LB-500	Magnesium, as Mg Dissolved	< 0.62	22	20	2	9.1%	0.2	2.7
LB-500	Magnesium, as Mg Total	< 1	26	7	19	73.1%	0.4	0.9
LB-500	Potassium, as K Dissolved	< 0.64	17	9	8	47.1%	0.14	1.2
LB-500	Potassium, as K Total	< 0.8	26	8	18	69.2%	0.17	1
LB-500	Sodium, as Na Dissolved	< 1	22	16	6	27.3%	0.43	2.2
LB-500	Sodium, as Na Total	< 1.7	21	15	6	28.6%	0.77	4
LB-500	Sulfate, as SO4	< 2.7	39	29	10	25.6%	1	22
LB-500	Ammonia	< 0.05	38	11	27	71.1%	0.01	0.12
LB-500	Nitrate	< 0.12	37	35	2	5.4%	0.02	0.4
LB-500	Nitrate + Nitrite, as N	0.1	30	30	0	0.0%	0.02	0.38
LB-500	Nitrite	< 0.009	23	2	21	91.3%	0.005	0.009
LB-500	OrthoPhosphorus	< 0.0038	40	19	21	52.5%	0.0008	0.013
LB-500	TKN	< 0.19	38	14	24	63.2%	0.05	1.2
LB-500	Total Inorganic Nitrogen	< 0.12	18	16	2	11.1%	0.03	0.4
LB-500	Total Phosphorus	< 0.0069	38	27	11	28.9%	0.0024	0.02
LB-500	Aluminum, as Al Dissolved	< 0.011	17	15	2	11.8%	0.0051	0.024
LB-500	Aluminum, as Al Total	< 0.022	23	16	7	30.4%	0.007	0.11
LB-500	Antimony, as Sb Dissolved	< 0.00025	23	2	21	91.3%	0.00005	0.0002
LB-500	Antimony, as Sb Total	< 0.00025	22	3	19	86.4%	0.000057	0.00034
LB-500	Arsenic, as As Dissolved	< 0.00028	22	12	10	45.5%	0.00019	0.00035
LB-500	Arsenic, as As Total	< 0.00032	22	11	11	50.0%	0.00025	0.00056
LB-500	Barium, as Ba Dissolved	< 0.0028	21	12	9	42.9%	0.0019	0.0045
LB-500	Barium, as Ba Total	< 0.0029	23	13	10	43.5%	0.0019	0.0043
LB-500	Beryllium, as Be Dissolved	< 0.0002	23	1	22	95.7%	0.0001	0.0001
LB-500	Beryllium, as Be Total	< 0.0002	23	1	22	95.7%	0.00003	0.00003
LB-500	Cadmium, as Cd Dissolved	< 0.00004	14	4	10	71.4%	0.000017	0.000081
LB-500	Cadmium, as Cd Total	< 0.00004	15	4	11	73.3%	0.000013	0.0001
LB-500	Chromium, as Cr Dissolved	< 0.00044	23	6	17	73.9%	0.00017	0.00056
LB-500	Chromium, as Cr Total	< 0.00047	23	3	20	87.0%	0.00019	0.00047
LB-500	Copper, as Cu Dissolved	< 0.00043	23	7	16	69.6%	0.00028	0.00085

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-500	Copper, as Cu Total	< 0.00038	23	6	17	73.9%	0.00025	0.001
LB-500	Iron, as Fe Dissolved	< 0.0086	23	8	15	65.2%	0.004	0.021
LB-500	Iron, as Fe Total	< 0.02	23	11	12	52.2%	0.0038	0.13
LB-500	Lead, as Pb Dissolved	< 0.00005	19	4	15	79.0%	0.000054	0.00017
LB-500	Lead, as Pb Total	< 0.00015	19	9	10	52.6%	0.000061	0.001
LB-500	Manganese, as Mn Dissolved	< 0.00076	20	9	11	55.0%	0.00023	0.0019
LB-500	Manganese, as Mn Total	< 0.0016	23	13	10	43.5%	0.00012	0.0072
LB-500	Mercury, as Hg Dissolved	< 0.000026	16	7	9	56.3%	0.000018	0.000048
LB-500	Mercury, as Hg Total	< 0.00002	15	4	11	73.3%	0.000014	0.000046
LB-500	Nickel, as Ni Dissolved	< 0.0005	23	6	17	73.9%	0.00025	0.00058
LB-500	Nickel, as Ni Total	< 0.0017	23	2	21	91.3%	0.0017	0.0047
LB-500	Selenium, as Se Dissolved	< 0.00025	23	1	22	95.7%	0.00013	0.00013
LB-500	Selenium, as Se Total	< 0.00025	23	1	22	95.7%	0.00017	0.00017
LB-500	Silver, as Ag Dissolved	< 0.00025	18	0	18	100.0%		
LB-500	Silver, as Ag Total	< 0.00025	19	3	16	84.2%	0.0003	0.0004
LB-500	Thallium, as Tl Dissolved	< 0.0002	10	1	9	90.0%	0.0018	0.0018
LB-500	Thallium, as Tl Total	< 0.0002	10	1	9	90.0%	0.0024	0.0024
LB-500	Zinc, as Zn Dissolved	< 0.0015	21	8	13	61.9%	0.00096	0.0028
LB-500	Zinc, as Zn Total	< 0.002	23	6	17	73.9%	0.0014	0.003
LB-800	Field Conductivity	28	16	16	0	0.0%	11	37
LB-800	Field pH	6.8	24	24	0	0.0%	4.6	8.2
LB-800	Field Temp	4	25	25	0	0.0%	0	18
LB-800	Flow	37	25	25	0	0.0%	2.9	250
LB-800	Lab pH	6.4	24	24	0	0.0%	5.4	7.1
LB-800	Lab SC	25	17	17	0	0.0%	14	41
LB-800	TDS	19	17	17	0	0.0%	6	46
LB-800	TSS	< 2.6	25	8	17	68.0%	1	30
LB-800	Turbidity	< 0.86	24	22	2	8.3%	0.17	10
LB-800	Alkalinity, Bicarbonate as HCO3	11	24	24	0	0.0%	0	26
LB-800	Alkalinity, Total as CaCO3	9	24	24	0	0.0%	2	21
LB-800	Calcium, as Ca Total	< 1.9	17	14	3	17.6%	1	4
LB-800	Chloride, as Cl	< 1	25	3	22	88.0%	1	3
LB-800	Fluoride, as F	< 0.05	25	5	20	80.0%	0.01	0.05
LB-800	Hardness, as CaCO3	< 3	17	8	9	52.9%	0	8
LB-800	Magnesium, as Mg Total	< 1	25	1	24	96.0%	2	2
LB-800	Potassium, as K Total	< 1	25	1	24	96.0%	1	1
LB-800	Sodium, as Na Total	< 2	17	13	4	23.5%	1	4
LB-800	Sulfate, as SO4	< 1.5	17	12	5	29.4%	1	2
LB-800	Ammonia	< 0.074	17	6	11	64.7%	0.05	0.23
LB-800	Nitrate	0.04	17	17	0	0.0%	0.02	0.51
LB-800	Nitrate + Nitrite, as N	0.04	17	17	0	0.0%	0.02	0.51
LB-800	OrthoPhosphorus	< 0.005	25	7	18	72.0%	0.005	0.013
LB-800	TKN	< 0.28	17	8	9	52.9%	0.16	0.7
LB-800	Total Phosphorus	< 0.01	25	15	10	40.0%	0.005	0.088
LB-1000	Field Conductivity	36	6	6	0	0.0%	29	64
LB-1000	Field pH	7.4	21	21	0	0.0%	6.3	7.8
LB-1000	Field Temp	8	23	23	0	0.0%	0.5	18
LB-1000	Flow	18	20	20	0	0.0%	2.9	120
LB-1000	Lab pH	6.9	17	17	0	0.0%	6	7.8
LB-1000	Lab SC	43	6	6	0	0.0%	30	74
LB-1000	TDS	< 28	6	5	1	16.7%	21	46
LB-1000	TSS	< 1	18	4	14	77.8%	0.49	3
LB-1000	Turbidity	< 0.42	18	15	3	16.7%	0.16	2.3
LB-1000	Alkalinity, Bicarbonate as HCO3	21	18	18	0	0.0%	8	39
LB-1000	Alkalinity, Total as CaCO3	18	18	18	0	0.0%	7	39
LB-1000	Calcium, as Ca Dissolved	4.1	5	5	0	0.0%	3.2	8.4
LB-1000	Calcium, as Ca Total	4.9	1	1	0	0.0%	4.9	4.9
LB-1000	Chloride, as Cl	< 1	18	4	14	77.8%	0.19	1
LB-1000	Fluoride, as F	< 0.05	7	0	7	100.0%		
LB-1000	Hardness, as CaCO3	18	6	6	0	0.0%	13	33
LB-1000	Magnesium, as Mg Dissolved	1.3	5	5	0	0.0%	1.1	3
LB-1000	Magnesium, as Mg Total	< 1.6	13	12	1	7.7%	0.5	2.6
LB-1000	Potassium, as K Dissolved	< 0.62	4	2	2	50.0%	0.22	0.26
LB-1000	Potassium, as K Total	< 0.65	13	6	7	53.8%	0.2	0.3
LB-1000	Sodium, as Na Dissolved	< 0.98	5	4	1	20.0%	0.8	1.3
LB-1000	Sodium, as Na Total	1.2	1	1	0	0.0%	1.2	1.2
LB-1000	Sulfate, as SO4	1.4	6	6	0	0.0%	1	2.5
LB-1000	Ammonia	< 0.035	6	1	5	83.3%	0.02	0.02
LB-1000	Nitrate	0.03	6	6	0	0.0%	0.01	0.098
LB-1000	Nitrate + Nitrite, as N	0.025	4	4	0	0.0%	0.01	0.04
LB-1000	Nitrite	< 0.01	6	1	5	83.3%	0.036	0.036
LB-1000	OrthoPhosphorus	< 0.005	18	4	14	77.8%	0.001	0.005
LB-1000	TKN	< 0.1	5	1	4	80.0%	0.08	0.08
LB-1000	Total Inorganic Nitrogen	< 0.057	6	4	2	33.3%	0.03	0.15
LB-1000	Total Phosphorus	< 0.0099	18	11	7	38.9%	0.0045	0.05

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-1000	Aluminum, as Al Dissolved	0.0055	3	3	0	0.0%	0.0041	0.044
LB-1000	Aluminum, as Al Total	< 0.038	6	3	3	50.0%	0.0064	0.099
LB-1000	Antimony, as Sb Dissolved	< 0.00025	5	1	4	80.0%	0.000057	0.000057
LB-1000	Antimony, as Sb Total	< 0.0016	6	0	6	100.0%		
LB-1000	Arsenic, as As Dissolved	< 0.00022	5	2	3	60.0%	0.00021	0.00023
LB-1000	Arsenic, as As Total	< 0.00026	6	2	4	66.7%	0.00023	0.00033
LB-1000	Barium, as Ba Dissolved	< 0.0063	5	4	1	20.0%	0.0052	0.0089
LB-1000	Barium, as Ba Total	0.0067	6	6	0	0.0%	0.006	0.0096
LB-1000	Beryllium, as Be Dissolved	< 0.0001	5	1	4	80.0%	0.000022	0.000022
LB-1000	Beryllium, as Be Total	< 0.00055	6	0	6	100.0%		
LB-1000	Cadmium, as Cd Dissolved	< 0.000029	3	2	1	33.3%	0.000014	0.000033
LB-1000	Cadmium, as Cd Total	< 0.000013	3	0	3	100.0%		
LB-1000	Chromium, as Cr Dissolved	< 0.00019	5	2	3	60.0%	0.00016	0.00021
LB-1000	Chromium, as Cr Total	< 0.0023	6	1	5	83.3%	0.00058	0.00058
LB-1000	Copper, as Cu Dissolved	< 0.00042	5	1	4	80.0%	0.00042	0.00042
LB-1000	Copper, as Cu Total	< 0.00052	6	2	4	66.7%	0.0005	0.00056
LB-1000	Iron, as Fe Dissolved	< 0.0093	5	2	3	60.0%	0.00092	0.026
LB-1000	Iron, as Fe Total	< 0.019	6	2	4	66.7%	0.0031	0.1
LB-1000	Lead, as Pb Dissolved	< 0.000073	5	2	3	60.0%	0.000061	0.00012
LB-1000	Lead, as Pb Total	< 0.00005	6	1	5	83.3%	0.00012	0.00012
LB-1000	Manganese, as Mn Dissolved	< 0.00063	5	3	2	40.0%	0.00034	0.001
LB-1000	Manganese, as Mn Total	< 0.0013	6	3	3	50.0%	0.00043	0.003
LB-1000	Mercury, as Hg Dissolved	< 0.00002	5	1	4	80.0%	0.000073	0.000073
LB-1000	Mercury, as Hg Total	< 0.000017	6	0	6	100.0%		
LB-1000	Nickel, as Ni Dissolved	< 0.00025	5	0	5	100.0%		
LB-1000	Nickel, as Ni Total	< 0.0054	6	1	5	83.3%	0.00074	0.00074
LB-1000	Selenium, as Se Dissolved	< 0.00025	5	1	4	80.0%	0.00015	0.00015
LB-1000	Selenium, as Se Total	< 0.00063	6	0	6	100.0%		
LB-1000	Silver, as Ag Dissolved	< 0.00025	5	0	5	100.0%		
LB-1000	Silver, as Ag Total	< 0.00023	6	0	6	100.0%		
LB-1000	Thallium, as Tl Total	< 0.0002	3	0	3	100.0%		
LB-1000	Zinc, as Zn Dissolved	< 0.0016	5	2	3	60.0%	0.0013	0.0024
LB-1000	Zinc, as Zn Total	< 0.0024	6	2	4	66.7%	0.002	0.0044
LB-2000	Field Conductivity	40	8	8	0	0.0%	21	71
LB-2000	Field pH	7	25	25	0	0.0%	5.5	8.1
LB-2000	Field Temp	5.4	28	28	0	0.0%	0	18
LB-2000	Flow	43	24	24	0	0.0%	5.8	193
LB-2000	Lab pH	7.1	27	27	0	0.0%	5.4	7.9
LB-2000	Lab SC	47	8	8	0	0.0%	23	76
LB-2000	TDS	< 29	8	7	1	12.5%	21	47
LB-2000	TSS	< 1.5	28	12	16	57.1%	0	13
LB-2000	Turbidity	< 1.4	28	25	3	10.7%	0.09	12
LB-2000	Alkalinity, Bicarbonate as HCO3	24	28	28	0	0.0%	6	41
LB-2000	Alkalinity, Total as CaCO3	20	28	28	0	0.0%	5	38
LB-2000	Calcium, as Ca Dissolved	4.5	5	5	0	0.0%	3.4	8.6
LB-2000	Calcium, as Ca Total	4.9	3	3	0	0.0%	3	7
LB-2000	Chloride, as Cl	< 1	28	5	23	82.1%	0.27	4
LB-2000	Fluoride, as F	< 0.05	17	0	17	100.0%		
LB-2000	Hardness, as CaCO3	< 19	8	7	1	12.5%	8	35
LB-2000	Magnesium, as Mg Dissolved	1.5	5	5	0	0.0%	1.2	3.3
LB-2000	Magnesium, as Mg Total	< 1.6	23	15	8	34.8%	0.6	3.1
LB-2000	Potassium, as K Dissolved	< 0.64	4	2	2	50.0%	0.26	0.31
LB-2000	Potassium, as K Total	< 0.81	23	7	16	69.6%	0.2	1
LB-2000	Sodium, as Na Dissolved	< 1.1	5	4	1	20.0%	0.9	1.5
LB-2000	Sodium, as Na Total	1	3	3	0	0.0%	1	1.3
LB-2000	Sulfate, as SO4	< 2.2	8	6	2	25.0%	1	2
LB-2000	Ammonia	< 0.05	8	2	6	75.0%	0.02	0.07
LB-2000	Nitrate	< 0.044	8	7	1	12.5%	0.01	0.099
LB-2000	Nitrate + Nitrite, as N	< 0.035	6	5	1	16.7%	0.01	0.09
LB-2000	Nitrite	< 0.01	6	1	5	83.3%	0.032	0.032
LB-2000	OrthoPhosphorus	< 0.005	28	7	21	75.0%	0.0015	0.017
LB-2000	TKN	< 0.11	7	1	6	85.7%	0.11	0.11
LB-2000	Total Inorganic Nitrogen	< 0.056	6	4	2	33.3%	0.03	0.15
LB-2000	Total Phosphorus	< 0.011	28	16	12	42.9%	0.0018	0.12
LB-2000	Aluminum, as Al Dissolved	0.006	3	3	0	0.0%	0.0046	0.055
LB-2000	Aluminum, as Al Total	< 0.029	6	3	3	50.0%	0.0099	0.12
LB-2000	Antimony, as Sb Dissolved	< 0.00025	5	1	4	80.0%	0.000063	0.000063
LB-2000	Antimony, as Sb Total	< 0.0016	6	1	5	83.3%	0.00017	0.00017
LB-2000	Arsenic, as As Dissolved	< 0.00025	5	3	2	40.0%	0.0002	0.00029
LB-2000	Arsenic, as As Total	< 0.00033	6	3	3	50.0%	0.00025	0.00037
LB-2000	Barium, as Ba Dissolved	< 0.0066	5	4	1	20.0%	0.0053	0.0092
LB-2000	Barium, as Ba Total	0.007	6	6	0	0.0%	0.0067	0.0093
LB-2000	Beryllium, as Be Dissolved	< 0.0001	5	0	5	100.0%		
LB-2000	Beryllium, as Be Total	< 0.00055	6	1	5	83.3%	0.000098	0.000098
LB-2000	Cadmium, as Cd Dissolved	< 0.000013	3	0	3	100.0%		

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-2000	Cadmium, as Cd Total	< 0.000041	3	1	2	66.7%	0.000071	0.000071
LB-2000	Chromium, as Cr Dissolved	< 0.00025	5	1	4	80.0%	0.00021	0.00021
LB-2000	Chromium, as Cr Total	< 0.0021	6	1	5	83.3%	0.00016	0.00016
LB-2000	Copper, as Cu Dissolved	< 0.00031	5	2	3	60.0%	0.00025	0.00044
LB-2000	Copper, as Cu Total	< 0.00038	6	2	4	66.7%	0.0003	0.00054
LB-2000	Iron, as Fe Dissolved	< 0.013	5	2	3	60.0%	0.0018	0.035
LB-2000	Iron, as Fe Total	< 0.037	6	3	3	50.0%	0.011	0.11
LB-2000	Lead, as Pb Dissolved	< 0.00019	5	2	3	60.0%	0.000076	0.00065
LB-2000	Lead, as Pb Total	< 0.000074	6	3	3	50.0%	0.00005	0.00017
LB-2000	Manganese, as Mn Dissolved	< 0.00082	5	3	2	40.0%	0.0006	0.00097
LB-2000	Manganese, as Mn Total	< 0.0014	6	3	3	50.0%	0.00046	0.0029
LB-2000	Mercury, as Hg Dissolved	< 0.00002	5	1	4	80.0%	0.000088	0.000088
LB-2000	Mercury, as Hg Total	< 0.000017	6	0	6	100.0%		
LB-2000	Nickel, as Ni Dissolved	< 0.00025	5	0	5	100.0%		
LB-2000	Nickel, as Ni Total	< 0.0051	6	0	6	100.0%		
LB-2000	Selenium, as Se Dissolved	< 0.00025	5	1	4	80.0%	0.00017	0.00017
LB-2000	Selenium, as Se Total	< 0.00063	6	0	6	100.0%		
LB-2000	Silver, as Ag Dissolved	< 0.00025	5	0	5	100.0%		
LB-2000	Silver, as Ag Total	< 0.00023	6	1	5	83.3%	0.0002	0.0002
LB-2000	Thallium, as Tl Total	< 0.0002	3	0	3	100.0%		
LB-2000	Zinc, as Zn Dissolved	< 0.002	5	2	3	60.0%	0.0019	0.0025
LB-2000	Zinc, as Zn Total	< 0.002	6	1	5	83.3%	0.0032	0.0032
LB-3000	Field Conductivity	56	24	24	0	0.0%	25	110
LB-3000	Field pH	7.2	35	35	0	0.0%	5.9	8.5
LB-3000	Field Temp	5.9	35	35	0	0.0%	0	18
LB-3000	Flow	69	34	34	0	0.0%	11	748
LB-3000	Lab pH	7.3	35	35	0	0.0%	5.7	8.4
LB-3000	Lab SC	56	26	26	0	0.0%	16	215
LB-3000	TDS	39	26	26	0	0.0%	13	135
LB-3000	TSS	< 2.4	36	13	23	63.9%	0.7	34
LB-3000	Turbidity	< 1.6	36	31	5	13.9%	0.15	21
LB-3000	Alkalinity, Bicarbonate as HCO3	< 39	35	34	1	2.9%	12	125
LB-3000	Alkalinity, Total as CaCO3	30	36	36	0	0.0%	10	102
LB-3000	Calcium, as Ca Dissolved	10	6	6	0	0.0%	5	18
LB-3000	Calcium, as Ca Total	5	21	21	0	0.0%	3	28
LB-3000	Chloride, as Cl	< 1.2	36	12	24	66.7%	0.25	6
LB-3000	Fluoride, as F	< 0.05	25	5	20	80.0%	0.01	0.06
LB-3000	Hardness, as CaCO3	< 28	26	23	3	11.5%	8	115
LB-3000	Magnesium, as Mg Dissolved	3.3	6	6	0	0.0%	1.7	7
LB-3000	Magnesium, as Mg Total	< 2.6	31	25	6	19.4%	1	11
LB-3000	Potassium, as K Dissolved	< 0.75	5	2	3	60.0%	0.37	0.39
LB-3000	Potassium, as K Total	< 1	31	5	26	83.9%	0.3	1
LB-3000	Sodium, as Na Dissolved	< 1.3	6	5	1	16.7%	1	2
LB-3000	Sodium, as Na Total	< 1.9	21	17	4	19.0%	1	4
LB-3000	Sulfate, as SO4	< 2.3	26	21	5	19.2%	1	7
LB-3000	Ammonia	< 0.065	26	8	18	69.2%	0.05	0.21
LB-3000	Nitrate	< 0.064	26	23	3	11.5%	0.01	0.16
LB-3000	Nitrate + Nitrite, as N	< 0.064	23	20	3	13.0%	0.01	0.16
LB-3000	Nitrite	< 0.01	9	2	7	77.8%	0.0031	0.02
LB-3000	OrthoPhosphorus	< 0.0056	36	11	25	69.4%	0.0013	0.043
LB-3000	TKN	< 0.17	25	10	15	60.0%	0.09	0.47
LB-3000	Total Inorganic Nitrogen	< 0.041	6	2	4	66.7%	0.037	0.06
LB-3000	Total Phosphorus	< 0.011	36	23	13	36.1%	0.0022	0.1
LB-3000	Aluminum, as Al Dissolved	< 0.024	5	4	1	20.0%	0.0035	0.068
LB-3000	Aluminum, as Al Total	< 0.024	9	4	5	55.6%	0.0057	0.11
LB-3000	Antimony, as Sb Dissolved	< 0.003	7	1	6	85.7%	0.000051	0.000051
LB-3000	Antimony, as Sb Total	< 0.003	9	0	9	100.0%		
LB-3000	Arsenic, as As Dissolved	< 0.00032	7	3	4	57.1%	0.0003	0.00034
LB-3000	Arsenic, as As Total	< 0.00034	9	3	6	66.7%	0.00031	0.0004
LB-3000	Barium, as Ba Dissolved	< 0.015	7	6	1	14.3%	0.0086	0.026
LB-3000	Barium, as Ba Total	0.016	9	9	0	0.0%	0.009	0.037
LB-3000	Beryllium, as Be Dissolved	< 0.001	7	0	7	100.0%		
LB-3000	Beryllium, as Be Total	< 0.001	9	0	9	100.0%		
LB-3000	Cadmium, as Cd Dissolved	< 0.00004	5	0	5	100.0%		
LB-3000	Cadmium, as Cd Total	< 0.00008	7	2	5	71.4%	0.000013	0.0002
LB-3000	Chromium, as Cr Dissolved	< 0.001	7	1	6	85.7%	0.00058	0.00058
LB-3000	Chromium, as Cr Total	< 0.001	9	0	9	100.0%		
LB-3000	Copper, as Cu Dissolved	< 0.001	7	1	6	85.7%	0.00037	0.00037
LB-3000	Copper, as Cu Total	< 0.001	9	1	8	88.9%	0.00075	0.00075
LB-3000	Iron, as Fe Dissolved	< 0.017	7	3	4	57.1%	0.0054	0.043
LB-3000	Iron, as Fe Total	< 0.026	9	5	4	44.4%	0.0054	0.097
LB-3000	Lead, as Pb Dissolved	< 0.000067	7	3	4	57.1%	0.000054	0.0001
LB-3000	Lead, as Pb Total	< 0.00041	9	6	3	33.3%	0.000051	0.003
LB-3000	Manganese, as Mn Dissolved	< 0.00072	7	3	4	57.1%	0.00035	0.00091
LB-3000	Manganese, as Mn Total	< 0.0012	9	3	6	66.7%	0.00062	0.0022

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-3000	Mercury, as Hg Dissolved	< 0.000017	6	1	5	83.3%	0.000044	0.000044
LB-3000	Mercury, as Hg Total	< 0.000017	8	1	7	87.5%	0.000066	0.000066
LB-3000	Nickel, as Ni Dissolved	< 0.01	7	2	5	71.4%	0.00026	0.00027
LB-3000	Nickel, as Ni Total	< 0.01	9	0	9	100.0%		
LB-3000	Selenium, as Se Dissolved	< 0.001	7	1	6	85.7%	0.00018	0.00018
LB-3000	Selenium, as Se Total	< 0.001	9	0	9	100.0%		
LB-3000	Silver, as Ag Dissolved	< 0.00025	5	0	5	100.0%		
LB-3000	Silver, as Ag Total	< 0.00023	6	2	4	66.7%	0.0002	0.0004
LB-3000	Thallium, as Tl Dissolved	< 0.0002	4	0	4	100.0%		
LB-3000	Thallium, as Tl Total	< 0.0002	6	0	6	100.0%		
LB-3000	Zinc, as Zn Dissolved	< 0.0025	7	2	5	71.4%	0.0015	0.0026
LB-3000	Zinc, as Zn Total	< 0.0021	9	3	6	66.7%	0.002	0.0026
LC-100	Field Conductivity	20	26	26	0	0.0%	12	40
LC-100	Field pH	6.5	25	25	0	0.0%	5.2	8.4
LC-100	Field Temp	5.5	28	28	0	0.0%	0	15
LC-100	Flow	0.98	29	29	0	0.0%	0.02	50
LC-100	Lab pH	6.6	28	28	0	0.0%	5.5	7.3
LC-100	Lab SC	23	28	28	0	0.0%	10	42
LC-100	TDS	< 24	28	27	1	3.6%	11	50
LC-100	TSS	< 1	28	4	24	85.7%	1	5
LC-100	Turbidity	< 0.32	28	26	2	7.1%	0.13	1.1
LC-100	Alkalinity, Bicarbonate as HCO3	10	27	27	0	0.0%	0	28
LC-100	Alkalinity, Total as CaCO3	8	28	28	0	0.0%	3	23
LC-100	Calcium, as Ca Total	< 1.9	28	18	10	35.7%	0.2	4
LC-100	Chloride, as Cl	< 1	28	3	25	89.3%	1	1
LC-100	Fluoride, as F	< 0.05	23	4	19	82.6%	0.01	0.06
LC-100	Hardness, as CaCO3	< 4.8	28	18	10	35.7%	0	15
LC-100	Magnesium, as Mg Total	< 1	28	8	20	71.4%	0.3	1.2
LC-100	Potassium, as K Total	< 1	28	8	20	71.4%	0.2	1
LC-100	Sodium, as Na Total	< 1.9	28	24	4	14.3%	0.6	6
LC-100	Sulfate, as SO4	< 1.8	28	18	10	35.7%	1	4
LC-100	Ammonia	< 0.064	28	9	19	67.9%	0.05	0.23
LC-100	Nitrate	< 0.021	28	13	15	53.6%	0.01	0.16
LC-100	Nitrate + Nitrite, as N	< 0.022	28	13	15	53.6%	0.01	0.16
LC-100	OrthoPhosphorus	< 0.007	28	13	15	53.6%	0.005	0.025
LC-100	TKN	< 0.23	28	12	16	57.1%	0.17	0.67
LC-100	Total Phosphorus	< 0.013	28	23	5	17.9%	0.005	0.049
LC-600	Field Conductivity	26	25	25	0	0.0%	10	85
LC-600	Field pH	6.8	24	24	0	0.0%	5.2	8
LC-600	Field Temp	5	26	26	0	0.0%	0	16
LC-600	Flow	3.2	25	25	0	0.0%	0.2	13
LC-600	Lab pH	6.7	26	26	0	0.0%	5.2	7.6
LC-600	Lab SC	26	26	26	0	0.0%	15	93
LC-600	TDS	27	26	26	0	0.0%	8	66
LC-600	TSS	< 3.9	26	20	6	23.1%	1	26
LC-600	Turbidity	1.1	26	26	0	0.0%	0.47	19
LC-600	Alkalinity, Bicarbonate as HCO3	13	25	25	0	0.0%	6	57
LC-600	Alkalinity, Total as CaCO3	11	26	26	0	0.0%	5	47
LC-600	Calcium, as Ca Total	< 2.9	26	23	3	11.5%	1	9
LC-600	Chloride, as Cl	< 1	26	4	22	84.6%	1	1
LC-600	Fluoride, as F	< 0.05	26	4	22	84.6%	0.02	0.06
LC-600	Hardness, as CaCO3	< 7.7	26	12	14	53.9%	0	35
LC-600	Magnesium, as Mg Total	< 1	26	6	20	76.9%	1	3
LC-600	Potassium, as K Total	< 1	26	3	23	88.5%	1	2
LC-600	Sodium, as Na Total	< 2.3	26	22	4	15.4%	1	5
LC-600	Sulfate, as SO4	< 1.6	26	18	8	30.8%	1	5
LC-600	Ammonia	< 0.064	26	8	18	69.2%	0.05	0.23
LC-600	Nitrate	< 0.01	26	6	20	76.9%	0.02	2
LC-600	Nitrate + Nitrite, as N	< 0.01	26	6	20	76.9%	0.02	2
LC-600	OrthoPhosphorus	< 0.0063	26	14	12	46.2%	0.005	0.012
LC-600	TKN	< 0.22	26	12	14	53.9%	0.2	0.34
LC-600	Total Phosphorus	< 0.015	26	20	6	23.1%	0.005	0.1
LC-800	Dissolved Oxygen	11	8	8	0	0.0%	9.6	13
LC-800	Field Conductivity	56	28	28	0	0.0%	18	95
LC-800	Field pH	7.3	30	30	0	0.0%	6.1	8
LC-800	Field Temp	5.1	31	31	0	0.0%	1.2	16
LC-800	Flow	0.47	20	20	0	0.0%	0.15	52
LC-800	Lab pH	7.2	27	27	0	0.0%	6.1	7.9
LC-800	Lab SC	52	28	28	0	0.0%	10	102
LC-800	TDS	< 39	30	27	3	10.0%	10	73
LC-800	TSS	< 6.8	30	16	14	46.7%	0.57	118
LC-800	Turbidity	< 5.5	31	27	4	12.9%	0.05	89
LC-800	Alkalinity, Bicarbonate as HCO3	33	31	31	0	0.0%	9	55
LC-800	Alkalinity, Total as CaCO3	27	31	31	0	0.0%	7	55
LC-800	Calcium, as Ca Dissolved	5.4	12	12	0	0.0%	1.5	10

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LC-800	Calcium, as Ca Total	4.7	19	19	0	0.0%	1.2	9.9
LC-800	Chloride, as Cl	< 1.1	29	15	14	48.3%	0.2	4
LC-800	Fluoride, as F	< 0.075	11	4	7	63.6%	0.05	0.11
LC-800	Hardness, as CaCO3	< 22	31	29	2	6.5%	5.8	42
LC-800	Magnesium, as Mg Dissolved	< 2	12	11	1	8.3%	0.34	4.2
LC-800	Magnesium, as Mg Total	< 2.2	19	18	1	5.3%	0.82	4
LC-800	Potassium, as K Dissolved	< 0.73	10	5	5	50.0%	0.31	0.61
LC-800	Potassium, as K Total	< 0.91	19	7	12	63.2%	0.2	3
LC-800	Sodium, as Na Dissolved	< 1.6	12	11	1	8.3%	0.39	2.3
LC-800	Sodium, as Na Total	< 1.6	19	18	1	5.3%	0.8	3
LC-800	Sulfate, as SO4	< 2.7	30	17	13	43.3%	0.5	16
LC-800	Ammonia	< 0.12	31	13	18	58.1%	0.01	2.7
LC-800	Nitrate	< 0.033	28	15	13	46.4%	0.01	0.34
LC-800	Nitrate + Nitrite, as N	< 0.03	26	11	15	57.7%	0.01	0.34
LC-800	Nitrite	< 0.01	18	2	16	88.9%	0.01	0.017
LC-800	OrthoPhosphorus	< 0.026	30	15	15	50.0%	0.0009	0.048
LC-800	TKN	< 0.22	30	14	16	53.3%	0.11	0.7
LC-800	Total Inorganic Nitrogen	< 0.032	13	7	6	46.2%	0.01	0.07
LC-800	Total Phosphorus	< 0.51	30	23	7	23.3%	0.002	15
LC-800	Aluminum, as Al Dissolved	0.012	6	6	0	0.0%	0.0052	0.027
LC-800	Aluminum, as Al Total	< 0.061	20	12	8	40.0%	0.0081	0.5
LC-800	Antimony, as Sb Dissolved	< 0.00025	12	1	11	91.7%	0.000096	0.000096
LC-800	Antimony, as Sb Total	< 0.003	18	0	18	100.0%		
LC-800	Arsenic, as As Dissolved	< 0.00032	12	3	9	75.0%	0.000089	0.00037
LC-800	Arsenic, as As Total	< 0.001	20	3	17	85.0%	0.00027	0.00034
LC-800	Barium, as Ba Dissolved	0.012	12	12	0	0.0%	0.0059	0.02
LC-800	Barium, as Ba Total	0.012	17	17	0	0.0%	0.0031	0.022
LC-800	Beryllium, as Be Dissolved	< 0.00055	12	2	10	83.3%	0.000037	0.017
LC-800	Beryllium, as Be Total	< 0.001	17	0	17	100.0%		
LC-800	Cadmium, as Cd Dissolved	< 0.000029	7	1	6	85.7%	0.000029	0.000029
LC-800	Cadmium, as Cd Total	< 0.00004	9	2	7	77.8%	0.0002	0.0004
LC-800	Chromium, as Cr Dissolved	< 0.00025	12	3	9	75.0%	0.00016	0.00025
LC-800	Chromium, as Cr Total	< 0.001	20	4	16	80.0%	0.00022	0.004
LC-800	Copper, as Cu Dissolved	< 0.00071	11	2	9	81.8%	0.00032	0.00071
LC-800	Copper, as Cu Total	< 0.00047	20	7	13	65.0%	0.00026	0.002
LC-800	Iron, as Fe Dissolved	< 0.019	12	4	8	66.7%	0.0069	0.054
LC-800	Iron, as Fe Total	< 0.067	20	11	9	45.0%	0.0099	0.49
LC-800	Lead, as Pb Dissolved	< 0.00005	12	3	9	75.0%	0.00012	0.0011
LC-800	Lead, as Pb Total	< 0.00013	13	5	8	61.5%	0.000062	0.00036
LC-800	Manganese, as Mn Dissolved	< 0.0023	12	7	5	41.7%	0.00057	0.0071
LC-800	Manganese, as Mn Total	< 0.0048	20	12	8	40.0%	0.001	0.019
LC-800	Mercury, as Hg Dissolved	< 0.00002	11	3	8	72.7%	0.00003	0.000059
LC-800	Mercury, as Hg Total	< 0.00002	12	1	11	91.7%	0.000032	0.000032
LC-800	Nickel, as Ni Dissolved	< 0.00079	12	2	10	83.3%	0.00057	0.001
LC-800	Nickel, as Ni Total	< 0.0051	14	0	14	100.0%		
LC-800	Selenium, as Se Dissolved	< 0.00025	12	1	11	91.7%	0.00017	0.00017
LC-800	Selenium, as Se Total	< 0.001	17	0	17	100.0%		
LC-800	Silver, as Ag Dissolved	< 0.00025	12	1	11	91.7%	0.016	0.016
LC-800	Silver, as Ag Total	< 0.0002	17	1	16	94.1%	0.0003	0.0003
LC-800	Thallium, as Tl Dissolved	< 0.0002	5	0	5	100.0%		
LC-800	Thallium, as Tl Total	< 0.0002	6	1	5	83.3%	0.0003	0.0003
LC-800	Zinc, as Zn Dissolved	< 0.002	12	3	9	75.0%	0.0019	0.032
LC-800	Zinc, as Zn Total	< 0.0025	20	5	15	75.0%	0.0011	0.0037
Midas Cr	Alkalinity, Bicarbonate as HCO3	115	1	1	0	0.0%	115	115
Midas Cr	Alkalinity, Total as CaCO3	95	1	1	0	0.0%	95	95
Midas Cr	Field Temp	2	1	1	0	0.0%	2	2
Midas Cr	Lab pH	8	1	1	0	0.0%	8	8
Midas Cr	Lab SC	174	1	1	0	0.0%	174	174
Midas Cr	TDS	81	1	1	0	0.0%	81	81
Midas Cr	TSS	3	1	1	0	0.0%	3	3
Midas Cr	Calcium, as Ca Dissolved	16	1	1	0	0.0%	16	16
Midas Cr	Calcium, as Ca Total	20	1	1	0	0.0%	20	20
Midas Cr	Chloride, as Cl	2	1	1	0	0.0%	2	2
Midas Cr	Hardness, as CaCO3	73	1	1	0	0.0%	73	73
Midas Cr	Magnesium, as Mg Dissolved	8	1	1	0	0.0%	8	8
Midas Cr	Magnesium, as Mg Total	10	1	1	0	0.0%	10	10
Midas Cr	Potassium, as K Dissolved	< 1	1	0	1	100.0%	0	0
Midas Cr	Potassium, as K Total	< 1	1	0	1	100.0%	0	0
Midas Cr	Sodium, as Na Dissolved	3	1	1	0	0.0%	3	3
Midas Cr	Sodium, as Na Total	3	1	1	0	0.0%	3	3
Midas Cr	Sulfate, as SO4	< 5	1	0	1	100.0%	0	0
Midas Cr	Ammonia	< 0.05	1	0	1	100.0%	0	0
Midas Cr	Nitrate + Nitrite, as N	< 0.01	1	0	1	100.0%	0	0
Midas Cr	Total Phosphorus	0.017	1	1	0	0.0%	0.017	0.017
Midas Cr	Aluminum, as Al Dissolved	< 0.03	1	0	1	100.0%	0	0

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Midas Cr	Aluminum, as Al Total	0.2	1	1	0	0.0%	0.2	0.2
Midas Cr	Antimony, as Sb Dissolved	< 0.003	1	0	1	100.0%	0	0
Midas Cr	Antimony, as Sb Total	< 0.003	1	0	1	100.0%	0	0
Midas Cr	Arsenic, as As Dissolved	< 0.003	1	0	1	100.0%	0	0
Midas Cr	Arsenic, as As Total	< 0.003	1	0	1	100.0%	0	0
Midas Cr	Barium, as Ba Dissolved	0.026	1	1	0	0.0%	0.026	0.026
Midas Cr	Barium, as Ba Total	0.026	1	1	0	0.0%	0.026	0.026
Midas Cr	Beryllium, as Be Dissolved	< 0.001	1	0	1	100.0%	0	0
Midas Cr	Beryllium, as Be Total	< 0.001	1	0	1	100.0%	0	0
Midas Cr	Cadmium, as Cd Dissolved	< 0.00008	1	0	1	100.0%	0	0
Midas Cr	Cadmium, as Cd Total	< 0.00008	1	0	1	100.0%	0	0
Midas Cr	Chromium, as Cr Dissolved	< 0.001	1	0	1	100.0%	0	0
Midas Cr	Chromium, as Cr Total	< 0.001	1	0	1	100.0%	0	0
Midas Cr	Copper, as Cu Dissolved	< 0.001	1	0	1	100.0%	0	0
Midas Cr	Copper, as Cu Total	0.002	1	1	0	0.0%	0.002	0.002
Midas Cr	Iron, as Fe Dissolved	< 0.05	1	0	1	100.0%	0	0
Midas Cr	Iron, as Fe Total	0.21	1	1	0	0.0%	0.21	0.21
Midas Cr	Lead, as Pb Dissolved	0.00014	1	1	0	0.0%	0.00014	0.00014
Midas Cr	Lead, as Pb Total	0.0003	1	1	0	0.0%	0.0003	0.0003
Midas Cr	Manganese, as Mn Dissolved	< 0.005	1	0	1	100.0%	0	0
Midas Cr	Manganese, as Mn Total	< 0.005	1	0	1	100.0%	0	0
Midas Cr	Mercury, as Hg Dissolved	< 0.00001	1	0	1	100.0%	0	0
Midas Cr	Mercury, as Hg Total	< 0.00001	1	0	1	100.0%	0	0
Midas Cr	Nickel, as Ni Dissolved	< 0.01	1	0	1	100.0%	0	0
Midas Cr	Nickel, as Ni Total	< 0.01	1	0	1	100.0%	0	0
Midas Cr	Selenium, as Se Dissolved	< 0.001	1	0	1	100.0%	0	0
Midas Cr	Selenium, as Se Total	< 0.001	1	0	1	100.0%	0	0
Midas Cr	Thallium, as Tl Dissolved	< 0.0002	1	0	1	100.0%	0	0
Midas Cr	Thallium, as Tl Total	< 0.0002	1	0	1	100.0%	0	0
Midas Cr	Zinc, as Zn Dissolved	< 0.01	1	0	1	100.0%	0	0
Midas Cr	Zinc, as Zn Total	< 0.01	1	0	1	100.0%	0	0
PM-500	Field Conductivity	23	17	17	0	0.0%	15	33
PM-500	Field pH	6.6	17	17	0	0.0%	5.3	8.4
PM-500	Field Temp	3.5	18	18	0	0.0%	0	13
PM-500	Flow	5.9	18	18	0	0.0%	0.51	85
PM-500	Lab pH	6.7	18	18	0	0.0%	5.6	7.2
PM-500	Lab SC	23	18	18	0	0.0%	15	39
PM-500	TDS	< 18	18	17	1	5.6%	5	48
PM-500	TSS	< 1	18	2	16	88.9%	1	1
PM-500	Turbidity	< 0.23	18	16	2	11.1%	0.13	0.35
PM-500	Alkalinity, Bicarbonate as HCO3	11	17	17	0	0.0%	0	21
PM-500	Alkalinity, Total as CaCO3	9	18	18	0	0.0%	1	17
PM-500	Calcium, as Ca Total	< 2.3	18	17	1	5.6%	1	4
PM-500	Chloride, as Cl	< 1	18	1	17	94.4%	1	1
PM-500	Fluoride, as F	< 0.049	15	5	10	66.7%	0.02	0.08
PM-500	Hardness, as CaCO3	< 6.7	18	12	6	33.3%	5	14
PM-500	Magnesium, as Mg Total	< 1	18	1	17	94.4%	1	1
PM-500	Potassium, as K Total	< 1	18	0	18	100.0%		
PM-500	Sodium, as Na Total	< 2	18	10	8	44.4%	1	5
PM-500	Sulfate, as SO4	< 2.3	18	16	2	11.1%	1	4
PM-500	Ammonia	< 0.067	18	6	12	66.7%	0.05	0.23
PM-500	Nitrate	0.1	18	18	0	0.0%	0.04	0.22
PM-500	Nitrate + Nitrite, as N	0.1	18	18	0	0.0%	0.04	0.22
PM-500	OrthoPhosphorus	< 0.005	18	4	14	77.8%	0.005	0.01
PM-500	TKN	< 0.29	18	9	9	50.0%	0.22	0.54
PM-500	Total Phosphorus	< 0.0074	18	10	8	44.4%	0.005	0.018
PM-1000	Dissolved Oxygen	12	9	9	0	0.0%	9.4	16
PM-1000	Field Conductivity	25	41	41	0	0.0%	14	44
PM-1000	Field pH	7	41	41	0	0.0%	5.6	8.7
PM-1000	Field Temp	4.6	44	44	0	0.0%	0	14
PM-1000	Flow	7.3	36	36	0	0.0%	0.7	91
PM-1000	Lab pH	6.9	41	41	0	0.0%	5.5	7.8
PM-1000	Lab SC	26	42	42	0	0.0%	16	49
PM-1000	TDS	< 22	44	39	5	11.4%	10	50
PM-1000	TSS	< 1	44	7	37	84.1%	0.5	4
PM-1000	Turbidity	< 0.23	44	32	12	27.3%	0.11	1
PM-1000	Alkalinity, Bicarbonate as HCO3	14	42	42	0	0.0%	7	26
PM-1000	Alkalinity, Total as CaCO3	12	44	44	0	0.0%	6	21
PM-1000	Calcium, as Ca Dissolved	3.9	12	12	0	0.0%	1.9	5.4
PM-1000	Calcium, as Ca Total	< 2.8	32	31	1	3.1%	1	7
PM-1000	Chloride, as Cl	< 1	43	12	31	72.1%	0.15	2
PM-1000	Fluoride, as F	< 0.05	25	4	21	84.0%	0.01	0.09
PM-1000	Hardness, as CaCO3	< 9.4	44	36	8	18.2%	3	26
PM-1000	Magnesium, as Mg Dissolved	< 0.95	12	11	1	8.3%	0.55	1.5
PM-1000	Magnesium, as Mg Total	< 0.96	32	12	20	62.5%	0.5	2

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
PM-1000	Potassium, as K Dissolved	< 0.63	10	5	5	50.0%	0.2	0.47
PM-1000	Potassium, as K Total	< 1	32	2	30	93.8%	0.2	0.2
PM-1000	Sodium, as Na Dissolved	< 0.96	12	7	5	41.7%	0.53	1.7
PM-1000	Sodium, as Na Total	< 1.5	32	20	12	37.5%	0.5	6
PM-1000	Sulfate, as SO4	< 2.1	43	32	11	25.6%	0.78	7
PM-1000	Ammonia	< 0.05	44	10	34	77.3%	0.01	1.2
PM-1000	Nitrate	0.05	41	41	0	0.0%	0.01	0.15
PM-1000	Nitrate + Nitrite, as N	0.05	39	39	0	0.0%	0.01	0.12
PM-1000	Nitrite	< 0.01	19	0	19	100.0%		
PM-1000	OrthoPhosphorus	< 0.018	43	13	30	69.8%	0.0008	0.012
PM-1000	TKN	< 0.17	43	18	25	58.1%	0.08	0.63
PM-1000	Total Inorganic Nitrogen	< 0.06	13	9	4	30.8%	0.03	0.16
PM-1000	Total Phosphorus	< 0.012	44	28	16	36.4%	0.0017	0.22
PM-1000	Aluminum, as Al Dissolved	0.009	7	7	0	0.0%	0.005	0.019
PM-1000	Aluminum, as Al Total	< 0.023	20	8	12	60.0%	0.0053	0.2
PM-1000	Antimony, as Sb Dissolved	< 0.00027	12	1	11	91.7%	0.00028	0.00028
PM-1000	Antimony, as Sb Total	< 0.003	18	1	17	94.4%	0.000062	0.000062
PM-1000	Arsenic, as As Dissolved	< 0.00026	12	6	6	50.0%	0.0002	0.00037
PM-1000	Arsenic, as As Total	< 0.001	20	5	15	75.0%	0.00018	0.00028
PM-1000	Barium, as Ba Dissolved	< 0.0058	12	10	2	16.7%	0.004	0.012
PM-1000	Barium, as Ba Total	< 0.0065	17	14	3	17.7%	0.00096	0.018
PM-1000	Beryllium, as Be Dissolved	< 0.0001	12	2	10	83.3%	0.00002	0.00008
PM-1000	Beryllium, as Be Total	< 0.001	17	0	17	100.0%		
PM-1000	Cadmium, as Cd Dissolved	< 0.00004	7	2	5	71.4%	0.000022	0.000049
PM-1000	Cadmium, as Cd Total	< 0.000018	7	1	6	85.7%	0.000018	0.000018
PM-1000	Chromium, as Cr Dissolved	< 0.00025	12	3	9	75.0%	0.00019	0.00024
PM-1000	Chromium, as Cr Total	< 0.001	20	2	18	90.0%	0.00039	0.00097
PM-1000	Copper, as Cu Dissolved	< 0.0007	12	3	9	75.0%	0.00025	0.0064
PM-1000	Copper, as Cu Total	< 0.001	20	4	16	80.0%	0.00028	0.002
PM-1000	Iron, as Fe Dissolved	< 0.025	12	3	9	75.0%	0.0011	0.0054
PM-1000	Iron, as Fe Total	< 0.032	20	4	16	80.0%	0.0018	0.039
PM-1000	Lead, as Pb Dissolved	< 0.00005	12	2	10	83.3%	0.000068	0.0011
PM-1000	Lead, as Pb Total	< 0.00005	13	2	11	84.6%	0.000051	0.00006
PM-1000	Manganese, as Mn Dissolved	< 0.0004	11	5	6	54.6%	0.00011	0.00085
PM-1000	Manganese, as Mn Total	< 0.00099	20	6	14	70.0%	0.00019	0.0034
PM-1000	Mercury, as Hg Dissolved	< 0.00002	11	3	8	72.7%	0.000038	0.000058
PM-1000	Mercury, as Hg Total	< 0.000017	12	1	11	91.7%	0.000013	0.000013
PM-1000	Nickel, as Ni Dissolved	< 0.00068	12	1	11	91.7%	0.0011	0.0011
PM-1000	Nickel, as Ni Total	< 0.0052	14	1	13	92.9%	0.00034	0.00034
PM-1000	Selenium, as Se Dissolved	< 0.00025	12	1	11	91.7%	0.00013	0.00013
PM-1000	Selenium, as Se Total	< 0.001	17	0	17	100.0%		
PM-1000	Silver, as Ag Dissolved	< 0.00025	12	1	11	91.7%	0.0009	0.0009
PM-1000	Silver, as Ag Total	< 0.0002	17	0	17	100.0%		
PM-1000	Thallium, as Tl Dissolved	< 0.0002	5	0	5	100.0%		
PM-1000	Thallium, as Tl Total	< 0.0002	6	0	6	100.0%		
PM-1000	Zinc, as Zn Dissolved	< 0.002	12	3	9	75.0%	0.0016	0.033
PM-1000	Zinc, as Zn Total	< 0.0025	20	2	18	90.0%	0.002	0.0026
RA-100	Field Conductivity	12	13	13	0	0.0%	7	16
RA-100	Field pH	5.9	13	13	0	0.0%	5.3	7
RA-100	Field Temp	6	13	13	0	0.0%	1	14
RA-100	Flow	1.6	12	12	0	0.0%	0	31
RA-100	Lab pH	6.1	13	13	0	0.0%	5.6	7.1
RA-100	Lab SC	< 16	13	12	1	7.7%	7	47
RA-100	TDS	< 19	13	11	2	15.4%	8	54
RA-100	TSS	< 1	13	3	10	76.9%	1	7
RA-100	Turbidity	< 0.59	13	12	1	7.7%	0.15	3.6
RA-100	Alkalinity, Bicarbonate as HCO3	5	13	13	0	0.0%	2	6
RA-100	Alkalinity, Total as CaCO3	4	13	13	0	0.0%	2	5
RA-100	Calcium, as Ca Total	< 1.1	13	10	3	23.1%	0.6	2
RA-100	Chloride, as Cl	< 1	13	1	12	92.3%	2	2
RA-100	Fluoride, as F	< 0.05	9	1	8	88.9%	0.06	0.06
RA-100	Hardness, as CaCO3	< 4.9	13	7	6	46.2%	3.8	9
RA-100	Magnesium, as Mg Total	< 0.71	13	4	9	69.2%	0.2	0.3
RA-100	Potassium, as K Total	< 0.65	13	5	8	61.5%	0.1	1
RA-100	Sodium, as Na Total	< 0.92	13	6	7	53.8%	0.2	3
RA-100	Sulfate, as SO4	< 2.3	13	10	3	23.1%	1	5
RA-100	Ammonia	< 0.05	13	3	10	76.9%	0.05	0.09
RA-100	Nitrate	0.1	13	13	0	0.0%	0.04	0.26
RA-100	Nitrate + Nitrite, as N	0.1	13	13	0	0.0%	0.04	0.26
RA-100	OrthoPhosphorus	< 0.005	13	3	10	76.9%	0.005	0.01
RA-100	TKN	< 0.23	13	7	6	46.2%	0.21	0.3
RA-100	Total Phosphorus	< 0.008	13	9	4	30.8%	0.005	0.02
RA-200	Field Conductivity	14	14	14	0	0.0%	6	24
RA-200	Field pH	6.5	14	14	0	0.0%	5.1	7.3
RA-200	Field Temp	5.3	14	14	0	0.0%	1	13

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
RA-200	Flow	5.1	13	13	0	0.0%	1.1	44
RA-200	Lab pH	6.3	14	14	0	0.0%	4.8	6.9
RA-200	Lab SC	< 12	15	14	1	6.7%	7	26
RA-200	TDS	< 12	15	12	3	20.0%	7	23
RA-200	TSS	< 1	15	3	12	80.0%	1	3
RA-200	Turbidity	< 0.33	15	14	1	6.7%	0.18	0.55
RA-200	Alkalinity, Bicarbonate as HCO3	6	15	15	0	0.0%	2	7
RA-200	Alkalinity, Total as CaCO3	5	15	15	0	0.0%	2	6
RA-200	Calcium, as Ca Total	< 1.1	15	11	4	26.7%	0.6	2
RA-200	Chloride, as Cl	< 1	15	2	13	86.7%	2	2
RA-200	Fluoride, as F	< 0.05	10	0	10	100.0%		
RA-200	Hardness, as CaCO3	< 4.2	15	8	7	46.7%	1.9	10
RA-200	Magnesium, as Mg Total	< 0.7	15	6	9	60.0%	0.1	1
RA-200	Potassium, as K Total	< 0.65	15	5	10	66.7%	0.1	0.2
RA-200	Sodium, as Na Total	< 0.99	15	10	5	33.3%	0.3	3
RA-200	Sulfate, as SO4	< 2.1	15	9	6	40.0%	1	4
RA-200	Ammonia	< 0.066	15	6	9	60.0%	0.05	0.12
RA-200	Nitrate	0.12	15	15	0	0.0%	0.02	0.37
RA-200	Nitrate + Nitrite, as N	0.12	15	15	0	0.0%	0.02	0.37
RA-200	OrthoPhosphorus	< 0.0061	15	6	9	60.0%	0.005	0.016
RA-200	TKN	< 0.2	15	3	12	80.0%	0.21	0.36
RA-200	Total Phosphorus	< 0.0082	15	11	4	26.7%	0.005	0.02
RA-400	Dissolved Oxygen	11	6	6	0	0.0%	2.7	13
RA-400	Field Conductivity	17	6	6	0	0.0%	12	19
RA-400	Field pH	7.1	7	7	0	0.0%	6.4	7.2
RA-400	Field Temp	4.3	7	7	0	0.0%	1.4	8
RA-400	Flow	5.9	6	6	0	0.0%	1.7	52
RA-400	Lab pH	6.9	7	7	0	0.0%	6.7	7
RA-400	Lab SC	15	7	7	0	0.0%	11	24
RA-400	TDS	< 17	7	6	1	14.3%	15	25
RA-400	TSS	< 0.84	7	3	4	57.1%	0.5	2.2
RA-400	Turbidity	< 0.3	7	5	2	28.6%	0.16	0.85
RA-400	Alkalinity, Bicarbonate as HCO3	7.6	7	7	0	0.0%	6	17
RA-400	Alkalinity, Total as CaCO3	7	7	7	0	0.0%	5	17
RA-400	Calcium, as Ca Dissolved	1.5	7	7	0	0.0%	1.1	1.7
RA-400	Chloride, as Cl	< 0.69	7	4	3	42.9%	0.14	1
RA-400	Hardness, as CaCO3	< 5.1	7	6	1	14.3%	3.7	6.1
RA-400	Magnesium, as Mg Dissolved	< 0.41	7	6	1	14.3%	0.14	0.43
RA-400	Potassium, as K Dissolved	< 0.6	6	3	3	50.0%	0.16	0.27
RA-400	Sodium, as Na Dissolved	< 0.8	7	4	3	42.9%	0.19	1
RA-400	Sulfate, as SO4	< 1.6	7	5	2	28.6%	1	2.8
RA-400	Ammonia	< 0.01	7	1	6	85.7%	0.01	0.01
RA-400	Nitrate	0.08	7	7	0	0.0%	0.04	0.15
RA-400	Nitrate + Nitrite, as N	0.055	4	4	0	0.0%	0.04	0.08
RA-400	Nitrite	< 0.005	7	1	6	85.7%	0.0033	0.0033
RA-400	OrthoPhosphorus	< 0.00088	6	2	4	66.7%	0.0008	0.001
RA-400	TKN	< 0.1	7	1	6	85.7%	0.06	0.06
RA-400	Total Inorganic Nitrogen	< 0.088	7	6	1	14.3%	0.05	0.17
RA-400	Total Phosphorus	< 0.008	6	5	1	16.7%	0.0038	0.018
RA-400	Aluminum, as Al Dissolved	0.016	4	4	0	0.0%	0.011	0.02
RA-400	Aluminum, as Al Total	< 0.025	7	4	3	42.9%	0.018	0.034
RA-400	Antimony, as Sb Dissolved	< 0.00025	7	0	7	100.0%		
RA-400	Antimony, as Sb Total	< 0.00025	7	0	7	100.0%		
RA-400	Arsenic, as As Dissolved	< 0.00025	7	2	5	71.4%	0.000093	0.00011
RA-400	Arsenic, as As Total	< 0.00025	7	2	5	71.4%	0.00011	0.00017
RA-400	Barium, as Ba Dissolved	< 0.0027	7	4	3	42.9%	0.0018	0.0037
RA-400	Barium, as Ba Total	< 0.0093	7	4	3	42.9%	0.0019	0.05
RA-400	Beryllium, as Be Dissolved	< 0.0001	7	0	7	100.0%		
RA-400	Beryllium, as Be Total	< 0.0001	7	1	6	85.7%	0.000031	0.000031
RA-400	Cadmium, as Cd Dissolved	< 0.000033	4	1	3	75.0%	0.000025	0.000025
RA-400	Cadmium, as Cd Total	< 0.00004	5	1	4	80.0%	0.0001	0.0001
RA-400	Chromium, as Cr Dissolved	< 0.00036	7	3	4	57.1%	0.00028	0.00049
RA-400	Chromium, as Cr Total	< 0.00044	7	1	6	85.7%	0.00044	0.00044
RA-400	Copper, as Cu Dissolved	< 0.001	7	2	5	71.4%	0.00034	0.0014
RA-400	Copper, as Cu Total	< 0.0019	7	4	3	42.9%	0.00027	0.0099
RA-400	Iron, as Fe Dissolved	< 0.025	7	2	5	71.4%	0.0056	0.0098
RA-400	Iron, as Fe Total	< 0.2	7	3	4	57.1%	0.011	1.3
RA-400	Lead, as Pb Dissolved	< 0.00005	7	1	6	85.7%	0.00007	0.00007
RA-400	Lead, as Pb Total	< 0.00014	7	3	4	57.1%	0.0001	0.00039
RA-400	Manganese, as Mn Dissolved	< 0.0012	7	4	3	42.9%	0.00017	0.0034
RA-400	Manganese, as Mn Total	< 0.006	7	4	3	42.9%	0.00071	0.037
RA-400	Mercury, as Hg Dissolved	< 0.000027	6	3	3	50.0%	0.00002	0.000043
RA-400	Mercury, as Hg Total	< 0.00002	6	1	5	83.3%	0.000021	0.000021
RA-400	Nickel, as Ni Dissolved	< 0.00034	7	3	4	57.1%	0.00025	0.0006
RA-400	Nickel, as Ni Total	< 0.00028	7	1	6	85.7%	0.00028	0.00028

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
RA-400	Selenium, as Se Dissolved	< 0.00025	7	0	7	100.0%		
RA-400	Selenium, as Se Total	< 0.00025	7	0	7	100.0%		
RA-400	Silver, as Ag Dissolved	< 0.00025	7	0	7	100.0%		
RA-400	Silver, as Ag Total	< 0.00025	7	1	6	85.7%	0.0004	0.0004
RA-400	Thallium, as Tl Dissolved	< 0.0002	3	0	3	100.0%		
RA-400	Thallium, as Tl Total	< 0.0002	3	0	3	100.0%		
RA-400	Zinc, as Zn Dissolved	< 0.002	7	2	5	71.4%	0.0011	0.0084
RA-400	Zinc, as Zn Total	< 0.0023	7	4	3	42.9%	0.0012	0.007
RA-500550600	Dissolved Oxygen	12	4	4	0	0.0%	10	14
RA-500550600	Field Conductivity	16	43	43	0	0.0%	8	31
RA-500550600	Field pH	6.8	44	44	0	0.0%	5.3	8
RA-500550600	Field Temp	4.1	49	49	0	0.0%	0	17
RA-500550600	Flow	14	38	38	0	0.0%	1.2	120
RA-500550600	Lab pH	6.4	46	46	0	0.0%	5.2	7.2
RA-500550600	Lab SC	15	47	47	0	0.0%	7	21
RA-500550600	TDS	< 12	49	39	10	20.4%	1	29
RA-500550600	TSS	< 1	49	14	35	71.4%	0	5.1
RA-500550600	Turbidity	< 0.29	48	40	8	16.7%	0.09	1.7
RA-500550600	Alkalinity, Bicarbonate as HCO3	6	48	48	0	0.0%	1	11
RA-500550600	Alkalinity, Total as CaCO3	5.9	49	49	0	0.0%	1	10
RA-500550600	Calcium, as Ca Dissolved	1.6	5	5	0	0.0%	1.2	1.8
RA-500550600	Calcium, as Ca Total	< 1.3	44	25	19	43.2%	0.2	4
RA-500550600	Chloride, as Cl	< 1	48	14	34	70.8%	0.1	3
RA-500550600	Fluoride, as F	< 0.05	37	3	34	91.9%	0.01	0.02
RA-500550600	Hardness, as CaCO3	< 3.8	49	27	22	44.9%	0	10
RA-500550600	Magnesium, as Mg Dissolved	0.4	5	5	0	0.0%	0.3	0.44
RA-500550600	Magnesium, as Mg Total	< 1	44	10	34	77.3%	0.25	0.8
RA-500550600	Potassium, as K Dissolved	< 0.58	4	2	2	50.0%	0.15	0.16
RA-500550600	Potassium, as K Total	< 1	44	5	39	88.6%	0.1	0.2
RA-500550600	Sodium, as Na Dissolved	< 0.89	5	3	2	40.0%	0.61	0.92
RA-500550600	Sodium, as Na Total	< 1.6	44	31	13	29.5%	0.4	4
RA-500550600	Sulfate, as SO4	< 2.1	48	37	11	22.9%	0.91	6
RA-500550600	Ammonia	< 0.054	49	15	34	69.4%	0.01	0.98
RA-500550600	Nitrate	< 0.082	46	45	1	2.2%	0.02	0.5
RA-500550600	Nitrate + Nitrite, as N	< 0.08	47	46	1	2.1%	0.02	0.5
RA-500550600	Nitrite	< 0.01	11	0	11	100.0%		
RA-500550600	OrthoPhosphorus	< 0.005	49	13	36	73.5%	0.0005	0.21
RA-500550600	TKN	< 0.17	48	22	26	54.2%	0	0.82
RA-500550600	Total Inorganic Nitrogen	< 0.052	6	5	1	16.7%	0.03	0.093
RA-500550600	Total Phosphorus	< 0.011	49	30	19	38.8%	0.001	0.13
RA-500550600	Aluminum, as Al Dissolved	0.011	3	3	0	0.0%	0.0096	0.02
RA-500550600	Aluminum, as Al Total	< 0.029	13	4	9	69.2%	0.024	0.046
RA-500550600	Antimony, as Sb Dissolved	< 0.00025	5	1	4	80.0%	0.000056	0.000056
RA-500550600	Antimony, as Sb Total	< 0.003	11	0	11	100.0%		
RA-500550600	Arsenic, as As Dissolved	< 0.00011	5	2	3	60.0%	0.000079	0.00014
RA-500550600	Arsenic, as As Total	< 0.003	13	2	11	84.6%	0.00018	0.00019
RA-500550600	Barium, as Ba Dissolved	< 0.0029	5	3	2	40.0%	0.0027	0.0031
RA-500550600	Barium, as Ba Total	< 0.004	10	6	4	40.0%	0.002	0.01
RA-500550600	Beryllium, as Be Dissolved	< 0.0001	5	0	5	100.0%		
RA-500550600	Beryllium, as Be Total	< 0.001	10	0	10	100.0%		
RA-500550600	Cadmium, as Cd Dissolved	< 0.000013	3	0	3	100.0%		
RA-500550600	Cadmium, as Cd Total	< 0.000022	3	1	2	66.7%	0.000014	0.000014
RA-500550600	Chromium, as Cr Dissolved	< 0.00025	5	1	4	80.0%	0.00024	0.00024
RA-500550600	Chromium, as Cr Total	< 0.001	13	1	12	92.3%	0.0004	0.0004
RA-500550600	Copper, as Cu Dissolved	< 0.00039	5	1	4	80.0%	0.00039	0.00039
RA-500550600	Copper, as Cu Total	< 0.001	13	3	10	76.9%	0.00031	0.002
RA-500550600	Iron, as Fe Dissolved	< 0.025	5	1	4	80.0%	0.0041	0.0041
RA-500550600	Iron, as Fe Total	< 0.05	13	3	10	76.9%	0.026	0.1
RA-500550600	Lead, as Pb Dissolved	< 0.000084	5	2	3	60.0%	0.000082	0.000093
RA-500550600	Lead, as Pb Total	< 0.00012	6	3	3	50.0%	0.00008	0.00032
RA-500550600	Manganese, as Mn Dissolved	< 0.00066	5	3	2	40.0%	0.00047	0.00098
RA-500550600	Manganese, as Mn Total	< 0.0027	13	4	9	69.2%	0.0015	0.0063
RA-500550600	Mercury, as Hg Dissolved	< 0.00002	5	1	4	80.0%	0.000036	0.000036
RA-500550600	Mercury, as Hg Total	< 0.00003	6	2	4	66.7%	0.000024	0.000059
RA-500550600	Nickel, as Ni Dissolved	< 0.00025	5	0	5	100.0%		
RA-500550600	Nickel, as Ni Total	< 0.01	7	0	7	100.0%		
RA-500550600	Selenium, as Se Dissolved	< 0.00025	5	1	4	80.0%	0.00014	0.00014
RA-500550600	Selenium, as Se Total	< 0.001	10	0	10	100.0%		
RA-500550600	Silver, as Ag Dissolved	< 0.00025	5	0	5	100.0%		
RA-500550600	Silver, as Ag Total	< 0.0002	10	0	10	100.0%		
RA-500550600	Thallium, as Tl Dissolved	< 0.0002	2	0	2	100.0%		
RA-500550600	Thallium, as Tl Total	< 0.0002	3	0	3	100.0%		
RA-500550600	Zinc, as Zn Dissolved	< 0.0047	5	3	2	40.0%	0.0031	0.011
RA-500550600	Zinc, as Zn Total	< 0.005	13	2	11	84.6%	0.00096	0.0025
RC-850	Alkalinity, Bicarbonate as HCO3	6	1	1	0	0.0%	6	6

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Value		Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
RC-850	Alkalinity, Total as CaCO3		5	1	1	0	0.0%	5	5
RC-850	Field Conductivity		7	1	1	0	0.0%	7	7
RC-850	Field pH		6.6	1	1	0	0.0%	6.6	6.6
RC-850	Field Temp		5	2	2	0	0.0%	2	8
RC-850	Flow		12	2	2	0	0.0%	0	24.2
RC-850	Lab pH		6.9	1	1	0	0.0%	6.9	6.9
RC-850	Lab SC		11	1	1	0	0.0%	11	11
RC-850	TDS		8	1	1	0	0.0%	8	8
RC-850	TSS		1	1	1	0	0.0%	1	1
RC-850	Turbid		0.15	1	1	0	0.0%	0.15	0.15
RC-850	Calcium, as Ca Total		1	1	1	0	0.0%	1	1
RC-850	Chloride, as Cl	<	1	1	0	1	100.0%	0	0
RC-850	Fluoride, as F	<	0.05	1	0	1	100.0%	0	0
RC-850	Hardness, as CaCO3	<	3	1	0	1	100.0%	0	0
RC-850	Magnesium, as Mg Total	<	1	1	0	1	100.0%	0	0
RC-850	Potassium, as K Total		1	1	1	0	0.0%	1	1
RC-850	Sodium, as Na Total		1	1	1	0	0.0%	1	1
RC-850	Sulfate, as SO4		1	1	1	0	0.0%	1	1
RC-850	Ammonia	<	0.05	1	0	1	100.0%	0	0
RC-850	Nitrate		0.02	1	1	0	0.0%	0.02	0.02
RC-850	Nitrate + Nitrite, as N		0.02	1	1	0	0.0%	0.02	0.02
RC-850	OrthoPhosphorus	<	0.005	1	0	1	100.0%	0	0
RC-850	TKN	<	0.2	1	0	1	100.0%	0	0
RC-850	Total Phosphorus	<	0.005	1	0	1	100.0%	0	0
RC-2000	Field Temp		2	2	2	0	0.0%	2	2
RC-2000	Flow		0	2	2	0	0.0%	0	0

Units are mg/L, except pH in standard units, temperature in degrees celsius, turbidity in NTUs, conductivity and SC (specific conductivity) in mS/cm, and flow in cfs.

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-1R	Field Temp	5	3	3	0	0.0%	2	6.5
SP-1R	Flow	0.9	3	3	0	0.0%	0.5	8.9766
SP-1R	Lab pH	6.7	3	3	0	0.0%	6.4	7.3
SP-1R	Lab SC	13	4	4	0	0.0%	6.2	19
SP-1R	TDS	9.4	3	3	0	0.0%		
SP-1R	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100.0%		
SP-1R	Alkalinity, Total as CaCO3	< 76	3	2	1	33.3%	83	144
SP-1R	Calcium, as Ca Total	1.2	3	3	0	0.0%		
SP-1R	Chloride, as Cl	< 0.74	3	2	1	33.3%	0.022	0.21
SP-1R	Fluoride, as F	< 0.05	2	0	2	100.0%		
SP-1R	Magnesium, as Mg Total	< 0.69	3	2	1	33.3%	0.36	0.72
SP-1R	Potassium, as K Total	< 0.41	3	2	1	33.3%	0.07	0.15
SP-1R	Sodium, as Na Total	< 0.59	3	2	1	33.3%	0.29	0.48
SP-1R	Sulfate, as SO4	< 2	3	2	1	33.3%	0.47	0.59
SP-1R	Ammonia	< 0.05	2	0	2	100.0%		
SP-1R	Nitrate	1	2	2	0	0.0%	0.56	1.5
SP-1R	Total Phosphorus	< 0.005	2	0	2	100.0%		
SP-2R	Field Conductivity	8.8	1	1	0	0.0%	8.8	8.8
SP-2R	Field Temp	6.5	1	1	0	0.0%	6.5	6.5
SP-2R	Flow	4	1	1	0	0.0%	4	4
SP-2R	TDS	5.2	1	1	0	0.0%	5.2	5.2
SP-4	Field Conductivity	26	2	2	0	0.0%	24	27
SP-4	Field pH	7.1	2	2	0	0.0%	6.8	7.4
SP-4	Field Temp	7.3	2	2	0	0.0%	7	7.6
SP-4	Flow	15	2	2	0	0.0%	9	20
SP-4	Lab pH	7.5	2	2	0	0.0%	7.4	7.5
SP-4	Lab SC	30	2	2	0	0.0%	27	33
SP-4	TDS	20	2	2	0	0.0%	15	25
SP-4	Alkalinity, Bicarbonate as HCO3	16	2	2	0	0.0%	13	18
SP-4	Alkalinity, Total as CaCO3	13	2	2	0	0.0%	11	15
SP-4	Calcium, as Ca Total	2	2	2	0	0.0%	2	2
SP-4	Chloride, as Cl	< 1	2	0	2	100.0%		
SP-4	Hardness, as CaCO3	< 5	2	0	2	100.0%		
SP-4	Magnesium, as Mg Total	< 1	2	0	2	100.0%		
SP-4	Potassium, as K Total	< 1	2	1	1	50.0%	1	1
SP-4	Sodium, as Na Total	1.5	2	2	0	0.0%	1	2
SP-4	Sulfate, as SO4	< 1.5	2	1	1	50.0%	2	2
SP-4	Nitrate + Nitrite, as N	0.025	2	2	0	0.0%	0.02	0.03
SP-4	Aluminum, as Al Total	< 0.1	2	0	2	100.0%		
SP-4	Arsenic, as As Total	< 0.005	2	0	2	100.0%		
SP-4	Cadmium, as Cd Total	0.001	1	1	0	0.0%	0.001	0.001
SP-4	Chromium, as Cr Total	< 0.02	2	0	2	100.0%		
SP-4	Iron, as Fe Total	< 0.05	2	0	2	100.0%		
SP-4	Manganese, as Mn Total	< 0.02	2	0	2	100.0%		
SP-4	Molybdenum, as Mo Total	< 0.05	2	1	1	50.0%	0.05	0.05
SP-4	Zinc, as Zn Total	< 0.02	2	0	2	100.0%		
SP-4R	Field Temp	2	1	1	0	0.0%	2	2
SP-4R	Flow	5	1	1	0	0.0%	5	5
SP-4R	Lab pH	6.2	1	1	0	0.0%	6.2	6.2
SP-4R	Lab SC	2.6	1	1	0	0.0%	2.6	2.6
SP-4R	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100.0%		
SP-4R	Alkalinity, Total as CaCO3	< 1	1	0	1	100.0%		
SP-4R	Calcium, as Ca Total	< 1	1	0	1	100.0%		
SP-4R	Chloride, as Cl	< 2	1	0	1	100.0%		
SP-4R	Magnesium, as Mg Total	< 1	1	0	1	100.0%		
SP-4R	Potassium, as K Total	< 1	1	0	1	100.0%		
SP-4R	Sodium, as Na Total	< 1	1	0	1	100.0%		
SP-4R	Sulfate, as SO4	< 5	1	0	1	100.0%		
SP-5/3R	Field Conductivity	25	2	2	0	0.0%	18	31
SP-5/3R	Field pH	7.1	3	3	0	0.0%	6.2	7.5
SP-5/3R	Field Temp	2	4	4	0	0.0%	2	8.5
SP-5/3R	Flow	14	2	2	0	0.0%	5	22
SP-5/3R	Lab pH	7.2	4	4	0	0.0%	6.2	7.6
SP-5/3R	Lab SC	24	4	4	0	0.0%	21	26
SP-5/3R	TDS	12	3	3	0	0.0%	6	32
SP-5/3R	Alkalinity, Bicarbonate as HCO3	16	3	3	0	0.0%	12	20
SP-5/3R	Alkalinity, Total as CaCO3	13	4	4	0	0.0%	10	16
SP-5/3R	Calcium, as Ca Total	2.5	4	4	0	0.0%	1	3.1
SP-5/3R	Chloride, as Cl	< 1	4	1	3	75.0%	0.082	0.082
SP-5/3R	Fluoride, as F	0.05	1	1	0	0.0%	0.05	0.05
SP-5/3R	Hardness, as CaCO3	< 6.7	3	1	2	66.7%	8	8
SP-5/3R	Magnesium, as Mg Total	< 1	4	1	3	75.0%	0.67	0.67
SP-5/3R	Potassium, as K Total	< 0.81	4	2	2	50.0%	0.24	1
SP-5/3R	Silica, as SiO2 Total	5.6	1	1	0	0.0%	5.6	5.6
SP-5/3R	Sodium, as Na Total	< 1	4	3	1	25.0%	1	1

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-5/3R	Sulfate, as SO4	1.5	4	4	0	0.0%	1	3
SP-5/3R	Nitrate + Nitrite, as N	0.1	4	4	0	0.0%	0.08	0.42
SP-5/3R	Aluminum, as Al Total	< 0.1	3	0	3	100.0%		
SP-5/3R	Arsenic, as As Total	< 0.005	3	0	3	100.0%		
SP-5/3R	Cadmium, as Cd Total	0.001	2	2	0	0.0%	0.001	0.001
SP-5/3R	Chromium, as Cr Total	< 0.02	3	0	3	100.0%		
SP-5/3R	Iron, as Fe Total	< 0.05	3	0	3	100.0%		
SP-5/3R	Manganese, as Mn Total	< 0.02	3	0	3	100.0%		
SP-5/3R	Molybdenum, as Mo Total	< 0.05	3	0	3	100.0%		
SP-5/3R	Zinc, as Zn Total	< 0.02	3	0	3	100.0%		
SP-10	Field pH	6.4	1	1	0	0.0%	6.4	6.4
SP-10	Field Temp	2	1	1	0	0.0%	2	2
SP-10	Lab pH	6.7	1	1	0	0.0%	6.7	6.7
SP-10	Lab SC	91	1	1	0	0.0%	91	91
SP-10	TDS	97	1	1	0	0.0%	97	97
SP-10	Alkalinity, Bicarbonate as HCO3	60	1	1	0	0.0%	60	60
SP-10	Alkalinity, Total as CaCO3	49	1	1	0	0.0%	49	49
SP-10	Calcium, as Ca Total	10	1	1	0	0.0%	10	10
SP-10	Chloride, as Cl	1	1	1	0	0.0%	1	1
SP-10	Fluoride, as F	0.07	1	1	0	0.0%	0.07	0.07
SP-10	Hardness, as CaCO3	46	1	1	0	0.0%	46	46
SP-10	Magnesium, as Mg Total	5	1	1	0	0.0%	5	5
SP-10	Potassium, as K Total	1	1	1	0	0.0%	1	1
SP-10	Sodium, as Na Total	2	1	1	0	0.0%	2	2
SP-10	Sulfate, as SO4	3	1	1	0	0.0%	3	3
SP-10	Nitrate + Nitrite, as N	0.01	1	1	0	0.0%	0.01	0.01
SP-10	Aluminum, as Al Total	< 0.01	1	0	1	100.0%		
SP-10	Arsenic, as As Total	< 0.005	1	0	1	100.0%		
SP-10	Chromium, as Cr Total	< 0.02	1	0	1	100.0%		
SP-10	Iron, as Fe Total	< 0.05	1	0	1	100.0%		
SP-10	Manganese, as Mn Total	0.03	1	1	0	0.0%	0.03	0.03
SP-10	Molybdenum, as Mo Total	< 0.05	1	0	1	100.0%		
SP-10	Zinc, as Zn Total	< 0.02	1	0	1	100.0%		
SP-11	Field pH	7.2	1	1	0	0.0%	7.2	7.2
SP-11	Field Temp	2	1	1	0	0.0%	2	2
SP-11	Lab pH	7.2	1	1	0	0.0%	7.2	7.2
SP-11	Lab SC	68	1	1	0	0.0%	68	68
SP-11	TDS	79	1	1	0	0.0%	79	79
SP-11	Alkalinity, Bicarbonate as HCO3	48	1	1	0	0.0%	48	48
SP-11	Alkalinity, Total as CaCO3	39	1	1	0	0.0%	39	39
SP-11	Calcium, as Ca Total	12	1	1	0	0.0%	12	12
SP-11	Chloride, as Cl	< 1	1	0	1	100.0%		
SP-11	Fluoride, as F	0.07	1	1	0	0.0%	0.07	0.07
SP-11	Hardness, as CaCO3	38	1	1	0	0.0%	38	38
SP-11	Magnesium, as Mg Total	2	1	1	0	0.0%	2	2
SP-11	Potassium, as K Total	< 1	1	0	1	100.0%		
SP-11	Sodium, as Na Total	< 1	1	0	1	100.0%		
SP-11	Sulfate, as SO4	2	1	1	0	0.0%	2	2
SP-11	Nitrate + Nitrite, as N	< 0.01	1	0	1	100.0%		
SP-11	Aluminum, as Al Total	< 0.01	1	0	1	100.0%		
SP-11	Arsenic, as As Total	< 0.005	1	0	1	100.0%		
SP-11	Chromium, as Cr Total	< 0.02	1	0	1	100.0%		
SP-11	Iron, as Fe Total	< 0.05	1	0	1	100.0%		
SP-11	Manganese, as Mn Total	< 0.02	1	0	1	100.0%		
SP-11	Molybdenum, as Mo Total	< 0.05	1	0	1	100.0%		
SP-11	Zinc, as Zn Total	< 0.02	1	0	1	100.0%		
SP-12	Field pH	5.8	1	1	0	0.0%	5.8	5.8
SP-12	Field Temp	13	1	1	0	0.0%	13	13
SP-12	Lab pH	5.7	1	1	0	0.0%	5.7	5.7
SP-12	Lab SC	42	1	1	0	0.0%	42	42
SP-12	TDS	86	1	1	0	0.0%	86	86
SP-12	Alkalinity, Bicarbonate as HCO3	27	1	1	0	0.0%	27	27
SP-12	Alkalinity, Total as CaCO3	22	1	1	0	0.0%	22	22
SP-12	Calcium, as Ca Total	6	1	1	0	0.0%	6	6
SP-12	Chloride, as Cl	1	1	1	0	0.0%	1	1
SP-12	Fluoride, as F	< 0.05	1	0	1	100.0%		
SP-12	Hardness, as CaCO3	19	1	1	0	0.0%	19	19
SP-12	Magnesium, as Mg Total	1	1	1	0	0.0%	1	1
SP-12	Potassium, as K Total	< 1	1	0	1	100.0%		
SP-12	Sodium, as Na Total	2	1	1	0	0.0%	2	2
SP-12	Sulfate, as SO4	2	1	1	0	0.0%	2	2
SP-12	Nitrate + Nitrite, as N	< 0.01	1	0	1	100.0%		
SP-12	Aluminum, as Al Total	< 0.1	1	0	1	100.0%		
SP-12	Arsenic, as As Total	< 0.005	1	0	1	100.0%		
SP-12	Chromium, as Cr Total	< 0.02	1	0	1	100.0%		

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-12	Iron, as Fe Total	0.36	1	1	0	0.0%	0.36	0.36
SP-12	Manganese, as Mn Total	< 0.02	1	0	1	100.0%		
SP-12	Molybdenum, as Mo Total	< 0.05	1	0	1	100.0%		
SP-12	Zinc, as Zn Total	< 0.02	1	0	1	100.0%		
SP-13	Field pH	7.2	1	1	0	0.0%	7.2	7.2
SP-13	Field Temp	2	1	1	0	0.0%	2	2
SP-13	Lab pH	7.1	1	1	0	0.0%	7.1	7.1
SP-13	Lab SC	138	1	1	0	0.0%	138	138
SP-13	TDS	91	1	1	0	0.0%	91	91
SP-13	Alkalinity, Bicarbonate as HCO3	83	1	1	0	0.0%	83	83
SP-13	Alkalinity, Total as CaCO3	68	1	1	0	0.0%	68	68
SP-13	Calcium, as Ca Total	18	1	1	0	0.0%	18	18
SP-13	Chloride, as Cl	< 1	1	0	1	100.0%		
SP-13	Fluoride, as F	< 0.05	1	0	1	100.0%		
SP-13	Hardness, as CaCO3	66	1	1	0	0.0%	66	66
SP-13	Magnesium, as Mg Total	5	1	1	0	0.0%	5	5
SP-13	Potassium, as K Total	< 1	1	0	1	100.0%		
SP-13	Sodium, as Na Total	< 1	1	0	1	100.0%		
SP-13	Sulfate, as SO4	2	1	1	0	0.0%	2	2
SP-13	Nitrate + Nitrite, as N	< 0.05	1	0	1	100.0%		
SP-13	Aluminum, as Al Total	< 0.1	1	0	1	100.0%		
SP-13	Arsenic, as As Total	< 0.005	1	0	1	100.0%		
SP-13	Chromium, as Cr Total	< 0.02	1	0	1	100.0%		
SP-13	Iron, as Fe Total	< 0.05	1	0	1	100.0%		
SP-13	Manganese, as Mn Total	< 0.02	1	0	1	100.0%		
SP-13	Molybdenum, as Mo Total	< 0.05	1	0	1	100.0%		
SP-13	Zinc, as Zn Total	< 0.02	1	0	1	100.0%		
SP-14	Field Temp	2	1	1	0	0.0%	2	2
SP-14	Lab pH	6.7	1	1	0	0.0%	6.7	6.7
SP-14	Lab SC	226	1	1	0	0.0%	226	226
SP-14	TDS	154	1	1	0	0.0%	154	154
SP-14	Alkalinity, Bicarbonate as HCO3	140	1	1	0	0.0%	140	140
SP-14	Alkalinity, Total as CaCO3	115	1	1	0	0.0%	115	115
SP-14	Calcium, as Ca Total	30	1	1	0	0.0%	30	30
SP-14	Chloride, as Cl	1	1	1	0	0.0%	1	1
SP-14	Fluoride, as F	0.08	1	1	0	0.0%	0.08	0.08
SP-14	Hardness, as CaCO3	108	1	1	0	0.0%	108	108
SP-14	Magnesium, as Mg Total	8	1	1	0	0.0%	8	8
SP-14	Potassium, as K Total	< 1	1	0	1	100.0%		
SP-14	Sodium, as Na Total	6	1	1	0	0.0%	6	6
SP-14	Sulfate, as SO4	< 1	1	0	1	100.0%		
SP-14	Nitrate + Nitrite, as N	< 0.01	1	0	1	100.0%		
SP-14	Aluminum, as Al Total	< 0.1	1	0	1	100.0%		
SP-14	Arsenic, as As Total	< 0.005	1	0	1	100.0%		
SP-14	Chromium, as Cr Total	< 0.02	1	0	1	100.0%		
SP-14	Iron, as Fe Total	0.67	1	1	0	0.0%	0.67	0.67
SP-14	Manganese, as Mn Total	0.71	1	1	0	0.0%	0.71	0.71
SP-14	Molybdenum, as Mo Total	< 0.05	1	0	1	100.0%		
SP-14	Zinc, as Zn Total	< 0.02	1	0	1	100.0%		
SP-15	Field Conductivity	18	1	1	0	0.0%	18	18
SP-15	Field pH	7.1	1	1	0	0.0%	7.1	7.1
SP-15	Field Temp	5	1	1	0	0.0%	5	5
SP-15	TDS	< 20	1	0	1	100.0%		
SP-15	Alkalinity, Bicarbonate as HCO3	9	1	1	0	0.0%	9	9
SP-15	Alkalinity, Total as CaCO3	7	1	1	0	0.0%	7	7
SP-15	Calcium, as Ca Total	1	1	1	0	0.0%	1	1
SP-15	Chloride, as Cl	< 1	1	0	1	100.0%		
SP-15	Hardness, as CaCO3	< 7	1	0	1	100.0%		
SP-15	Magnesium, as Mg Total	< 1	1	0	1	100.0%		
SP-15	Potassium, as K Total	< 1	1	0	1	100.0%		
SP-15	Sodium, as Na Total	< 1	1	0	1	100.0%		
SP-15	Sulfate, as SO4	< 1	1	0	1	100.0%		
SP-15	Nitrate + Nitrite, as N	< 0.07	1	0	1	100.0%		
SP-15	Arsenic, as As Total	< 0.005	1	0	1	100.0%		
SP-15	Cadmium, as Cd Total	< 0.0005	1	0	1	100.0%		
SP-15	Chromium, as Cr Total	< 0.02	1	0	1	100.0%		
SP-15	Copper, as Cu Total	< 0.01	1	0	1	100.0%		
SP-15	Iron, as Fe Total	< 0.05	1	0	1	100.0%		
SP-15	Lead, as Pb Total	< 0.01	1	0	1	100.0%		
SP-15	Manganese, as Mn Total	< 0.02	1	0	1	100.0%		
SP-15	Mercury, as Hg Total	< 0.0002	1	0	1	100.0%		
SP-15	Silver, as Ag Total	< 0.001	1	0	1	100.0%		
SP-15	Zinc, as Zn Total	< 0.02	1	0	1	100.0%		
SP-16	Field pH	7.1	1	1	0	0.0%	7.1	7.1
SP-16	Field Temp	4.5	1	1	0	0.0%	4.5	4.5

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-16	Lab pH	6.2	1	1	0	0.0%	6.2	6.2
SP-16	Lab SC	18	1	1	0	0.0%	18	18
SP-16	TDS	< 20	1	0	1	100.0%		
SP-16	Alkalinity, Bicarbonate as HCO3	9	1	1	0	0.0%	9	9
SP-16	Alkalinity, Total as CaCO3	7	1	1	0	0.0%	7	7
SP-16	Calcium, as Ca Total	1	1	1	0	0.0%	1	1
SP-16	Chloride, as Cl	< 1	1	0	1	100.0%		
SP-16	Fluoride, as F	< 0.05	1	0	1	100.0%		
SP-16	Hardness, as CaCO3	< 7	1	0	1	100.0%		
SP-16	Magnesium, as Mg Total	< 1	1	0	1	100.0%		
SP-16	Potassium, as K Total	< 1	1	0	1	100.0%		
SP-16	Sodium, as Na Total	< 1	1	0	1	100.0%		
SP-16	Sulfate, as SO4	< 1	1	0	1	100.0%		
SP-16	Nitrate + Nitrite, as N	< 0.07	1	0	1	100.0%		
SP-16	Aluminum, as Al Total	< 0.1	1	0	1	100.0%		
SP-16	Arsenic, as As Total	< 0.005	1	0	1	100.0%		
SP-16	Chromium, as Cr Total	< 0.02	1	0	1	100.0%		
SP-16	Iron, as Fe Total	< 0.05	1	0	1	100.0%		
SP-16	Manganese, as Mn Total	< 0.02	1	0	1	100.0%		
SP-16	Molybdenum, as Mo Total	0.05	1	1	0	0.0%	0.05	0.05
SP-16	Zinc, as Zn Total	< 0.02	1	0	1	100.0%		
SP-21	Field Conductivity	88	1	1	0	0.0%	88	88
SP-21	Field pH	6.4	1	1	0	0.0%	6.4	6.4
SP-21	Field Temp	25	1	1	0	0.0%	25	25
SP-21	Flow	1	1	1	0	0.0%	1	1
SP-21	TDS	84	1	1	0	0.0%	84	84
SP-21	TSS	48	1	1	0	0.0%	48	48
SP-21	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100.0%		
SP-21	Alkalinity, Total as CaCO3	13	1	1	0	0.0%	13	13
SP-21	Calcium, as Ca Total	6.4	1	1	0	0.0%	6.4	6.4
SP-21	Chloride, as Cl	1	1	1	0	0.0%	1	1
SP-21	Hardness, as CaCO3	26	1	1	0	0.0%	26	26
SP-21	Magnesium, as Mg Total	2.5	1	1	0	0.0%	2.5	2.5
SP-21	Potassium, as K Total	0.84	1	1	0	0.0%	0.84	0.84
SP-21	Sodium, as Na Total	7.3	1	1	0	0.0%	7.3	7.3
SP-21	Sulfate, as SO4	< 5	1	0	1	100.0%		
SP-21	Ammonia	0.45	1	1	0	0.0%	0.45	0.45
SP-21	Nitrate + Nitrite, as N	0.22	1	1	0	0.0%	0.22	0.22
SP-21	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
SP-21	Total Phosphorus	< 0.001	1	0	1	100.0%		
SP-21	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
SP-21	Cadmium, as Cd Total	0.0001	1	1	0	0.0%	0.0001	0.0001
SP-21	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
SP-21	Copper, as Cu Total	0.005	1	1	0	0.0%	0.005	0.005
SP-21	Iron, as Fe Total	16	1	1	0	0.0%	16	16
SP-21	Lead, as Pb Total	0.012	1	1	0	0.0%	0.012	0.012
SP-21	Manganese, as Mn Total	1.2	1	1	0	0.0%	1.2	1.2
SP-21	Mercury, as Hg Total	< 0.0002	1	0	1	100.0%		
SP-21	Silver, as Ag Total	< 0.0005	1	0	1	100.0%		
SP-21	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
SP-25	Field Conductivity	38	1	1	0	0.0%	38	38
SP-25	Field pH	6.9	1	1	0	0.0%	6.9	6.9
SP-25	Field Temp	13	1	1	0	0.0%	13	13
SP-25	Flow	5	1	1	0	0.0%	5	5
SP-25	TDS	< 10	1	0	1	100.0%		
SP-25	TSS	< 1	1	0	1	100.0%		
SP-25	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100.0%		
SP-25	Alkalinity, Total as CaCO3	8	1	1	0	0.0%	8	8
SP-25	Calcium, as Ca Total	1.3	1	1	0	0.0%	1.3	1.3
SP-25	Chloride, as Cl	1.6	1	1	0	0.0%	1.6	1.6
SP-25	Hardness, as CaCO3	4	1	1	0	0.0%	4	4
SP-25	Magnesium, as Mg Total	0.26	1	1	0	0.0%	0.26	0.26
SP-25	Potassium, as K Total	0.4	1	1	0	0.0%	0.4	0.4
SP-25	Sodium, as Na Total	1.7	1	1	0	0.0%	1.7	1.7
SP-25	Sulfate, as SO4	< 5	1	0	1	100.0%		
SP-25	Ammonia	< 0.05	1	0	1	100.0%		
SP-25	Nitrate + Nitrite, as N	0.7	1	1	0	0.0%	0.7	0.7
SP-25	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
SP-25	Total Phosphorus	< 0.001	1	0	1	100.0%		
SP-25	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
SP-25	Cadmium, as Cd Total	< 0.00008	1	0	1	100.0%		
SP-25	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
SP-25	Copper, as Cu Total	< 0.001	1	0	1	100.0%		
SP-25	Iron, as Fe Total	< 0.01	1	0	1	100.0%		
SP-25	Lead, as Pb Total	< 0.0005	1	0	1	100.0%		

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-25	Manganese, as Mn Total	< 0.005	1	0	1	100.0%		
SP-25	Mercury, as Hg Total	< 0.0002	1	0	1	100.0%		
SP-25	Silver, as Ag Total	< 0.0005	1	0	1	100.0%		
SP-25	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
SP-26	Field Conductivity	219	1	1	0	0.0%	219	219
SP-26	Field pH	7.7	1	1	0	0.0%	7.7	7.7
SP-26	Field Temp	14	1	1	0	0.0%	14	14
SP-26	Flow	0.5	1	1	0	0.0%	0.5	0.5
SP-26	TDS	< 10	1	0	1	100.0%		
SP-26	TSS	80	1	1	0	0.0%	80	80
SP-26	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100.0%		
SP-26	Alkalinity, Total as CaCO3	110	1	1	0	0.0%	110	110
SP-26	Calcium, as Ca Total	30	1	1	0	0.0%	30	30
SP-26	Chloride, as Cl	1.4	1	1	0	0.0%	1.4	1.4
SP-26	Hardness, as CaCO3	114	1	1	0	0.0%	114	114
SP-26	Magnesium, as Mg Total	9.9	1	1	0	0.0%	9.9	9.9
SP-26	Potassium, as K Total	0.74	1	1	0	0.0%	0.74	0.74
SP-26	Sodium, as Na Total	3.2	1	1	0	0.0%	3.2	3.2
SP-26	Sulfate, as SO4	< 5	1	0	1	100.0%		
SP-26	Ammonia	< 0.05	1	0	1	100.0%		
SP-26	Nitrate + Nitrite, as N	0.82	1	1	0	0.0%	0.82	0.82
SP-26	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
SP-26	Total Phosphorus	< 0.001	1	0	1	100.0%		
SP-26	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
SP-26	Cadmium, as Cd Total	0.0001	1	1	0	0.0%	0.0001	0.0001
SP-26	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
SP-26	Copper, as Cu Total	0.005	1	1	0	0.0%	0.005	0.005
SP-26	Iron, as Fe Total	0.79	1	1	0	0.0%	0.79	0.79
SP-26	Lead, as Pb Total	0.005	1	1	0	0.0%	0.005	0.005
SP-26	Manganese, as Mn Total	0.22	1	1	0	0.0%	0.22	0.22
SP-26	Mercury, as Hg Total	< 0.0002	1	0	1	100.0%		
SP-26	Silver, as Ag Total	< 0.0005	1	0	1	100.0%		
SP-26	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
SP-27	Field Conductivity	15	1	1	0	0.0%	15	15
SP-27	Field pH	7	1	1	0	0.0%	7	7
SP-27	Field Temp	12	1	1	0	0.0%	12	12
SP-27	Flow	2	1	1	0	0.0%	2	2
SP-27	TDS	49	1	1	0	0.0%	49	49
SP-27	TSS	< 1	1	0	1	100.0%		
SP-27	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100.0%		
SP-27	Alkalinity, Total as CaCO3	7	1	1	0	0.0%	7	7
SP-27	Calcium, as Ca Total	1	1	1	0	0.0%	1	1
SP-27	Chloride, as Cl	1	1	1	0	0.0%	1	1
SP-27	Hardness, as CaCO3	4.6	1	1	0	0.0%	4.6	4.6
SP-27	Magnesium, as Mg Total	0.3	1	1	0	0.0%	0.3	0.3
SP-27	Potassium, as K Total	0.6	1	1	0	0.0%	0.6	0.6
SP-27	Sodium, as Na Total	1	1	1	0	0.0%	1	1
SP-27	Sulfate, as SO4	< 5	1	0	1	100.0%		
SP-27	Ammonia	0.34	1	1	0	0.0%	0.34	0.34
SP-27	Nitrate + Nitrite, as N	0.23	1	1	0	0.0%	0.23	0.23
SP-27	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
SP-27	Total Phosphorus	< 0.001	1	0	1	100.0%		
SP-27	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
SP-27	Cadmium, as Cd Total	< 0.00008	1	0	1	100.0%		
SP-27	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
SP-27	Copper, as Cu Total	0.001	1	1	0	0.0%	0.001	0.001
SP-27	Iron, as Fe Total	0.017	1	1	0	0.0%	0.017	0.017
SP-27	Lead, as Pb Total	0.003	1	1	0	0.0%	0.003	0.003
SP-27	Manganese, as Mn Total	< 0.005	1	0	1	100.0%		
SP-27	Mercury, as Hg Total	< 0.0002	1	0	1	100.0%		
SP-27	Silver, as Ag Total	< 0.0005	1	0	1	100.0%		
SP-27	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
SP-28	Field Conductivity	334	1	1	0	0.0%	334	334
SP-28	Field pH	8.3	1	1	0	0.0%	8.3	8.3
SP-28	Field Temp	15	1	1	0	0.0%	15	15
SP-28	Flow	4	1	1	0	0.0%	4	4
SP-28	TDS	< 10	1	0	1	100.0%		
SP-28	TSS	< 1	1	0	1	100.0%		
SP-28	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100.0%		
SP-28	Alkalinity, Total as CaCO3	169	1	1	0	0.0%	169	169
SP-28	Calcium, as Ca Total	51	1	1	0	0.0%	51	51
SP-28	Chloride, as Cl	1	1	1	0	0.0%	1	1
SP-28	Hardness, as CaCO3	181	1	1	0	0.0%	181	181
SP-28	Magnesium, as Mg Total	13	1	1	0	0.0%	13	13
SP-28	Potassium, as K Total	0.9	1	1	0	0.0%	0.9	0.9

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-28	Sodium, as Na Total	2.5	1	1	0	0.0%	2.5	2.5
SP-28	Sulfate, as SO4	< 5	1	0	1	100.0%		
SP-28	Ammonia	< 0.05	1	0	1	100.0%		
SP-28	Nitrate + Nitrite, as N	< 1	1	0	1	100.0%		
SP-28	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
SP-28	Total Phosphorus	< 0.001	1	0	1	100.0%		
SP-28	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
SP-28	Cadmium, as Cd Total	0.0001	1	1	0	0.0%	0.0001	0.0001
SP-28	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
SP-28	Copper, as Cu Total	< 0.001	1	0	1	100.0%		
SP-28	Iron, as Fe Total	< 0.01	1	0	1	100.0%		
SP-28	Lead, as Pb Total	< 0.0005	1	0	1	100.0%		
SP-28	Manganese, as Mn Total	< 0.005	1	0	1	100.0%		
SP-28	Mercury, as Hg Total	< 0.0002	1	0	1	100.0%		
SP-28	Silver, as Ag Total	< 0.0005	1	0	1	100.0%		
SP-28	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
SP-30	Field Conductivity	315	1	1	0	0.0%	315	315
SP-30	Field pH	8.3	1	1	0	0.0%	8.3	8.3
SP-30	Field Temp	24	1	1	0	0.0%	24	24
SP-30	Flow	5	1	1	0	0.0%	5	5
SP-30	TDS	173	1	1	0	0.0%	173	173
SP-30	TSS	< 1	1	0	1	100.0%		
SP-30	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100.0%		
SP-30	Alkalinity, Total as CaCO3	160	1	1	0	0.0%	160	160
SP-30	Calcium, as Ca Total	42	1	1	0	0.0%	42	42
SP-30	Chloride, as Cl	< 1	1	0	1	100.0%		
SP-30	Hardness, as CaCO3	161	1	1	0	0.0%	161	161
SP-30	Magnesium, as Mg Total	14	1	1	0	0.0%	14	14
SP-30	Potassium, as K Total	0.6	1	1	0	0.0%	0.6	0.6
SP-30	Sodium, as Na Total	2.6	1	1	0	0.0%	2.6	2.6
SP-30	Sulfate, as SO4	< 5	1	0	1	100.0%		
SP-30	Ammonia	0.35	1	1	0	0.0%	0.35	0.35
SP-30	Nitrate + Nitrite, as N	< 1	1	0	1	100.0%		
SP-30	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
SP-30	Total Phosphorus	< 0.001	1	0	1	100.0%		
SP-30	Arsenic, as As Total	< 0.003	1	0	1	100.0%		
SP-30	Cadmium, as Cd Total	< 0.00008	1	0	1	100.0%		
SP-30	Chromium, as Cr Total	< 0.001	1	0	1	100.0%		
SP-30	Copper, as Cu Total	< 0.001	1	0	1	100.0%		
SP-30	Iron, as Fe Total	0.086	1	1	0	0.0%	0.086	0.086
SP-30	Lead, as Pb Total	0.005	1	1	0	0.0%	0.005	0.005
SP-30	Manganese, as Mn Total	0.014	1	1	0	0.0%	0.014	0.014
SP-30	Mercury, as Hg Total	< 0.0002	1	0	1	100.0%		
SP-30	Silver, as Ag Total	< 0.0005	1	0	1	100.0%		
SP-30	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		
SP-32	Field Conductivity	87	1	1	0	0.0%	87	87
SP-32	Field pH	7.7	1	1	0	0.0%	7.7	7.7
SP-32	Copper, as Cu Total	< 0.001	1	0	1	100.0%		
SP-32	Lead, as Pb Total	< 0.01	1	0	1	100.0%		
SP-32	Zinc, as Zn Total	< 0.01	1	0	1	100.0%		

Units are mg/L, except pH in standard units, temperature in degrees celsius, turbidity in NTUs, conductivity and SC (specific conductivity) in mS/cm, and flow in gpm.

Appendix K-3. Statistical summary of lake data.

Location ID	Parameter	Representative Value	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Lower Libby Lake	Field Conductivity	3.4	13	13	0	0.0%	2.1	13
Lower Libby Lake	Field pH	6.1	13	13	0	0.0%	5.8	6.3
Lower Libby Lake	Calcium, as Ca Total	0.2	13	13	0	0.0%	0.096	0.26
Lower Libby Lake	Chloride, as Cl	0.11	13	13	0	0.0%	0.024	0.4
Lower Libby Lake	Magnesium, as Mg Total	0.057	13	13	0	0.0%	0.019	0.095
Lower Libby Lake	Potassium, as K Total	< 0.097	13	12	1	7.7%	0.041	0.22
Lower Libby Lake	Sodium, as Na Total	0.23	13	13	0	0.0%	0.12	0.53
Lower Libby Lake	Sulfate, as SO4	0.22	13	13	0	0.0%	0.16	0.44
Lower Libby Lake	Ammonia	< 0.029	13	10	3	23.1%	0.011	0.15
Lower Libby Lake	Nitrate	< 0.033	13	6	7	53.8%	0.024	0.09
Upper Libby Lake	Field Conductivity	2.6	14	14	0	0.0%	0.19	4
Upper Libby Lake	Field pH	5.6	14	14	0	0.0%	5.4	6
Upper Libby Lake	Calcium, as Ca Total	0.087	14	14	0	0.0%	0.029	0.16
Upper Libby Lake	Chloride, as Cl	0.08	14	14	0	0.0%	0.02	0.23
Upper Libby Lake	Magnesium, as Mg Total	< 0.017	14	13	1	7.1%	0.006	0.032
Upper Libby Lake	Potassium, as K Total	< 0.065	14	13	1	7.1%	0.038	0.15
Upper Libby Lake	Sodium, as Na Total	0.12	14	14	0	0.0%	0.069	0.23
Upper Libby Lake	Sulfate, as SO4	0.19	14	14	0	0.0%	0.11	13
Upper Libby Lake	Ammonia	< 0.02	14	12	2	14.3%	0.002	0.078
Upper Libby Lake	Nitrate	< 0.087	14	6	8	57.1%	0.055	0.31
Rock Lake Intflow	Field Conductivity	7.6	8	8	0	0.0%	4.3	13
Rock Lake Intflow	Field pH	6.5	7	7	0	0.0%	6.3	7.3
Rock Lake Intflow	Field Temp	7	9	9	0	0.0%	2.5	9.5
Rock Lake Intflow	Flow	2.6	6	6	0	0.0%	0.22	14
Rock Lake Intflow	TDS	4.3	7	7	0	0.0%	2.5	7.5
Rock Lake Intflow	Alkalinity, Bicarbonate as HCO3	4	7	7	0	0.0%	4	8
Rock Lake Intflow	Alkalinity, Total as CaCO3	52	7	7	0	0.0%	4	122
Rock Lake Intflow	Calcium, as Ca Total	0.82	8	8	0	0.0%	0.51	2
Rock Lake Intflow	Chloride, as Cl	< 0.41	8	6	2	25.0%	0.026	0.091
Rock Lake Intflow	Magnesium, as Mg Total	< 0.35	8	7	1	12.5%	0.12	0.51
Rock Lake Intflow	Potassium, as K Total	< 0.2	8	7	1	12.5%	0.055	0.13
Rock Lake Intflow	Sodium, as Na Total	< 0.26	8	7	1	12.5%	0.064	0.26
Rock Lake Intflow	Sulfate, as SO4	< 0.99	7	6	1	14.3%	0.22	0.43
Rock Lake Intflow	Ammonia	< 0.034	6	3	3	50.0%	0.004	0.029
Rock Lake Intflow	Nitrate + Nitrite, as N	0.15	7	7	0	0.0%	0.022	0.48
Rock Lake Intflow	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
Rock Lake Intflow	TKN	< 0.2	1	0	1	100.0%		
Rock Lake Intflow	Total Phosphorus	0.025	1	1	0	0.0%	0.025	0.025
Rock Lake Intflow	Barium, as Ba Total	< 0.014	4	3	1	25.0%	0.004	0.043
Rock Lake Intflow	Bromide	< 0.049	5	2	3	60.0%	0.018	0.026
Rock Lake Outflow	Field Conductivity	6	8	8	0	0.0%	4.4	8
Rock Lake Outflow	Field pH	6.5	7	7	0	0.0%	6.2	7.6
Rock Lake Outflow	Field Temp	9.1	9	9	0	0.0%	3	15
Rock Lake Outflow	Flow	4	8	8	0	0.0%	0.76	35
Rock Lake Outflow	TDS	3.6	7	7	0	0.0%	2.9	4.7
Rock Lake Outflow	Alkalinity, Bicarbonate as HCO3	4	7	7	0	0.0%	4	6
Rock Lake Outflow	Alkalinity, Total as CaCO3	53	5	5	0	0.0%	3	64
Rock Lake Outflow	Calcium, as Ca Total	0.79	8	8	0	0.0%	0.55	1
Rock Lake Outflow	Chloride, as Cl	< 0.42	8	6	2	25.0%	0.03	0.086
Rock Lake Outflow	Magnesium, as Mg Total	< 0.31	8	7	1	12.5%	0.15	0.3
Rock Lake Outflow	Potassium, as K Total	< 0.23	8	7	1	12.5%	0.098	0.2
Rock Lake Outflow	Sodium, as Na Total	< 0.28	8	7	1	12.5%	0.12	0.37
Rock Lake Outflow	Sulfate, as SO4	< 0.96	7	6	1	14.3%	0.24	0.39
Rock Lake Outflow	Ammonia	0.035	5	5	0	0.0%	0.002	0.09
Rock Lake Outflow	Nitrate + Nitrite, as N	0.15	5	5	0	0.0%	0.039	0.45
Rock Lake Outflow	OrthoPhosphorus	< 0.001	1	0	1	100.0%		
Rock Lake Outflow	TKN	< 0.2	1	0	1	100.0%		
Rock Lake Outflow	Total Phosphorus	0.036	1	1	0	0.0%	0.036	0.036
Rock Lake Outflow	Barium, as Ba Total	< 0.0038	4	3	1	25.0%	0.002	0.004
Rock Lake Outflow	Bromide	< 0.01	5	0	5	100.0%		
St. Paul Lake	Field Conductivity	18	1	1	0	0.0%	18	18
St. Paul Lake	Field pH	6.7	1	1	0	0.0%	6.7	6.7
St. Paul Lake	Calcium, as Ca Total	2.4	1	1	0	0.0%	2.4	2.4
St. Paul Lake	Chloride, as Cl	0.072	1	1	0	0.0%	0.072	0.072
St. Paul Lake	Hardness, as CaCO3	8.5	1	1	0	0.0%	8.5	8.5
St. Paul Lake	Magnesium, as Mg Total	0.62	1	1	0	0.0%	0.62	0.62
St. Paul Lake	Potassium, as K Total	0.19	1	1	0	0.0%	0.19	0.19
St. Paul Lake	Sodium, as Na Total	0.31	1	1	0	0.0%	0.31	0.31
St. Paul Lake	Sulfate, as SO4	0.45	1	1	0	0.0%	0.45	0.45
St. Paul Lake	Ammonia	< 0.01	1	0	1	100.0%		
St. Paul Lake	Nitrate	< 0.01	1	0	1	100.0%		
St. Paul Lake	OrthoPhosphorus	< 0.01	1	0	1	100.0%		

Units are mg/L, except pH in standard units, temperature in degrees celsius, turbidity in NTUs, conductivity and SC (specific conductivity) in mS/cm, and flow in gpm.

Table K-4. Ground water data summary.

Parameter	Libby Adit Area Wells (MW07-01 and MW07-02)			LAD Area Well (WDS-1V)			LCC Area Well (LCTM-8V)			Adit Water (RAW-1)		
	Representative Concentation	No. Samples	No. BDL	Representative Concentation	No. Samples	No. BDL	Representative Concentation	No. Samples	No. BDL	Representative Concentation	No. Samples	No. BDL
Field Conductivity (µmhos/cm)	49	48	0	66	14	0	62	13	0	192	25	0
Field pH (su)	6.3	47	0	6.6	14	0	6	14	0	7.9	34	0
TDS	< 35	47	1	63	15	0	60	16	0	108	20	0
Alkalinity, Bicarbonate as HCO3	< 15	45	6	42	16	0	37	16	0	82	31	0
Alkalinity, Total as CaCO3	12	48	0	35	16	0	32	16	0	76	25	0
Calcium, as Ca Dissolved	< 5.7	50	1	6	16	0	4.1	16	0	18	26	0
Chloride, as Cl	< 0.68	50	19	< 0.81	16	8	< 1.3	16	7	< 3.5	19	1
Hardness, as CaCO3	17	42	0	23	16	0	18	16	0	74	10	0
Magnesium, as Mg Dissolved	< 1.1	48	6	2	16	0	2	16	0	< 4.2	26	2
Potassium, as K Dissolved	< 0.4	40	21	< 1	16	13	< 0.78	16	9	< 1	10	3
Sodium, as Na Dissolved	< 2.8	50	4	5	16	0	6	16	0	13	14	0
Sulfate, as SO4	< 9.9	50	1	< 2	16	10	< 4.5	16	8	21	43	0
Ammonia as N	< 0.05	47	43	< 0.033	16	11	< 0.042	16	10	< 0.05	59	46
Nitrate as N	< 0.23	48	3	0.06	16	0	< 0.1	16	1	< 0.22	31	2
Nitrate + Nitrite, as N	< 0.25	33	1	0.06	13	0	0.07	13	0	< 0.36	53	12
Nitrite as N	< 0.0034	49	45	< 0.013	16	12	< 0.026	16	13	< 0.1	22	12
Total Kjeldahl Nitrogen	< 0.16	46	27	< 0.14	7	5	< 0.6	7	4	< 0.11	29	20
Total Inorganic Nitrogen	0.1	35	0	< 0.11	6	1	0.085	6	0	< 0.32	18	2
OrthoPhosphorus	< 0.004	40	9	0.024	16	0	< 0.0082	16	3	< 0.01	14	4
Total Phosphorus	< 0.0089	40	8	0.099	15	0	0.074	16	0	< 0.015	14	2
Aluminum, as Al Dissolved	< 0.01	50	21	< 0.05	16	12	< 0.05	16	13	< 0.014	13	1
Antimony, as Sb Dissolved	< 0.00026	50	39	< 0.003	16	16	< 0.003	16	16	< 0.00049	14	4
Arsenic, as As Dissolved	< 0.00037	50	27	< 0.003	16	13	< 0.003	16	16	< 0.00092	12	2
Barium, as Ba Dissolved	< 0.005	50	17	< 0.0067	16	4	< 0.04	16	3	0.013	13	0
Cadmium, as Cd Dissolved	< 0.00008	46	37	< 0.0001	16	13	< 0.0001	16	13	< 0.00004	22	17
Chromium, as Cr Dissolved	< 0.0003	50	34	< 0.001	16	12	< 0.00074	16	11	< 0.0004	28	19
Copper, as Cu Dissolved	< 0.00082	49	35	< 0.001	16	14	< 0.0012	16	11	< 0.001	28	23
Iron, as Fe Dissolved	< 0.025	49	36	< 0.052	16	8	< 0.01	16	14	< 0.017	27	11
Lead, as Pb Dissolved	< 0.00005	45	40	< 0.00034	16	14	< 0.00028	16	14	< 0.00027	25	15
Manganese, as Mn Dissolved	< 0.0011	50	27	< 0.081	16	1	< 0.077	16	4	< 0.0077	28	16
Mercury, as Hg Dissolved	< 0.00002	44	34	< 0.00002	16	14	< 0.00003	16	13	< 0.000016	18	10
Nickel, as Ni Dissolved	< 0.00054	50	44	< 0.01	16	13	< 0.01	16	13	< 0.00063	13	3
Selenium, as Se Dissolved	< 0.00033	50	47	< 0.001	16	16	< 0.001	16	13	< 0.00025	13	13
Silver, as Ag Dissolved	< 0.00025	50	46	< 0.0005	16	16	< 0.0005	16	16	< 0.00025	10	8
Zinc, as Zn Dissolved	< 0.0021	50	34	< 0.01	16	12	< 0.0064	16	8	< 0.0072	27	15

All values are in milligrams per liter (mg/L) unless noted in first column.
su = standard units; µmhos/cm = micromhos/centimeter; < = less than concentration used in representative concentation calculation.
Conc. = concentration; No. Samples = number of samples analyzed; No. BDL = number of analyzed samples with concentrations below the detection limit.
Representative concentrations reflect data outlier review and removal based on professional judgement; Median concentration reported for parameters with no below detection limit values or with greater than 70% below detection limit values.
Mean concentrations reported for parameters with below detection limit values (If two or more detected values were reported, the mean was calculated using the Kaplan Meier method. If zero or one detected value was reported, mean concentration was calculated useing the detection limit value reported).

Appendix K-5. Statistical summary of post-construction adit water.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
TDS	108	20	20	0.0%	56	169
Nitrate + Nitrite, as N	< 0.36	53	41	22.6%	0.020	2.7
Ammonia	< 0.050	59	13	78.0%	0.010	0.57
Antimony, as Sb Total	< 0.00043	14	10	28.6%	0.00025	0.00069
Antimony, as Sb Dissolved	< 0.00049	14	10	28.6%	0.00028	0.00086
Arsenic, as As Total	< 0.0013	12	10	16.7%	0.0010	0.0020
Arsenic, as As Dissolved	< 0.00092	12	10	16.7%	0.00060	0.0012
Cadmium, as Cd Total	< 0.000040	22	3	86.4%	0.0000040	0.0000050
Cadmium, as Cd Dissolved	< 0.000040	22	5	77.3%	0.0000050	0.000022
Chromium, as Cr Total	< 0.00075	28	13	53.6%	0.00024	0.0040
Chromium, as Cr Dissolved	< 0.00040	28	9	67.9%	0.00018	0.0020
Copper, as Cu Total	< 0.00083	28	13	53.6%	0.00025	0.0078
Copper, as Cu Dissolved	< 0.0010	28	5	82.1%	0.00025	0.0010
Iron, as Fe Total	< 0.26	28	26	7.1%	0.020	1.3
Iron, as Fe Dissolved	< 0.017	27	16	40.7%	0.0076	0.052
Lead, as Pb Total	< 0.00093	26	17	34.6%	0.000090	0.0070
Lead, as Pb Dissolved	< 0.00027	25	10	60.0%	0.000010	0.0050
Manganese, as Mn Total	< 0.0091	28	13	53.6%	0.0049	0.030
Manganese, as Mn Dissolved	< 0.0077	28	12	57.1%	0.0044	0.046
Mercury, as Hg Total	< 0.000011	17	7	58.8%	0.00000015	0.000074
Mercury, as Hg Dissolved	< 0.000016	18	8	55.6%	0.00000015	0.00010
Silver, as Ag Total	< 0.00025	11	1	90.9%	0.0020	0.0020
Silver, as Ag Dissolved	< 0.00025	10	2	80.0%	0.00035	0.00043
Zinc, as Zn Total	< 0.012	27	15	44.4%	0.0030	0.028
Zinc, as Zn Dissolved	< 0.0072	27	12	55.6%	0.0017	0.021

Notes:

All concentrations in units of mg/L

One result per location per analyte per day evaluated

Detection limit used in calculating the representative concentration

Representative concentration is the median if the percentage of non-detects is 0 or greater than 70

Representative concentration is the mean if the percentage of non-detects is greater than 0 but less than or equal to 70

Data summarized from samples RAW-1

Appendix K-6. Statistical summary of post-closure mine water.

Parameter		Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Field pH		7.5	12	12	0.0%	6.9	8.0
Total dissolved solids		115	14	14	0.0%	82	156
Total Alkalinity		76	14	14	0.0%	40	92
Bicarbonate Alkalinity		92	14	14	0.0%	49	112
Hardness		99	14	14	0.0%	53	127
Calcium, total		28	14	14	0.0%	16	34
Magnesium, total		7.0	14	14	0.0%	3.0	10
Potassium, total	<	1.2	14	10	28.6%	1.0	2.0
Sodium, total	<	2.4	14	13	7.1%	1.0	4.0
Sulfate, total		21	13	13	0.0%	17	25
Ammonia	<	0.75	14	12	14.3%	0.070	2.3
Nitrate + Nitrite, as N		2.5	14	14	0.0%	0.70	8.0
Antimony, dissolved	<	0.0088	6	5	16.7%	0.0060	0.015
Antimony, total		0.01	12	12	0.0%	0.0060	0.032
Arsenic, dissolved	<	0.0026	6	3	50.0%	0.0010	0.0080
Arsenic, total	<	0.023	12	6	50.0%	0.0070	0.080
Cadmium, dissolved		0.0015	2	2	0.0%	0.00087	0.0022
Chromium, dissolved	<	0.0010	2	0	100.0%		
Copper, dissolved		0.042	5	5	0.0%	0.041	0.084
Copper, total		0.57	12	12	0.0%	0.064	12
Iron, dissolved	<	0.018	5	2	60.0%	0.010	0.050
Iron, total		2.6	14	14	0.0%	0.020	13
Lead, dissolved	<	0.011	6	3	50.0%	0.0021	0.047
Lead, total	<	0.26	12	11	8.3%	0.0040	0.95
Manganese, dissolved		0.22	6	6	0.0%	0.025	0.31
Manganese, total		0.18	12	12	0.0%	0.026	1.7
Mercury, dissolved	<	0.000005	2	1	50.0%	0.0000050	0.0000050
Silver, dissolved	<	0.0030	6	0	100.0%		
Silver, total	<	0.022	12	5	58.3%	0.0060	0.10
Zinc, dissolved	<	0.012	6	2	66.7%	0.010	0.020
Zinc, total	<	0.028	12	6	50.0%	0.010	0.070

Notes:

All concentrations in units of mg/L except pH in standard units
One result per location per analyte per day evaluated
Detection limit used in calculating the representative concentration
Representative concentration is the median if the percentage of non-detects is 0 or greater than 70
Representative concentration is the mean if the percentage of non-detects is greater than 0 but less than or equal to 70
Data summarized from Troy Mine samples Service Adit P and Service Adit D

Appendix L— Draft 404(b)(1) Analysis

Draft
404(b)(1) Analysis
Montanore Project

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MONTANORE PROJECT

INTRODUCTION AND PURPOSE

Montanore Minerals Corp. (MMC) proposes to construct a copper and silver underground mine and associated facilities, including a new transmission line, near Libby, Montana. The proposed project is called the Montanore Project. MMC has requested the U.S. Department of Agriculture (USDA), Kootenai National Forest (KNF) to approve a Plan of Operations for the Montanore Project. The KNF and the Montana Department of Environmental Quality (DEQ) are the lead agencies for the preparation of an environmental impact statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA).

From the DEQ's perspective, the MMC's proposed mining operation is covered by a DEQ Operating Permit first issued by the Montana Department of State Lands (DSL) to Noranda Minerals Corp. (Noranda). MMC has applied to the DEQ for a modification of the existing 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. MMC has applied for other permits, such as a section 404 permit for discharge of dredged or fill material from the U.S. Army Corps of Engineers (Corps) and renewal of an existing Montana Pollutant Discharge Elimination System (MPDES) permit from the DEQ.

The lead agencies issued the Montanore Project Draft EIS (DEIS) for public comment in February 2009. In response to comment on the DEIS, the lead agencies prepared this draft 404(b)(1) analysis 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. This analysis is not intended to represent the Corps' conclusions or their final 404(b)(1) determination. The analysis should be read in conjunction with a companion report, *Tailings Disposal Alternatives Analysis*, which describes the lead agencies' alternatives analysis for tailings disposal. This analysis addresses the lead agencies' preferred alternatives, mine Alternative 3, Agency Mitigated Poorman Impoundment Alternative and transmission line Alternative D-R, and Miller Creek Alternative, in accordance with informal guidance provided by the Corps and the Environmental Protection Agency (EPA) during the development of the analysis.

404(b)(1) Guidelines and Corps' NEPA Regulations

The Corps and the EPA use regulations, informally called the "404(b)(l) Guidelines" or "Guidelines," to evaluate impacts from dredged or fill disposal activities on waters of the U.S., and to determine compliance with Section 404 (40 CFR 230 *et seq.*). The Guidelines require identification and evaluation of special characteristics of a disposal site and the surrounding area that may be affected by its use. These special characteristics include biological characteristics, special aquatic sites, and human use characteristics. Wetlands and riffle and pool complexes are considered special aquatic sites; both types of sites exist in the Permit Area.

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. Under the Guidelines, the term practicable connotes "available or capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 CFR 230.10(a)(2)). It is the Corps' responsibility to determine if a specific alternative is practicable.

For projects that are not water dependent, the Guidelines presume that practicable alternatives that do not involve special aquatic sites, such as wetlands, are available, unless clearly demonstrated otherwise. In addition, 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" (Section 230.10(a)(3)). It is applicant's (MMC's) responsibility to rebut these presumptions. The reasonable alternatives developed for an EIS will, in most cases, provide the information for the evaluation of alternatives under the Guidelines (40 CFR 230.10(a)(4)).

The Guidelines include a section (40 CFR 230.12) that requires findings of compliance or noncompliance with the restrictions on discharge. The Corps will make these findings when it makes a 404(b)(1) compliance determination on MMC's 404 permit application for the project. This analysis does not discuss section 40 CFR 230.12 in accordance with informal guidance provided by the Corps during the development of the analysis.

The Corps has established regulations regarding procedures it uses in implementing NEPA (33 CFR 325, Appendix B). Under these regulations, the Corps considers only reasonable alternatives in detail. The regulations further state reasonable alternatives must be those that are feasible and such feasibility must focus on the accomplishment of the underlying purpose and need that would be satisfied by permit issuance. The "no action" alternative is one that results in no construction requiring a Corps permit. It may be brought by the applicant electing to modify the proposal to eliminate work under the jurisdiction of the Corps, or by denial of the permit. The EIS should also discuss geographic alternatives, such as changes in location, and functional alternatives, such as project substitutes and design modifications. The EIS should also indicate any cost considerations that are likely to be relevant to a decision.

Project Purpose

Basic Project Purpose

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.

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, however, 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 profitably extract, in an economically viable manner, copper and silver from ore in northwestern Montana in order to meet demand.

PROJECT DESCRIPTION

General Description

The Montanore Project is a proposed copper and silver underground mine and associated transmission line located about 18 miles south of Libby near the Cabinet Mountains of northwestern Montana (Figure

1). The ore body is beneath the Cabinet Mountains Wilderness (CMW). All access and surface facilities would be located outside of the CMW boundary. MMC, a wholly owned subsidiary of Mines Management, Inc. (MMI), would be the project operator. 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.

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 Libby Plant Site. Copper and silver minerals would be removed from the ore by a flotation process. Silver/copper concentrate from the plant 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.

The term “permit area,” as used in this analysis, is from the Corps’ permitting regulations (33 CFR 325, Appendix C) and means those areas comprising the waters of the U.S. that would be directly affected by the proposed discharges and uplands directly affected as a result of authorizing the discharges. The definition as used by the Corps varies from that used by the DEQ under the Metal Mine Reclamation Act. The area that would be covered by a DEQ operating permit is shown in Figure 2.

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. Tailings from the milling process would be transported through a pipeline to a tailings impoundment site between the Little Cherry Creek and Poorman Creek, about 3 miles from the Libby Plant Site. The design developed for the Poorman Tailings Impoundment Site is conceptual only, and is based on limited geotechnical investigations. It is unclear as to the need for a Rock Toe Berm or other specific design features. The tailings facility design would be based on additional site information obtained during the design process, which likely would include a preliminary design phase and a final design phase. Site information would be collected during field exploration programs for each of the two design phases. 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 3). 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. A Saddle Dam of construction similar to the Starter Dam would be required in the north perimeter of the impoundment area. 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. Smaller lateral drains would convey water to the main trunk drains, which would then convey water to the Seepage Collection Pond. 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 (Figure 3).

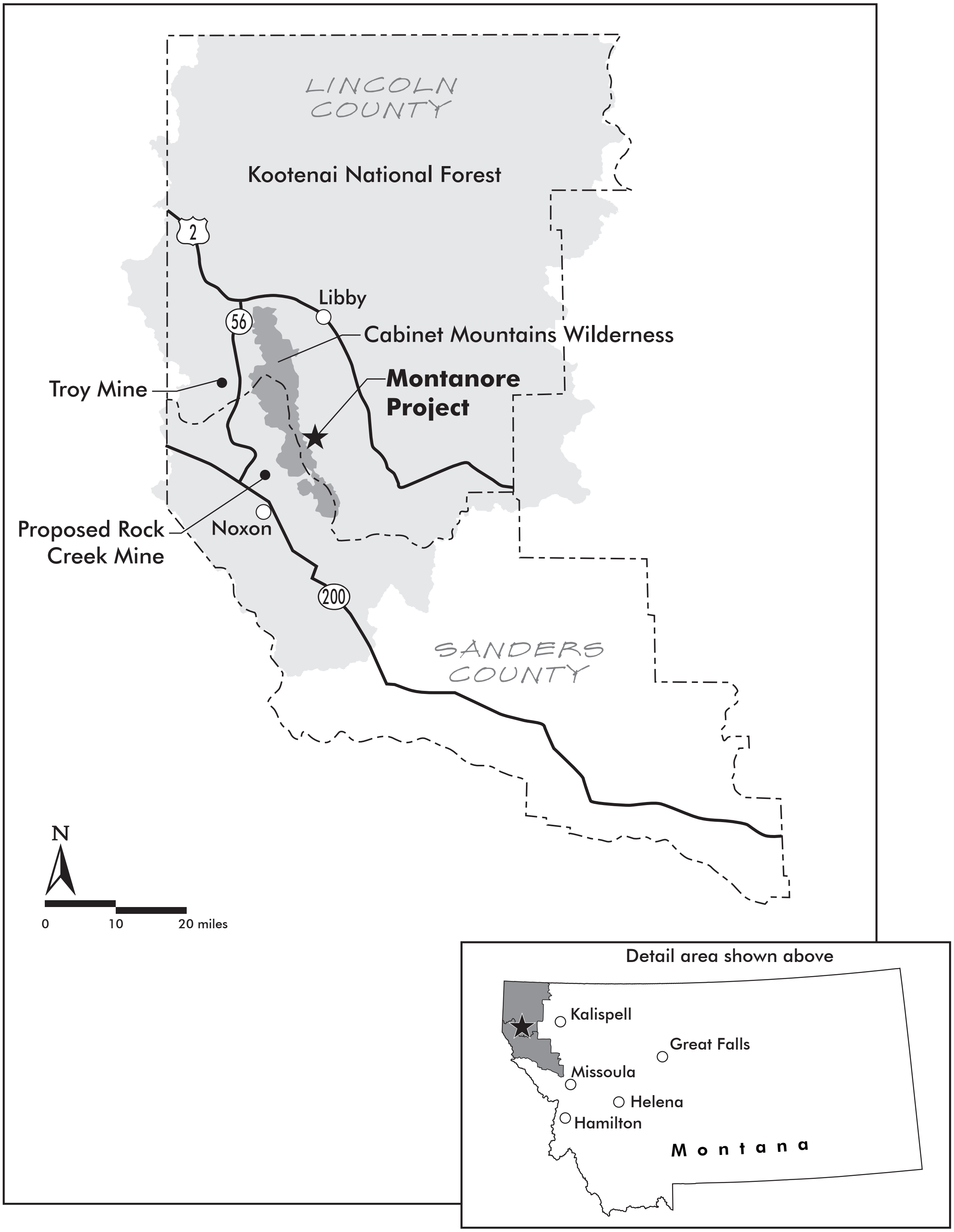

Figure 1. Location Map, Montanore Project, Kootenai National Forest.

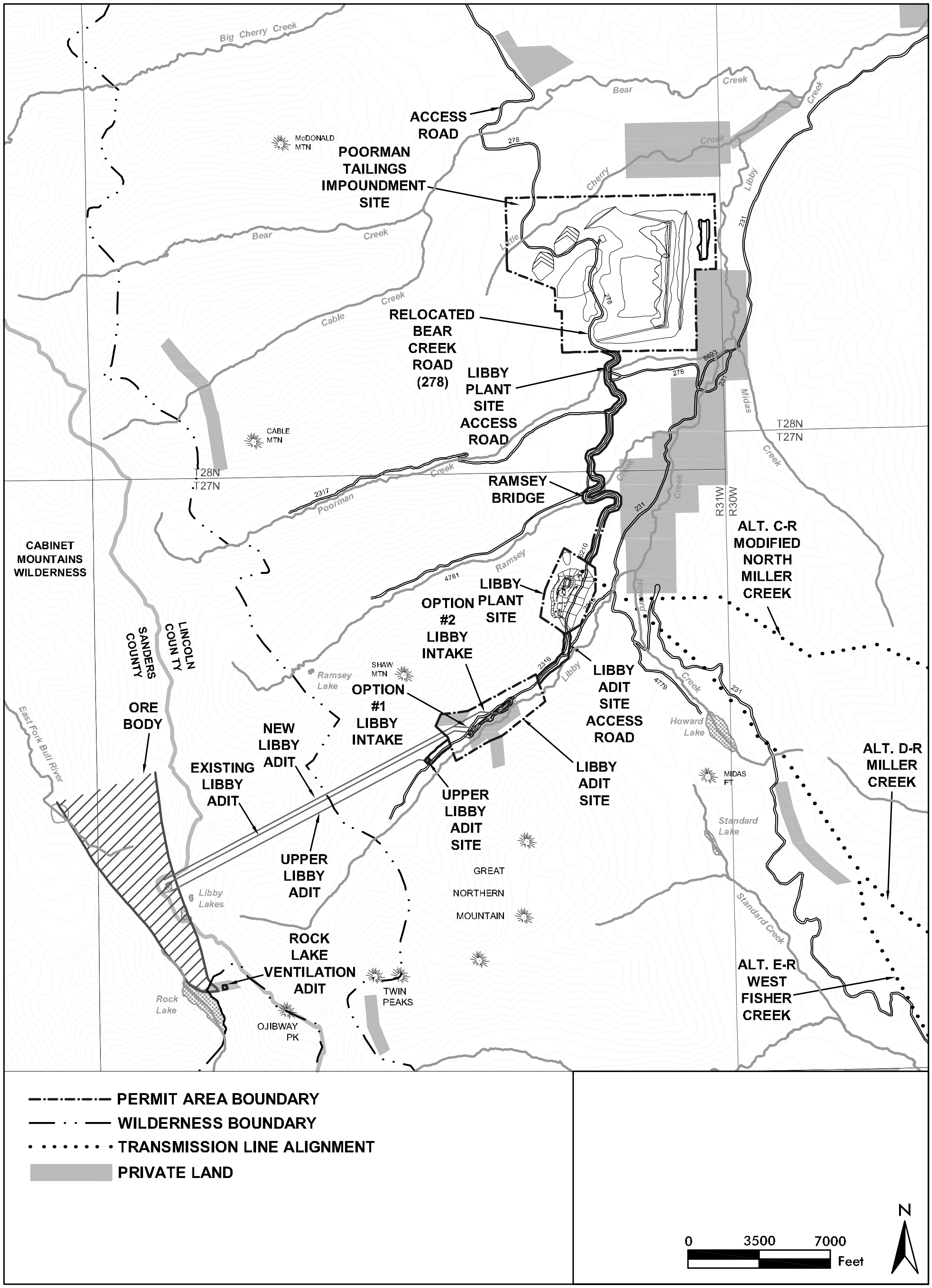

Figure 2. Mine Facilities and Permit Areas, Alternative 3

Tailings would be thickened to a density greater than 55 percent at a thickener plant at the impoundment site. Slurry 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 Main 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.

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 bypass 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. 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 would not come in contact with surface waters. A lined flume and trestle would be constructed where the pipelines would cross Poorman Creek.

Access to the mine and all surface facilities would be via U.S. 2 and the existing National Forest System road #278, the Bear Creek Road. About 13 miles of the Bear Creek Road (NFS road #278), from U.S. 2 to the Poorman Tailings Impoundment Site, would be upgraded and paved to a roadway width of 26 feet. Additional widening would be necessary on curves. The disturbed area, including ditches and cut-and-fill slopes, is expected to 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. During upgrading of the Bear Creek Road, MMC would use the Libby Creek Road. South of Little Cherry Creek, MMC would build 1.6 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). MMC would construct a new bridge crossing of Poorman Creek just upstream and adjacent to the existing crossing. The road would have a chip-seal surface and would be constructed to a width to accommodate haul traffic.

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.

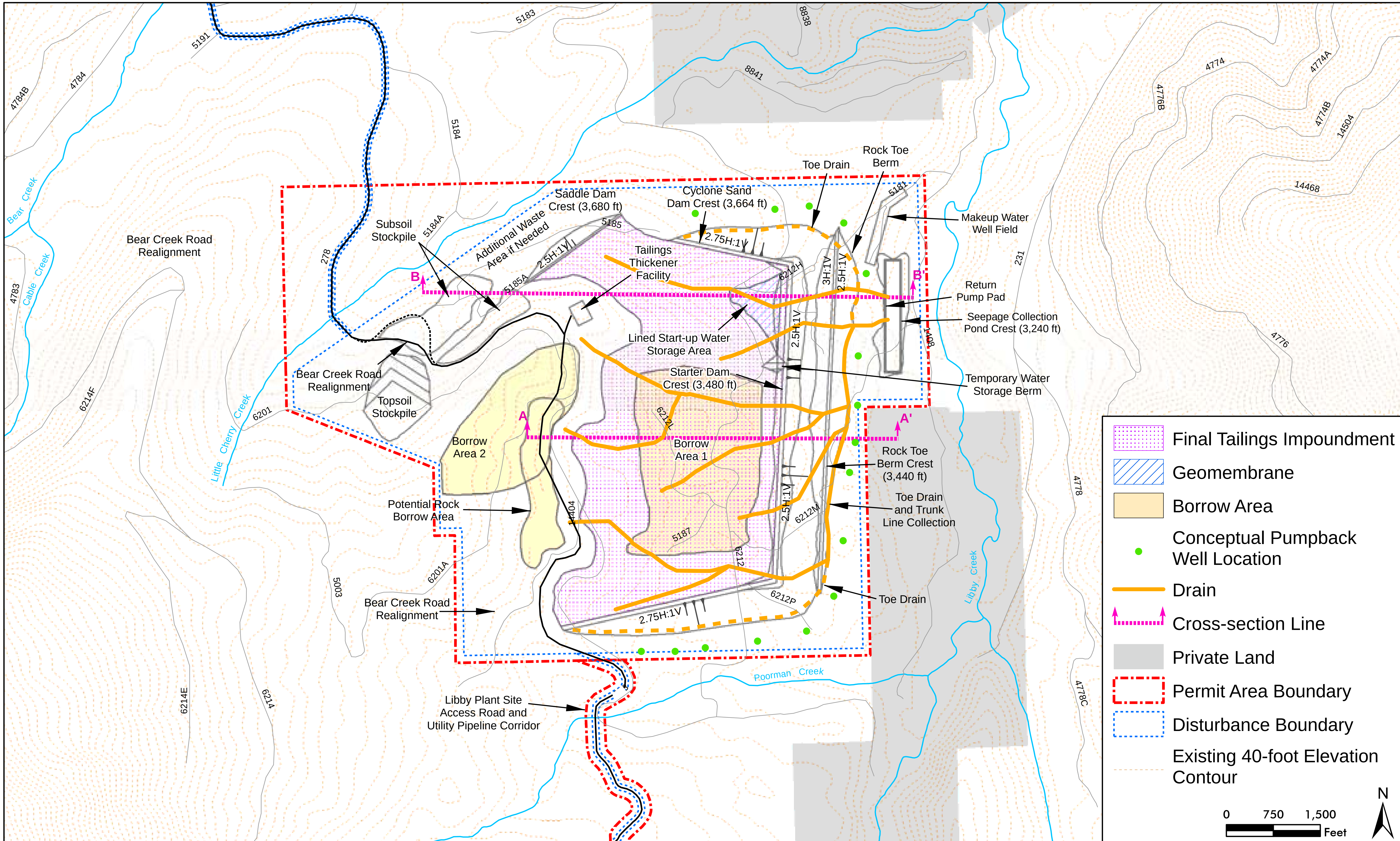

Figure 3. Poorman Tailings Impoundment Site, Alternative 3

Permits and Authorizations Held by MMC

The Montana DEQ is responsible for enforcing compliance with water quality laws on all lands in Montana, excluding Tribal lands. The Forest Service has a Memorandum of Understanding with the state that allows the Forest Service and the DEQ to work collaboratively to address water quality issues on National Forest System lands. The 1987 Kootenai Forest Plan (KFP) established management areas within the forest with different goals and objectives based on the capabilities of lands within this area (USDA Forest Service 1987).

Board of Health and Environmental Sciences Order No. 93-001-WQB

Noranda submitted a "Petition for Change in Quality of Ambient Waters" in 1989 to the Board of Health and Environmental Sciences (BHES) requesting an increase in the allowable concentration of select constituents in surface water and groundwater above ambient water quality, as required by Montana's 1971 nondegradation statute. Noranda submitted supplemental information to support the petition in 1992. In response to Noranda's petition, the BHES issued an order in 1992, authorizing degradation and establishing nondegradation limits in surface water and groundwater adjacent to the Montanore Project for discharges from the project. The Order established numeric nondegradation limits for total dissolved solids, chromium, copper, iron, manganese, and zinc in both surface water and groundwater; 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 obtains an authorization to degrade under current statute. The Order remains in effect for the operational life of the project and for as long as necessary thereafter.

MPDES Permit No. MT-0030279

The DEQ issued a MPDES to Noranda in 1997 for Libby Adit discharge to the local groundwater or Libby Creek. Three outfalls are included in the permit: outfall 001 – percolation pond; outfall 002 – infiltration system of buried pipes; and outfall 003 – pipeline outlet to Libby Creek. Only outfall 001 has been used since permit issuance. The DEQ renewed the permit in 2006. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from Noranda to MMC. In 2011, MMC applied to the DEQ to renew the existing MPDES permit and requested the inclusion of five new stormwater outfalls under the permit. 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.

Nature of Proposed Discharges

MMC would discharge several types of materials that would be considered fill under Section 404. The Corps defines fill as material placed in waters of the U.S. where the material has the effect of replacing any portion of a water of the U.S. with dry land, or changing the bottom elevation of any portion of a water of the U.S. (33 CFR 323.2(e)). Proposed discharges would be:

- General fill and waste rock during tailings impoundment site construction
- General fill, aggregate, incidental fill, and corrugated metal pipe during road construction or improvements
- Vegetation during clearing operations
- Large rocks and logs for fish structures associated with fisheries mitigation
- Concrete or similar materials for streamflow or lake level measurements

Fill Associated with Tailings Impoundment Site Construction and Disposal

At the Impoundment Site, most wetlands and the beds of waters of the U.S. would be excavated during initial site preparation to construct drains for the Seepage Collection System. Sand and gravel alluvial material available from the Impoundment Site would be used for the drains. Following excavation, 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. The drains would be covered with fill to prevent the fine tailings from piping into the drain materials during Operations.

The Rock Toe Berm would be constructed with waste rock available from initial mine development and early mine operations and borrow material excavated from surface and near surface glacial deposits within or adjacent to the impoundment. Any waste rock used at the Impoundment Site would meet criteria specified in a waste rock management plan. The Starter Dam and Saddle Dam would be constructed with borrow material excavated from surface and near surface glacial deposits within or adjacent to the impoundment. During operations, MMC would discharge fill for road construction and other facilities within the impoundment site into waters of the U.S. not excavated during initial site preparation.

Fill Associated with Road Construction or Improvements

MMC would discharge fill during road construction or improvements. The fill would consist of coarse soil fill with gravel, riprap of varying sizes to protect culvert outfalls, coarse sand for culvert bedding, and corrugated metal pipe as culverts.

Vegetation during Clearing Operations

Vegetation clearing would be needed during site preparation for construction of mine facilities and the transmission line. Woody vegetation may incidentally be discharged into waters of the U.S. during clearing operations. Large woody debris may be left in waters of the U.S. to improve fish habitat.

Large Rocks and Logs Associated with Fisheries Mitigation

To improve bull trout habitat in Libby Creek, MMC would install and maintain formidable wood structures in the floodplain and riparian zone that can stabilize this reach and improve spawning and rearing habitat for fish by increasing channel depth, complexity and stability, and sediment retention. Formidable wood structures will also create more habitat for other aquatic and semiaquatic biota and allow establishment of riparian vegetation. Vegetation removed in the impoundment site may be used to provide large woody debris. Other fisheries mitigation may require discharge of fill into waters of the U.S.

Concrete or Similar Materials for Streamflow Measurements

MMC would install continuous streamflow recorders in area streams. Fill associated with these water measurement devices would consist of concrete, wood, and similar materials.

In this analysis, these discharges are referred to as “proposed discharges” or “proposed 404-permitted discharges.” In addition, MMC may have discharges regulated under Section 402 of the Clean Water Act. Currently, MMC is permitted under MPDES Permit MT0030279 to discharge water from three outfalls at the Libby Adit and has applied for additional stormwater outfalls. When discharges regulated under Section 402 are discussed in this analysis, they are referred to as “proposed 402-permitted discharges.”

SUBPART B – COMPLIANCE WITH THE GUIDELINES

Section 230.10 – Restrictions on the Discharge

Section 230.10(a) – Practicable Alternatives Analysis

The agencies' analysis of underground mine, tailings disposal, and plant site and adit alternatives is described in detail in a separate *Tailings Disposal Alternatives Analysis*. The following sections summarize the KNF's and the DEQ's alternatives analysis supporting Alternative 3 (Agency Mitigated Poorman Impoundment Alternative) and Alternative D-R (North Miller Creek Alternative) as the preferred alternatives.

Development of Alternatives

The alternatives development process was designed to identify a reasonable range of practicable alternatives for detailed analysis in the EIS. The agencies developed alternatives in accordance with the requirements of NEPA, MEPA, the Montana Major Facility Siting Act, and Section 404 of the Clean Water Act. To develop a reasonable range of alternatives, the lead agencies separated the proposed 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

Underground Mine Location

The agencies evaluated alternative copper-silver resources in northwest Montana, consistent with the Corps' purpose and need to determine if an alternative mine location was reasonable. A U.S. Geological Survey (USGS) review of copper-silver deposits in western Montana and eastern Idaho provided the primary basis for the agencies' analysis (Boleneus et al. 2005). World-class deposits are those that exceed the 90th percentile of discovered metal, and contain more than 2.2 million tons of copper. World-class deposits are significant because production from any of them would affect the world's supply-demand relation for the metal. Only three world-class stratabound copper-silver deposits are found in North America: the Rock Creek and Montanore deposit (Montana), the Kona deposit (Michigan), and the White Pine deposit (Michigan). Individually, the Rock Creek and Montanore deposits are also considered world-class silver deposits. Such deposits represent a "supergiant" silver deposit, 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 may 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 may reasonably obtain, use, or manage.

Combined Mining Operations (Rock Creek Project and Montanore Project)

In the 1992 Final EIS for the Montanore Project, the lead agencies evaluated the potential alternative of combining ASARCO's (now Rock Creek Resources') Rock Creek Project with the Montanore Project. A similar analysis was conducted and disclosed in the Rock Creek Project Final EIS. In the Rock Creek Project Final EIS, the agencies determined that the potential advantages of a joint operation were outweighed by the disadvantages. The alternative was dismissed for environmental, engineering, and legal reasons. In the Montanore Project analysis of joint operation, the agencies concluded they had no regulatory authority to require a combined operation, and joint operation is not a practicable alternative. If the companies were to develop an operational agreement and propose a joint operation, the agencies would initiate a NEPA/MEPA review as appropriate to disclose the effects of such a proposal.

Tailings Backfill Options

Backfilling 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 tons per day, reduce the volume of tailings requiring surface disposal by 33 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*. Room-and-pillar mining with delayed paste backfill is the only technically feasible method of underground tailings disposal. An aboveground paste plant, outside the CMW, is the only feasible backfill plant location.

If the volume of surface tailings could be reduced by 33 to 40 percent, effects on wetlands and other waters of the U.S. would be reduced. Screening criteria for tailings impoundment locations are discussed in the next section. Less than 9 acres of wetlands would be affected at the Impoundment Site if thickened tailings were deposited on the surface. Backfilling 40 percent of the tailings along with paste tailings would reduce impacts to wetlands by an estimated 1.6 acres. Based on a preliminary, assessment-level economic analysis, which could vary by more than 30 percent, the agencies' analysis found that backfilling would result in significantly greater capital and operating costs than would normally be associated with room-and-pillar mining projects. Backfilling was eliminated from detailed analysis.

Tailings Impoundment Location

The agencies analyzed 22 sites for surface tailings disposal using three successive levels of screening to narrow the range of tailings impoundment options analyzed in detail in the EIS. The criteria included logistical and environmental considerations. Sites were eliminated because they were unavailable, did not provide adequate capacity, or had more adverse environmental effects. The agencies retained two sites for detailed analysis in the EIS: the Little Cherry Creek and the Poorman impoundment sites, both of which result in wetland impacts (Table 1). During final design, MMC would avoid and minimize effects on wetlands and other waters of the U.S. to the extent practical.

Plant Site

The agencies analyzed plant sites on the west side of the Cabinet Mountains in the Rock Creek drainage, and concluded that either they were not available, or they did not offer any environmental advantages over sites on the east side of the Cabinet Mountains. The lead agencies initially considered three plant sites along Libby Creek upstream of the confluence of Libby and Howard creeks: 1) on private land at the existing Libby Adit Site; 2) farther up Libby Creek on National Forest System land, but outside of the CMW (the upstream site); and 3) farther down Libby Creek on National Forest System land just west of the Libby Creek Recreational Gold Panning Area, a popular recreation site (the downstream site). After the initial analysis, the lead agencies completed additional analysis of three other options: 1) a site on private land on the south side of Libby Creek at the Libby Adit Site; 2) a site immediately adjacent to the Libby Adit Site upstream on Libby Creek; and 3) a site slightly west of the downstream Libby Creek site evaluated initially. Criteria included logistical and environmental considerations. The agencies identified the lower Libby Creek site as the option for a plant site with the least environmental impact because it would accommodate all necessary facilities, and would not affect wetlands, Riparian Habitat Conservation Areas, or an Inventoried Roadless Area.

Access Road

The agencies analyzed four possible roads to provide access: NFS road #278 south from U.S. 2 about 10 miles along Big Cherry Creek; NFS road #231 (Libby Creek Road) west from U.S. 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. Criteria included logistical and environmental considerations. The agencies identified NFS road #278 south from U.S. 2 as the option for the access road with the least environmental impact.

Transmission Line and Substation

The Sedlak Park Substation design was modified to avoid wetlands and waters of the U.S. Discharges to wetlands and waters of the U.S. are expected to be avoided by placement of transmission structures outside of wetlands and waters of the U.S. Unavoidable wetland effects would be determined during final design. Minor discharges to wetlands and waters of the U.S. may occur from road construction activities.

Comparison of Alternatives

The four alternatives that were retained for detailed analysis are: Alternative 1 No Action Alternative, Alternative 2 Little Cherry Creek Impoundment, Alternative 3 Poorman Impoundment, and Alternative 4 Modified Little Cherry Creek Impoundment. The criteria to determine if an alternative is practicable (cost, logistics, and existing technology) (40 CFR 230.3(q)) and effects on aquatic resources for each alternative are summarized in Table 1. Alternative 3 Poorman Impoundment is the KNF’s preferred alternative and was determined as the least environmental damaging practicable alternative. The impacts analysis in the remaining sections of this document is for Alternative 3 only.

Table 1. Comparison of the Four Mine Alternatives.

Characteristic	Alternative 1 No Action – (No Mine)	Alternative 2 Little Cherry Creek Impoundment – (MMC's Proposed Mine)	Alternative 3 Poorman Impoundment – (KNF's Preferred Alternative)	Alternative 4 Modified Little Cherry Creek Impoundment
Practicable Criteria 40 CFR 230.10(a)(2)				
Cost	Not applicable	Alternative cost reasonable in terms of overall scope of cost of a similar project	Higher operating and capital costs for tailings disposal would be partially offset by decreased cost of avoiding Little Cherry Creek diversion; higher mitigation and monitoring costs. Alternative cost reasonable in terms of overall scope of cost of a similar project.	Higher mitigation and monitoring costs than Alternative 2. Alternative cost reasonable in terms of overall scope of cost of a similar project.
Logistics	Not applicable	Alternative logistically feasible	Same as Alternative 2	Same as Alternative 2
Existing Technology	Not applicable	All operations use existing technology	Same as Alternative 2	Same as Alternative 2
Environmental Considerations				
Permit Area (acres)	0[†]	3,628	2,030	2,793
Disturbance Area (acres)	0	2,582	1,539	1,887
Area of Jurisdictional Wetlands (acres)[§]	0	33.5	8.8	35.5
Area of Isolated Wetlands (acres)[§]	0	1.3	3.4	1.2
Length of Other Waters of the U.S. (linear feet)	0	29,791	19,160	29,044

The jurisdictional status of the wetlands and other waters of the U.S. is preliminary and impacts may change when the Corps completes an approved jurisdictional determination.
[†] The DEQ's Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002 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 lands.

Section 230.10(b) – Discharge Compliance with Guidelines

The 404(b)(1) Guidelines Section 230.10(b) require that no discharge shall be authorized if it:

- Causes or contributes to any violation of water quality standards
- Violates any applicable toxic effluent standard or prohibition under Section 307 of the Act

- Jeopardizes the continued existence of species listed as threatened or endangered under the Endangered Species Act (ESA), or results in the likelihood of destruction or adverse modification of designated critical habitat under the ESA
- Violates any requirement imposed by the Secretary of Commerce to protect any marine sanctuary

State Water Quality Standards

None of the proposed 404-permitted discharges would cause or contribute to a violation of a water quality standard. The tailings impoundment is designed with an underdrain system to collect seepage from the tailings and divert intercepted water to a Seepage Collection Pond downgradient of the impoundment. Some of the percolating water would seep into the underlying aquifer. Seepage from the tailings not collected by the underdrain system is estimated to decrease from 25 gpm during operations to 5 gpm over the long term. The seepage would mix with the underlying groundwater and be intercepted by the pumpback well system. During operations, tailings seepage and groundwater intercepted by the pumpback well system would be used in the mill for ore processing. At closure, tailings seepage and groundwater intercepted by the pumpback well system would be treated at a Water Treatment Plant and discharged at a 402-permitted outfall, or recycled to the tailings impoundment. All discharges from the Water Treatment Plant would be subject to MPDES-permitted effluent limits designed to maintain beneficial uses in all receiving waters. Post-Closure, MMC would operate the seepage collection and the pumpback well systems until water quality standards or BHES Order nondegradation limits were met without additional treatment. None of the 402-permitted discharges would cause or contribute to a violation of a surface water quality standard.

Other proposed discharges, such as those associated with road construction or reconstruction, fish habitat structures, or water measurement devices, would increase turbidity at the discharge site. Turbidity would increase above ambient conditions. The increase would be temporary and would be permitted under a DEQ 318 permit. None of the 404-permitted discharges would cause or contribute to a violation of a surface water quality standard.

Toxic Effluent Standard or Prohibition

For industrial sources, national effluent limitation guidelines (ELGs) have been developed for specific categories of industrial facilities and represent technology-based effluent limits. The project is in an industrial category that is specifically identified and included in the ELGs at 40 CFR 440, Ore Mining and Dressing Point Source Category, Subpart J – Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory.

The federal ELGs apply to mine drainage and process wastewater that discharge to surface water. Mine drainage is “any water pumped, drained, or siphoned from a mine” (40 CFR 440.131). Process wastewater is “any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate produce, finished product, by-product, or waste product” (40 CFR 401.11). In terms of the ELG requirements for copper mines that use froth flotation for milling, tailings water is considered process wastewater. Process wastewater from copper mines that use froth flotation for milling is not allowed to be discharged to state surface waters except in areas of net precipitation (where precipitation and surface runoff within the impoundment area exceeds evaporation). Because precipitation and surface runoff within the impoundment area would not consistently exceed evaporation, the impoundment would be designed as a zero-discharge facility and all tailings seepage would be intercepted by the Seepage Collection System or pumpback wells.

Threatened or Endangered Species

Section 230.30 – Threatened and Endangered Species of this analysis provides detailed discussion on the anticipated effects on threatened or endangered species in the Permit Area. In summary, the project:

- May affect, and is likely to adversely affect, the grizzly bear
- May affect, and is likely to adversely affect, the Canada lynx
- May affect, and is likely to adversely affect, the bull trout and designated bull trout critical habitat

ESA compliance would be ensured through Section 7 consultation. The KNF will submit a biological assessment (BA) to the U.S. Fish and Wildlife Service (FWS) that describes the potential effect on threatened and endangered species that may be present in the area. After review of the BA and consultation, the FWS will issue a biological opinion (BO) for the proposed project. If FWS's opinion is "jeopardy," the FWS also will describe reasonable and prudent alternatives to the proposed action, if any.

Requirements to Project Marine Sanctuaries

The project would have no effect on any marine sanctuary.

Section 230.10(c) – Degradation of Waters of the U.S.

Under the Guidelines, effects contributing to significant degradation considered individually or collectively, include:

- Significantly adverse effects of the discharge of pollutants on human health or welfare including, but not limited to, effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites
- Significantly adverse effects of the discharge of pollutants on life stages of aquatic life and other wildlife dependent on aquatic ecosystems, including the transfer, concentration, and spread of pollutants or their byproducts outside of the disposal site through biological, physical, and chemical processes
- Significantly adverse effects of the discharge of pollutants on aquatic ecosystem diversity, productivity, and stability. Such effects may include, but are not limited to, loss of fish and wildlife habitat or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy
- Significantly adverse effects of discharge of pollutants on recreational, aesthetic, and economic values

Human Health or Welfare

The proposed discharges would not significantly adversely affect human health or welfare. All discharges would comply with the human health surface water quality standards. No municipal or private water supplies would be affected by the proposed discharges. Section 230.31 – Fish, Crustaceans, Mollusks, and Other Aquatic Organisms discusses effects on aquatic life. Section 230.30 – Threatened and Endangered Species and Section 230.32 – Other Wildlife discuss the effects on wildlife. Effects on special aquatic sites are discussed in detail in Subpart E – Potential Impacts on Special Aquatic Sites. Discharges would unavoidably fill 8.8 acres of jurisdictional wetlands and 19,160 linear feet of waters of the U.S. Any work in a water of the U.S. along an access road would be completed in compliance with Inland Native Fish Strategy (INFS) standards and guidelines. Streams within the Impoundment Site are not fish-bearing streams, and riffle and pool complexes are not expected to be affected at the Impoundment Site. Negligible areas of riffle and pool complexes may be affected at road crossings. The proposed mitigation plan would adequately compensate for unavoidable effects on fish, other aquatic life, and wetlands, and mitigated effects would not be significantly adverse.

Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems

The proposed discharges would not significantly adversely affect life stages of aquatic life and other wildlife dependent on aquatic ecosystems. The four tributaries in the tailings impoundment site do not provide habitat for fish. Some segments of the tributaries are perennial and provide year-round habitat for amphibians. The wetlands in the impoundment area are seasonally saturated and do not provide year-round aquatic habitat. Wetlands that dry up in the impoundment area provide seasonal habitat for amphibians, and year-round habitat for terrestrial wildlife. The terrestrial wildlife found within the project area do not depend on the aquatic ecosystem. Discharges of fill would eliminate habitat for amphibians and other aquatic species in 19,160 linear feet of waters of the U.S. (approximately 2.1 acres) and 8.8 acres of jurisdictional wetlands. Because surface flow from these tributaries into Libby Creek is infrequent, the reduced flow into Libby Creek would be a negligible effect on the total flow and aquatic habitat downstream on Libby Creek.

MMC's proposed mitigation plan would create about 6 acres of wetlands and associated aquatic habitat near the impoundment site and mitigate for loss of waters of the U.S. Off-site mitigation would restore 20 acres of degraded wetlands. Compensation for lost functions and values of wetlands will be presented in the final mitigation plan for the Montanore Project. Mitigated effects would not be significantly adverse. Mitigation would occur prior to project impacts, which would create a temporal gain for aquatic ecosystems. Other proposed discharges, such as fill for road construction or improvements or water measurements, would have a negligible effect on the life stages of aquatic life and other wildlife dependent on aquatic ecosystems. Discharges for fish habitat mitigation would improve habitat in Libby Creek.

Aquatic Ecosystem Diversity, Productivity, and Stability

The proposed discharges would not significantly adversely affect aquatic ecosystem diversity, productivity, and stability. The waters of the U.S. in the tailings impoundment site do not provide habitat for fish. The wetlands in the impoundment area are seasonally saturated and do not provide year-round aquatic habitat. The functions and services provided by 8.8 acres of jurisdictional wetlands in the impoundment area would be unavoidably lost. Effects on wetlands are discussed in detail in Subpart E – Potential Impacts on Special Aquatic Sites. The proposed mitigation plan would adequately compensate for unavoidable effects on fish, other aquatic life, and wetlands, and mitigated effects would not be significantly adverse. Other proposed discharges, such as fill for road construction or improvements or water measurements, would have an insignificant effect on aquatic ecosystem diversity, productivity, and stability.

The surface waters of the Libby Creek drainage have low concentrations for most dissolved nutrients. Increased nutrient (nitrate and ammonia) concentrations as a result of 402-permitted discharges during all phases except Operations would occur in the Libby Creek drainage. No 402-permitted discharges are expected to occur during the Operations Phase and if they did, the effect on nutrients would be the same or less than the Construction Phase. For 402-permitted discharges, the total inorganic nitrogen (TIN) concentrations in Permit Area streams may increase up to 1 mg/L under the BHES Order. Although the projected TIN concentration would be greater than existing conditions, the ammonia component of TIN would remain well below the applicable ammonia aquatic life standard, indicating no potential toxicity from increased ammonia concentrations.

A TIN concentration greater than 0.233 mg/L may cause an increase in algal growth in Libby Creek, but algal growth may be limited by factors other than nitrogen, such as phosphorus, temperature, or streambed scouring. Increased algal growth associated with total nitrogen concentrations less than 0.233 mg/L would stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations. Whether TIN concentrations greater than 0.233 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. It has been documented that elevated total nitrogen and total phosphorus concentrations can lead to significant seasonal dissolved oxygen decreases along a stream, which would be harmful to fish. Data collected to date indicate that the total phosphorus concentrations in Libby Creek are below those identified by the DEQ's preliminary technical analysis to cause an increase in algal growth. Libby Creek from the U.S. 2 bridge to the Kootenai River is 303(d) listed for sedimentation/siltation that could increase total phosphorus availability in the stream channel.

The BHES Order discussed protection of beneficial uses. On page 5, the Order states "surface 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 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 is observed or lower numeric standards for nutrients were adopted. To address the uncertainty regarding the response of area streams to increased TIN concentrations, MMC would implement the water quality and aquatic biology monitoring, including monitoring for periphyton and chlorophyll-a, monthly between July and September.

Recreational, Aesthetic, and Economic Values

The proposed discharges would not significantly adversely affect recreational, aesthetic, and economic values. The effects of the discharges on recreational, aesthetic, and economic values are discussed in the following sections.

Recreational Values. The proposed discharges at the tailings impoundment area would reduce public recreational access. Snowmobile and cross-country skiing use of the Libby Creek Road and parts of Upper Libby Creek Road during construction, and of the Bear Creek Road during mine life would be eliminated. Road closures also would be implemented throughout the Permit Area to mitigate for the effects on the grizzly bear. The overall character of the trail user experience would be reduced in the Libby Creek drainage due to noise, traffic, and visual effects associated with the proposed facilities. These effects, combined with increased knowledge of, and access to, the general analysis area, would likely displace some dispersed recreation (hunting, hiking, and camping) to other areas of the forest. Individuals who are currently accustomed to these areas may use other areas of the forest with fewer visitors and developed facilities.

During mine operations, the level of mine facility development would change the recreational opportunity from less developed to more developed recreation settings for some portions of the Permit Area. These changes would likely displace some recreationists seeking a more remote and dispersed recreational experiences.

Waters of the U.S. affected by the Impoundment Site are not fish-bearing and do not provide recreational fishing access. The project would not affect recreational fishing opportunities. Construction of habitat structures in Libby Creek would improve fish habitat and may increase recreational fishing opportunities on those streams. The project would comply with all applicable criteria for recreation in the KFP.

Aesthetic Values. The discharges at the tailings impoundment area would alter scenic integrity over the short term from key observation points and portions of the CMW. The impoundment's relatively large size would create noticeable contrasts in landscape character and substantial alterations in scenic integrity. Scenic integrity and landscape character from the private land parcel due east of the impoundment dam, about 350 feet between the dam and nearest property line, would be permanently and substantially altered. Scenic integrity would be reduced in westerly views from the north end of the private parcel due to a mostly unobstructed view of the 270-foot-high impoundment dam face. Scenic integrity would be moderately reduced in northwesterly views from the southern portion of this parcel due to the increasing screening effects of the forest with increasing distance from the impoundment. Following the mine closure in the future, revegetation of the tailings impoundment would partially reduce color and texture contrasts between the tailings impoundment and surrounding landscape. Other proposed discharges, such as fill for road construction or improvements or water measurements, would have a negligible effect on aesthetic values. The project would comply with all applicable criteria for visual quality in the KFP.

Economic Values. The project would beneficially affect economic values. Estimated total employment during the construction phase would be 581 jobs at Year 3. About 21 percent of the direct employment would be construction related and the remainder attributable to operations. Employment during the Operations Phase would vary with the production rate. For production Years 4 through 8, total employment would vary from about 500 jobs in Year 4 to about 400 jobs in Years 5 through 8. Secondary employment would account for about 190 jobs in Year 4 and would drop to about 150 jobs during Years 5 through 8. In Year 9, the production rate is expected to increase from 12,500 tons per day to 17,000 tons per day. Direct mine employment would increase from 246 jobs to 450 jobs during this production increase. Secondary employment also would increase from about 150 jobs to 260 jobs. When production increases from 17,000 tons per day to 20,000 tons per day, direct employment would remain at 450 jobs and secondary employment would increase slightly.

At Year 3 of the proposed project, direct labor income would be about $15.9 million and total income would be about $22.2 million. About 23 percent of the direct labor income would be construction related and the remainder would be attributable to operations. The 23-person crew required for construction of the 230-kV transmission line would account for about 35 percent or $1.3 million of the direct labor income for construction in each of the Years 3 and 4. Estimated total labor income would range from a low of $16.1 million in project Years 5 through 8 to a peak of $29.2 million in Years 14 through 19 during the Operations Phase. The increased labor income would correspond to the expansion in mine production. In general, with the exception of Years 5 through 8, estimated total labor income would exceed $20 million. On a per-job basis, direct annual labor income for construction and operations employment would average about $57,000 and $50,000, respectively. Annual labor income for secondary employment would be about $26,000 per job.

Net impacts to local governments would start with a $180,242 deficit in Year 1, followed by net surpluses starting in Year 2 with a net surplus of about $4.8 million in Year 5. MMC's proposed mitigation of $180,000 would mitigate for the Year 1 fiscal deficit. While not directly affected by the project, Sanders County would receive $208,000 in gross proceeds tax in Year 4 and $546,000 in Year 5.

Section 230.10(d) – Appropriate and Practical Steps to Minimize Potential Adverse Impacts

This analysis is based on preliminary designs that include a variety of appropriate and practical measures to minimize potential adverse impacts. These measures are discussed in Subpart H – Actions to Minimize Adverse Effects. During final design, MMC would implement all appropriate and practical measures to avoid and minimize discharges into waters of the U.S. Before construction, MMC would submit final design plans to the agencies for approval.

Section 230.11 – Factual Determinations

The factual determinations of the potential short-term or long-term, direct and secondary effects of the proposed discharges on the physical, chemical, and biological components of the aquatic environment are described in Subpart C – Potential Impacts on the Physical and Chemical Characteristics of the Aquatic Ecosystem through Subpart F – Potential Effect on Human Use Characteristics. These sections address Sections 230.11(a) through 230.11(e) and Section 230.11(h).

Section 230.11(f) – Proposed Disposal Site Determinations

A mixing zone is not anticipated for any 404-permitted discharge. During the MPDES permitting process for the 402-permitted discharges, the DEQ would determine if the groundwater and surface water mixing zones in the current MPDES permit would be renewed.

Section 230.11(g) – Determination of Cumulative Impacts to the Aquatic Ecosystem

The Montanore and Rock Creek projects, assuming they occurred concurrently, would cumulatively reduce flows in the Rock Creek and East Fork Bull River watersheds. No other aspects of the two projects would have cumulative effects on surface water resources. The cumulative effects would result in additional habitat loss downstream of Rock Lake and St. Paul Lake, including during the bull trout spawning period. The cumulative effects of the project with all other reasonably foreseeable actions would not be significant.

SUBPART C – POTENTIAL IMPACTS ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Section 230.20 – Physical Substrate Determinations

The substrate of the aquatic ecosystem underlies open waters of the U.S. and constitutes the surface of wetlands. It consists of organic and inorganic solid materials and includes water and other liquids or gases that fill the spaces between solid particles (40 CFR 230.20(a)).

Four tributaries of Libby Creek in the Impoundment Site (WUS-3a, 5a, 10a, and 14) flow east toward Libby Creek Figure 4. The four tributaries comprise a small, 996-acre watershed of Libby Creek, and Libby Creek is a third-order stream where the four tributaries flow toward Libby Creek. The watershed of Libby Creek, upstream of and including the watershed of the four unnamed tributaries, is 23,245 acres. Major tributaries of Libby Creek upstream of the Impoundment Site are Poorman Creek, Ramsey Creek, Howard Creek, and Midas Creek.

Based on the Corps' 2008 preliminary jurisdictional determination, the four tributaries are subject to the Corps' jurisdiction (Corps 2008a). The jurisdictional status of the wetlands and other waters of the U.S., including the four tributaries, may change when the Corps completes an approved jurisdictional determination. All four tributaries originate at springs in the impoundment area and consist of mostly perennial reaches on the upper portion of the watershed and intermittent reaches closer to Libby Creek. Some of the tributaries may not have a surface flow connection through a channel with an ordinary high water mark or defined bed and bank to Libby Creek. In 2011, additional data are being collected on the tributaries to assist the Corps in making an approved jurisdictional determination.

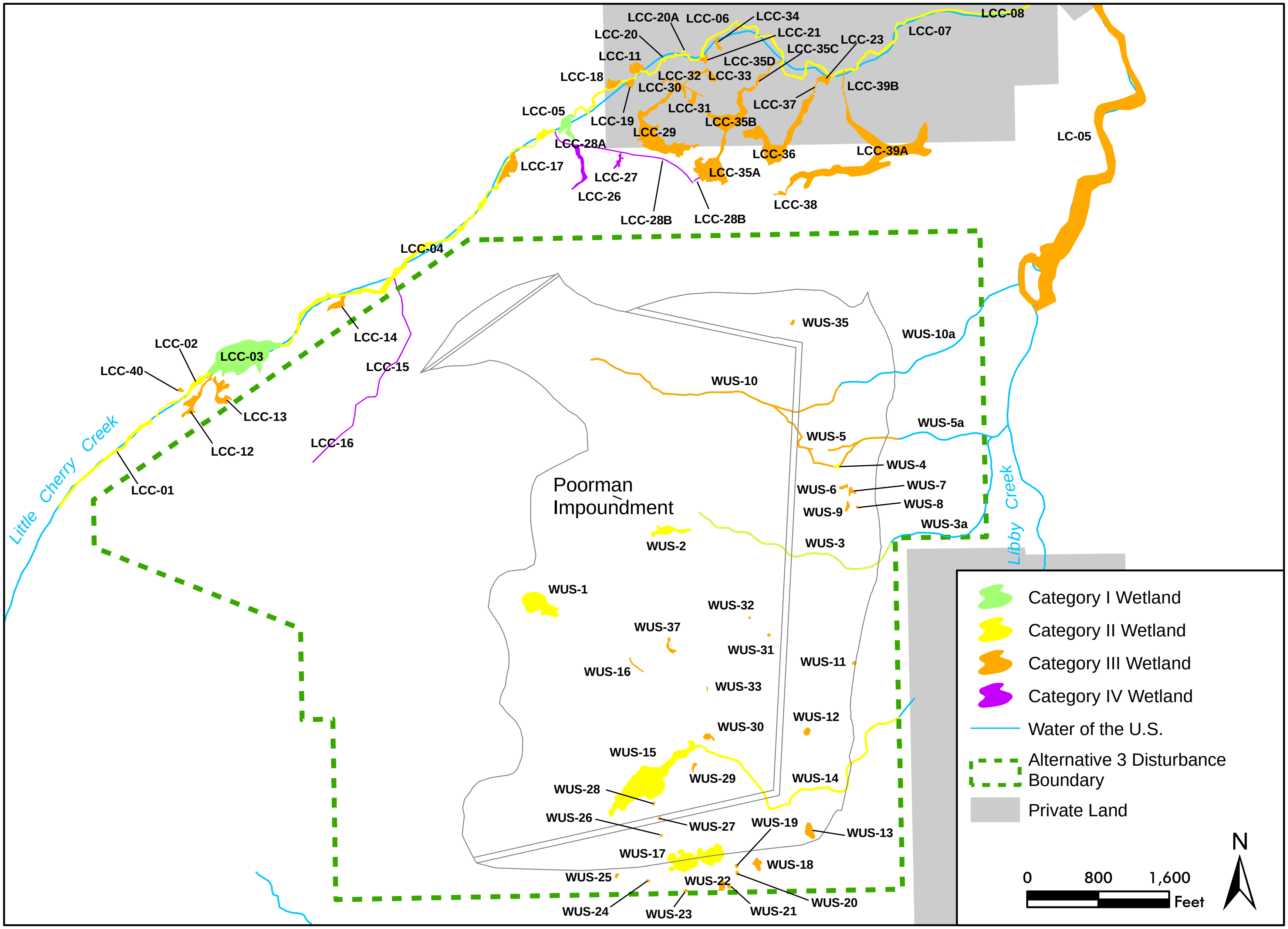

Figure 4. Wetlands and Other Waters of the U.S. in Poorman Impoundment Site

The upper reaches of the four tributaries have wetlands along the channel. Other potentially jurisdictional and isolated wetlands occur within the project area. Fill material would be placed in 19,160 linear feet of waters of the U.S. and up to 12.2 acres of seasonally saturated and semipermanent aquatic habitat, of which 3.4 acres would be isolated wetlands (Table 2). Discharge of waste rock and fill at the Impoundment Site would unavoidably fill 8.6 acres of wetlands and 18,357 linear feet of waters of the U.S. Road construction and reconstruction would unavoidably fill 0.2 acre of wetlands and 803 linear feet of substrate of waters of the U.S. The substrate elevation would be altered, and substrate functions would be eliminated. Proposed construction of new roads to provide access, and improvements of existing roads would require the discharge of fill and man-made materials, such as corrugated metal pipe and fill. These discharges would adversely affect bottom-dwelling organisms at the site by smothering immobile forms or forcing mobile forms to migrate. Benthic forms present prior to a discharge are unlikely to recolonize on the discharged material. The effect on substrate from other proposed discharges, such as materials for sediment control structures or water measurement devices, would be minimal.

Table 2. Wetlands and Waters of the U.S. within Preferred Alternative Disturbance Areas.

Facility	Area of Jurisdictional Wetlands (acres)§	Area of Isolated Wetlands (acres)§	Length of Other Waters of the U.S. (linear feet)	Area of Other Waters of the U.S. (acres)
Impoundment Site	8.6	3.3	18,357	1.3
Plant Site	0.0	0.1	0	0.0
Roads	0.2	<0.1	803	0.9
Libby Adit Site	0.0	<0.1	0	0.0
Total	**8.8**	**3.4**	**19,160**	**2.1**

The jurisdictional status of the wetlands and other waters of the U.S. is preliminary and impacts may change when the Corps completes an approved jurisdictional determination.
§Area of streams has been subtracted from the area of wetlands.
Totals may vary due to rounding.

Section 230.21 – Suspended Particulates/Turbidity

Suspended particulates in the aquatic ecosystem consist of fine-grained mineral particles (usually smaller than silt) and organic particles. Suspended particulates may enter water bodies as a result of land runoff, flooding, vegetative and planktonic breakdown, resuspension of bottom sediments, and human activities including dredging and filling. Particulates may remain suspended in the water column for variable lengths of time from factors such as agitation of the water mass, particulate specific gravity, particle shape, and physical and chemical properties of particle surfaces (40 CFR 230.21(a)).

Proposed discharges, such as associated with road construction or reconstruction, instream structures, or water measurement devices, would increase turbidity at the discharge site for a short period during construction. The effect of a short-term increase in suspended particulates and turbidity on aquatic life would be minor. The DEQ would authorize the increase through a 318 authorization.

To minimize sediment reaching streams, MMC would implement and maintain all appropriate BMPs for roads during their use by the project. Appropriate BMPs would be those that: 1) disconnect road surfaces and drainage ditches from streams; 2) shorten road surface lengths draining to surface waters; 3) seed and revegetate disturbed soils; and 4) harden road surfaces. BMPs that accomplish these would be the most effective way to minimize sediment delivery from affected forest roads.

Surface water monitoring would include regular sampling for total suspended sediments and turbidity. MMC would inspect the BMPs at least once every 14 calendar days, and within 24 hours after any precipitation event of 0.5 inch or greater or within 24 hours after a snowmelt event that produced visible runoff at the construction site. MMC would maintain the BMPs so that they remain effective. Post-Construction, BMPs would be inspected at least monthly (during the snow-free period) until revegetation was successful and, as during construction, within 24 hours after any precipitation event of 0.5 inch or greater or a snowmelt event that produces visible runoff. Inspection and monitoring of stormwater BMPs would continue until the areas disturbed during construction were finally stabilized. If the agencies were to observe increased suspended sediment concentrations that could not be explained by natural events such as snowmelt or large precipitation events, the agencies would investigate the source of the increased sediment load to the stream. If the agencies determined that sediment discharge was occurring to a stream from a construction or post-construction mine or transmission line site, MMC would be required, after notification from the agencies, to implement measures to eliminate the sediment source to the stream within 24 hours. These measures would minimize the effect of suspended sediment on aquatic life.

Section 230.22 – Water

Water is the part of the aquatic ecosystem in which organic and inorganic constituents are dissolved or suspended. Water constitutes part of the liquid phase and is contained by the substrate. Water forms part of a dynamic aquatic life-supporting system. Water clarity, nutrients and chemical content, physical and biological content, dissolved gas levels, pH, and temperature contribute to its life-sustaining capabilities (40 CFR 230.22(a)).

None of the 404-permitted discharges would affect nutrients and chemical content, physical and biological content, dissolved gas levels, pH, or temperature of receiving waters. The suitability of receiving waters for populations of aquatic organisms, and for human consumption, recreation, and aesthetics would not be affected. Certain water characteristics would be affected by 402-permitted discharges. These effects are described in the following sections.

Nutrients and Chemical Content

MMC would treat excess water at the existing Water Treatment Plant prior to discharge at one of three MPDES-permitted outfalls. The treatment plant would be modified to treat nutrients, and if necessary, dissolved metals. Water discharged from the Water Treatment Plant would not cause an exceedance in BHES Order nondegradation limits or water quality standards for any parameter downstream of the mixing zone. To ensure protection of beneficial uses, MMC would implement the water quality and aquatic biology monitoring, such as monitoring for periphyton and chlorophyll-a monthly between July and September.

Temperature

The temperature of the discharge of mine and adit water during the Evaluation and Construction phases is expected to be between 13°C and 15°C. The temperature of the tailings water discharge during the Closure and Post-Closure phases is expected to be close to ambient temperature at the time of discharge. Discharges would be to either groundwater or surface water from the Water Treatment Plant at the Libby Adit Site. For all discharges, the DEQ would determine during the MPDES permitting process effluent limits for each outfall that were protective of aquatic life. Temperatures in all receiving surface waters downstream of the outfalls would be monitored during water resources and aquatic biology monitoring.

Other Characteristics

Water clarity is discussed in Section 230.21 – Suspended Particulates/Turbidity. The proposed discharges would not affect dissolved gas levels or pH.

Section 230.23 – Current Patterns and Water Circulation

Current patterns and water circulation are the physical movements of water in the aquatic ecosystem. Currents and circulation respond to natural forces as modified by basin shape and cover, physical and chemical characteristics of water strata and masses, and energy-dissipating factors (40 CFR 230.23(a)).

This section describes the direct effects of 404-permitted discharges, 402-permitted discharges, and the indirect effects of the project on current patterns and water circulation. In this section, potentially affected streams on the east of the Cabinet Mountains; Libby Creek and its perennial tributaries; Ramsey, Poorman, and Little Cherry creeks; the Fisher River and its perennial tributaries such as Hunter, West Fisher, and Miller creeks; and other perennial, intermittent, and ephemeral waters of the U.S. are referred to as “east side streams.” Potentially affected streams on the west side of the Cabinet Mountains; East Fork Rock Creek; Rock Creek; East Fork Bull River; Placer Creek; and other perennial, intermittent, and ephemeral waters of the U.S. are referred to as “west side streams.”

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. Both models are limited by simplifying assumptions and limited data with which to calibrate the model. A groundwater model also was used to assess effects in the tailings impoundment area.

With the data currently available, the model results provide a plausible range of dewatering and pumping rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using groundwater models. Both 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 to surface water resources in the project area, including simulation of mitigation measures, could change and would have greater certainty.

East Side Streams

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 except the Operations Phase 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. 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.

The Impoundment Site would be located in the watersheds of four small tributaries to Libby Creek. Discharges of materials at the Impoundment Site would require diversion of runoff from watersheds above the impoundment to either Poorman Creek or Little Cherry Creek during the Construction, Operations, and Closure phases. Any flow within the watershed above the impoundment would be routed to Poorman Creek or Little Cherry Creek. Water from above the Impoundment Site and Plant Access Road would be diverted either to Poorman Creek or Little Cherry Creek, increasing the watershed of both creeks by about 3 percent. Average annual flow in both creeks would increase by about 3 percent. The watersheds of the tributaries in the Impoundment Site would be reduced by about 85 percent during Operations. Flow in the four tributaries in the Impoundment Site, which is currently perennial in upper reaches and intermittent in lower reaches, would rarely occur during Operations. The mitigation plan would mitigate the loss of the functions of the tributaries.

Flow in Poorman Creek would decrease slightly during the Operations through the early Post-Closure phases due to mine inflows. Flow in lower Poorman Creek would be reduced during the Operations through Post-Closure phases from a pumpback well system around the Impoundment Site. Flow in Poorman Creek would return to existing rates after groundwater levels reached steady state conditions and the pumpback well system ceased operations. Flow in lower Poorman Creek would be reduced during the Operations through Post-Closure phases from a pumpback well system around the Impoundment Site.

After the surface of the impoundment was reclaimed and runoff was no longer subject to effluent limit guidelines, 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 be stable and would be covered with coarse rock to prevent erosion. The channel section through the abutment would be backfilled with a porous dam section designed to retain the Probable Maximum Flood and dissipate the flood water at a flow rate of 2 cubic feet per second (cfs) or within a 60-day period, whichever flow rate is the greater. The watershed area of Little Cherry Creek would increase by 644 acres, an increase of 44 percent. Because water would either infiltrate or evaporate, average annual flows in Little Cherry Creek would increase slightly (about 0.01 cfs). The larger watershed would increase runoff during storm events, but would not affect low flow. As part of the final closure plan, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed diversion channel based on the final mine plan, 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. A part of the agencies' mitigation plan for waters of the U.S. is to minimize effects on channel stability in the tributary of Little Cherry Creek. The average annual flow in Libby Creek between Poorman Creek and Little Cherry Creek would decrease by 3 percent as result of the diversion of runoff to Little Cherry Creek.

Discharges of fill for road improvement and new road construction, fish habitat structures, and water measurement devices would have a minor effect on current patterns and water circulation. Most new roads would be associated with the transmission line and would involve short crossings of intermittent or ephemeral waters of the U.S. Road improvements along Libby Creek Road (NFS road 231) or Bear Creek Road (NFS road 278) and for transmission line access would require replacement of existing culverts or installation of new culverts. Current patterns and water circulation would be altered for short distances at each crossing.

Discharges of large rocks and logs for fish habitat structures to improve fish habitat for bull trout, an endangered species, would have a minor effect on current patterns and water circulation in Libby Creek. Water measurement devices would be installed in Libby Creek and in alpine lakes, such as Wanless Lake. The fill for water measurement devices in area streams would have a minor effect on current patterns and water circulation; the fill in alpine lakes would have no effect on current patterns and water circulation.

West Side Streams

In general, the project would reduce streamflow in East Fork Rock Creek and East Fork Bull River during the Evaluation through early Post-Closure phases. 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 1,200 to 1,300 years, $7Q_2$ and $7Q_{10}$ flows in upper East Fork Rock Creek (above Rock Lake) would be permanently reduced. Without mitigation, $7Q_2$ and $7Q_{10}$ flow in East Fork Rock Creek, Rock Creek, and East Fork Bull River would be permanently reduced. Mitigation would reduce post-mining effects to 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.

Lakes

Without mitigation, the 3D model predicts the lowest water table elevation in the vicinity of Rock Lake would occur 16 years after the adits were plugged, and would be below the bottom of Rock Lake. During baseflow periods (late summer/early fall and winter), the 3D model predicts the creek above Rock Lake would be dry, and there would be no groundwater inflow to the lake. The model predicts that when the water table is below the bottom of the lake, water stored in Rock Lake would flow along bedrock fractures toward the mine void as it filled. The model predicts that this would occur for about 135 years post-mining. After the mine void filled and the groundwater table reached steady state (1,172 years after mining ceased), baseflow in the creek above Rock Lake would be reduced by 50 percent and groundwater inflow to Rock Lake would be permanently reduced.

With mitigation, the 3D model predicts the lowest water table elevation would be above the bottom of Rock Lake. During baseflow periods (late summer/early fall and winter), the 3D model predicts the creek above Rock Lake would be dry, and groundwater inflow to the lake would be reduced. Because the groundwater table would be above the lake bottom, water stored in the lake would not flow from the lake toward the mine void. After the mine void filled and the groundwater table reached steady state conditions (1,322 years after mining ceased), baseflow in the creek above Rock Lake would be reduced by 25 percent and groundwater inflow to Rock Lake would be permanently reduced.

The reduction in groundwater inflow without mitigation is predicted to occur at a maximum rate of 0.29 cfs at 16 years after mine closure and 0.03 cfs at steady state conditions post-closure. Because of the loss of water stored in Rock Lake, the total effect at 16 years after mine closure would be a rate of water loss from Rock Lake of 0.44 cfs. The reduction in groundwater inflow to the lake with mitigation is predicted to occur at a maximum rate of 0.17 cfs at 16 years after mine closure, and 0.01 cfs is predicted to occur at steady state conditions post-closure. No lake storage reduction is predicted to occur with mitigation.

The estimated reduction in lake volume and water level would be greatest 16 years after mining ceased and the adits were plugged, and would gradually decrease after that time. During the late summer/early fall period, without mitigation, the volume of the lake would be reduced by a maximum of about 4 percent and the lake level would decline by 1.2 feet. Without mitigation, after the mine void filled and groundwater levels stabilized, Rock Lake would have a permanent volume reduction estimated to be less than 1 percent of the full lake volume and a lake level reduction of about 0.1 foot. With mitigation, the volume of the lake would be reduced by a maximum of 1.6 percent and the lake level would decline by 0.5 foot. With mitigation, the volume and level of Rock Lake at steady state conditions would return to pre-mining conditions.

During the 7-month winter period, the lake volume would be reduced by an estimated maximum of 5 percent and the lake level would decline by about 1.5 feet. The permanent effect on the lake (after groundwater levels stabilized post-closure) during the 7-month winter period would be a reduced groundwater inflow to the lake of about 10 percent, which would result in 10 percent less outflow from the lake into the East Fork Rock Creek. The volume or level of the lake would not be affected. With mitigation, there would be no permanent effect to the volume or level of Rock Lake, or to groundwater inflow to the lake and surface water outflow from the lake.

St. Paul Lake is located within glacial moraine material, which causes the lake level to fluctuate to a much greater extent than Rock Lake. St. Paul Lake may be affected by mining, but effects predicted by the 3D model would likely not be separable from the large natural lake level variations. Because the Libby Lakes are at an elevation of about 7,000 feet and perched above the groundwater table, they likely would not be affected by mining activities. MMC would monitor lower Libby and St. Paul lakes. Howard Lake is at an elevation of 4,100 feet and southeast of the Libby Adit, and would be too far from mining activities to be affected. Ramsey Lake, near the proposed Ramsey Plant Site and the Ramsey Adits proposed in Alternative 2, is at an elevation of about 4,450 feet. Ramsey Lake is fed mostly by snowmelt and water flowing in shallow surface deposits in the Ramsey Creek drainage. The Ramsey Lake level varies substantially and changes in the lake level due to mining probably would not be detectable.

Section 230.24 – Normal Water Fluctuations

Normal water fluctuations in a natural aquatic system consist of daily, seasonal, and annual tidal and flood fluctuations in water level. Biological and physical components of such a system are either attuned to or characterized by these periodic water fluctuations (40 CFR 230.24(a)).

The project would indirectly alter streamflow in Rock Creek, East Fork Bull River, and Libby Creek and their tributaries. These changes are expected to be minor and would have no notable effect on channel morphology.

Section 230.25 – Salinity Gradients

Salinity gradients form where salt water from the ocean meets and mixes with fresh water from land (40 CFR 230.25(a)). The Permit Area is not in or near an ocean and salinity gradients would not be affected by the proposed project.

SUBPART D – POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Section 230.30 – Threatened and Endangered Species

An endangered species is a plant or animal in danger of extinction throughout all or a significant portion of its range. A threatened species is one in danger of becoming an endangered species in the foreseeable future throughout all or a significant portion of its range. Listings of threatened and endangered species as well as critical habitats are maintained by some individual states and by the FWS (40 CFR 230.30(a)). The threatened or endangered species potentially affected in the Permit Area are the bull trout, grizzly bear, and Canada lynx. No federally threatened or endangered listed plant species are found in the Permit Area.

Bull Trout

Bull trout populations and designated critical habitat in the Libby Creek, East Fork Rock Creek, Rock Creek, and East Fork Bull River drainages would be adversely affected by the project. 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 may decrease. Increased nutrient and metal concentrations may affect the critical habitat in Libby Creek during all phases except Operations. If subsurface flow that reaches Libby Creek is eliminated from the tributaries in the Impoundment Site, slight changes in water temperature may adversely affect bull trout habitat along the reach below the Impoundment Site.

Grizzly Bear

The Permit Area is in the Cabinet-Yaak Ecosystem of the Grizzly Bear Recovery Zone. The Grizzly Bear Recovery Zone is comprised of planning areas called Bear Management Units, or BMUs. A BMU is an area of land containing sufficient quantity and quality of all seasonal habitat components to support a female grizzly. Areas outside of the Grizzly Bear Recovery Zone where recurring grizzly bear use has been documented have been delineated as bears outside recovery zone (BORZ) polygons.

The agencies used six measurable criteria to assess effects on the grizzly bear: percent core habitat, percent open motorized route density (OMRD), percent total motorized route density (TMRD), linear open road density, percent habitat effectiveness (HE), and displacement effects. Because percent OMRD, percent TMRD, and linear open road density are all a function of open roads, only percent OMRD is discussed in this analysis. The reader is referred to Section 3.25.5, Threatened, Endangered, and Proposed Species in the EIS for a complete analysis of effects on threatened and endangered wildlife species. Impacts to grizzly bears in the BORZ were evaluated based on predicted changes in habitat quality, including displacement effects, changes in road densities, and potential for increased food attractants. Physical losses of grizzly bear habitat were evaluated for the entire Permit Area. The effects of the project on the grizzly bear are described by habitat parameter below. Effects in BMU 2 would be limited to additional displacement effects from increased road use and are not discussed further.

Physical Habitat Loss

The project would result in the physical loss of 1,537 acres of grizzly bear habitat due to the construction of mine facilities, new or upgraded roads, and the Sedlak Park Substation. Construction and improvement of access roads during transmission line construction would temporarily remove habitat. All areas disturbed during transmission line construction would be seeded with grass and shrub species after transmission line construction. Once revegetated, disturbed areas of the transmission line would provide additional forage habitat as forage species become established.

The agencies' proposed land acquisition requirements for grizzly bear mitigation would mitigate impacts of physical habitat loss. The land acquisition requirement is 3,074 acres for the agencies' preferred mine and transmission line alternatives. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. The land acquisition requirement would protect habitat from habitat alteration resulting from regional increases in land development and would likely increase grizzly bear HE through road access changes and elimination of sources of grizzly bear disturbance. The mitigation plan also requires that MMC contribute funding to support monitoring of bear movements and population status in the Cabinet Mountains to confirm the effectiveness of habitat acquisition in mitigating the effects of grizzly bear habitat loss. If monitoring indicated that proposed habitat acquisition was not adequate, mitigation measures would be developed to address issues identified through monitoring.

Included in the physical loss of 1,537 acres would be 16 acres of wetlands and riparian areas in the mine area that provide potential grizzly bear feeding areas, particularly during the spring. The agencies' mitigation for wetlands and riparian areas would partially mitigate for the loss of grizzly bear feeding areas. The Swamp Creek Mitigation Site is outside of the Recovery Zone and the Grizzly Bear Outside the Recovery Zone Reoccurring Use Areas. The agencies' proposed land acquisition requirements for grizzly bear mitigation would likely contain sufficient wetlands and riparian areas to offset the loss of grizzly bear feeding areas in the mine area.

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 restricted), or motorized trail open during the active bear season. Core habitat may contain restricted roads, but such roads must be effectively closed with devices including, but not limited to, earthen berms, barriers, or vegetative growth. Federal agencies will work toward attaining a core area of at least 55 percent in the BMU and will allow no loss of core areas on federally-owned land within the BMU.

About 14 acres of core habitat would be physically lost in BMU 5, primarily due to the construction of the tailings impoundment. Use of new or opened roads would reduce the effectiveness of core habitat in BMU 5 on 228 acres. Use of new or opened roads would not reduce effectiveness of core habitat in BMU 6.

The agencies' proposed road access changes included in the mitigation plan would create core habitat. Core habitat in BMU 5 would be improved from current levels (60 percent) to between 65 and 66 percent during construction, operations, and closure. Core habitat in BMU 6 (54 percent) currently is below the goal of 55 percent. Through access changes, core would increase to 57 percent during construction, operations and closure.

The agencies' proposed land acquisition requirements for grizzly bear mitigation also would reduce impacts to core habitat. Parcels that might otherwise be developed in a manner inconsistent with bear needs would be acquired by MMC, conveyed to the KNF, and managed for grizzly bear use in perpetuity. The land acquisition requirement has the potential to increase core habitat through access changes on acquired land.

Open Motorized Route Density

OMRD is a measure of the density of roads or trails in a BMU that are open for motorized access. Best science indicates that OMRD greater than 1 mi/mi^2 should not exceed 33 percent of a BMU. Federal agencies will allow no net increase in OMRD on federally-owned land within the BMU. Compliance with OMRD direction is based on densities at mine closure.

Currently, OMRD in BMU 5 is 27 percent and 35 percent in BMU 6. OMRD in BMU 5 would increase by 1 percent during Construction and Operations, and decrease by 1 percent after Closure. In BMU 6, percent OMRD would not change from existing conditions in any phase of the project. The land acquisition requirement has the potential to decrease long-term OMRD conditions in BMUs 2, 5, and 6 through access changes on acquired land.

Habitat Effectiveness and Displacement Effects

HE is the amount of secure grizzly bear habitat (habitat at least 0.25 mile from open roads, developments, and high levels of human activity during the active bear year) remaining within a BMU after affected areas and Management Situation 3 lands (where grizzly bear presence is possible but infrequent) are subtracted from the total habitat in the BMU. Management Situation 3 lands are areas of high human use where grizzly bear presence is possible but infrequent and where conflict minimization is a high priority management consideration. Grizzly bear presence and factors contributing to their presence will be actively discouraged.

HE is calculated for all lands within an affected BMU, regardless of ownership. In calculating HE, the extent of a zone of influence depends on the type of activity. HE should be maintained equal to or greater than 70 percent of the BMU.

In BMU 5, HE is currently 72 percent. The project would reduce HE to 69 percent during construction and to 70 percent during operations, and HE would return to existing levels at closure. At 66 percent, HE in BMU 6 is currently worse than the standard. HE in BMU 6 would be reduced to 60 percent during construction, mostly due to the temporary effects of helicopter construction, returning to existing levels during operations and closure. Impacts to HE during all three phases would be reduced through the land acquisition requirements for grizzly bear mitigation. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. The land acquisition requirement would likely result in a net gain in grizzly bear HE, through access changes and elimination of sources of grizzly bear disturbance, where possible.

Mine construction and operations, road construction and use, and helicopter use would temporarily increase displacement effects to bears inside the recovery zone. The zone of influence for combined action alternative activities would include currently undisturbed areas as well as areas currently being affected by human activities such as road use or activities on private land. Within the recovery zone, temporary new displacement effects to undisturbed grizzly bear habitat would occur on 6,250 acres. Additional temporary displacement effects to currently affected grizzly bear habitat would occur on 7,097 acres. The majority of displacement effects would be due to helicopter activities. Road access changes included in the mitigation plan would provide 13,400 acres of habitat, which is 4,772 more acres than required to compensate for displacement impacts.

Canada Lynx

The impacts analysis for the Canada lynx follows the objectives, standards, and guidelines established in the Northern Rockies Lynx Management Direction (Lynx Amendment). Standards are evaluated for Lynx Analysis Unit that approximate a lynx home range size. The project would affect 283 acres of lynx habitat. The project would comply with all Lynx Amendment standards with the following exception. The project would affect 54 acres of multistory or late-successional forest snowshoe hare (lynx denning) habitat and would not meet the standard associated with this habitat. Impacts to multistory or late-successional forest would be offset through enhancement of 558 acres of lynx stem exclusion habitat and implementation of the Vegetation Removal and Disposition Plan.

Section 230.31 – Fish, Crustaceans, Mollusks, and Other Aquatic Organisms

Aquatic organisms in the food web include, but are not limited to, finfish, crustaceans, mollusks, insects, annelids, planktonic organisms, and the plants and animals on which they feed and depend upon for their needs. All forms and life stages of an organism, throughout its geographic range, are included in this category (40 CFR 230.31(a)).

Fill material would be placed in 19,160 linear feet of waters of the U.S. and up to 12.2 acres of seasonally saturated and semipermanent aquatic habitat, of which 3.4 acres would be isolated wetlands (see Section 230.41 – Wetlands). Discharge of fill into wetlands and other waters of the U.S. would eliminate local populations of aquatic organisms within the Impoundment Site. At access roads, the effects would be on a smaller scale and may only affect a small percentage of aquatic organism populations. If some organisms complete an early life stage within the Impoundment Site and migrate to other areas, the fill would disrupt the advancement of life stages and would have an indirect effect on aquatic life in other areas. Construction of stream crossings for transmission line access roads would require discharge of minor amounts of material into aquatic habitat. The effect on aquatic organisms would be minor. Implementation of BMPs and Environmental Specifications for the transmission line would minimize adverse effects. Many effects on aquatic habitat and organisms would be indirect from changes in water quantity and quality and barriers to movement. Indirect effects are discussed in the following sections.

Water Quantity and Quality

In general, reductions in streamflow in Libby Creek, East Fork Rock Creek, Rock Creek, and East Fork Bull River during one or more mining phases would decrease available aquatic habitat. During the Evaluation and Construction phases, 402-permitted discharges in upper Libby Creek below the Libby Adit would increase streamflow in Libby Creek and would increase available aquatic habitat.

Increased concentrations of some metals, total dissolved solids, and nutrients as a result of 402-permitted discharges during all phases except Operations would occur in the Libby Creek drainage. A TIN concentration greater than 0.233 mg/L may cause an increase in algal growth in Libby Creek, but algal growth may be limited by factors other than nitrogen, such as phosphorus, temperature, or streambed scouring. Increased algal growth associated with total nitrogen concentrations less than 0.233 mg/L would stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations. Whether TIN concentrations greater than 0.233 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. It has been documented that elevated total nitrogen and total phosphorus concentrations can lead to significant seasonal dissolved oxygen decreases along a stream, which would be harmful to fish. Data collected to date indicate the total phosphorus concentrations in Libby Creek are below those identified by the DEQ’s preliminary technical analysis to cause an increase in algal growth. Libby Creek from the

U.S. 2 bridge to the Kootenai River is 303(d) listed for sedimentation/siltation that could increase total phosphorus availability in the stream channel. To address the uncertainty regarding the response of area streams to increased TIN concentrations, MMC would implement the water quality and aquatic biology monitoring, including monitoring for periphyton and chlorophyll-a monthly between July and September.

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 could not exceed the chronic aquatic life standard of 0.00285 mg/L. Potential effects to aquatic life from an increase in copper concentrations are difficult to determine given recent uncertainties regarding the protectiveness of the hardness-modified copper standard and existing instream copper concentrations. Typical groundwater and snowmelt-fed mountain streams would be expected to have low dissolved organic carbon concentrations that make dissolved copper bioavailable and potentially toxic. Predicted increased nitrogen concentrations may increase primary productivity and likely increase dissolved organic carbon concentrations, which may offset potential toxic responses due to increased copper concentrations. Furthermore, measured instream copper concentrations are either at or near minimum laboratory detection limits, creating some uncertainty with any change in concentration from existing conditions.

Fish Barriers

All bridges proposed for construction or upgrades would comply with INFS standards and guidelines and would not impact fish passage. Additionally, culverts along a 13-mile segment of Bear Creek Road and along a 1.4-mile segment of Libby Creek Road would be replaced as necessary to allow for fish passage. Culvert removal associated with access changes would improve fish passage in affected drainages.

Decreased base flows predicted to occur in the upper Rock Creek and East Fork Bull River drainages may reduce available bull trout and westslope cutthroat trout 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, dewatered reaches of Rock Creek have been observed during low-flow periods under existing conditions, and these reaches might remain dewatered for longer periods and/or the length of stream dewatered 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 thought to be comprised primarily of resident fish, but migrant bull trout also have been observed. To some extent, the dewatered reaches may be protecting the resident bull trout population in Rock Creek from hybridization or competition with nonnative fish by limiting nonnative fish access to Rock Creek from the lower Clark Fork River.

The mitigation plan includes replacement of culverts in Poorman and Little Cherry creeks, which would improve fish passage in these two streams.

Section 230.32 – Other Wildlife

Wildlife associated with aquatic ecosystems are resident and transient mammals, birds, reptiles, and amphibians (40 CFR 230.32(a)).

The project would disturb habitat of various resident and transient mammals, birds, reptiles, and amphibians throughout the Permit Area. Larger wildlife, such as elk or moose, would be displaced by surface disturbance and human activity. Temporary displacement could result in increased mortality from vehicle collisions and increased resource competition. Populations of smaller wildlife would be affected by displacement and mortality. Section 3.25 of the EIS describes effects on other wildlife.

SUBPART E – POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES

Section 230.40 – Sanctuaries and Refuges

Sanctuaries and refuges consist of areas designated under state and federal laws or local ordinances to be managed principally for the preservation and use of fish and wildlife resources (40 CFR 230.40(a)). No sanctuaries or refuges are in the Permit Area.

Section 230.41 – Wetlands

Wetlands consist of areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (40 CFR 230.41a)).

Wetlands within the Permit Area are a mix of palustrine emergent, scrub-shrub, and forested types. Within the Impoundment Site, wetlands occur along tributaries to Libby Creek and as isolated wetlands. A few nonwetland tributaries flow to Libby Creek. Six springs associated with wetlands and other waters of the U.S. occur in the Impoundment Site, and one spring is 1,500 feet south of the Libby Plant Site. Wetlands occur at road crossings on Ramsey and Poorman creeks.

Wetlands in the Permit Area are classified as Category I, II, III, or IV. The Montana Method has the following definitions for Category I-IV wetlands (Berglund and McEldowney 2008):

- Category I wetlands – exceptionally high quality wetlands and are generally rare to uncommon. They can provide primary habitat for federally listed or proposed threatened or endangered species, represent a high quality example of a rare wetland type, provide irreplaceable ecological functions (*e.g.*, are not replaceable within a human lifetime such as with fens or mature forested wetlands), exhibit exceptionally high flood attenuation capability, or are assigned high ratings for most of the assessed functions and services.
- Category II wetlands – more common than Category I wetlands. They provide habitat for sensitive plants and animals; function at very high levels for wildlife/fish habitat, are unique in a given region, or are assigned high ratings for many of the assessed functions and services.
- Category III wetlands – more common than Category II or I wetlands, generally less diverse, and are often smaller than Category II or I wetlands. These wetlands can provide many functions and values, and they may not be assigned high ratings for as many parameters as Category I and II wetlands.
- Category IV wetlands – generally small, isolated, and lack vegetative diversity. These wetlands provide minor wildlife habitat and are typically disturbed. Both Category II and III wetlands occur within the Impoundment Site.

Direct Effects

Discharges of materials at the Impoundment Site would unavoidably fill 8.6 acres of jurisdictional wetlands and 19,160 linear feet of other waters of the U.S. (Figure 4). Roads not associated with the impoundment would affect 0.2 acre of jurisdictional wetlands (Table 2). Stream crossings on Ramsey, Poorman, and Bear creeks would be bridged and would not affect wetlands or other waters of the U.S. Discharges at the Impoundment Site, Libby Plant Site, and at stream crossings would fill 3.4 acres of isolated, nonjurisdictional wetlands.

Functional Category II and III wetland types were found in the Impoundment Site. Of the 8.6 acres of jurisdictional wetlands in the Impoundment Site, 7.5 acres are Category II wetlands, 1.1 acres are Category III wetlands, and 0.01 acre is Category IV wetlands. The location and functional category of each wetland in the Impoundment Site is shown on Figure 4, and the acres are provided in Table 2.

Table 3. Summary of Jurisdictional Wetland Effects.

Site	Label	Functional Category	Impact† (acres)
Poorman Impoundment Site			
Poorman Impoundment	WUS-1	II	1.48
Poorman Impoundment	WUS-2	II	0.46
Poorman Impoundment	WUS-3	II	0.11
Poorman Impoundment	WUS-4	II	0.05
Poorman Impoundment	WUS-5	III	0.36
Poorman Impoundment	WUS-10	III	0.51
Poorman Impoundment	WUS-11	III	0.03
Poorman Impoundment	WUS-14	II	0.93
Poorman Impoundment	WUS-15	II	4.44
Poorman Impoundment	WUS-30	III	0.10
Poorman Impoundment	WUS-36	III	0.04
Poorman Impoundment	WUS-37	III	0.09
Subtotal			**8.60**
Roads			
Access Road to Poorman Impoundment – Bear Creek	BC-01	NA	0.09
Access Road to U.S. 2 – Tributary	BCR-01	NA	0.03
Access Road to U.S. 2 – Tributary	BCR-02	NA	0.01
Access Road to U.S. 2 – Tributary	BCR-03	NA	0.01
Access Road to U.S. 2 – Tributary	BCR-04	NA	0.02
Access Road to U.S. 2 – Tributary	BCR-05	NA	0.01
Access Road to U.S. 2 – Tributary	BCR-06	NA	0.02
Access Road to U.S. 2 – Tributary	BCR-07	NA	0.01
Access Road to Poorman Impoundment – Little Cherry Creek	LCC-01	II	0.03
Subtotal			**0.2**
Total			**8.8**

†Impact calculations of jurisdictional wetlands are based on a preliminary jurisdictional determination and may change after an approved jurisdictional determination is complete.
NA = not analyzed.

Four tributaries to Libby Creek with a total of 18,357 linear feet occur in the Impoundment Site (Table 4). These tributaries are 1st order headwater streams. The project would cause the loss of 18,357 linear feet of 1st order headwater streams in a 996-acre watershed tributary to Libby Creek. An additional 803 linear feet of stream channel would be impacted by access roads. The total linear feet of tributaries that would be impacted is 19,160. Additional information on the four tributaries is being collected in 2011 and would be used in support of stream mitigation following guidelines in the Montana Stream Mitigation Procedure (Corps 2010).

Table 4. Summary of Impacts on Channels within Tributaries.

Site	Label	Area (acres)	Length (linear feet)
Poorman Impoundment Site			
Poorman Impoundment	WUS-3	0.18	2,525
Poorman Disturbance Area	WUS-3a	0.09	1,267
Poorman Impoundment	WUS-5	0.18	2,618
Poorman Disturbance Area	WUS-5a	0.07	1,008
Poorman Impoundment	WUS-10	0.21	3,120
Poorman Impoundment	WUS-10a	0.14	1,982
Poorman Impoundment	WUS-14	0.23	3,362
Poorman Disturbance Area	LCC-15	0.12	1,862
Poorman Disturbance Area	LCC-16	0.04	613
Subtotal		**1.26**	**18,357**
Roads			
Access Road to Libby Plant Site – Poorman Creek	PC-01	0.27	195
Access Road to Libby Plant Site – Ramsey Creek	RC-02B & RC-03	0.60	540
Improved Road to Upper Libby Adit	WUS-38	<0.01	68
Subtotal		**0.87**	**803**
Total		**2.13**	**19,160**

Indirect Effects

Indirect effects on wetlands, springs, and seeps may occur during mine dewatering. A groundwater dependent ecosystem (GDE) inventory and subsequent monitoring would be completed of a selected area overlying the proposed mine and adits and used to evaluate indirect wetland effects. The inventory would include a vegetation survey to describe and document existing vegetation characteristics and establish a prevalence index used by the Corps to determine wetland vegetation (Corps 2008b). The prevalence index would be used to assess changes in vegetation composition as described in the GDE inventory and monitoring plan. The monitoring would not alter the effect of the project but would assist in determining if an impact was occurring and the scale of any impact.

Several isolated, nonjurisdictional wetlands, such as WUS-18 through WUS-25 and a portion of WUS-17 (Figure 4) are south of the impoundment footprint. These wetlands would not be filled by the tailings but are within the disturbance area and likely would be filled by access roads or other project facilities. During final design, MMC would avoid and minimize effects on wetlands and other waters of the U.S. to the extent practical. A narrow band of wetlands adjacent to a tributary to Libby Creek occurs below the southeast section of the dam (WUS 14). The tributary flows east of the impoundment area, onto private property. Three other tributaries without associated wetlands (WUS 3a, 5a, and 10a) are found below the dam. These tributaries have both intermittent and perennial reaches. If the tributaries and associated wetlands were not filled, the pumpback well system would reduce groundwater levels in the impoundment area and may reduce or eliminate the hydrologic support for the wetlands. Flow in the tributaries would either be reduced or eliminated. Near Libby Creek, the channel of the tributaries becomes indiscernible in some areas. The connection to Libby Creek will be further investigated during 2011, and additional information will be provided to the Corps to assist in making an approved jurisdictional determination. Because surface flow from these tributaries into Libby Creek is infrequent, the reduced flow into Libby Creek would be a negligible effect on the total flow and wetlands downstream on Libby Creek. Mitigation for jurisdictional wetlands and waters of the U.S. within the disturbance area is described in Section 230.93 – General Compensatory Mitigation Requirements.

One year before mill operation started, MMC would install two nested shallow piezometers in each of two wetlands (LCC-35A and LCC-39A shown on Figure 4). Water levels in the piezometers would be measured four times over the annual hydrograph. The purpose of the monitoring would be to determine hydraulic gradient at the wetlands and to assess the source of hydrologic support to the wetlands. Vegetation in these two wetlands also would be monitored. The monitoring would continue through the Closure Phase as long as the pumpback well system operated.

Springs SP-14 and SP-15 adjacent to the Impoundment Site would be monitored for flow. The flow of each spring would be measured twice, once in early June or when the area was initially accessible, and once between mid-August and mid-September during a time of little or no precipitation. The monitoring would begin 1 year before construction and continue through the Closure Phase as long as the pumpback well system operated. The most accurate site-specific method for measuring spring flow would be used.

No springs or seeps have been identified below (east of) the Impoundment Site. The pumpback well system would not affect any known springs or seeps below the Impoundment Site.

Section 230.42 – Mudflats

Mudflats are broad flat areas along the sea coast and in coastal rivers to the head of tidal influence and in inland lakes, ponds, and riverine systems (40 CFR 230.42(a)). No mudflats are in the Permit Area.

Section 230.43 – Vegetated Shallows

Vegetated shallows are permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as turtle grass and eelgrass in estuarine or marine systems as well as a number of freshwater species in rivers and lakes (40 CFR 230.43(a)). Most wetlands in the Impoundment Site have persistent emergent vegetation. Because of the seasonal water regime with the Impoundment Site, areas with rooted aquatic vegetation are less likely to occur and no vegetated shallows would be affected.

Section 230.44 – Coral Reefs

Coral reefs consist of the skeletal deposit, usually of calcareous or silicaceous materials, produced by the vital activities of anthozoan polyps or other invertebrate organisms present in growing portions of the reef (40 CFR 230.43(a)). No coral reefs are in the Permit Area.

Section 230.45 – Riffle and Pool Complexes

Steep gradient sections of streams are sometimes characterized by riffle and pool complexes. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. Pools are characterized by a slower stream velocity, a steaming flow, a smooth surface, and a finer substrate. Riffle and pool complexes are particularly valuable habitat for fish and wildlife (40 CFR 230.45(a)). Streams within the Impoundment Site are not fish-bearing, and riffle and pool complexes are not expected to be affected at the Impoundment Site. Negligible areas of riffle and pool complexes may be affected at road crossings.

SUBPART F – POTENTIAL EFFECT ON HUMAN USE CHARACTERISTICS

Section 230.50 – Municipal and Private Water Supplies

Municipal and private water supplies consist of surface water or groundwater that is directed to the intake of a municipal or private water supply system (40 CFR 230.50)). No municipal or private water supplies are in the Permit Area or would be affected by the proposed discharges.

Section 230.51 – Recreational and Commercial Fisheries

Recreational and commercial fisheries consist of harvestable fish, crustaceans, shellfish, and other aquatic organisms used by man (40 CFR 230.51(a)). The Permit Area does not support a commercial fishery. Tributaries affected by the Impoundment Site are not fish-bearing and do not provide recreational fishing access. Changes in water quality or streamflow would not affect recreational fishing opportunities. The Compensatory Mitigation Plan and Wildlife Mitigation Plan would substantially reduce sediment reaching area streams, improve fish habitat, and may increase recreational fishing opportunities.

Section 230.52 – Water-Related Recreation

Water-related recreation encompasses activities undertaken for amusement and relaxation. Activities encompass two broad categories of use: consumptive, *e.g.*, harvesting resources by hunting and fishing; and nonconsumptive, *e.g.*, canoeing and sightseeing (40 CFR 230.52(a)). Effects on recreational fishing are discussed in Section 230.51 – Recreational and Commercial Fisheries. Noise during construction of the Libby Plant Site and transmission line and views of the transmission line may adversely affect recreational use and enjoyment of the Libby Creek Recreational Gold Panning Area. The Little Cherry Loop Road (NFS road #6212) closure and other road closures within the Permit Area would restrict both motorized and nonmotorized recreation access. The improvements to the Bear Creek Road (NFS road #278) would improve recreational access to the area.

Section 230.53 – Aesthetics

Aesthetics associated with the aquatic ecosystem consist of the perception of beauty by one or a combination of the senses of sight, hearing, touch, and smell. Aesthetics of aquatic ecosystems apply to the quality of life enjoyed by the public and property owners (40 CFR 230.53(a)).

The Impoundment Site would alter scenic integrity over the short term from key observation points and portions of the CMW. Although the visual absorption capability of the tailings impoundment location is moderate, its relatively large size in all views would create noticeable contrasts in landscape character and substantial alterations in scenic integrity. Scenic integrity and landscape character from the private land parcel due east of the impoundment dam, about 0.06 mile (350 feet) between dam and nearest property line, would be permanently and substantially altered. Scenic integrity would be substantially reduced in westerly views from the north end of the private parcel due to a mostly unobstructed view of the 270-foot-high impoundment dam face. Scenic integrity would be moderately reduced in northwesterly views from the southern portion of this parcel due to the increasing screening effects of the forest with increasing distance from the impoundment. The size of the impoundment would diminish with increasing viewing distance. Following the mine closure, revegetation of the tailings impoundment would partially reduce color and texture contrasts between the tailings impoundment and surrounding landscape. Other proposed discharges, such as fill for road construction or improvements or water measurements, would have a negligible effect on aesthetic values.

Section 230.54 – Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

These preserves consist of areas designated under federal and state laws or local ordinances to be managed for their aesthetic, educational, historical, recreational, or scientific value (40 CFR 230.54(a)). No parks, national and historical monuments, national seashores, research sites, or similar preserves would be affected by the proposed discharge of dredged or fill material. The CMW would not be directly affected by any discharge of dredged or fill material.

Groundwater drawdown may indirectly impact aquatic habitat and associated ecological processes within the CMW, potentially resulting in seasonal reductions in Rock Lake water levels and streamflow in Libby Creek, Rock Creek, and East Fork Bull River and their tributaries within the CMW (see Section 230.23 – Current Patterns and Water Circulation). Reductions in streamflow and lake levels may reduce habitat for fish and other aquatic life.

The visitor experience within the CMW would be indirectly affected by mining-related activities. Some of the mining facilities including the Impoundment Site would be visible from viewpoints within the CMW. Night lighting of the mine facilities and areas cleared of timber would also be visible from portions of the CMW. The visual effects of mining operations would be noticeable during construction and operations and would diminish following facility reclamation and closure. During construction, operation, and reclamation, noise from generators, fans, equipment, traffic, and plant operations would extend westward into the CMW and interfere with the peaceful experience of wilderness users. Following mine closure and reclamation, noise levels in the CMW would return to pre-mine levels. Elevated noise levels would occur periodically from traffic and monitoring activities following reclamation. Noise levels would return to pre-mine levels over the long term.

Because the wilderness experience is highly personal and individual, the perceived effect would differ among individuals. It is likely that the visual and noise effects of the project would reduce the natural quality of the wilderness experience for some individuals in portions of the wilderness. Visitation in the portions of the CMW exposed to sound and visual effects may decrease. Other qualities such as untrammeled, undeveloped, and outstanding opportunities for solitude or a primitive and unconfined type of recreation may also be diminished at some locations within the CMW for visitors during operation. These effects would occur throughout the duration of project operations and diminish following operations and reclamation.

SUBPART G – EVALUATION AND TESTING

Section 230.60 – General Evaluation of Dredged or Fill Material

Fill material used in road construction and improvements, impoundment construction, and fish structures would be comprised primarily of sand, gravel, or other naturally occurring inert material found on National Forest System lands. The sites from which the dredged or fill material would be extracted have been examined and they are sufficiently removed from sources of pollution to provide reasonable assurance that the proposed discharge material would not be a carrier of contaminants. The chemical and biological testing sequence in Section 230.61 would not be required and Section 230.61 is not discussed further.

SUBPART H – ACTIONS TO MINIMIZE ADVERSE EFFECTS

Section 230.70 – Actions Concerning the Location of the Discharge

An extensive alternatives analysis was conducted, consisting of three levels of successive screening of 22 possible impoundment sites and 9 plant and adit sites. Following the initial analysis, three alternatives underwent a more thorough environmental analysis to determine the least environmentally damaging practicable alternative. During final design, MMC would minimize and avoid, to the extent practicable, filling wetlands and other waters of the U.S.

Section 230.71 through 230.74 – Actions Concerning the Material to be Discharged, the Material after Discharge, and the Method of Dispersion and Related Technology

No material that contains hazardous materials would be discharged into waters of the U.S. BMPs would be used to control the material after discharge. Temporary and permanent erosion-control devices would be used during construction of all project facilities to control discharges and methods of discharges into waters of the U.S. All runoff from the tailings impoundment would be intercepted by diversion ditches, routed to the Seepage Collection Pond, and pumped back to the tailings impoundment. During operations, water from the impoundment would be pumped to the mill for ore processing. During the Closure and Post-Closure phases, intercepted runoff would be treated and discharged at the Water Treatment Plant until the tailings impoundment was reclaimed and no longer subject to the effluent limit guidelines. MMC would implement a construction stormwater management plan.

Section 230.75 – Actions Affecting Plant and Animal Populations

Nonwetland Waters of the U.S. and Fisheries

MMC would use standard 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.

MMC would implement and maintain all appropriate BMPs for roads during their use by the project. Appropriate BMPs include: 1) disconnecting road surfaces and drainage ditches from streams, 2) shortening road surface lengths and decreasing road surface areas that drain to surface waters, 3) seeding and revegetating disturbed soils, and 4) hardening road surfaces. These BMPs would be the most effective way to minimize sediment delivery from affected forest roads and are predicted to be between 88 and 99 percent effective.

During the Evaluation Phase, MMC would implement BMPs, such as installing, replacing, or upgrading culverts, to bring the proposed access roads (NFS roads #231 and #2316) up to INFS standards. All ditches on NFS roads #231 and #2316 would be cleaned out to enhance drainage and reduce sedimentation.

MMC would use the Montana Stream Mitigation Procedure developed by the Montana Corps office to evaluate effects on nonwetland waters of the U.S. (Corps 2010). The method uses debits and credits to determine adequate compensatory mitigation for impacts to the channel within the tributaries. Twelve possible stream enhancement or restoration projects, and riparian planting along seven streams or channels, would replace the functions of the tributaries directly or indirectly affected by the Poorman tailings impoundment. The mitigation projects are:

- Create channel from reclaimed Poorman tailings impoundment to Little Cherry Creek
- Increase discharge in Little Cherry Creek
- Reconfigure Poorman tailings impoundment channel remnants
- Evaluate potential for habitat restoration or enhancement in Poorman Creek
- Replace culvert where NFS road #278 crosses Poorman Creek
- Remove bridge where NFS road #6212 crosses Poorman Creek

- Replace culvert where NFS roads #6212 and #278 cross Little Cherry Creek
- Stabilize Little Cherry Creek sediment sources
- Construct formidable wood structures in Libby Creek floodplain
- Modify flow in tributary channels to Swamp Creek
- Exclude livestock from Swamp Creek property
- Plant riparian vegetation where beneficial along streams and channels in project area, including Swamp Creek Site

Other stream mitigation is being considered and will be presented in the Final Mitigation Plan for the project.

Terrestrial Wildlife

MMC would implement a variety of measures designed to avoid, minimize, or mitigate effects on terrestrial wildlife. MMC would:

- Implement measures to reduce grizzly bear mortality risks, maintain grizzly bear HE and core habitat, and ensure mitigation plan management.
- Implement a wildlife awareness program.
- Fund habitat enhancement on lynx stem exclusion habitat to mitigate for the physical loss of suitable lynx habitat.
- If a wolf den or rendezvous site was located in or near the project facilities by FWP wolf monitoring personnel, 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.
- Avoid removal of old growth habitat (effective or replacement) between April 1 and July 15 to avoid direct mortality to active nest sites for bird species using old growth habitat.
- Leave snags within the disturbance area unless required to be removed for safety or operational reasons.
- Fund surveys to monitor mountain goats.
- Avoid 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.
- Do not remove vegetation in the nesting season to avoid direct mortality at active nest sites or complete surveys to locate active nests in appropriate habitat. If an active nest were found, an area surrounding the nest would be delineated and not disturbed until after the young fledged.
- Fund or conduct monitoring of landbird populations annually on two standard Region One monitoring transects within the Crazy and Silverfish Planning Subunits.

Vegetation

MMC would implement a variety of measures designed to avoid, minimize, or mitigate effects on plant populations. MMC would:

- Implement a Vegetation Removal and Disposition Plan to minimize vegetation clearing.

- Complete a survey for threatened, endangered, and Forest Service- and state-sensitive plant species on National Forest System lands for any areas where such surveys have not been completed and that would be disturbed by the alternative. If adverse effects could not be avoided, develop appropriate mitigation plans for the agencies' approval and implement the mitigation before any ground-disturbing activities.
- To the extent possible, survey all proposed ground disturbance areas for noxious weeds prior to initiating disturbance. Where noxious weeds were found, treat infestation the season before the activity was planned.
- Implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS for all weed-control measures.
- Use reclamation success criteria to evaluate revegetation success before bond release.
- Modify all seed mixes so that mixes would be comprised of species native to northwestern Montana.
- Plant sufficient trees and shrubs to achieve 400 trees and 200 shrubs per acre 15 years after planting.
- 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.
- Develop and implement a final Road Management Plan that would describe 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.

Section 230.76 – Actions Affecting Human Use

Recreational Use

Current human use in the analysis area is primarily recreation. Effects on recreational experiences would be minimized by continuing to allow access to most areas within the analysis area. Recreational access to the area would be improved with improvements to Bear Creek Road (NFS road #278). Winter recreation access, with the exception of snowmobilers, would be improved because Bear Creek Road would be plowed.

To minimize noise effects, sound levels of all surface and mill equipment would not exceed 55 decibels (dBA), measured 250 feet from the mill for continuous periods exceeding an hour. Intake and exhaust ventilation fans in the Libby Adits would be adjusted to generate sounds less than 82 dBA measured 50 feet downwind of the portal. If necessary, specially designed low-noise fan blades or active noise-suppression equipment would be used.

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 fund a volunteer campground host from Memorial Day through Labor Day at Howard Lake Campground during the Construction and Operation phases of the mine. MMC would shield or baffle night lighting at all facilities.

Dust Control

MMC would use BMPs during Construction, Operation, and Closure phases 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 watering 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 adjacent to the mill facilities.

The tailings from the mill would be slurried through a pipeline to a tailings impoundment site. Excess water would be returned to the mill for reuse. 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 nonsubmerged 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. Water used by the sprinklers would be obtained from the water reclaim system, which returns water to the mill from the tailings impoundment. Although the tailings would be wetted with a sprinkler system, some drying may occur in the summer months. To control fugitive dust on the tailings impoundment, a fugitive dust-control plan would be submitted by MMC for review and approval by the DEQ.

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 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 on a regular basis during the day 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.

Tailings Pipeline Monitoring

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 bypass 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. 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 where the pipelines would cross Poorman Creek.

Impoundment Reclamation

At closure, the tailings impoundment would be reclaimed. 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.

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. 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 operate the seepage collection and the pumpback well systems until water quality standards or BHES Order nondegradation limits were met without additional treatment. Long-term treatment may be required if water quality standards 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 water quality standards or BHES Order nondegradation limits were met, seepage from the underdrains and seepage not intercepted by the underdrains would flow to Libby Creek.

MMC would develop a design to recontour faces of the tailings impoundment dams to 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.

Section 230.77 – Other Actions

Controlling Runoff from Impoundment

Until the tailings impoundment was reclaimed, runoff from all fill material associated with impoundment construction, such as waste rock or tailings, would be subject to the Effluent Limit Guidelines (40 CFR 440.100). Diversion ditches at the toe of the impoundment dam would intercept all surface water runoff and route it to a Seepage Collection Pond. The ditches would be sized to accommodate a 10-year/24-hour storm event.

Deposition of the tailings at closure would produce a final surface that would drain toward an unnamed tributary of Little Cherry Creek. 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. The channel section through the abutment would be backfilled with a porous dam section designed to retain the PMF and dissipate the flood water at a flow rate of 2 cfs or within a 60-day period, whichever flow rate is the greater. As part of the final closure plan, MMC would complete a H&H analysis of the proposed diversion 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.

Water Releases

The dam associated with the Impoundment Site is designed primarily to retain tailings. Water would retained behind the dam with the tailings during construction and operations as part of an overall water management plan. No water would be released from the impoundment dam. All surface water runoff from the impoundment would be intercepted by diversion ditches and routed to a Seepage Collection Pond and pumped to the mill for reuse during operations. 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. At closure, seepage intercepted by the pumpback well system would be sent to the Water Treatment Plant, or pumped back to the impoundment. MMC would continue to operate the seepage collection and pumpback well systems, and the Water Treatment Plant until water quality standards, BHES Order nondegradation limits, and MPDES permitted effluent limits were met without treatment.

Maintaining Desired Water Quality

The project is not a dredging project funded by any federal agency. The existing Water Treatment Plant would be used solely to treat any waters prior to discharge at the existing MPDES-permitted outfalls. Water would not be discharged at the LAD Areas. MMC would maintain the current MPDES permit MT0030279 with three outfalls at the Libby Adit Site. No additional discharges of wastewater are anticipated. During the MPDES permitting process, the DEQ would determine if load limits in the current permit would be changed and if the groundwater and surface water mixing zones in the permit would be renewed. The DEQ also would determine where compliance with applicable standards would be measured.

SUBPART I – PLANNING TO SHORTEN PERMIT PROCESSING TIME

Section 230.80 – Advanced Identification of Disposal Areas

No advanced identification of possible future disposal sites or areas generally unsuitable for disposal site specification has been conducted beyond the sites described in this document and the EIS. The EIS includes an analysis of alternative locations for the tailings impoundment, Plant Site, adit sites, and transmission line alignments.

SUBPART J – COMPENSATORY MITIGATION FOR LOSSES OF AQUATIC LIFE

Section 230.93 – General Compensatory Mitigation Requirements

Compensatory mitigation is required for 8.8 acres of jurisdictional wetlands and 19,160 linear feet of other waters. In addition to mitigation for jurisdictional wetlands and other waters, MMC would mitigate for nonjurisdictional wetlands at a ratio of 1 acre mitigated to 1 acre impacted. MMC prepared a Draft Conceptual Mitigation Plan for Impacts to Waters of the U.S. (Geomatrix and Kline Environmental Research 2011). MMC will prepare a Final Mitigation Plan that would be implemented according to the final rule for Compensatory Mitigation for Losses of Aquatic Resources (40 CFR 230, Subpart J). Based on the 2011 draft mitigation plan, on-site mitigation would be 4 acres south of Little Cherry Creek and 2 acres at the former gravel pit site south of the Impoundment Site. The Little Cherry Creek sites would be on land owned by MMC; the Poorman gravel pit site is National Forest System land. The on-site mitigation sites would be combined with the off-site mitigation site described in the Off-site Wetland Mitigation section as the compensatory mitigation for all unavoidable effects on wetlands. Mitigation for waters of the U.S., such as streams, is also described below. The Corps would be responsible for developing final mitigation requirements for jurisdictional wetlands and other waters of the U.S.

All of the proposed mitigation areas were selected to adequately replace lost functions and services, including aquatic habitat and connectivity, hydrologic conditions, biological characteristics, landscape and land use, and ecological benefits. MMC would submit detailed information and site-specific maps for the selected compensatory mitigation sites for approval by the Corps.

The Corps would be responsible for developing final mitigation requirements for jurisdictional wetlands and other waters of the U.S., depending on the functions and services of the affected wetlands. The Corps may use the functional assessment method, acreage ratio method, and/or stream mitigation procedure to evaluate the amount of compensation needed for direct and indirect impacts to wetlands and other waters of U.S. The Corps typically does not establish mitigation ratios for nonjurisdictional wetlands. Projects that implement mitigation prior to project losses would have a lower mitigation requirement than projects that implement mitigation after wetland losses have occurred.

On-site Wetland Mitigation

Proposed on-site mitigation consists of about 4 acres of wetland mitigation at three sites near the Little Cherry Creek drainage and about 2 acres of wetland mitigation at a former gravel pit that is degraded with little vegetation. Construction of mitigation sites would occur prior to any project impacts, providing a temporal gain for wetland losses.

On-site wetlands would be developed through excavation of shallow depressions in locations where surface water would collect and be retained. In 2010, MMC installed shallow piezometers (monitoring wells) in the proposed Little Cherry Creek mitigation sites and measured water levels in June and September. Before submitting the final mitigation plan, MMC would complete 6 months of monthly monitoring (April through September) of water levels to determine groundwater levels. Monitoring data would be submitted with the final mitigation plan. The shallow wells would be used to verify that groundwater would support wetlands if the mitigation sites were excavated to near the groundwater surface. Hydrologic support would be provided by direct precipitation or shallow groundwater. Where feasible, wetland soil, sod, and shrubs would be excavated from existing wetlands prior to filling during construction and placed in the wetland mitigation areas.

Off-site Wetland Mitigation

The proposed Swamp Creek off-site wetland mitigation area encompasses 67 acres and consists of uplands and meadows. The meadows cover about 30 acres. According to the landowner, the property supported a dense stand of shrubs on land too wet for hay production. 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.

Implementation of mitigation would occur prior to any project impacts, providing a temporal gain for wetland losses. A wetland delineation completed in 2011 (Geomatrix 2011) shows 20 acres of degraded wetland that could be subject to restoration (reestablishment) at the Swamp Creek Site. Supportive wetland hydrology would be reestablished for the restoration area either through realigning the channel, grading, or diversions of surface water. With surface diversion of water to the restoration area, growing conditions would become favorable for the recolonization by native wetland species of sedges, forbs, and shrubs. Agronomic grass species would be replaced because growing conditions would be unfavorable for plants adapted to less hydric moisture regimes. To enhance the recolonization of native species, the dense litter mat created by the highly productive agronomic grasses could be burned.

According to oral history and consultation, there are known Native American Traditional Use Areas on the uplands adjacent to the proposed Swamp Creek wetlands mitigation site and within the private land boundary. These upland sites adjacent to the wetlands have been used traditionally for camping by the Kootenai Tribe as they traveled through what is now the U.S. 2 corridor on a seasonal basis for hunting and gathering purposes. If wetland mitigation sites on private land were 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.

Nonwetland Waters of the U.S. and Fisheries

MMC would use the Montana Stream Mitigation Procedure developed by the Montana Corps office to evaluate effects on nonwetland waters of the U.S. The method uses debits and credits to determine adequate compensatory mitigation for impacts to nonwetland channels. Twelve possible stream enhancement or restoration projects and riparian planting along seven streams or channels would replace the functions of the channels directly or indirectly affected by the Poorman tailings impoundment. Implementation of stream mitigation would occur prior to any project impacts, providing a temporal gain for stream losses. The potential mitigation projects, which would be finalized in the final mitigation plan, are:

- Create channel from reclaimed Poorman tailings impoundment to Little Cherry Creek
- Increase discharge in Little Cherry Creek
- Reconfigure Poorman tailings impoundment channel remnants
- Evaluate potential for habitat restoration or enhancement in Poorman Creek
- Replace culvert where NFS road #278 crosses Poorman Creek
- Remove bridge where NFS road #6212 crosses Poorman Creek
- Replace culvert where NFS roads #6212 and #278 cross Little Cherry Creek
- Stabilize Little Cherry Creek sediment sources
- Construct formidable wood structures in Libby Creek floodplain
- Modify flow in tributary channels to Swamp Creek
- Exclude livestock from Swamp Creek property
- Plant riparian vegetation where beneficial along streams and channels in project area, including Swamp Creek Site

Additional stream data on the impacted tributaries are being collected in 2011 in support of developing the final mitigation plan.

Section 230.94 – Planning and Documentation

As part of the planning and documentation requirements for mitigation, MMC has been coordinating with the Corps Montana's Regulatory office. Several site meetings with the Corps were held between 2009 and 2011 to discuss potential mitigation sites and to incorporate Corps' input into the mitigation plan. A draft conceptual mitigation plan was submitted to the Corps in 2011. Ongoing data gathering for groundwater depths and site conditions at the proposed mitigation sites will occur throughout the 2011 growing season. Data would be presented to the Corps for justification that supportive hydrologic conditions occur for wetlands. Future site meetings are expected to further refine the final mitigation plan. The individual permit application will have a public comment period as designated by the Corps. Responses and consideration will be given for any substantive comments received during the public comment period.

Section 230.95 – Ecological Performance Standards

Detailed performance standards or criteria for wetland and nonwetland mitigation sites would be established in a final mitigation plan. Examples of specific performance criteria for wetland mitigation sites include: size of wetland area, percent herbaceous cover, wetland plant species diversity, percent cover of invasive species, and wetland hydrology.

Wetland functional assessments would be conducted using the same methods used to estimate required levels of compensatory mitigation as part of the monitoring. Successful reclamation would be achieved once functional capacity of created, restored, and/or enhanced wetlands equaled the loss and degradation of wetland functions and values that would result from implementation of the project. Boundaries of successful wetland restoration, creation, or enhancement areas would be established periodically to determine if the total mitigation area attains the intended design area.

Examples of specific performance criteria for nonwetland channel mitigation sites include: channel and bank stability, eroded areas, reduction in sediment load, percent riparian vegetation cover, height and percent cover of planted woody vegetation, percent cover of invasive species, and hydrologic conditions.

Section 230.96 – 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 this section may be modified in the 404 permit. Monitoring would follow the Corps' Regulatory Guidance Letter (RGL 06-3) that addresses monitoring requirements for compensatory mitigation projects. Performance standards for the three wetlands parameters: hydrophytic vegetation, hydric soil, and appropriate hydrology would be established in the 404 permit. Additional performance standards based on functional assessment methods may be incorporated into the performance standard evaluations to determine if the site was achieving the desired functional capacity.

Vegetation data would be collected at established quadrat sampling points along established transects to determine vegetation composition. Hydrology data from shallow groundwater wells or piezometers in each mitigation site would be collected in spring and fall. Soil conditions also would be investigated for evidence of saturation. Wetland functional assessments would be conducted using the same methodology used to estimate required levels of compensatory mitigation as part of the monitoring. Boundaries of successful wetland establishment areas would be established annually to determine if the total mitigation area attains the intended design area. Monitoring would also be performed for the nonwetland channel mitigation sites. Specific monitoring requirements and methods would be included in the final mitigation plan.

The monitoring period for wetland and nonwetland mitigation would be sufficient to demonstrate that the compensatory mitigation project met performance standards, but not less than 5 years. Some compensatory mitigation projects may require inspections more frequently than annually during the early stages of development to identify and address problems that may develop. Monitoring of the wetland and nonwetland mitigation sites would be performed semiannually during the first 5 years of mitigation.

Section 230.97 – Management

After performance standards have been achieved for all wetland mitigation sites, MMC would be responsible for long-term management, except for any sites on National Forest System lands. The final mitigation plan would include a description of management needs, cost estimates, and the funding mechanism that would be used to meet those needs. In addition, the final mitigation plan would include provisions allowing MMC to transfer long-term management responsibilities for private land mitigation sites to a land stewardship entity, such as the Forest Service or conservation group. A deed restriction may also be used for the mitigation on private property to assure continued long-term management of the property that contains the mitigation sites.

Adaptive management is a strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project. If the compensatory mitigation project cannot be constructed in accordance with the approved final mitigation plan, or if performance standards were not being met as anticipated, MMC would notify the Corps, with approval required for any significant modification of the mitigation plan. Performance standards may be revised in accordance with adaptive management to account for measures taken to address deficiencies in the mitigation.

Adaptive management may include the following measures: 1) plant additional wetland vegetation species in areas where new growth is inadequate; 2) adjust site conditions to improve hydrologic conditions; 3) improve/enhance erosion-control measures; 4) improve fence design if cattle are getting inside exclusion areas; 5) irrigate areas to improve vegetation growth; and 6) provide for additional access restrictions if human disturbance is occurring. The final mitigation plan would include more details about adaptive management and how it would be implemented.

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