Draft Supplemental Environmental Impact Statement for the Rock Creek Project

Volume II

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Cliff Lake from Saint Paul Peak *Photo by Michael Burnside*

United States Department of Agriculture
Forest Service
Northern Region

Kootenai National Forest

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Appendices

2001 FEIS Appendix	SEIS Appendix
Appendix A: Definition of Significance in NEPA/MEPA	Refer to 2001 FEIS
Appendix B: Final Biological Assessment	Refer to 2001 FEIS
Appendix C: Department Decision on Air Quality Permit	Appendix C: RCR's Montana Air Quality Permit #24114-03
Appendix D: Proposed MPDES Permit, Fact Sheet, and Statement of Basis	Outfalls 001 and 002 were remanded. RCR will submit a revised permit application.
Appendix E: USFWS Biological Opinion	Replaced with select portions of 2006 BO and 2007 BO Supplement
Appendix F: Section 404(b)(1) Showing	No longer needed. The Corps determined an individual 404 permit for the Rock Creek Project is not necessary.
Appendix G: Tailings, Subsidence, and Hydrofracturing	Updates to the information in Appendix G of the 2001 FEIS were incorporated into the body of the SEIS. Information in the SEIS replaces Appendix G.
Appendix H: Kootenai National Forest BMP Process	Refer to 2001 FEIS
Appendix I: Description of Reagents	Refer to 2001 FEIS
Appendix J: Revegetation Plans	Included in SEIS. No Changes from 2001 FEIS.
Appendix K: Agencies' Conceptual Monitoring Plans	Updated for SEIS
Appendix L: Wetlands Mitigation Plan for Alternative V	Replaced with RCR's updated Alternative V Wetlands Mitigation Plan. The Corps determined an individual 404 permit for the Project is not necessary. Impacts to isolated wetlands in impoundment footprint are on RCR land.
Appendix M: McKay Creek Alternative Description	Updates to the information in Appendix M of the 2001 FEIS were incorporated into the body of the SIES. Information in the SEIS replaces Appendix M.
Appendix N: Discussion on R1-WATSED Model and Results	Updated for SEIS
Appendix O: New Management Area Descriptions	Refer to 2001 FEIS
Appendix P: Tailings facility Failure Modes Effects Analysis	Refer to 2001 FEIS
Not in 2001 FEIS	Appendix Q (Added for SEIS): Subsidence Failure Modes Effects Analysis

Chapter 4. Environmental Consequences

4.1 Introduction

This chapter contains the KNF's, and for analyses that have not changed since the 2001 FEIS, DEQ's, analysis of probable impacts on the environment (including its human elements) that would result from construction and operation of the proposed Rock Creek Mine and its associated facilities (the Rock Creek Project). This chapter discusses the environmental impacts for each resource that may result from implementation of each alternative and provides the scientific and analytic basis for the comparison of alternatives presented. It also contains the analysis of probable cumulative impacts that would result from adding the proposed Rock Creek Project to other existing and reasonably foreseeable activities in the study area and the CMW, in the vicinity of Noxon, Montana. Methods used to analyze resource impacts are described by resource, as applicable. The last four sections of this chapter, Sections 4.22, *Unavoidable Adverse Effects* through 4.25, *Environmental Justice* describe by resource the probable environmental effects that could not be avoided, the relationship between short-term uses and long-term productivity, irreversible and irretrievable commitments of resources, and environmental justice, respectively.

4.1.1 Terms Used in this SEIS

4.1.1.1 Direct, Indirect, and Cumulative Effects

Environmental effects can be direct, indirect, or cumulative and long or short in duration. Direct effects are those that are caused by the action and occur at the same time and place. Indirect effects are those that are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions (40 CFR 1508.7), which were discussed in Chapter 2. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time and are discussed at the end of each resource impact section.

4.1.1.2 Short-Term and Long-Term Impacts

The short-term impacts and uses for the mining-related aspects of the Rock Creek Project are those that would occur during the life of the project. Long-term impacts of the Rock Creek Project are those that would persist beyond mine closure and final reclamation bond release. Impacts can be both short- and long-term and should be considered both unless otherwise specified. The relationship between short-term uses of the environment and long-term productivity is discussed in Section 4.23, *Short-Term Uses and Long-Term Productivity*.

4.1.1.3 Irreversible or Irretrievable Commitment of Resources

An irreversible or irretrievable commitment of resources would occur when resources were either consumed, committed, or lost as a result of the Rock Creek Project. The commitment of a resource would be irreversible if the Rock Creek Project started a process (chemical, biological, and/or physical) that could not be stopped. As a result, the resource, or its productivity, and/or its utility would be consumed, committed, or lost forever. Commitment of a resource would be considered irretrievable when the Rock Creek Project would directly eliminate the resource, its productivity, and/or its utility for the life of the project. Irreversible and irretrievable commitment of resources are discussed in Section 4.24, *Irreversible and Irretrievable Commitments of Resources*.

4.1.2 Resource Modifications

As part of this SEIS, all alternatives have been analyzed. For each resource section, Alternative V impacts are discussed first followed by the other alternatives in descending order. For action alternatives other than Alternative V, only those impacts that would differ from Alternative V are listed. The reader may assume then that all impacts listed under Alternative V would occur under the subsequent action alternatives (II, III, and IV) unless otherwise stated. For all resource sections, *Effectiveness of Mitigation* and *Regulatory Compliance* subsections, which were not previously included in the 2001 FEIS, have been added where applicable; only Alternative V is evaluated in these subsections. Applicable direction from the 2015 KFP was incorporated in all sections. Where impacts changed substantially from the 2001 FEIS, they are described in detail. Where resource impacts have not changed or have changed little from those disclosed in the 2001 FEIS, a brief summary of the resource impacts is provided. Additional modifications for the following resource sections were made since the 2001 FEIS.

Kootenai Forest Plan Direction. A revised KFP went into effect in February 2015. The *Environmental Consequences* section for 2015 KFP direction has been revised to incorporate the 2015 KFP, including revised MA designations.

Climate and Greenhouse Gases. The analysis of impacts of the alternatives on climate has been updated and the impact of the Rock Creek Project on GHGs has been added to incorporate current EPA and CEQ guidelines.

Air Quality. Updates were made to the description of the Rock Creek Project's air pollution emissions sources, potential impacts on ambient air quality, air pollution controls, and regulatory requirements. A brief description of the air pollution dispersion modeling that was completed in preparation of the new MAQP application has been described.

Geology. The subsidence section has been updated to include recent analyses performed at the Troy Mine. New information regarding the estimated Rock Creek ore reserves has been added. The ARD and metals leaching sections have been removed from the Section 4.5, *Geology*, and have been added to the relevant subsection of Section 4.7, *Water Quantity and Quality*.

Geotechnical Engineering. The state-of-the-practice for paste production has been revised based on the improved methods for thickening slurry tailings to paste specifications developed since the 2001 FEIS. A preliminary estimate of the effects from a larger peak ground acceleration (PGA) has been evaluated. New seismic data have been evaluated and have been used in a revised seismic stability assessment.

Water Quality and Quantity. Updates from the 2001 FEIS were made to the *Environmental Consequences* section for water quality and water quantity, and updates to the analysis methods were made. The *Environmental Consequences – Water Quantity and Water Quality* section has been restructured from that presented in the 2001 FEIS to facilitate understanding of interrelated water quality and hydrologic concepts.

The *Environmental Consequences* section for groundwater and surface water have been updated to include information from the new numerical 3D groundwater model and 2D simulation, and the new probabilistic tailings seepage model. As a result, the groundwater quantity sections have been revised to reflect a revised conceptual model and revised estimates of potential impacts on the groundwater contribution to streams. The estimated mine inflows have been updated to reflect the current model analyses. The section has been updated to incorporate a revised water balance for Alternative V and a discussion of effects on stream temperature. Updates also include clarification of the effects of Phase I and Phase II sediment mitigation plans, which have been described in greater detail since the 2001 FEIS.

Water Rights. This SEIS has been restructured to include a separate *Water Rights* section. Effects on surface water and groundwater rights were discussed in several locations in the *Surface Water Quantity* and *Groundwater Quality* sections of the 2001 FEIS.

Soils. Updates to *Environmental Consequences* section were made.

Wetlands and Nonwetland Waters of the U.S. Updates were made to the *Environmental Consequences* section for wetlands and nonwetland waters of the U.S. due to revised mapping completed in 2011, the Corps' 2013 issuance of an approved JD, and avoidance measures. Wetlands have been reassessed for functions and services and the KNF determined the area of impacts on wetlands by functional categories along with the impacts of area streams (nonwetland waters). Indirect impacts on wetlands affected by changes in groundwater and streamflow from hydrologic impacts have been discussed qualitatively.

Aquatics and Fisheries. Section 4.11, *Aquatic Life and Fisheries* updates the 2001 FEIS analysis of potential environmental consequences to aquatics and fisheries resources based on modifications to the preferred alternative (Alternative V) and new information. Updates include clarification of the effects of Phase I and Phase II sediment mitigation plans, which have been described in greater detail since the 2001 FEIS. The analysis of environmental consequences to aquatics and fisheries has also been updated to incorporate new information since the 2001 FEIS, such as development of a 3D groundwater model and additional baseline data.

Biodiversity. The analysis of effects on biodiversity has been updated based on the current Forest Service Region 1 list of sensitive plant and animal species; MNHP list of species of special concern; changes in the state and county noxious weed lists; 2015 KFP direction; current elk security and elk, white-tailed deer, bighorn sheep, and mountain goat winter range mapping; and population information for several species. Updates have also been made to the *Environmental Consequences* sections for wildlife habitat, vegetation, and wildlife species and the *Regulatory Compliance* section.

Threatened and Endangered Species. Updates were made based on updated baseline information for grizzly bear habitat, components of the 2015 KFP addressing access management standards for grizzly bear, components of the 2015 KFP incorporating standards and guidelines for lynx management established in the NRLMD, change in status of the wolverine, designation of critical bull trout habitat, and modifications to Alternative V.

Socioeconomics. Updates to the employment and income effects in the *Environmental Consequences* section were made based on the Forest Service analysis of potential employment and labor income effects from the proposed Rock Creek Project during specific years within the three project phases.

Transportation. Updates to the *Environmental Consequences* section were made based on the most recent vehicle counts for NFS road #150 conducted in 2002 and 2007.

Recreation. Updates to the *Environmental Consequences* section were made.

Wilderness, Roadless Areas, and Wild and Scenic Rivers. Updates to the *Environmental Consequences* and *Regulatory Compliance* sections for wilderness, roadless areas, and wild and scenic rivers were made.

Sound. Updates to the *Environmental Consequences* section were made.

Scenic Resources. Updates to the *Environmental Consequences* and *Regulatory Compliance* sections were made.

4.1.3 Assumptions for the Action Alternatives

Certain assumptions were made in evaluating the action alternatives. Impact analysis assumptions for Alternatives II through V include:

- Mining and reclamation technology would not change substantially throughout mine life
- Labor, equipment, and/or market shortages/surpluses would not materially change projected levels of development
- Impacts on copper/silver supply or demand are beyond the scope of this SEIS
- The estimated project development schedule listed in Table 2-2 would result in a total project life of 32.5 to 38 years depending upon the actual amount of ore reserves and extraction rates compared with estimated reserves and rates
- The Rock Creek Project would be initiated within the next 8 years

4.2 Kootenai Forest Plan

This section updates the *Environmental Consequences* section for 2015 KFP direction, with a focus on Alternative V, and includes a *Regulatory/Forest Plan Consistency* subsection not previously in the 2001 FEIS.

4.2.1 Summary

The 2015 revision of the 1987 KFP became effective as of February 17, 2015. In this SEIS, Alternative V has been analyzed for consistency with the new 2015 KFP. Alternative V would require three project-specific amendments to the 2015 KFP for the alternative to be consistent with the plan. The three amendments are described in Section 2.3.6, *Forest Plan Amendment*. With the three amendments, Alternative V would be consistent with the 2015 KFP.

4.2.2 Alternative V Amendments

As part of this SEIS, the KNF evaluated consistency of Alternative V with the 2015 KFP. Information from the 2015 KFP consistency worksheets and supporting memorandums is referenced in this SEIS. The complete documents and spreadsheets are included in the project record. Based on the evaluation, three amendments to the 2015 KFP were identified for Alternative V to be consistent with the 2015 KFP (Section 2.3.6, *Forest Plan Amendment*).

4.2.2.1 Need for Forest Plan Amendment 1

Alternative V would require an amendment to the 2015 KFP for a project-specific variance to suspend the requirement for full consistency with forestwide guideline FW-GDL-WL-09 (related to avoiding native ungulate winter range areas during the critical mid-winter period). The Rock Creek Project would operate yearlong in elk, mule deer, and white-tailed deer winter range. Because it would not be practicable to avoid or minimize construction and operation activities during January and February, Alternative V would not be consistent with FW-GDL-WL-09 unless the 2015 KFP was amended.

4.2.2.2 Need for Forest Plan Amendment 2

Alternative V would require an amendment to the 2015 KFP for a project-specific variance to suspend the requirement for full consistency with forestwide guideline FW-GDL-AR-01 (i.e., consistency of management activities with the mapped SIO). Under the 2015 KFP, the Rock Creek Project study area SIOs were mapped primarily as moderate with some areas of high and very high. However, mine facilities (i.e., paste tailing facility, mill site, and air-intake ventilation adit), the realignment of NFS road #150, and the overhead power line along NFS road #150 proposed in Alternative V would result in a scenic integrity

lower than the mapped SIOs in the 2015 KFP, Alternative V would not be consistent with FW-GDL-AR-01 unless the 2015 KFP was amended.

4.2.2.3 Need for Forest Plan Amendment 3

Alternative V would require an amendment to the 2015 KFP for a project-specific variance to suspend the requirement for full consistency with designated wilderness guideline MA1a-GDL-AR-01 (i.e., consistency of management activities with the mapped SIO of very high). In a mapped SIO of very high, the landscape is intact with changes resulting primarily through natural processes and disturbance regimes (USFS 2015b). The introduction of the air-intake ventilation adit proposed in Alternative V would result in a scenic integrity lower than the mapped SIO of very high. In Alternative V, the air-intake ventilation adit was located to reduce effects on the CMW relative to Alternative II; however, location outside of the CMW would not be practicable. Alternative V would not be consistent with MA1a-GDL-AR-01 unless the 2015 KFP was amended.

4.2.3 Alternatives Considered

4.2.3.1 No Amendment Alternative

Alternative V could not be designed to be consistent with the 2015 KFP without an amendment. It would not be practicable to avoid or minimize construction and operation activities in ungulate winter range during January and February nor would it be feasible to site mine facilities to completely avoid areas with mapped SIOs of moderate to high. If the 2015 KFP was not amended, the KNF would not be in compliance with the United States mining laws described in Section 1.6.4, *Laws and Regulations Applicable to the Forest Service*. 16 USC 478 bars the Forest Service from prohibiting locatable mineral operations on lands subject to United States mining laws, either directly or by regulation, amounting to a prohibition.

4.2.3.2 Other Alternatives

Alternatives to the three amendments described above were not considered because Alternative V could not be designed to be consistent with the 2015 KFP.

4.2.4 Direct and Indirect Effects of Amendments

The following section summarizes the effects of the amendments on achieving desired conditions related to ungulate winter range and scenic resources. In April 2012, the U.S. Department of Agriculture adopted a new NFS land management planning rule, referred to as the 2012 Planning Rule (36 CFR 219). The 2012 Planning Rule guides the development, amendment, and revision of NFS land management plans. The following section also discusses the effects of the amendments on 2015 KFP conformity with the substantive requirements of the 2012 Planning Rule.

4.2.4.1 Effects on Ungulate Winter Range

The 2015 KFP includes a desired condition that habitat for native ungulates is available and well-distributed across the landscape to provide prey for carnivores (FW-DC-WL-08). As described in Section 4.12, *Biodiversity of Wildlife Habitat/Vegetation and Wildlife Species (Biodiversity)* of the SEIS, losses of winter range for elk and deer as a result of Alternative V would mostly occur within the footprint of the paste tailings facility, which is predominantly on private land, where the 2015 KFP guidelines do not apply. The remaining loss of winter range for elk and deer would occur within the disturbance footprint of the wastewater treatment plant, paste plant, and realigned section of NFS road #150 on lands managed by the KNF. The winter range in these areas is affected by existing disturbance, such as fragmentation by Montana Highway 200, existing Forest Service roads, a powerline, train tracks, and Noxon Reservoir.

Other human activity in the area includes the Rock Creek Gravel Pit on lower Rock Creek and a sawmill near Montana Highway 200.

Vehicle use of NFS road #150 during the winter could disturb wintering elk and deer, resulting in decreased use of winter range near the road. Direct loss of winter range habitat would also occur from construction of the realigned section of NFS road #150, the paste tailings facility, and wastewater treatment plant. Increased human presence in these areas also could result in less winter use of these areas by elk and deer.

The area of elk, mule deer, and white-tailed deer winter range that would be disturbed by Alternative V construction and operations (57 acres on NFS land and 288 acres on non-NFS land) would be minimal relative to the amount of elk, mule deer, and white-tailed deer winter range available forestwide (367,465 acres, 354,883 acres, and 284,173 acres, respectively; KNF 2015a). Given available habitat and current human activity, additional disturbance to wintering elk and deer would likely be minimal when compared with existing disturbance in the area.

4.2.4.2 Effects on Scenic Resources

The 2015 KFP includes a desired condition that the scenic resources of the KNF complement the recreation settings and experiences while reflecting healthy and sustainable ecosystem conditions (FW-DC-AR-02). The 2015 KFP also includes a management guideline for access and recreation in wilderness (i.e., the CMW) stipulating consistency of management activities with the SIO of very high (MA1a-GDL-AR-01). The project-specific variance would not change the SIOs relative to the desired condition or the management guideline in the 2015 KFP for the study area or any other areas in the KNF. As described in Section 4.21, *Scenic Resources* of the SEIS, Alternative V activities would occur on 0.02 acre with SIO mapped as very high, 41 acres with SIO mapped as high, and 72 acres with SIO mapped as moderate. About 38% of the KNF, or 843,258 acres, is mapped with SIOs of moderate to very high (KNF 2015b). Effects of Alternative V on scenic resources would be localized from specific viewpoints in the Rock Creek study area. Even with the project-specific variance, Alternative V would affect a very small proportion (less than .01%) of areas in the KNF with mapped SIOs of moderate to very high. Scenic resources of the KNF would continue to compliment the recreation settings and experiences across broad areas of the Forest (FW-DC-AR-02). Outside of the 0.02 acre, management activities would continue to be consistent with the SIO of very high throughout the CMW (MA1a-GDL-AR-01).

4.2.4.3 Conformity of Kootenai Forest Plan with Planning Regulations

According to the 2012 Planning Rule, NFS land management plan components must meet:

- the sustainability requirements of § 219.8
- the diversity requirements of § 219.9
- the multiple-use requirements of § 219.10
- the timber requirements of § 219.11 (36 CFR 219.14(a)(2))

The 2015 KFP would continue to meet these requirements with implementation of the three amendments. A detailed analysis of the effects of the amendments on overall 2015 KFP conformity with the substantive requirements of the planning regulations is available in the project record.

4.2.4.4 Cumulative Effects of Amendments

Since the establishment of the 2015 KFP, no other project-specific amendments for 2015 KFP components related to ungulate winter range or scenic resources have been approved, although they are proposed for the Montanore Project. The Rock Creek Project and the Montanore Project are discrete

projects that would be implemented in geographically separate locations, and the project-specific amendments proposed for these two projects would be implemented in discrete, limited areas. As described above, Alternative V would affect minimal ungulate winter range for elk, mule deer, and white-tailed deer relative to the amount available forestwide. The proposed amendment for the Montanore Project for ungulate winter range is specific to moose. Thus, there are no cumulative effects for ungulate winter range in combination with the Montanore Project. Project-specific amendments for the Montanore Project for NFS lands not meeting SIOs would address 1,595 acres in the short term and 434 acres in the long term. Thus, the Rock Creek and Montanore Projects would cumulatively affect a very small (0.2%) proportion of areas in the KNF with mapped SIOs of moderate to very high. The plan amendments proposed for Alternative V, in combination with those proposed for the Montanore Project, would not preclude the 2015 KFP from achieving well-distributed ungulate habitat across the landscape to provide prey for carnivores (FW-DC-WL-08) and scenic resources that complement the recreation settings and experiences while reflecting healthy and sustainable ecosystem conditions (FW-DC-AR-02).

4.2.5 Regulatory Compliance/Forest Plan Consistency

All three amendments would be completed in accordance with the regulations governing Forest Plan amendments found in 36 CFR 219 and Forest Service Manual 1921.03. The analysis disclosed in this SEIS satisfies the requirements for an evaluation for the amendments. With the amendments, Alternative V would be consistent with FW-GDL-WL-09, FW-GDL-AR-01, and all other components of the 2015 KFP.

4.3 Climate and Greenhouse Gases

4.3.1 Summary

For a proposed action that would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2-equivalent (CO_2e) GHG emissions on an annual basis, the CEQ (2010) recommends that agencies consider a quantitative and qualitative assessment of the contributions of that proposed action on climate change. For long-term actions that have annual direct emissions of less than 25,000 metric tons of CO_2e, the CEQ encourages agencies to consider whether the action's long-term emissions should receive similar analysis (CEQ 2010). Anticipated emissions of GHGs from the Rock Creek Project combustion sources are about 9,200 metric tons per year CO_2e from underground mobile sources. Other potential combustion sources would be insignificant. The air pollution mitigation strategies would effectively minimize GHG emissions.

4.3.2 Introduction

The analysis of impacts of the alternatives on climate and GHGs was updated to incorporate current EPA and CEQ guidelines. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on climate and GHGs in the study area. The Agencies did not identify any incomplete or unavailable information. The following subsections describe the updated analysis of impacts of each alternative on climate and GHG emissions.

4.3.3 Alternative V

Anticipated total emissions of GHGs from Rock Creek Project combustion sources would be 9,124 metric tons per year. Although no federal or state regulations on GHGs apply to the Rock Creek Project, all action alternatives would use equipment that meets current EPA specifications to minimize air pollution and GHG emissions. EPA air quality regulations require reporting of GHG emissions from listed facilities and facilities with stationary sources that emit more than 25,000 metric tons CO_2e in a calendar year. Annual Rock Creek GHG emissions would be primarily mobile sources with potential GHG emissions below 10,000 metric tons per year and would not be subject to reporting requirements. Potential sources of GHG emissions from Alternative V include product load-out, electric power generation, on-site generator, building heaters, emergency generator, and mobile sources.

Product Load-out: The concentrate slurry would be pumped to a fully enclosed building where it would be dewatered to 8 to 10% moisture using a rotary drum filter, filter press, or similar equipment. No combustion sources would be used in the dewatering process. The still-moist concentrate would be conveyed to railcars and then shipped to another facility for further processing (Bison 2014).

Electricity for lights and electric-powered equipment would be provided through a utility contract. No *on-site* generators, other than an emergency backup diesel generator on the surface, would be used for either the Evaluation or Operations Phase (Bison 2014).

Building heaters may be electric, with zero air pollutant emissions, or may rely on combustion of natural gas or propane. If combustion-based, the heaters would be designed with heat input capacities of less than 5 million British thermal units per hour (MMBtu/hr) and would produce negligible quantities of GHG emissions.

A *diesel emergency backup generator* would be installed at the evaluation adit, and after Phase I, moved to the mill site and operated as required during electrical power outages and for maintenance. The

generator would not operate more than 100 hours per year. The engine would conform to 40 CFR Part 89 emission limits for Tier 4 engines manufactured after 2011 and would be sized between 130 and 560 kW. Emergency generators are considered intermittent emissions sources and are typically excluded from emission analyses by EPA and DEQ.

Emissions from underground diesel vehicles would issue from one of two adit portals rather than being dispersed throughout the property, as would be the case for surface mobile source emissions. Based on a maximum potential consumption of 900,000 gallons per year of diesel fuel, total GHG emissions from underground diesel vehicles were estimated to be 9,124 metric tons CO_2/year (Bridges Unlimited 2012). Contributions to total GHG emissions from methane and nitrous oxide would be negligible.

4.3.4 Alternatives II, III, and IV

In Alternative II, the concentrate would be trucked to Hereford Loadout, rather than slurried in buried pipeline in Alternative V, or trucked to the Miller Gulch loadout in Alternatives III and IV, resulting in more mobile source air pollution emissions than the other alternatives. In Alternatives III and IV, the concentrate would be trucked to the Miller Gulch rail loadout, rather than slurried in buried pipeline, resulting in slightly more mobile source air pollution emissions than Alternative V. Despite small differences in mobile source air pollution, GHG emissions would not be measurably different among alternatives.

4.3.5 Alternative I

GHGs would remain similar to current conditions. Any changes in air quality conditions would be unrelated to mine development. The primary anticipated air quality impact would be from increased vehicle traffic and home heating associated with population growth. No new significant industrial air pollution sources are anticipated in the area.

4.3.6 Effectiveness of Agencies' Proposed Mitigation

The proposed Rock Creek Project would use the control technologies determined to qualify as Best Available Control Technology (BACT) for each applicable emissions source and pollutant combination. These technologies would effectively minimize GHG emissions from combustion sources.

4.3.7 Cumulative Impacts

The Production Phase of the mine is expected to last 30 years. At the projected emission rate of 9,124 metric tons CO_2/year, total GHG emissions are projected to be 274,000 metric tons over the life of the Rock Creek Project. States in EPA Region 8 were responsible for 5.3% of the nation's GHG emissions in 2005, totaling 362 million metric tons of CO_2 (EPA 2008). Anticipated emissions of GHGs from the Rock Creek Project would represent 0.0025% of 2005 EPA Region 8 emissions. A typical coal-burning power plant emits several million tons of CO_2/year. The 9,124 metric tons of anticipated annual CO_2 emissions is comparable to the emissions from burning 48 rail cars of coal, or the annual energy use of about 803 homes.

4.3.8 Regulatory Compliance

The GHG Tailoring Rule applies to PSD-NSR major stationary sources that emit greater than 100,000 tons CO_2e or that modify their facility with a resulting emissions increase greater than 75,000 tons CO_2e/year. The Rock Creek Project would not be a major PSD-NSR stationary source, nor would its

GHG emissions exceed the applicable threshold. The GHG Tailoring Rule would not apply to the facility (Bison 2014).

The Greenhouse Gas Mandatory Reporting Rule requires reporting of GHG emissions from listed facilities and facilities with stationary sources that emit more than 25,000 metric tons CO_2e in a calendar year. The Rock Creek Project's potential GHG emissions would be less than 10,000 metric tons CO_2e/year.

4.4 Air Quality

4.4.1 Summary

The Rock Creek Mine would be a minor source of regulated air pollution emissions. Facility-wide potential emissions of criteria air pollutants regulated under federal and state standards are below major source thresholds for the Prevention of Significant Deterioration – New Source Review (PSD-NSR) requirements. Potential criteria and hazardous air pollutant emissions would also be below major source thresholds. Emissions from the Rock Creek Project are not expected to cause or contribute to an adverse impact on visibility within the CMW. At mine closure, air quality conditions would return to existing levels, assuming revegetation is successful.

4.4.2 Introduction

ASARCO previously submitted a MAQP application for the Rock Creek Project in 1987. The DEQ issued a Final MAQP to Sterling in 2003. In MAQP #2414-01 (and subsequently MAQP #2414-02), the DEQ required that "construction must begin within 3 years of permit issuance and proceed with due diligence until the Rock Creek Project is complete or the permit shall be revoked. If, after 3 years, Sterling desires to keep the permit active but has not commenced construction, an alteration application could be submitted." RCR did not complete construction and did not submit a permit application to keep the permit active and therefore, the MAQP was considered invalid as of March 28, 2006, even though the permit was not revoked. RCR submitted a new MAQP application to the DEQ in March 2014 (Bison 2014). DEQ issued its permit (MAQP #2414-03), effective November 1, 2014. The final permit (MAQP #2414-03) is provided in Appendix C.

Although the 2003 permit was considered invalid , the major characteristics of the proposed Rock Creek Project affecting air emissions have not changed. This section updates the description of the Rock Creek Project's air pollution emissions sources, potential impacts on ambient air quality, air pollution controls, and regulatory requirements. A brief description of the air pollution dispersion modeling that was completed in preparation of the new 2014 MAQP application is also described. The 2014 MAQP application was prepared for Alternative V. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on air quality in the study area. The Agencies did not identify any incomplete or unavailable information. The effects of minor differences in the other alternatives on air quality are described below.

4.4.3 Alternative V

Air pollutant emissions associated with the proposed Rock Creek Project would originate primarily from point sources (underground scrubber, above ground scrubber, ore baghouse, and emergency generator) and from fugitive sources (blasting, wind erosion of paste tailings facility and stockpiles, and road dust). Table 4-1 lists the estimated emissions from the Rock Creek Project, including the emission control equipment and practices that would be used. Emissions of SO_2 would be negligible. Emulsion blasting material would be used, with negligible sulfur emissions (Bison 2014).

Table 4-1. Summary of Potential Air Pollution Emission Rates, Type of Emission, and Emissions Controls by Source.

Source Description	Potential Emissions (tons per year)							Source Type[1]	Emissions Control(s)[2]
	PM	PM10	PM2.5	NO_x	CO	VOC	SO_2		
Blasting	0.33	0.17	0.010	0.38	20.3			F	BOPs
Underground Ore Processing and Handling (Scrubber #1)	0.22	0.079	0.0087					P	Inherent moisture, wet scrubber
Aboveground Ore Processing and Handling (Scrubber #2)	0.26	0.10	0.012					P	Inherent moisture, wet scrubber
Fine Ore Processing and Handling (Baghouse)	0.091	0.030	0.0028					P	Inherent moisture, fabric filter baghouse
Emergency Generator	0.018	0.018	0.018	0.304	0.38	0.043		P	BOPs
Wind Erosion	2.4	1.2	0.18					F	BOPs and water spray
Road Dust	4.8	0.96	0.24					F	Washing and sweeping, BOPs
Total Facility-Wide Emissions	**8.1**	**2.6**	**0.47**	**0.68**	**21**	**0.043**	**0**		

[1] F = Fugitive source; P = Point source.
[2] BOPs = Best operating practices.
Source: Bison 2014.

Several components of Alternative V would reduce uncontrolled air pollutant emissions and resulting impacts:

1. Paste Technology Tailings Management – Tailings would be deposited as a paste, with lower water content than a slurry, allowing for alternative construction methods. The potential emissions from the proposed paste tailings management system would be much less than from a conventional slurry tailings system. Paste tailings would be deposited in panels with some concurrent reclamation and reduced exposed tailings area, reducing the potential for wind erosion and fugitive dust. The revegetation plan would include seeding paste tailings to facilitate interim revegetation and dust control.

2. RCR would maintain an adequate level of dust control from wind erosion at the tailings disposal area. Adequate dust control may include, but is not limited to, chemical stabilization of some areas, development of a detailed sprinkler system operating plan, and operation and upgrading of the sprinkler system.

3. Electric Underground Mining Equipment – Most underground mobile equipment would be electric powered and any diesel-fueled equipment would run on ultra-low sulfur diesel with a maximum sulfur content of 15 ppm. Emissions from any diesel-fueled equipment would be below emission limits for nonroad diesel engines specified in 40 CFR 89 for Tier 4 engines manufactured after 2011.

4. Powerline – Power to the evaluation adit site would be provided through a powerline rather than using generators. A 300-kW backup generator would be located at the adit portal and would

provide power only during periods when line power was not available. No other generators would be used.

5. Concentrate Slurry – Processed concentrate would be conveyed from the mill site to the Miller Gulch rail siding by slurry pipeline rather than by haul trucks, eliminating the emissions associated with hauling proposed in the other action alternatives.

6. Blasting – RCR would use Best Operating Practices for minimizing blasting emissions, including hole size optimization, water spray after each blast, and minimizing time between charge loading and detonation.

7. Best Available Control Technologies – RCR would use BACT for each applicable emissions source and pollutant combination.

4.4.3.1 Emissions

Fugitive dust emissions from traffic on access roads inside the mine permit boundary and by wind erosion of material storage piles would be the largest sources of PM emissions. Numerous dust mitigation methods would be implemented, which are described in Section 2.3.1.12, *Erosion and Sediment Control*.

Other air emissions sources during the Evaluation and Production Phases are blasting, scrubbers, baghouses, and the emergency generator (Table 4-1). Blasting would be the largest source of carbon monoxide air pollution emissions. Blasting emissions were estimated using industry studies. Emissions from the emergency generator were determined using the worst-case emission factors for this type of diesel generator based on current EPA emission standards described in 40 CFR 89. All other emissions were calculated using the emission factors specified by the EPA for each process, equipment, and fuel, as described in EPA's AP-42 Compilation of Air Pollutant Emission Factors.

The DEQ classified the following stationary sources as insignificant in the MAQP:

- Underground road dust: equipment would travel at low rates of speed for short distances and water sprays would be used in the mucking process to ensure worker safety.
- Building heaters would be electric (zero air pollutant emissions) or would operate on natural gas or propane fuel. If combustion-based, the heaters would be designed with heat input capacities of less than 5 MMBtu/hr and would produce negligible air emissions.
- Storage of diesel fuel in a 20,000-gallon, fixed-roof tank: potential VOC emissions estimated at 7 pounds per year.
- Processing wet materials or materials with significant moisture: negligible amounts of particulate emissions.

Tailpipe emissions from mobile sources (cars and trucks) are regulated under the federal CAA separately from stationary sources, and are not usually addressed in applications for a stationary source air permit. However, potential mobile source emissions from underground diesel vehicles were analyzed. Because most of the vehicular use would be underground, these emissions would be emitted from one of the two adit portals, mimicking a stationary source. All mobile diesel equipment would comply with the current EPA emission standards for the equipment as described in 40 CFR 1039 Tier 4 emission limits for nonroad compression ignition engines. Emission calculations were based on these emission limits and AP-42, Compilation of Air Pollutant Emission Factors for the maximum annual diesel fuel consumption for the Rock Creek Project of 900,000 gallons per year, and the emission factors that EPA specifies for this source. The emission calculations are summarized in Table 4-2.

Metallic hazardous air pollutants (HAPs) in the PM would be emitted during mining and milling. A worst-case analysis was done, assuming that all potential PM emissions contain metallic HAPs in the same proportions as found in a 1987 assay of the mine ore. Based on this conservative calculation, the worst-case potential HAP emission rates are shown in Table 4-2. Predicted concentrations of lead are below federal and state ambient air quality standards. There are no standards for the other metals.

Table 4-2. Potential HAP Emission Rates.

Source	Emission Rate (tons/year)				
	Lead	Arsenic	Antimony	Chromium	Cadmium
Ore	0.00035	0.00027	0.000027	0.000041	
Tailings	0.000077	0.00029	0.000038	0.000038	0.000038
Subtotal	0.00043	0.00056	0.000065	0.000079	0.000038
Total HAPs	0.0012				

Source: Bison 2014.

Secondary or indirect air quality effects related to the Rock Creek Project would result from population growth. These effects would be primarily from increased vehicle traffic and home heating/wood burning, but would not be expected to exceed ambient air quality standards.

4.4.3.2 Modeling

4.4.3.2.1 MAAQS/NAAQS Compliance Demonstration

Potential emissions of criteria pollutants from stationary sources as shown in Table 4-1 are below levels that require dispersion modeling to demonstrate compliance with ambient air quality standards. Because of the proximity to the CMW and the need for NEPA disclosure, modeling was done to demonstrate compliance with NAAQS and MAAQS and to evaluate potential impacts on Class I area PSD increments and plume visibility.

AERMOD, EPA's refined air dispersion model, was used to demonstrate NAAQS/MAAQS compliance. Two phases of modeling were conducted:

1. *Preliminary Analysis*—the modeled concentrations of Rock Creek Project emissions only were compared to appropriate significant impact levels (SILs). If modeled peak concentrations at all locations were less than a particular SIL, RCR's emissions would not cause or contribute to a violation of the related MAAQS/NAAQS and no further modeling was conducted. Two scenarios were modeled: exhaust from the evaluation adit and exhaust from a production adit.

2. *Compliance Demonstration Analysis*—to evaluate compliance with applicable air quality standards, the modeled concentrations of Rock Creek Project emissions plus background concentrations and emissions from nearby sources were compared to applicable MAAQS/NAAQS. The EPA requires that all "nearby" sources be modeled to demonstrate compliance with NAAQS. Any source outside the mine that had a Montana air quality permit (MAQP) within 50 kilometers of the mine (the modeling distance limitation of AERMOD) was included in the cumulative impact analysis. The two nearby sources included in RCR modeling were the Genesis Inc. Troy Mine, 21 miles northwest of the Rock Creek Project, and the proposed Montanore Project, 12 miles to the northeast. The compliance demonstration analysis addressed potential emissions of NO_2, PM10, and PM2.5.

Potential peak CO, NO_2, PM10, and PM2.5 emissions were above SILs (Table 4-3). Although the EPA has vacated and remanded the PM2.5 SILs, the DEQ has the option to continue their application. This analysis showed CO and associated averaging periods were insignificant so no further modeling was necessary for CO (DEQ 2014a). To demonstrate compliance with NAAQS/MAAQS, the two nearby

sources (Troy Mine and Montanore Projects) and background concentrations were added to the Rock Creek Project's potential emissions of NO_2, PM10, and PM2.5. None of the potential criteria air pollutant emissions is expected to cause or contribute to an exceedance of any NAAQS or MAAQS (Table 4-4). The air quality permit analysis, which includes the modeling analyses, increment consumption, and emission calculations, is based on the facility's potential to emit. Actual emissions from the facility would likely be less than the potential emissions.

Table 4-3. Comparison of Class II Significant Impact Levels and Modeled Concentrations.

Pollutant / Time Interval	Class II Modeled Concentration (µg/m^3)[(a)]	Class II SIL (µg/m^3)	Significant (yes / no)	Background Concentration (µg/m^3)
PM10 24-hour	36	5	Yes	35
PM10 Annual	7.3	1	Yes	14
PM2.5 24-hour	4.3	1.2	Yes	10.4
PM2.5 Annual	0.9	0.3	Yes	3.5
NO_2 1-hour	121[(c)]	7.52[(b)]	Yes	35.7
NO_2 Annual	1.8[(c)]	1	Yes	6
CO 1-hour	6,805	2,000	Yes	690
CO 8-hour	2,045	500	Yes	575

[(a)] All concentrations are 1st-high for comparison to SILs. Annual and 24-hour PM2.5 and 1-hour NO_2 values were generated using 5-year meteorological data file for Troy RAWS data and the single year of 1985 Noxon data. All other values represent peak results from individual meteorological data years.
[(b)] EPA proposed an interim 1-hour NO_2 SIL of 4 ppb in a June 29, 2010, policy memo. The µg/m^3 value shown was calculated based on a standard temperature of 25ºC.
[(c)] NO^2 impact incorporate ozone limiting method.
µg/m^3 = microgram per cubic meter.
Source: Bison 2014.

Table 4-4. MAAQS/NAAQS Compliance Demonstration Modeling Results.

Pollutant / Time Interval	Cumulative Modeled Contri-bution (µg/m^3)[a]	Background Concen-tration (µg/m^3)	Ambient Concen-tration (µg/m^3)	NAAQS (µg/m^3)	Percent of NAAQS	MAAQS (µg/m^3)	Percent of MAAQS
PM10 24-hour	27.2[f]	35	62.2	150	41	150	41
PM10 Annual	7.43[d]	14	21.4	50	43	50	43
PM2.5 24-hour	4.36[g]	10.4	14.8	35	42	NS	—
PM2.5 Annual	1.01[h]	3.5	4.51	12	38	NS	—
NO_2 1-hour	107[b,e]	35.7	142	188	76	564[c]	25
NO_2 Annual	1.8[d,e]	6.0	7.83	100	8	94	8

[a] Values in the modeling files may differ slightly from the values shown here due to differences in the presentation of significant digits.
[b] Concentration is the 5-year average (for the Troy meteorological data) or 1-year average (for the Noxon on-site data) of the 98th percentile of daily maximum one-hour averages.
[c] Although the MAAQS form is not to be exceeded more than once per year, the relative stringency of the NAAQS renders it an acceptable surrogate for the MAAQS.
[d] Modeled concentration is the highest annual average of the modeled 6-year period (5 years of Troy meteorological data and 1 year of Noxon on-site data).
[e] NO2 modeling results incorporate OLM Tier 3 analysis method.
[f] Modeled concentration is the maximum high-2nd-high value for 1985 and the maximum high-6th-high for the 5-year average (Troy meteorological data).
[g] Modeled concentration is the 5-year average of maximum daily averages for the Noxon on-site data or maximum daily average for the single year of Noxon on-site data.
[h] Modeled concentration is the 5-year average of annual averages for the Noxon on-site data or the annual average for the single year of Noxon on-site data.
NS = no standard.
µg/m^3 = microgram per cubic meter.
Source: Bison 2014.

Similar modeling was conducted to assess potential impacts on the CMW Class I area, except that ambient background concentrations are not included. Modeled emissions would not cause an exceedance of the PSD Class I increments (Table 4-5).

Table 4-5. Modeled Concentrations in the CMW Compared to PSD Class I Increments.

Pollutant/ Time Interval	Peak Modeled Concentration ($\mu g/m^3$)	Class I SIL ($\mu g/m^3$)	Significant
NO_2 Annual	0.03	0.1	No
PM10 24-hour	0.26	0.3	No
PM10 Annual	0.02	0.2	No
PM10 24-hour	0.04	0.07	No
PM10 Annual	0.002	0.06	No

$\mu g/m^3$ = microgram per cubic meter.
Reported values are high-first-high values. PM2.5 Class I SILs have been codified at 40 CFR 52.21(k)(2). EPA proposed Class I SILs for other criteria pollutants in 1996 but has not finalized them.
Source: Bison 2014.

4.4.3.2.2 Nitrogen and Sulfur Deposition

Nitrogen and sulfur deposition on CMW lakes was modeled by Bison (2013) to determine the potential effects. Worst-case NO_x and SO_2 emissions were quantified using AERMOD and were compared against the nitrogen and sulfur deposition analysis threshold. Table 4-6 lists the model results. Deposition rates would be below the deposition analysis threshold for nitrogen and sulfur of 0.005 kilograms/hectare/year and would be considered negligible according to Federal Land Manager's guidance (USFS, National Park Service, and USFWS 2011).

Table 4-6. Maximum Predicted Nitrogen and Sulfur Deposition in Wilderness Lakes.

Lake	Peak Nitrogen Deposition Rate (kilograms/hectare/year)	Peak Sulfur Deposition Rate (kilograms/hectare/year)
Bramlet	0.0009	0.0000018
Cliff	0.0027	0.000003
Copper	0.0040	0.000013
Engle	0.0022	0.000015
Isabella	0.0008	0.0000009
Lower Libby	0.0010	0.0000012
Moran Basin	0.0045	0.0000086
Rock	0.0014	0.0000029
St. Paul	0.0018	0.000004
Upper Bramlet	0.0014	0.000012
Upper Libby	0.0010	0.000001
Wanless	0.0013	0.000022

Deposition Analysis Threshold = 0.005 kilograms/hectare/year.
Source: Bison 2013.

4.4.3.2.3 Best Available Control Technology Analysis

Emission controls to be used at the proposed mine would constitute BACT, as required by ARM 17.8.752(1)(a). Underground blasting would be controlled by using best operating practices. Coarse ore handling and processing would be controlled by wet scrubbing combined with applied and inherent moisture. Fine ore handling would be controlled by fabric filter baghouse control. Emergency generator emissions would be compliance with 40 CFR 60, Subpart III requirements and annual operations to no more than 300 hours. Fugitive emissions from disturbed/exposed soils would be controlled by revegetation of these areas in the first appropriate season after disturbance. Fugitive emissions from roads

would be controlled by paving the main access road to the mill facilities, watering or use of a dust palliative on all unpaved roads, restriction of vehicle speeds on haul roads, chemical stabilization or palliatives on heavily used roads, piping concentrate and tailings as a slurry, and transportation of personnel via a multi-passenger vans from the highway to the mill and mine sites. Conveyor emissions would be controlled by covering the conveyor system. Tailings impoundment emissions would be controlled by use of a sprinkler system.

4.4.3.2.4 Odor

Odor and noise are not regulated in the ARM. Odor is a potential nuisance, but the Rock Creek Project is not expected to increase odors.

4.4.4 Alternative IV

In Alternative IV, the ore concentrate would be trucked to the Miller Gulch rail loadout, rather than slurried in buried pipeline. This would mean additional mobile source air pollution emissions. Mobile source emissions are discussed above for Alternative V. Also, in Alternative IV, tailings would be deposited as a slurry, increasing the exposed tailings and increasing the potential for wind erosions, relative to Alternative V. Other Alternative IV impacts on air quality would be similar to Alternative V.

4.4.5 Alternative III

Less waste rock would be handled at the Alternative III mill site than for Alternatives IV and V, resulting in slightly lower particulate emissions. The emission points and impacted areas would be different for Alternative III compared to Alternatives IV and V. Neither the slight changes in emissions nor the different emission points would substantially alter the overall air quality impacts of the Rock Creek Project from those described for Alternative V. The use of a modified centerline construction method for the Alternative III tailings facility increases the amount of exposed tailings surface due to delayed reclamation of the embankment face. This would result in a higher potential for wind erosion during the 7 years of centerline construction. Wind erosion would be reduced through implementation of Alternative II erosion control measures described on page 2-49 of the 2001 FEIS that would also apply to Alternative III, including:

- The establishment of a temporary vegetative cover on portions of the tailings surface and embankment
- Chemical stabilization of some areas
- Upgrading of the sprinkler system to provide more extensive coverage and water availability
- Development of a detailed sprinkler operating plan that would be updated as the tailings surface expanded. This may include specific recordkeeping requirements such as times of sprinkler operation and the amount of water used. A minimum threshold wind speed, above which sprinkling would be required, could also be developed

More roads would be constructed or reconstructed for Alternative III than Alternative V. The additional roads for Alternative III would lead to slight increases in fugitive dust and mobile source emissions compared to Alternative V.

Similar to Alternative IV, under Alternative III, the ore concentrate would be trucked to the Miller Gulch rail loadout, rather than slurried in buried pipeline, resulting in additional mobile source air pollution emissions. Mobile source emissions are discussed above for Alternative V. Other Alternative III impacts on air quality would be similar to Alternative IV.

4.4.6 Alternative II

Alternative II impacts on air quality would be similar to Alternative III, except that in Alternative II, ore concentrate would be trucked to the Hereford Loadout, resulting in additional mobile source air pollution emissions. Mobile source emissions are discussed above for Alternative V. Also, the tailings facility would be constructed using the upstream method, which would result in less exposed tailings surface than for Alternative III.

4.4.7 Alternative I

Ambient air quality in the area would remain similar to its current condition. Any changes in air quality would be due to conditions unrelated to mine development. The primary future air quality impact would probably result from population growth with increased vehicle traffic and home heating. No new significant industrial air pollution sources are anticipated in the area at this time.

4.4.8 Effectiveness of Agencies' Proposed Mitigation

The reporting requirements described in Appendix K, along with the conditions and reporting requirements in DEQ's Final Determination (DEQ 2014a) (Appendix C) would be adequate to control emissions. ARM 17.8.752 requires that any new or altered source requiring an air quality permit install the maximum air pollution control capability that is technically practical and economically feasible. This level of emissions reduction is referred to as BACT. The EPA provides guidelines for the procedures to follow to determine BACT. The proposed Rock Creek Project would use BACT, based on EPA guidelines, for each applicable emissions source and pollutant combination.

The dry ore processing system consists of conveyors, feeders, crushers, and screens, all of which create PM emissions. These emissions would be mitigated by moisture inherent in the ore, water spray applied in the mine, wet scrubbers, and a fabric filter baghouse.

In addition to inherent and applied moisture effects, PM emissions from ore handling and processing would be controlled by two wet scrubbers and one fabric filter baghouse. A wet scrubber underground would control all underground emissions sources. A second wet scrubber would control all aboveground emissions up to loading of fine ore into the fine ore bin. Emissions from handling fine ore would be controlled by a baghouse. All three of these emissions control systems should provide a control efficiency of 98%.

As described under Alternative V above, fugitive dust emissions from traffic on access roads inside the mine permit boundary and by wind erosion of material storage piles would be the largest sources of PM emissions. Numerous dust mitigation measures would l be implemented and are described in Section 2.3.1.12, *Erosion and Sediment Control*.

4.4.9 Cumulative Impacts

The numerous small mining operations and gravel mining pits in the study area have had little effect on ambient air quality in the study area. Similarly, effects of other past and current activities in the study area, such as timber harvests, recreation, prescribed burning, and Avista-funded bull trout recovery activities on ambient air quality would be negligible.

The Troy Mine, an existing hard rock mine currently in care and maintenance status, is 24 miles northwest of the proposed Rock Creek Mine. The Troy Mine is classified as a minor emissions source under the Title V (40 CFR 70.2) and PSD regulations (40 CFR 52.21). Currently, the air quality classification of the area surrounding the mine is "Unclassifiable/Attainment" for all air quality criteria pollutants (40 CFR 81.327).

The proposed Montanore Project on the east side of the Cabinet Mountains in the Libby Creek drainage would contribute to the cumulative effects on air quality. The Montanore and Rock Creek mines would have similar emission sources associated with the plant site, paste tailings facility, and other surface disturbances. Although the Montanore Mine is only 12 miles northeast of the proposed Rock Creek Mine, the Cabinet Mountains lie between the two mines with elevations ranging from 2,880 to 8,738 feet. Due to this mountain range, the airsheds between these two mines are clearly distinct (DEQ 2014a). The Montanore Project is classified as a minor emissions source under Title V (40 CFR 70.2) and PSD regulations (40 CFR 52.21). Although the loadout area and part of the Bear Creek access road would be in the Libby nonattainment area, the air quality classification of the area surrounding the proposed mine is "Unclassifiable/Attainment" for all air quality criteria pollutants (40 CFR 81.327).

Modeled Rock Creek Project emissions plus background concentrations and emissions from the proposed Montanore Project and the Troy Mine were compared with applicable MAAQS/NAAQS as described in Section 4.4.3.2, *Modeling*. The Rock Creek Mine NOx with the corresponding emissions from the existing Troy Mine and proposed Montanore Project would not cause or contribute to a 1-hour NO_2 NAAQS. Furthermore, the daily and annual $PM_{2.5}$ and PM_{10} Rock Creek Project Production Phase emissions with the corresponding particulate emissions from the Troy and Montanore mines would not violate the corresponding NAAQS/MAAQS (DEQ 2014a).

As discussed in Section 4.4.3.2, *Modeling*, modeling conducted for the Rock Creek and Montanore projects predicted compliance with the Class I increments at the CMW boundary. Based on modeling results (Bison 2013), nitrogen and sulfur deposition on CMW lakes due to the Rock Creek Project would be negligible and would not contribute to cumulative effects.

Cumulative effects of the following reasonably foreseeable actions on ambient air quality would be negligible:

- Libby Creek Ventures drilling plan, which proposes to drill three borings adjacent to the Upper Libby Creek Road (NFS road #2316) on its two claims located in Section 15, Township 27 North, Range 31 West, may be expected to contribute localized short-term emissions. The short-term nature of these potential emissions makes it unlikely that they would add measurably to emissions from the Rock Creek Project.
- Wayup Mine and Fourth of July Road Access, which would involve reconstruction of roads in the upper West Fisher Creek drainage. Timber harvesting and use of unpaved roads associated with this project on unpaved roads would increase particulate emissions for a short duration. Concentrations of criteria pollutants would be well below the NAAQS and MAAQS.
- Miller-West Fisher Vegetation Management Project, which would involve timber harvest and other vegetation treatments in the Miller and West Fisher Creek drainages. Timber harvesting, thinning, and prescribed burning associated with this project would increase particulate emissions for a short duration. Concentrations of criteria pollutants would be well below the NAAQS and MAAQS.
- Forestwide herbicide weed control, which would treat noxious weeds in the KNF, may be expected to contribute localized, short-term, and transient emissions of fugitive dust. The short-term nature of these potential emissions makes it unlikely that they would add measurably to emissions from the Rock Creek Project.
- Timber harvest of private lands in the Rock Creek drainage and continued development of lands in the study area may be expected to contribute localized, short-term, and transient emissions of fugitive dust. The short- term nature of these potential emissions makes it unlikely that they would add measurably to emissions from the Rock Creek Project.

4.4.10 Regulatory Compliance

Alternative V would implement emission controls at the proposed mine that would constitute BACT, as required by ARM 17.8.752(1)(a). 36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on NFS surface resources; and comply with applicable state and federal air quality standards including the Clean Air Act. Alternative V would incorporate feasible measures to minimize adverse environmental impacts on NFS surface resources and comply with applicable state and federal air quality standards. These measures, which, in addition to using BACT, would include using paste technology to manage tailings; using a sprinkler system and, if appropriate, chemicals to stabilize tailings and control dust; using primarily electric-powered equipment and ultra-low sulfur diesel for any diesel-fueled equipment; providing power to the evaluation adit through a powerline rather than using generators; conveying concentrate from the mill site to the Miller Gulch rail siding by slurry pipeline rather than by haul trucks; and using Best Operating Practices to minimize blasting emissions and substantially reduce emissions. Other conditions and limitations on air emissions are described in the MAQP (DEQ 2014a) for the Rock Creek Project. Alternative V would be in compliance with the Montana Clean Air Act because construction activities and facility operations would not result in exceedances of any NAAQS or MAAQS. Alternative V would be consistent with the 2015 KFP components pertaining to air quality. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record.

4.5 Geology

This section updates the *Environmental Consequences* section for geology, and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously included in the 2001 FEIS.

4.5.1 Introduction

The following sections provide updates to the analysis of the effects of the alternatives on geology, specifically, an updated analysis of the potential for subsidence. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on geologic resources in the study area. The analysis of effects of the alternatives on geologic resources, topography and geomorphology, and potential for slope failure is provided on pages 4-21 through 4-33 of the 2001 FEIS. The effects on the potential for acid-rock drainage, trace metal release, and nutrient release potential are discussed in Section 3.6, *Environmental Geochemistry*. The effects on water quality and quantity are discussed in Section 4.7, *Water Quantity and Quality*.

4.5.2 Alternative V

4.5.2.1 Subsidence

Subsidence is the observable topographic change from the collapse of underground openings. The potential location, magnitude, and severity of subsidence impacts on the ground surface, the groundwater system, or to any surface lakes or streams in the area are unknown. The potential for and amount of surface subsidence is dependent on the strength of the rock; the amount of physical support provided by the mining method used (types of ground support used in the openings, number and size of pillars, and size of the rooms); and the stress distribution (the way in which pressure is spread within rock) in the surrounding rock. The potential environmental consequences from the collapse of underground openings include surface subsidence, a change in the groundwater regime, drainage of surface waters, and surface seep development.

Previously unknown evidence of subsidence related to failure of underground support pillars was observed recently above the Troy Mine (CNI 2014). It appears the original design criteria at the Troy Mine overestimated the load-bearing capacity of the support pillars. To reduce the possibility of similar failures at the Rock Creek Project, in Alternative V, RCR would leave stable support pillars, not mine areas where overburden thickness was less than 450 feet without further study and KNF and DEQ approval, maintain a 100-foot buffer on either side of the Moran and Copper Lake Faults and other faults encountered, and maintain a 1,000-foot buffer around Cliff Lake and the ore outcrops. These measures would reduce the recoverable tonnage of the in-place mineral resource.

RCR submitted a revised plan for the evaluation adit to the KNF and DEQ (RCR 2010). RCR would also submit an updated mine plan prior to Phase I that would reference the Troy Mine experience in its proposal for future pillar designs and highlight how the new designs account for and differ from failed designs at the Troy Mine. As pillar designs were refined, numerical modeling would be undertaken to further evaluate expected design performance, including the potential for shear failure at the pillar/roof or pillar/floor interface. Prior to Phase II (Construction), RCR would submit for KNF and DEQ approval a detailed mine plan, using the data collected during Phase I, that minimizes the risk of subsidence. The requirements of the updated mine plan are described in more detail in Section 2.3.1.3.2, *Final Underground Mine Design Process* and Section 2.3.1.4.2, *Mine Development*.

The potential for subsidence increases as the mining height increases and/or the mining depth decreases. The ore body ranges in thickness from 4 feet up to a maximum of 235 feet near the Copper Lake Fault.

The average thickness of the ore body is about 27 feet. Mining depth ranges from 0 feet at the outcrops to about 2,000 feet near St Paul Peak, and averages about 900 feet. As described in Section 2.3.1.4.2, *Mine Development*, in areas where the proposed ore extraction thickness exceeds practical mining limits, RCR would use a horizontal (sill) pillar (Figure 2-6) to facilitate extraction over the entire ore height.

Site-specific geologic discontinuities such as jointing, faults, or dikes affect the strength and response of the surrounding rock during mining. At Rock Creek, the nature and extent of such discontinuities, other than major faults, have not been identified in detail and their influence on the potential for subsidence is unknown. To reduce the potential for subsidence, RCR would complete detailed mapping of surficial geology and evaluation adit geology to identify discontinuities; review core logs for discontinuities; incorporate information about discontinuities into mine planning; and perform probe drilling in advance of development to detect minor faults. (Areas 1, 2, and 3 on Figure 4-2 of the 2001 FEIS).

Analytical rock mechanics data for the Rock Creek site are not available. As described in the Rock Mechanics Data Collection and Subsidence Monitoring Plan (Appendix K), some of these data would be obtained during construction of the evaluation adit and would be used to modify the initial underground mine plan to minimize the risk of subsidence. If the Rock Creek Project were to proceed, additional data would be obtained during construction of the production adits. Much of the existing information regarding rock strength, artificial support (for example, rock bolts), and room-and-pillar sizing and spacing is extrapolated from experience gained at the Troy Mine. Standard laboratory tests on rock samples from the Troy Mine and Montanore Project found high compressive strengths and overall rock quality to be good to excellent (Redpath Engineering 1991).

Recent subsidence events at the Troy Mine have called into question pillar design adequacy at the Troy Mine. RCR contracted CNI to develop a report (CNI 2014) on the causes of the Troy Mine subsidence events, in the context of Rock Creek Project plans. The KNF contracted AAI to review the CNI report and comment on its implications for the Rock Creek Project. AAI agreed with the main conclusion of the CNI report that subsidence observed over the Troy Mine was a result of inadequately sized pillars within the mine (AAI 2014). With AAI's assistance, the KNF completed a FMEA of the Rock Creek Project underground mine, taking into account the Troy Mine experience, and developed mitigations as part of Agency modified alternatives (AAI 2014). These mitigations are described in more detail in Section 2.3.1.3.2, *Final Underground Mine Design Process* and Section 2.3.1.4.2, *Mine Development.* One key requirement would be for RCR to provide updated mine plans that would reference the Troy Mine experience, and highlight how the new designs account for and differ from failed pillars at the Troy Mine. RCR would use a minimum 0.8 pillar width to height ratio as a preliminary numeric criterion (AAI 2014), to be finalized during later design efforts, and subject to KNF and DEQ approval. This criterion would mean, for example, that at the average ore body thickness of 27 feet, pillar dimensions would not be less than 22 feet in width or length. The criterion was adopted based on experience in hard rock and stone mines that shows that pillars with a low width–to-height ratio are more susceptible to failure driven by fractures or other weakness planes with continuity from one side of a pillar to the other. Data from the CNI report (2014) show that 21 of 23 failed pillar cases from the Troy Mine had pillar width-to-height ratios less than 0.7. RCR also would use a variety of pillar strength estimation approaches described in Chapter 2 to calculate pillar strength and corresponding safety factors. Using multiple approaches to calculate pillar strength and corresponding safety factors would allow the KNF and DEQ to better evaluate the RCR design in relation to other standard approaches.

Several reports addressing mine planning and subsidence potential at the nearby Montanore site concluded that given the proposed mine plan (which is also room-and-pillar) and geologic conditions, the potential for subsidence at Montanore is minimal provided adequate underground monitoring and rock characterization are carried out to refine the mine design once development is underway (Redpath Engineering 1991; AAI 1991, 2007). Contingent on the mitigations described in more detail in Section

2.3.1.3.2, *Final Underground Mine Design Process* and Section 2.3.1.4.2, *Mine Development*, including adequate monitoring, rock characterization, and pillar design, and given the similarities in rock strength and mining method of the Montanore Project, the risk for subsidence is expected to be low to insignificant, as discussed in the FMEA.

In addition to the trough subsidence events recently analyzed at the Troy Mine (CNI 2014; AAI 2014), two chimney subsidence events that resulted in sinkholes at the Troy Mine were reported (Tetra Tech and R Squared 2006). The sinkhole events appear to be different and distinct from the trough subsidence (AAI 2014). In accordance with NEPA and Forest Service policy, the KNF conducted a review of the report to determine its importance and whether a correction, supplement, or revision to the 2001 FEIS was necessary, or if the ROD needed to be amended. The KNF prepared a Supplemental Information Report that described its review and concluded that the information gathered from the sinkhole events supports the 2001 FEIS subsidence analysis, conclusions, and mitigation measures (KNF 2007c). The KNF's 2007 analysis is summarized below.

Sinkhole 1 was initially observed in October 1997 (CNI 2005), about 4 years after the Troy Mine had been shut down. When initially observed, the sinkhole was about 8 feet deep and 15 feet in diameter. On April 29, 2005, sinkhole 1 had increased to about 50 feet wide and 20 feet deep. At the mine level, material from the East Fault, a north- to northwest-trending normal fault that dips at about 65 degrees to the northeast, had accumulated in two separate drifts sometime between the closing of the Troy Mine in 1993 and spring of 2005. Based on measurements of the accumulation of fault material in the mine, estimation of the sinkhole volume, estimates of fault gouge bulking factors, spatial relationships between the East Fault and the mine workings, and other factors, CNI (2005) concluded that the sinkhole was probably not related to underground excavation.

A second sinkhole formed in February 2006, and the source of both sinkholes was analyzed by Tetra Tech and R Squared (2006). Sinkhole 2 was about 135 feet long and 100 feet wide, with a depth between 20 and 30 feet. It was first noticed 4 days after a ground failure and cave-in in the underground workings of the Troy Mine. Based on projections of the East Fault to the surface, the location of the sinkholes relative to these projections, and calculations regarding swell factor and chimney size, Tetra Tech and R Squared (2006) concluded that the sinkholes were mining related. The structurally weak East Fault acted as a conduit for progressive rock failure. The overlying rock in and next to the fault was so highly broken, fractured, and degraded that it lacked sufficient inherent strength to form a stable arch over the expanding void below.

While relevant to the analysis of subsidence potential at Rock Creek, the formation of sinkholes above the Troy Mine does not imply a similar risk of sinkhole formation at Rock Creek. The mining depths associated with the two Troy sinkholes were 270 feet and 320 feet, respectively (Tetra Tech and R Squared 2006). As discussed in Section 2.3.1.4.2, *Mine Development*, mining depths at Rock Creek are significantly greater (averaging 900 feet), except where the ore zone approaches the surface. The probability of sinkhole subsidence decreases with mining depth due to the fact that failed material occupies a larger volume than intact material. This is known as material bulking. As failure propagates from the mine level toward the surface, the volume of failed material eventually replaces that of the mined opening, and further propagation ceases. In trough subsidence, subsidence magnitude and severity of impacts also decrease with depth due to bulking.

In order to protect against surface subsidence, RCR would be required to not mine areas where overburden thickness was less than 450 feet without further study and agency approval. Additionally, RCR would not be allowed to mine closer than 1,000 feet from the outcrops or 100 feet from either side of the Moran and Copper Lake Faults and other minor faults encountered. No such plan was required at the Troy Mine, where the East Fault was routinely approached and/or penetrated as part of the mining operation.

The Agencies have also developed strict design, oversight, inspection, and reporting requirements during Phases I and II. As part of this oversight, a TAG would be formed to provide design review oversight. The TAG would include experts in underground mine design and rock mechanics. In addition to the TAG, the principal duties of which would be limited to design review (if deemed necessary by the KNF and DEQ), RCR may be required to fund an independent third-party technical advisor, whose duties would include providing QA/QC for the Agencies.

4.5.3 Alternatives III and IV

In Alternatives III and IV, RCR would be required to provide KNF and DEQ with an updated underground mine design within 2 years of operation (after mill startup). KNF and DEQ would conduct a design review and identify any potential problems that could lead to subsidence or increased rock fracturing. The purpose of this review would be to verify conclusions reached during the preliminary mine design and, if significant problems were noted, require modifications of the mine plan. To further reduce the potential for subsidence, RCR would submit detailed mine development plans in advance of entering areas of suspected rock instability (see Figure 4-2 in the 2001 FEIS).

Unlike Alternative V, Alternatives III and IV would not include the requirement to leave unmined areas where overburden thickness is less than 450 feet or to not mine buffer zones around lakes, faults, and outcrops. Compared to Alternative V, the potential for subsidence would be greater for Alternatives III and IV due to the lack of these protective measures.

4.5.4 Alternative II

Alternative II does not include measures to reduce the risk of subsidence included in the other action alternatives. Compared to the other action alternatives, the potential for subsidence would be greater for Alternative II due to the lack of these protective measures.

4.5.5 Alternative I

No mining would occur; therefore, the potential for mining-related subsidence would not be present. If the Rock Creek Project was not approved, RCR or other companies or individuals could conduct further evaluation of the Rock Creek or other nearby ore deposits.

4.5.6 Effectiveness of Agencies' Proposed Mitigation

The Alternative V requirements to leave support pillars, not mine areas where overburden thickness was less than 450 feet without further study and agency approval, maintain a 100-foot buffer on either side of the Moran and Copper Lake Faults and other minor faults encountered, maintain a 1,000-foot buffer around Cliff Lake and the ore outcrops, and require a minimum 0.8 pillar width-to-height ratio as a preliminary pillar numeric design criterion, in combination with the monitoring described the *Rock Mechanics Data Collection and Subsidence Monitoring Plan* (Appendix K), would be highly effective at reducing the risk of subsidence. The requirement that RCR update mine designs and plans, based on monitoring information, would further ensure the effectiveness of mitigation. The risks of subsidence were categorized as low to insignificant in the FMEA process, assuming that the mitigations included in the agency modified alternative were applied.

QA/QC during mining operations is critical to underground stability. Involving independent experts and third parties experienced in underground mine design and rock mechanics is an effective mitigation for ensuring mine design and data interpretation are protective against subsidence by creating a forum for technical discussion and debate.

4.5.7 Cumulative Impacts

The analysis of cumulative effects of the alternatives on geologic resources, topography and geomorphology, and potential for subsidence slope failure is provided on page 4-33 of the 2001 FEIS.

4.5.8 Regulatory Compliance

The 2015 KFP does not have specific goals, objectives, and standards for subsidence. It does contain goals, objectives, standards, and guidelines for the CMW. Goals can be found in the CMW Management Plan (USFS 2009). Alternative V has the potential to indirectly affect wilderness qualities. A detailed analysis of the consistency of Alternative V with all 2015 KFP components relevant to the CMW is available in the project record. Mitigation measures identified in Chapter 2 for Alternative V and monitoring required for Alternative V (Appendix K) would be implemented to minimize changes in wilderness character.

Mitigation measures identified in Chapter 2 for Alternative V and monitoring required for Alternative V (Appendix K) would be implemented to minimize changes in wilderness character. In Alternative V, potential subsidence affecting wilderness lakes and wilderness character would be minimized by the Agencies' mitigation described in Section 2.3.1.3.2, *Final Underground Mine Design Process.* Key mitigation measures include:

- Completing pre-mine surficial topographic survey and geologic mapping of lands overlying the mine area to confirm major geologic structures and identify geologic discontinuities
- Undertaking numerical modeling as pillar designs were refined to further evaluate expected design performance, including the potential for shear failure at the pillar/roof or pillar/floor interface
- Using a variety of pillar strength estimation approaches to calculate pillar strength and corresponding safety factors
- Using a minimum 0.8 pillar width-to-height ratio as a preliminary numeric criterion, to be finalized during later design efforts, and subject to KNF and DEQ approval
- Maintaining at least a 1,000-foot buffer around Cliff Lake and the north and south ore outcrop interfaces as a preliminary numeric criterion; a reduction in buffer size would require justification by RCR and prior approval by the KNF and DEQ
- During mining, maintaining a 100-foot buffer from the Copper Lake Fault, Moran Fault, and other faults unless the Agencies approved a narrower buffer
- Keeping the size and number of drives through the identified faults to the minimum necessary to achieve safe and efficient access across the fault unless the Agencies approved a narrower buffer
- Explicitly stating that no secondary mining (reduction in pillar width or length, or increase in pillar height, from designed final dimensions) would be allowed
- Funding biannual surveys of underground workings by an independent underground surveyor and funding an independent technical advisor to assist the Agencies with mine plan review

Mitigation measures and monitoring requirements in Alternative V are reasonable stipulations for protection of the wilderness character and are consistent with the use of the land for mineral development. Implementation of Alternative V would be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness, and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act. Alternative V would minimize adverse environmental impacts on surface resources within the wilderness, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on NFS lands.

4.6 Geotechnical Engineering

4.6.1 Introduction

Paste tailings are similar to conventional slurry tailings, except that much of the free water has been removed. A host of beneficial qualities comes with lower moisture such as improved tailings strength, construction flexibility, and reduced water management requirements. The paste tailings facility in Alternative V would be less susceptible to static and earthquake-induced failure due to the inherent strength of paste compared to the designs in Alternatives II, III, and IV. Additionally, less water is liberated from paste tailings, thereby reducing the amount of water collected in the underdrain system and reaching groundwater.

Previous analyses (Golder 1996; Knight Piesold 1997; Klohn-Crippen 1998) that modeled the stability of the paste facility used results from a laboratory tests conducted on paste samples derived from Troy Mine tailings. Some of the data were based on assumptions and professional opinion where lab tests were absent. Because the Troy Mine samples come from the same geologic unit that would be mined at Rock Creek, and because the laboratory test results fall within a reasonable range of physical characteristics for tailings material of this type, the agencies believe the data used in the analyses are a reasonable approximation of what can be expected from tests on samples from the Rock Creek-Montanore deposit. Since these analyses were conducted, the state-of-the-practice for paste production has advanced in both efficacy and efficiency with improved methods for thickening (i.e., dewatering) slurry tailings to paste specifications. Because the data used in the initial analyses were based on a small number of tests, more laboratory tests and stability analyses using updated test results would be required as part of the final design process. In addition, new information on the PGA that could be expected at the Rock Creek site has been developed and would be incorporated into an updated seismic analysis. A preliminary estimate of the effects from this larger PGA at the site is discussed below. Any new laboratory data and stability analyses would be reviewed by the PTTAG prior to implementing Phase II during the final design process. Appendix K discusses the KNF and DEQ requirements for additional testing and analysis. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects related to geotechnical engineering in the study area.

4.6.2 Alternative V

4.6.2.1 Seepage Management

Management of water released from tailings was a key issue in developing alternative paste tailings facility designs for the Rock Creek Project. This section briefly discusses the anticipated seepage rates and proposed management in each alternative.

In the 2001 FEIS, seepage was referred to water released from tailings after deposition. The volume of seepage requiring management is a function of the slurry density of tailings at deposition and the tailings production rate. All of the alternatives have an estimated production rate of 10,000 tons per day of tailings. In Alternatives II through IV, tailings would be deposited as a slurry at an estimated slurry density of 50%. For every 100 pounds of tailings deposited at a 50% slurry density, 12 gallons of water would be deposited in the tailings facility. At 10,000 tons per day, 2.4 million gallons per day of water would be sent to the tailings facility. Paste tailings proposed in Alternative V would have a slurry density of 80%, and 0.6 million gallons per day of water would be sent to the paste tailings facility, a reduction of 75%. Some of the total water sent to the paste tailings facility would be retained by the tailings in perpetuity, some would evaporate, and the remainder would be “seepage.” Infiltration of precipitation after the tailings were placed would be an additional source of water or seepage requiring management at the paste tailings facility.

In all alternatives, some of the seepage would be collected by engineered drains of highly permeable materials and a piping system beneath the paste tailings facility. In Alternative V, most, if not all, of the seepage would be precipitation infiltration and not water released from tailings consolidation. An extensive system of finger drains would be installed beneath the paste facility to maximize recovery of paste seepage and precipitation infiltration. A blanket drain beneath the compacted outer shell structural zone would supplement the finger drain network and aid in maintaining a lowered phreatic surface in the structural zone. This drain network proposed for Alternative V is in contrast to the design for Alternative II, where underdrains would be limited to widely spaced finger drains beneath the sand shell and North Saddle stabilizing berm and not beneath the starter dams (Dames & Moore 1993).

In all alternatives, some seepage would bypass the underdrain and seepage collection systems and enter groundwater. Under Alternative II, the proposed collection system consists of underdrains, trench drains located at the toe of the embankment, and pumpback wells downgradient of the embankment. The seepage collection systems for Alternatives III and IV would be similar to Alternative II. In the 2001 FEIS, a seepage rate to groundwater from the Alternative II tailings facility of 241 gpm was used in the groundwater loading analysis. For Alternative V, the agencies estimate that the annual average seepage rate to groundwater (not captured by the underdrains) would range from about 43 gpm to 67 gpm during the operation years (Hydrometrics 2014b; Schafer 2014). The common operating feature of Alternatives II, III, and IV is that the majority of the seepage coming from the tailings facility would be collected downgradient of the tailings facility. Conversely, the purpose of the extensive system of underdrains proposed in Alternative V would be to capture a majority of the seepage within the paste tailings facility footprint. A system of pumpback wells (conceptually similar to the pumpback system proposed in Alternatives II, III, and IV) is included in Alternative V as a contingency. If operational monitoring data indicated applicable standards could not be met outside of an approved mixing zone, the pumpback system would be required by the KNF and DEQ to protect downgradient groundwater quality. To assess water quality impacts from the paste tailings facility and uncertainty regarding the seepage rate from the facility, Schafer (2014) modeled the downgradient groundwater quality using a range of possible seepage rates (10 to 40% of precipitation) and underdrain capture efficiency (10 to 90% collection).

4.6.2.2 Failure Mechanisms

Failure of a paste tailings facility would likely result in less impacts on the environment compared with the failure of a slurry impoundment. Past experience with such occurrences for slurry tailings facilities has shown that the combined water and tailings can flow for long distances over relatively flat ground. Due to its low moisture content and increased strength properties, paste tailings generally do not have the capacity to flow like slurry tailings. Failure of a paste facility would likely result in localized slumping along the embankment face. Because of the potential for high consequences associated with any paste tailings facility failure, however unlikely, the KNF and DEQ would require a high degree of review and oversight during design, construction, and operations.

The Failure Modes Effects Analysis (Appendix P) identified several mechanisms that could lead to instability of the paste facility. These include foundation failure, earthquake-induced failure, and complications from increased paste moisture either from underdrain plugging, paste production problems, or from snow or rain infiltration. A review of the failure mechanisms and compensating factors identified in the FMEA for Alternative V are summarized below.

4.6.2.2.1 Foundation Failure

Soft clay deposits beneath the paste tailings facility could experience a build-up of pore pressure and slip under the weight of the overlying paste, and could potentially threaten the stability of the embankment. To compensate for this potential condition, there are engineering solutions to minimize the effects from soft foundation soils. The soft clay deposits would be removed in Alternative V, reducing the probability of a

foundation failure. As an alternative to removing all or some of the clay, shear keys of compacted higher strength borrow material could be constructed below the embankment in areas of soft material thereby adding strength to the underlying foundation. Pore pressure monitoring during construction within the clay foundation materials (if left in place) could be required to ensure pore pressures in the foundation were adequately controlled. The PTTAG would review a number of these construction mitigations as part of the final design process.

4.6.2.2.2 Earthquake-Induced Liquefaction

The risk of liquefaction of some or all of the tailings and the resulting impacts would be greatly reduced with paste tailings. While unamended, undrained paste tailings could be capable of liquefying during a seismic event, certain design features such as a compacted outer shell and foundation underdrains would greatly reduce the risk of a catastrophic failure of the facility by providing a compacted resisting buttress and by lowering the phreatic surface within the paste. The Knight-Piesold stability analysis (1997) assumed a portion of the paste would liquefy and assessed the effects on the overall facility stability under this condition. Their analysis determined that a compacted outer shell provides sufficient strength to resist the loss in strength of the liquefied tailings, and the result would be minor deformation of the embankment. The paste would consolidate and gain strength over time, and unless the foundation drains became blocked and nonoperational, the phreatic surface would remain at a low level within the paste and would not make the paste susceptible to liquefaction.

4.6.2.2.3 Excessive Paste Moisture

Surface Erosion. Although the paste tailings facility would not be susceptible to overtopping from surface water run-off, the embankment face may be prone to surface erosion. Erosion would not present a catastrophic threat to the stability of the embankment rather it could present a chronic maintenance problem. In addition to erosion, shallow localized slumps on the embankment might occur which would allow opportunity for increased water infiltration and the development of chronic wet or saturated areas. These too could lead to localized slumps on the embankment face. Implementation of erosion and sediment control measures described in Section 2.3.1.12, *Erosion and Sediment Control*, and erosion monitoring described in Appendix K, would minimize surface erosion on the paste tailings facility.

Paste Tailings Collapse. Preliminary laboratory testing (Golder 1996) suggests that the paste may exhibit behavior similar to liquefaction even without a triggering event like an earthquake. Under the rapid loading of additional paste over an area of previously placed paste tailings that are still saturated, pore pressures may increase enough to trigger weight-induced (static) liquefaction of the underlying tailings, resulting in deformation and slumping of the loaded area. If this occurred near the edge of the embankment slope, it could cause minor failure of the embankment face. Such deformation is generally a maintenance and operations issue, and is unlikely to present a threat of collapse of the entire embankment. This same effect could occur during use of heavy equipment on the surface of the paste tailings facility and could pose a threat during operations if the use of heavy equipment was integral to the construction process. The sequencing of paste deposition would need to be scheduled to allow adequate time for newly deposited paste to dewater and gain strength before placing another lift of paste over the top or operating heavy equipment. An operational monitoring program would be required as part of Alternative V to ensure the paste remained within design parameters and to prevent build-up of pore pressures within the paste. This monitoring requirement is described in Appendix K.

Seepage-Induced Piping. The cohesive nature and well-graded grain size distribution of paste along with minimal free water would be an effective deterrent to piping (i.e., internal erosion of soil in the embankment). Paste tailings are not generally susceptible to seepage-induced piping because of these characteristics. In addition, paste tailings are considered a nonsegregating material that inhibits the development of large particle pore spaces that allow the flushing out of smaller particles and ultimately

the development of the piping condition. Seepage rates and hydraulic gradients in paste are also significantly lower than in slurry tailings, thus reducing the opportunity for the rapid movement of water through the tailings that induces development of piping. In the event of increases in free water in the paste facility and an increase in the elevation of the phreatic surface within the tailings mass, it is conceivable that conditions for piping could develop at exit points and boundaries of the phreatic surface along the embankment face. Proper design of underdrains would ensure the drains met design requirements for piping control and permeability. Implementation of the QA/QC Plan during construction would ensure proper drain place, and monitoring of paste tailings facility operations described in Appendix K would identify potential piping conditions allowing correction. In addition, paste production monitoring described in Appendix K would detect changes in physical characteristics, such as water content, that could lead to piping, allowing time for changes in paste production to avoid its occurrence.

4.6.2.3 Stability Analysis

4.6.2.3.1 Previous Analyses

Three different analyses examining the stability of the Alternative V paste tailings facility were conducted: Golder (1996), Knight-Piesold (1997), and Klohn-Crippen (1998). The Knight-Piesold and Klohn-Crippen evaluations were the most detailed and came to similar conclusions that a seismically-stable paste facility could be constructed at the Rock Creek site. Both analyses were based on a facility that was constructed either starting from the bottom and working upslope (Bottom-Up) or starting at the top and working downslope (Top-Down).

The results from the Klohn-Crippen analysis (1998) indicated that both the Top-Down and Bottom-Up design options would be stable under normal operating conditions, as well as when subjected to the design earthquake provided underdrains were included in the design to maintain a low phreatic surface within the paste. The analysis was conducted by modeling the paste facility at the end of mine life. The stability analysis evaluated static conditions (no external forces other than gravity), seismically induced loading, and post-earthquake conditions where elevated pore pressures (from the movement of the paste mass by the earthquake forces) were assumed to be present within the paste. In the latter instance, there could be some temporary strength reduction of the paste due to elevated pore pressures. The analysis also assumed different amounts of water infiltration from rainfall. The analysis concluded that an increase in moisture content from rainfall infiltration could change the character and behavior of the paste tailings, and an increase in the elevation of the phreatic surface within the paste could lower the resistance to liquefaction in the event of an earthquake. Localized increases in moisture content due to production problems, prolonged rainfall, or snowmelt infiltration could create areas of softer paste, which could exhibit a reduction in strength, resulting in some degree of slope movement or shallow slumps in the tailings surface. This condition of elevated moisture in the paste could lead to slumping on slope faces and localized mud-like flows. Occurrences such as these would not jeopardize the overall stability of the paste facility, but could create ongoing maintenance and repair problems during operations and post-closure. Only a significant increase in moisture content throughout the paste tailings mass would potentially reduce the overall stability of the tailings facility.

In the Klohn-Crippen analysis (1998), the FOS against slope movement for all paste tailings deposition options under static conditions ranged between 1.2 and 2.0. The FOS during the design seismic event ranged between 0.9 and 1.35. A FOS >1.0 implies a structure would resist failure from the applied forces. The 0.9 value was for the Top-Down configuration without underdrains and assumed 20 inches per year of water infiltration into the paste pile during operations. The results from the stability analysis for earthquake-induced loading conditions indicate that Bottom-Up construction would provide the most stable facility with a FOS = 1.35. The FOS is greatly enhanced for the Bottom-Up design, the KNF and DEQ preferred construction method, because of the requirement to compact the outer shell of paste in order to complete the construction sequence (Figure 2-34, 2001 FEIS). This compacted paste shell would

act as a buttress to the paste located on the interior of the facility. The combined Bottom-Up/Top-Down design would also benefit from this outer shell of compacted paste.

The analysis conducted by Knight-Piesold (1997) assumed that portions of the paste would liquefy during a seismic event and evaluated the deformation of the paste embankment under these conditions. Only those portions of the paste that were fully saturated would be susceptible to seismically induced liquefaction. This included the bottom 20 feet of the tailing mass because underdrains would limit the phreatic surface build-up within the paste. The modeling indicated that failure from an earthquake would likely result in noncritical embankment deformation and slumping, but not collapse of the entire facility. This is due to the inherent strength of the paste, even in a liquefied state, and the unsaturated condition of the majority of the remaining paste.

A stability analysis was also conducted by Golder (1996), which calculated a FOS of 1.1 under seismic conditions. There are slight differences in both the static and seismic factors of safety in the three reports, which can be attributed to different assumptions made by the individual investigators when performing the stability modeling. All three analyses predicted a stable embankment condition under static and seismic conditions, provided there was sufficient buttressing to the downstream slope and a means (e.g., underdrains) to control water build-up within the paste.

During final design, as additional information regarding paste properties were confirmed, the stability estimate would be revised. The KNF and DEQ customarily would require a minimum static FOS of FOS $\geq$1.5, and a minimum seismic FOS >1.0. In order to achieve this design standard, RCR may need to make design modifications. Common changes could include reducing the embankment slope angle or adding a strength-enhancing binder such as cement or fly ash to the paste. As described in Section 2.3.1.7, *Tailings Deposition*, the need for additives would be determined by the PTTAG based on geotechnical and geochemical data collected during final design (see the Geochemical Characterization and Monitoring Plan, Phase I Data Evaluation Plan, and the Paste Tailings Facility and Tailings Slurry Line Construction and Operations Monitoring Plan in Appendix K for more detail). Water buildup within the paste would be minimized by incorporating underdrains into the design to facilitate water removal, using surface management practices that minimize the amount of water pooling on the facility surface, and ensuring that paste tailings are within specific moisture content limits. Alternative V would include operations QA/QC plans for paste production, paste facility management, and in-situ monitoring that would ensure there was no buildup of a phreatic surface in the paste and that saturated conditions would not develop. These QA/QC plans are found in Appendix K.

4.6.2.3.2 Material Properties and Updated Seismic Conditions

Since the analyses by Golder (1996), Knight-Piesold (1997), and Klohn-Crippen (1998) were conducted, the estimated seismic conditions at the Rock Creek site have been updated, and the mining industry has gained more experience with paste production and construction. The analyses by the previous investigators relied on a small number of tailings samples taken from the Troy Mine. There were differences in sample preparation and laboratory testing between the investigations. While no additional laboratory testing has been done to date, future testing during final design would standardize the sampling and testing components, and confirm the material properties to be used in the final design process. A brief discussion of the material properties is provided in the following section. Further, new seismic data for this region of the country have resulted in updated seismic probability maps for the Rock Creek site (USGS 2008). The new data were used in a revised seismic stability assessment described below.

Material Properties. The data used in the analyses by Golder (1996), Knight-Piesold (1997), and Klohn-Crippen (1998) were based on a small number of laboratory samples. The samples were collected from the Troy Mine paste tailings facility at different times and their preparation for lab testing varied between investigators. Permeability tests were performed by Golder and Knight-Piesold, and strength tests were

performed by Golder, Knight-Piesold, and Klohn-Crippen. The lab data used in the stability analyses by Knight-Piesold and Klohn-Crippen generally agreed, as did the stability analyses themselves. The permeability data generated by Golder and Knight-Piesold showed more variability. The available laboratory data were compensated for in part by assuming conservative field conditions for the stability analyses. These conditions included elevated phreatic surfaces (due to surface water infiltration) and liquefaction of portions of the paste during a seismic event.

Despite the differences in when and how representative samples were collected and which lab tests were performed, the test results used in the preliminary stability analyses fall within a reasonable range for paste material and are adequate to evaluate the stability of a paste facility for this SEIS. During final design, more comprehensive laboratory testing program and stability analyses would be required to refine the physical parameters of the paste that were used in these preliminary analyses, and to confirm the stability of the proposed design.

Seismic Conditions. Both Knight-Piesold (1997) and Klohn-Crippen (1998) conducted slope stability analyses of a paste facility using the Top-Down and Bottom-Up configurations. Because the Golder analysis made no distinction in how the facility was constructed, the KNF and DEQ regard the Knight-Piesold and Klohn-Crippen analyses as the best available information. For the seismic analyses, both investigations used a PGA of 0.16 g. A PGA of 0.16 g represents a horizontal force due to seismic shaking equivalent to 16% of the force of gravity and corresponds to the estimated force acting on the embankment at the Rock Creek location due to an earthquake. Gravity, or “g,” is the common measurement unit chosen for modelling earthquake forces. Since the 2001 FEIS, the USGS has updated its seismic hazard maps for the northern Rocky Mountain Region and revised the estimate of PGAs for various seismic events. Based on updated maps, the estimated PGA for the Rock Creek site would be closer to 0.19 g for the 2,500-year earthquake event (a 2% chance of occurrence in 50 years). This is a greater PGA than what was used in the Knight-Piesold and Klohn-Crippen analyses.

The Forest Service completed a revised seismic analysis using a PGA of 0.19 g (USFS 2014). The Forest Service analysis evaluated the extent of embankment deformation which could be expected from an earthquake event of magnitude M=7 using the Makdisi-Seed procedure (Makdisi and Seed 1977). This is the same approach used in the Knight-Piesold analysis, and is a commonly accepted evaluation technique that assesses the amount of post-earthquake deformation that may take place. This approach assumes some amount of “failure” of the embankment will take place, and examines the potential effects from this condition. A compromised embankment can be significant for water retaining reservoirs where deformation of the embankment crest could lead to overtopping and the evacuation of the water pool. For the Rock Creek paste facility however, because it is not a water-retaining structure, the impacts from embankment deformation would likely affect the structure’s ongoing use as a tailings repository as well as the costs associated with stabilizing the facility during closure so as to ensure long term reclamation stability.

Both the Knight-Piesold and Forest Service analyses used the same paste strength parameters and modelled the embankment at full build out. The principal difference in modelling approaches was that the Forest Service analysis used the updated PGA of 0.19 g compared to a PGA of 0.16 g used in the Knight Piesold analysis. Only the Bottom–Up configuration was evaluated as this is the preferred construction option for Alternative V. The Forest Service analysis estimated embankment deformation of between 36 and 69 inches. The Knight-Piesold analysis estimated embankment deformation on the order of 3 to 8 inches. The agencies believe the increase in estimated embankment deformation while large, would not result in the total collapse of the paste facility, rather this degree of movement would pose a significant challenge to using the facility for continuing mine operations, and would require a significant remediation effort to bring the facility back to an operating condition.

Critical facility components, such as the compacted outer shell, underdrains, and paste physical properties influence the overall stability and would impact the degree of deformation during a seismic event. The embankment profile modelled in the updated Forest Service seismic analysis represents one set of material parameters and site specific conditions available at this point in the design process. The paste facility design would undergo additional stability modelling as more information was gathered. Data on paste parameters would be especially relevant to the updated stability modelling. Ultimately, the final design process would include an updated stability and deformation analysis using any new available information (e.g., paste laboratory tests, seismic conditions), and an independent review of the design and design methodology by the PTTAG. Ongoing stability evaluations during various stages of project development are a common practice, and the agencies plan to follow a similar design process. Additionally, the Agencies have required an independent third-party technical advisor be retained to assist the Agencies with QA/QC of the paste tailings facility.

4.6.2.4 Risk Analysis

A risk assessment was conducted for Alternative V (Klohn-Crippen 1998) using FMEA protocol, a quantitative process that is intended to identify and characterize risks associated with the design and performance of engineered systems. The risk assessment is provided on page 4-39 and Appendix P of the 2001 FEIS.

4.6.3 Alternatives III and IV

During the analysis of these alternatives, KNF and DEQ concerns focused on the peak shear strengths of the clay foundation soils, the assumed densities of the in-place tailings, and the appropriate seismic evaluation criteria to be used. In response to KNF and DEQ concerns, RCR developed an alternative design for the tailings facility that included a combination upstream and centerline approach known as a “modified centerline” method. This modification in tailings facility design was a principal change incorporated into Alternatives III and IV. Centerline construction would be used for the first 7 years; the upstream method would be used after Year 7. Surface erosion and tailings collapse are not applicable failure mechanisms for Alternatives III and IV. Failure mechanisms potentially applicable to Alternatives II and IV are described below.

Foundation Sliding. The potential for foundation sliding would be the same as Alternative V.

Seepage-Induced Piping. Due to greater seepage rates, seepage-induced piping would be more likely for Alternatives III and IV than Alternative V. The risk of piping for Alternatives III and IV is described on page 4-36 of the 2001 FEIS.

Overtopping. Overtopping would be more likely for Alternatives III and IV than Alternative V. The risk of overtopping for Alternatives III and IV is described on page 4-36 of the 2001 FEIS.

Earthquake-Induced Liquefaction. While the modified centerline method of construction for Alternatives III and IV would be typically less susceptible to earthquake-induced liquefaction than upstream construction for Alternative II, it would be significantly more susceptible than Alternative V. Alternatives III and IV would contain additional requirements to mitigate against potential slope failure under seismic loading as described in the 2001 FEIS.

4.6.4 Alternative II

Alternative II would involve an upstream tailings facility as proposed by RCR and described in the 2001 FEIS. This alternative addresses the four potential failure mechanisms as follows.

Foundation Sliding. Unlike Alternative V, Alternative II proposed to use a slow rate of loading and "wick drains" to enhance water drainage in the clay instead of direct mitigation by removal of the clay foundation material as proposed under Alternative V.

Seepage-Induced Piping. The potential for seepage-induced piping would be similar to Alternatives III and IV. The risk of piping for Alternative II is described on page 4-35 of the 2001 FEIS.

Overtopping. The potential for overtopping would be similar to Alternatives III and IV and is described on page 4-35 of the 2001 FEIS.

Earthquake-Induced Liquefaction. The potential for earthquake-induced liquefaction for Alternative III would be greater than for Alternative V. The potential for earthquake-induced liquefaction of tailings under Alternative II is described on page 4-35 of the 2001 FEIS.

4.6.5 Alternative I

In Alternative I, no tailings facility would be built. The risk of a tailings facility failure and associated impacts would not exist.

4.6.6 Effectiveness of Agencies' Proposed Mitigation

In Alternatives III and IV, use of the "modified centerline" construction method and removal of soft clay deposits beneath the tailings facility would improve stability of the tailings facility. Sufficient design and construction information was not available in Alternatives III and IV to adequately demonstrate stability in the event of an earthquake. Clay material excavated at the location of the proposed tailings facility embankment used to seal (line) areas of the tailings facility footprint that would be underlain by materials of higher permeability would be effective in reducing the amount of seepage reaching groundwater.

The use of paste tailings in Alternative V would be highly effective in reducing tailings seepage reaching groundwater and in increasing tailings facility stability. Paste tailings, coupled with the proposed underdrain system, would be effective in maximizing the amount of seepage intercepted beneath the paste tailings facility. Alternative V would effectively reduce the risk for a catastrophic failure of the paste tailings facility due to overtopping of the dam.

The Agencies have developed strict design, oversight, inspection, and reporting requirements for the construction and management of the paste tailings facility. As part of this oversight, a TAG would be formed to provide design review oversight. The TAG would include experts in paste and geotechnical engineering. In addition to the TAG, whose principal duties would be limited to design review, RCR must also fund an independent third-party technical advisor, whose duties would include providing QA/QC for the Agencies. Involving independent experts and third parties experienced in paste and geotechnical engineering is an effective mitigation for ensuring the paste tailings facility is designed and operated as intended by creating a forum for technical discussion and debate.

4.6.7 Regulatory Compliance

The 2015 KFP does not have specific goals, objectives, standards, or guidelines for impoundment stability.

4.7 Water Quantity and Quality

4.7.1 Introduction

This section updates the *Environmental Consequences* section for water quality and water quantity and includes *Analysis Methods*, *Effectiveness of Mitigation*, and *Regulatory Compliance* subsections not previously included in the 2001 FEIS. The *Environmental Consequences – Water Quantity and Water Quality* section has been restructured from that presented in the 2001 FEIS to facilitate understanding of interrelated water quality and hydrologic concepts.

The *Environmental Consequences* section for groundwater was updated to include new information since the 2001 FEIS was issued. RCR developed a numerical model, discussed in Section 3.7.3, *Groundwater Hydrology*, to evaluate the groundwater hydrology of the mine area. As a result, the groundwater quantity sections were revised to reflect a revised conceptual model and revised estimates of potential impacts on the groundwater contribution to streams. The estimated mine inflows were updated to reflect the current model analyses. Baseline information was also updated to include more recently collected spring flow data.

The *Environmental Consequences* section for surface water was updated to include a discussion of effects on streams due to mine inflows and lakes in the CMW based on the results of the numerical model, including the 2D simulation. In addition, the section was updated to incorporate a revised water balance for Alternative V (see Table 2-5), an updated plan for sediment mitigation, and a discussion of effects on stream temperature. Also, using more recently collected water quality data, new analyses of effects on water quality were completed for the evaluation adit that are discussed in this section. The analysis of effects on groundwater quality due to seepage from the tailings facility was updated based on a revised conceptual model of how infiltration into the paste tailings and seepage from the paste tailings would occur. The tailings seepage model also accounted for potential chemical attenuation of selected metals in unsaturated sediments beneath the tailings facility. A range of possible seepage rates and water quality assumptions was used to evaluate effects on groundwater quality from the paste tailings facility. Recently collected precipitation and water quality data were used in the updated analysis. The revised tailings reclamation schedule also was a factor in the updated analysis.

The analysis of effects is organized by mining phase, specifically Phase I (Evaluation) and Phase II (Construction, Operation/Production, and Closure), which includes reclamation and post-closure, and facility (e.g., mine area and tailings facility). Predicted effects on surface water and groundwater quantity and quality are discussed below within this framework. Groundwater quantity sections are presented first, followed by surface water quantity, groundwater quality, and surface water quality sections.

4.7.2 Analysis Methods

4.7.2.1 Baseline Data Adequacy

The information collected and the analysis methods described in this section were adequate to evaluate and disclose reasonably foreseeable significant adverse effects on surface water and groundwater resources in the study area and to make a reasoned choice among alternatives. As discussed in Section 1.1.2.3.2, *Model Uncertainty*, the groundwater model preparation and calibration included the following data: USGS mapped locations that show where intermittent creeks become perennial; baseflow determinations from measured flow at the mouth of each major drainage; the site geology, including location of major faults; approximate minimum depth to water measured in several exploration boreholes; adit inflow measurements from the Libby Adit; hydraulic conductivity values from the Libby Adit testing; pressure measurements made from within the Libby Adit; and precipitation records for the study area.

The KNF carefully considered the adequacy of the existing baseline information to meet NEPA requirements in evaluating reasonably foreseeable significant adverse effects. The KNF concludes that it has sufficient data to make a reasoned choice among alternatives and to evaluate the reasonably foreseeable significant adverse effects on surface water and groundwater. The KNF also concludes that additional information is not essential to a reasoned choice among alternatives and is not necessary to evaluate the reasonably foreseeable significant adverse effects on surface water and groundwater for the following reasons:

1. The Agencies developed mitigation to protect surface water and groundwater and related resources (aquatic resources) and address the uncertainty in the 3D groundwater model predictions because of incomplete or unavailable information. More information would not change the mitigation measures that would be implemented to minimize impacts. The mitigation includes maintaining a mining buffer (no mining zone) 1,000 feet around Cliff Lake and the north and south ore outcrop zones; a 100-foot buffer on either side of the Copper Lake Fault, the Moran Fault, and other faults intersecting the ore zone; and a 450-foot vertical buffer between the mine workings and the surface. Additional groundwater information is not needed to know that such mitigations would reduce effects on groundwater and effects on stream flows overlying the mine void nor would additional information change the type of mitigation. The analysis provided by the 3D groundwater model, along with the required mitigation measures, provided the basis for a reasoned choice among alternatives and for evaluating the reasonably foreseeable significant adverse effects on surface water and groundwater.

2. The Forest Service's locatable mineral regulations require operators to comply with applicable federal and state water quality standards, including Clean Water Act regulations (36 CFR 228.8(b)). Forest Service mineral regulation 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DEQ is responsible for ensuring all mine operations comply with the Montana Water Quality Act and its implementing rules. DEQ could only issue a Hard Rock Operating Permit for the Rock Creek Project if it determined water quality, including streamflow, changes were not significant degradation, unless RCR obtained an authorization to degrade. The KNF would rely on DEQ regarding compliance with the Montana Water Quality Act and would not allow RCR to proceed with mining until DEQ issued the permit.

3. Additional subsurface geologic and hydrologic data would be collected during the completion of the evaluation adit with its associated underground drilling. Although the current 3D groundwater model has been developed and run using the best available information, the 3D model would be refined and rerun after data that can only be obtained underground during the Evaluation Phase were incorporated into the model. Following additional data collection and modeling, the predicted impacts on surface water and groundwater resources in the study area, including effectiveness of mitigation measures, would be refined and the model uncertainty would decrease. The additional data would be used to assess if substantial changes that are relevant to environmental concerns are necessary. The KNF would conduct additional NEPA analysis if data collected during Phase I required substantial changes that are relevant to environmental concerns or identify significant new circumstances or information relevant to environmental concerns and bearing on the proposed action, as required by 40 CFR 1502.9(c)(1).

4. The KNF would use adaptive mitigation to modify the mitigation plans, if necessary, to incorporate the revised model results.

5. The location and distribution of mineable mineral resources would be the same in all mine alternatives. Consequently, the mine void, the pumping necessary to dewater the mine void, and the effect on baseflow of streams in the area would be relatively similar in all mine alternatives. These effects on groundwater and surface water were estimated using a 3D groundwater model widely accepted in the scientific community.

4.7.2.2 Additional Data Collection

4.7.2.2.1 Mine Area Information

Underground mine development occurs in rock formations that are hundreds to thousands of feet in the subsurface, hidden from view and inaccessible other than through mine development or extensive drillholes. This limits the amount of data initially available and means there is necessarily a degree of uncertainty inherent in evaluating the specific environmental impacts related to surface water and groundwater prior to actual mine development. While models and estimates have been developed based on the best available information, actual knowledge of underground conditions may not be known or knowable until underground operations were underway.

Some of the specific additional geologic and hydrologic characteristics of the ore body that would be available and gathered in the future as underground operations were underway include information such as the precise underground location and attributes of geologic structures and discontinuities; the location, orientation, and density of faults and fractures; the exact nature of hydraulic conductivity and storativity of faults, fractures, and unfractured rock; and the specific groundwater potentiometric surface overlying the ore body. Much of this information would be collected and evaluated through underground drilling operations that would be conducted in advance of the underground mining (see Appendix K).

Additional data regarding the hydrologic characteristics of the streams, seeps, and springs above the mine would also be gathered in the future. These include the precise location where subsurface bedrock groundwater overlying the mine area discharges to surface water, the specific relationship between the rate of bedrock groundwater discharged to surface water and the rate of total surface flow, and the precise nature and timing when bedrock groundwater overlying the mine area discharging to surface water is the dominant component of streamflow. Some of the additional information, such as the precise relationship between the rate of bedrock groundwater discharged to surface water and the rate of total streamflow, could only be obtained with decades of data collection, and the overall cost would be exorbitant.

The KNF concludes that this additional mine area information is not essential to a reasoned choice among alternatives and is not necessary to evaluate the reasonably foreseeable significant adverse effects on groundwater and surface water; therefore, the requirements of 40 CFR 1502.22(b) have been met.

4.7.2.2.2 Paste Tailings Facility Area Information

As described in Section 4.6, *Geotechnical Engineering* and Section 3.7, *Water Quantity and Quality*, considerable geologic and hydrologic information has been collected as part of the baseline data for the paste tailings facility areas. RCR would be required to submit detailed mine plans for the KNF's and DEQ's approval at the completion of Phase I. Appendix K describes data that would be collected during Phase I monitoring and as part of a final design prior to Phase II construction. RCR would be required to collect geochemical data from the evaluation adit and produce representative tailings from evaluation adit ore that would undergo static and field kinetic testing (barrel tests). Additive testing would be developed with recommendations from the PTTAG. To assess the inflow, outflow, and general water or wastewater chemistry associated with the underground mine, water treatment facility, and paste tailings facility, a detailed analysis of water and wastewater chemistry, based on monitoring data specified in Appendix K, and a facility water balance would be maintained. Specific paste tailings facility monitoring requirements would be finalized in a stand-alone geotechnical monitoring plan developed during the final design

process for the paste tailings facility that would incorporate many, if not all, of the monitoring elements listed in Table K-11 in Appendix K. The PTTAG would provide an assessment of the final design, provide independent interpretation and analysis of existing and new laboratory test results and assumptions used in the design, provide objective QA/QC oversight on the final design and its components, and make recommendations for changes to the final design as appropriate.

As explained in Section 1.1.2.1 *Baseline Data Adequacy*, the KNF concludes that this additional paste tailings facility area information is not essential to a reasoned choice among alternatives and is not necessary to evaluate the reasonably foreseeable significant adverse effects on groundwater and surface water; therefore, the requirements of 40 CFR 1502.22(b) have been met.

4.7.2.3 Groundwater Quantity

As discussed in Section 3.7.3, *Groundwater Hydrology*, Hydrometrics prepared a 3D numerical hydrogeological model of the Rock Creek mine area (Hydrometrics 2014c). The 3D model was used to estimate groundwater inflow to the mine and adits, predict where and to what degree groundwater drawdown from mine and adit dewatering would occur, and estimate changes in baseflow for drainages within the study area. The 3D model was configured to simulate the location of the mine void and adits proposed in Alternative V. The 3D model was developed using a software package called FEFLOW, which is capable of simulating flow through variably saturated media. A detailed description of the model and the modeling process is provided in Hydrometrics (2014). To provide a more detailed simulation of the relationship between Cliff Lake and the regional potentiometric surface, Hydrometrics also prepared a vertical 2D model of the area around the lake. The 2D model used the 3D model as its basis and is discussed in Section 3.7.3, *Groundwater Hydrology*. AquaResource, a firm that specializes in groundwater modeling, assisted the KNF in reviewing the Hydrometrics model. The EPA also participated in the model review. AquaResource and EPA reviews are discussed in the following section on model uncertainty.

The model results are the best available estimates of impacts that can be obtained using currently available data. The analysis of impacts on groundwater in this SEIS, therefore, is based on the model results and includes a discussion in the following paragraphs about the uncertainty associated with the 3D model predictions. Appendix K discusses the hydrologic data that would be collected during Phase I Evaluation to refine the existing numerical model and reduce the uncertainty of the predictions.

The 3D model report includes a discussion of the model's sensitivity to a range of hydrologic characteristics, including varying the bulk hydraulic conductivity between 10^{-6} and 10^{-9} cm/sec (Hydrometrics 2014c). The 10^{-6} scenario produced results that are within range constraints established in the conceptual model. The 10^{-9} scenario resulted in a water table that is unrealistically high and is inconsistent with field data. Both the bulk permeability of the bedrock and the water table elevations would be better defined through additional testing during the Phase I evaluation adit development, which would determine which permeability range was most representative (Hydrometrics 2014c). A range of fault configurations and permeabilities were also simulated, providing a range of results. Hydrometrics (2014c) concluded that the overall differences between the various fault scenarios were minor.

The model domains of the 3D models for the proposed Montanore and Rock Creek projects overlapped and they each used the same software package. The modeling of the two projects was performed independently and used different approaches for their respective simulations. The model predictions are similar with respect to the magnitude of the predicted mine inflows and changes in baseflow due to mine dewatering. Table 4-7 provides a comparison of predicted premining baseflow for specific locations along two stream reaches where the two models overlap. While the premining baseflows can be compared, the predicted changes to baseflow from each mine cannot be compared because they are each based on the effects of dewatering each respective mine.

The differences in the predicted premining baseflows between the two models are greater in the upper watersheds with limited or no actual flow measurements for calibration. The Rock Creek model predicted greater premining baseflow in upper East Fork Rock Creek and less premining baseflow in upper East Fork Bull River than the Montanore model. The differences are likely the result of how recharge from precipitation was distributed at the higher elevations in each of the models. This comparison points out the difficulty in modeling premining baseflows in the upper watersheds without actual flow measurements for calibration. The following paragraphs provide a more detailed discussion of changes in baseflow and model uncertainty.

Table 4-7. Comparison of Model - Predicted Premining Baseflows – Rock Creek and Montanore Models.

Drainage and Location (Figure 4-4)	Rock Creek Premining Baseflow (cfs)	Montanore Premining Baseflow (cfs)
Rock Creek		
East Fork Rock Creek (at CMW boundary)	0.7	0.3
Rock Creek (above confluence with Clark Fork River)	7.8	7.7
East Fork Bull River		
East Fork Bull River (within CMW boundary)	1.4	4.4
East Fork Bull River (above confluence with Bull River)	10.4	11.3

Source: Hydrometrics (2014c) and Geomatrix (2011).

4.7.2.3.1 Changes in Baseflow

The effects of groundwater drawdown due to dewatering of the mine and adits discussed in this section are best expressed by estimating changes to baseflow. As part of the 3D model calibration process, the model-predicted baseflow values at the mouth of each creek/river were compared with baseflows determined by KNF from measured flows at the same locations (Wegner 2006) (Figure 4-3 below). Table 4-8 and Table 4-9 (below) and Table 4-1 in Hydrometrics (2014c) provide a comparison of measured and model determined values for baseflow at selected locations. Flow measurements, some of which were made subsequent to completion of the 3D model, in the East Fork Rock Creek above Rock Lake and East Fork Bull River above St. Paul Lake suggest that baseflow in these reaches is maintained by bedrock groundwater. It has not been determined whether there is discharge to the creeks from deeper bedrock fractures in other CMW drainages, including South Basin Creek, North Basin Creek, Chicago Creek, and Copper Gulch, where no flow data have been collected. The model results are based on the assumption that the predicted baseflow is representative of a typical precipitation year. The annual variability in baseflow in the upper watersheds is unknown.

The 3D model report provides several tables of predicted changes in baseflow for different mining periods or phases for specific locations along each of the potentially affected drainages (Hydrometrics 2014c). In this SEIS, the predicted baseflow and mine effects are reported at three locations: in Rock Creek above the confluence of the Clark Fork River, Bull River above the confluence of the Clark Fork River, and East Fork Bull River above the confluence with the Bull River (Figure 4-4 below). The modeling analysis cannot be used to quantify exact changes in baseflow in the upper watersheds because a number of model input parameters are not well defined and because pre-mining baseflow measurements in the upper watersheds were not available for model calibration; therefore, although the model report provided predicted baseflow and mine effects at other locations, they were not used quantitatively in the SEIS. Hydrometrics reported that the model indicated that changes in streamflow may be more significant in the small headwater drainages adjacent to the mine site. Potential changes to headwater streamflow are

not currently quantifiable given the current level of uncertainty in the model assumptions. The actual potential for impacts would depend on the extent to which these reaches are supported by groundwater flow from the deeper bedrock system (Hydrometrics 2014c).

Premining baseflow and predicted baseflow changes are reported in cfs, which is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (i.e., reported to 0.1 cfs). If the results were converted to gpm, they would be reported to the nearest 50 gpm. Streamflow variability and measurability are discussed in Section 4.7.3.2, *Surface Water Quantity*.

4.7.2.3.2 Model Uncertainty

The 3D model report discusses overall uncertainty of the model results. There is uncertainty associated with the hydraulic properties of the bedrock and faults that translates to uncertainty in various predictions, including impacts on water resources and mine recovery rates. The model results provide a potential range of stream baseflow impacts, which are the best available estimates of impacts that can be obtained using currently available data. The 3D groundwater flow model would be refined and rerun after data from Phase I Evaluation were incorporated into the model (see Appendix K). Following additional data collection and modeling, the predicted impacts on surface water resources in the study area, including simulation of mitigation measures, may change and the model uncertainty would decrease.

The KNF retained AquaResource (an internationally known consulting company specializing in groundwater modeling) to complete an independent evaluation of the Rock Creek Project 3D model. In its comments on the final 3D model report (Hydrometrics 2014c), AquaResource (2014) indicated the numerical modeling tools developed and used by Hydrometrics were widely accepted in the scientific community and appropriately represented the conceptual understanding of the mine area hydrology. AquaResources found the evaluation to be thorough and that it appropriately evaluated impacts throughout the groundwater flow system, the effect on surface water features, and the effectiveness of potential mitigation measures. The AquaResource review also included the following points in the discussion of various model uncertainties:

- AquaResource stated: "… it is our opinion that the modelling analysis developed for the proposed Rock Creek Mine is reasonable and appropriate for the purpose of evaluating the realistic range of impacts that can be expected for the mine, given the current understanding of site conditions." (p.3)

- "It is expected that future field work will include collection of appropriate data to refine the understanding of existing field conditions and lead to more reliable predictions in the future."

- With respect to the simulation of mitigation scenarios, AquaResource stated: "The report does not provide an uncertainty analysis for mitigation scenarios, including those representing set-backs/grouting to mitigate interaction with faults or plugging designed to return the [hydrologic] system to pre-development distributions of flows through the area. An uncertainty analysis is not required at this point; however, it is expected that by the time such measures would be required, additional data would be in place to refine and better constrain the analysis, such that appropriate mitigation measures can be designed."

The EPA reviewed the draft and final reports and participated in several meetings and conference calls with the KNF and Hydrometrics during model development. The EPA provided comments on the final model report (Pierce, pers. comm. 2014). The EPA also included recommendations for data collection and project mitigation and management measures that the KNF incorporated into Appendix K.

To avoid confusion, this SEIS uses the activity years reported in the 3D model report and Chapter 2 (Table 2-2, *Estimated Project Development Schedule – Alternatives II through V.*). The 3D model report assigns predictions to the nearest year, such as Year 70. There is uncertainty as to the actual year any specific event would occur, particularly for events that occur beyond the end of mining.

Because field-measured baseflow values from the uppermost watersheds are not currently available, the actual model values for predicted changes in the upper watersheds are not reported in this SEIS. The model provides reasonable estimates for these values, which provides an understanding of how dewatering could affect the upper watersheds. The model preparation and calibration included the following data: USGS mapped locations that show where intermittent creeks become perennial; baseflow determinations from measured flow at the mouth of each major drainage; the site geology, including location of major faults; approximate minimum depth to water measured in several exploration boreholes; adit inflow measurements from the Libby Adit; hydraulic conductivity values from the Libby Adit testing; pressure measurements made from within the Libby Adit; and precipitation records for the site. Considerable effort was made constructing the 3D model and calibrating to known hydrologic conditions. The model provides an effective tool for simulating current conditions and for predicting possible changes in the hydrology due to mine dewatering. The most important result of the simulation is the estimation of mine and adit inflow. These values drive many aspects of the water balance and play a major role in establishing the extent of drawdown due to dewatering.

The modelers had access to data collected from the 14,000-foot-long Libby Adit, including a long history of adit inflow measurements and hydraulic conductivity values from testing. The model-predicted mine and adit inflows for the Rock Creek Project are similar to those predicted by two other numerical models for the Montanore Project. The predicted inflows and extent of drawdown are based on the best available science at this time. With additional site-specific data from the Evaluation Phase, the model would be refined. Unless the revised model predicted much different mine inflows than predicted by the current model, the overall impacts on stream baseflow would unlikely be substantially different than what has been predicted by the current model. It is possible that a revised model may distribute the baseflow reductions differently, but the overall magnitude of the impacts would likely be similar, assuming the mine inflows remained about the same. In addition to model uncertainty, there is the issue of measurability. The 3D model predicted baseflow changes at various locations along streams draining the mine area, but the model does not consider what is possible to detect or measure. Other factors should be considered when reviewing and interpreting predicted baseflow. For example, baseflow at any one location along a stream may not be easily defined within the range of the model-predicted changes. In other words, the predicted changes in baseflow may be small compared with the natural variability in stream baseflow, which may make it difficult to identify baseflow reduction due to mine dewatering. Impacts from dewatering the mine and adits may be expressed in other ways, such as a change in the elevation at which streams have perennial flow. Mine dewatering (and resultant groundwater drawdown) may result in perennial flow beginning at a lower elevation in the affected drainages. Section 4.7.3.2.2, *Mine Inflows – Effects on Streamflows* discusses streamflow variability and measurability.

4.7.2.4 Surface Water Quantity

Streamflow changes may occur due to mine and adit dewatering, interception of precipitation at mine facilities, use of stormwater runoff collected from the mine facilities, discharges from the wastewater treatment plant, vegetation clearing, potable water use, makeup water from a well located near the Clark Fork River, and pumpback wells at the paste tailings facility. In Alternative V, the makeup water well and pumpback wells would be implemented only if needed and are analyzed as contingency measures. All of these potential effects on streamflows could cumulatively increase or decrease streamflow in the study area. To determine changes in streamflow that may occur during Phases I and II and post-mining, the capture, use, and discharges of water within each affected watershed for each mine alternative were

evaluated. In addition, because the mine would intercept groundwater that may be a source of water to springs, lakes, and streams, the effects on surface water from underground mining also were evaluated.

The 3D model used the facility, mine, and adit configuration for Alternative V in the analysis of adit and mine inflows on baseflow, the groundwater component of streamflow. The relationship between baseflow and streamflow is discussed in Section 3.7.4.1, *Relationship of Surface Water and Groundwater*. The 3D model did not consider changes in baseflow due to the effects of mining and the mine facilities other than adit and mine inflows. The 3D model results provided baseflow impacts for a range of bedrock bulk permeabilities (10^{-6} to 10^{-9} cm/sec) and are the best currently available estimates of impacts that can be obtained from currently available data. The analysis of impacts on surface water is, therefore, based on the baseflow impact estimated from the 3D model results. The effects due to mine and adit inflows on baseflows for Alternatives II, III, and IV have not been quantified, but would be similar to the effects described for Alternative V. Except for discharges from the wastewater treatment plant to the Clark Fork River, and runoff collected during operations for use at the mill site and tailings facility (water that would not flow to nearby streams), other effects were not quantified and are discussed qualitatively.

Uncertainties associated with the 3D model predictions are discussed in Section 4.7.2.3, *Groundwater Quantity*. Appendix K discusses the hydrologic data that would be collected during Phase I Evaluation. As discussed in Section 4.7.2.3, *Groundwater Quantity*, the model would be refined and rerun after data collected during Phase I were incorporated into the model. Following additional data collection and modeling, the predicted impacts on surface water resources in the study area, including simulation of mitigation measures, would likely change and may have greater certainty.

Effects on peak flows for the Rock Creek Project were based on two water yield modeling programs (ECA and WATSED) used by the KNF. The Equivalent Clearcut Acres (ECA) model is a peak-flow centric model used by the KNF to evaluate potential impacts from land management (see Appendix N). The ECA model is based on the outputs from relationships developed from the R1-WATSED model. WATSED was not designed, nor was it used, to develop exact estimates of flow. The utility of the model is that it provided a consistent method for comparing alternatives. The values generated by the model were used, in concert with other water resource information, to interpret the potential effects on a stream channel as a result of implementing a proposed land management activity. Effects were analyzed with regard to normal or average conditions. Episodic climatic events such as rain-on-snow, high-intensity thunderstorms, mass soil movement, or short-duration peak flows cannot be addressed in the model. Analysis of these types of events, where needed, must be completed using professional judgment or other models (KNF 2013a).

To determine if mine facilities would be located within 100-year floodplains designated by FEMA, a GIS analysis was completed by overlaying the proposed facilities over the FEMA floodplain data for Sanders County. GIS analysis included comparing the stream and floodplain crossings required for the mine alternatives.

4.7.2.5 Groundwater Quality

Changes in groundwater quality may occur due to seepage through the evaluation adit portal pad, discharges to the infiltration ponds during the Evaluation Phase, and seepage from the tailings facility. A mass load model was used to evaluate potential effects of tailings seepage on groundwater quality. Potential effects from the portal pad and infiltration ponds were evaluated qualitatively.

The mass load model of the tailings area simulated mixing of chemical loads derived from tailings seepage as it mixes with lacustrine groundwater and basal gravel groundwater. Water that drains from the tailings would be derived from a combination of excess water contained in the deposited paste tailings, plus infiltration of precipitation. Some of the water draining from the tailings would be collected in an

underdrain system, while a fraction of the seepage may bypass the drain. Water collected in the drains would be piped to collection ponds and recycled back to the mill. The chemical parameters included in the mass load model were major ions (calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, and fluoride); selected nutrients (nitrate, ammonia, and phosphorus); and selected metals (aluminum, antimony, arsenic, cadmium, copper, iron, lead, manganese, and silver). Attenuation of selected metals (antimony, arsenic, cadmium, copper, lead, and silver) was simulated in the subsurface beneath the facility. A sensitivity analysis was performed to assess model uncertainty and to identify factors that most strongly affect predicted downgradient water quality.

The load model is a simplified representation of the fate and transport processes that may affect chemical constituents in the tailings facility. All models, however, have limitations and some of the uncertainty about the behavior of the groundwater system may not be captured in the model. Some of the model limitations include:

- The model does not account for travel time or dispersion, which are important factors affecting chemical fate. The model conservatively assumes zero travel time and ignores dispersion that tends to reduce predicted concentrations.
- The model assumes well-mixed conditions in that results predict average downgradient groundwater concentrations. If preferred flow paths exist, which is common in unsaturated soils and sediments and in layered groundwater systems, then localized concentrations may be higher or lower than model predictions. The model should accurately reflect average concentrations however.
- A linear adsorption process was assumed for attenuation of antimony, arsenic, cadmium, copper, lead, and silver in the lacustrine sediments. Most sediments have a maximum sorption capacity for metals. If sorbed amounts of metals increased significantly over background levels in the model, then the attenuation capacity of the system may be overestimated and concentrations in groundwater would be underpredicted. However, review of the model indicates that sorbed concentrations of antimony increased by about 0.9% in the lacustrine sediments while arsenic concentrations increased by 0.6%. Copper concentrations increased by about 0.3% and all other constituents remained within 0.2% of background (initial) levels. Therefore, owing to the limited concentration range in sorbed metal amounts, use of a linear sorption model is appropriate and conservative.
- Results are subject to the limitations of the degree to which the available data represent the final tailings facility. The available data appear to provide reasonable estimates of expected flows and groundwater quality, and use of wide ranges in the stochastic model enable the reader to evaluate the effects of variations in inputs.

4.7.2.6 Surface Water Quality

Changes in surface water quality may occur due to

- changes in sediment load from roads to streams
- discharges from stormwater detention and retention ponds and diversion ditches that exceed the design capacity
- mine and adit dewatering that would reduce the bedrock groundwater contribution to surface water
- discharges from the wastewater treatment plant to the Clark Fork River

Effects on sediment loading to streams were evaluated quantitatively using the WATSED model described in Appendix N and the 2001 FEIS. Other effects on surface water quality during all mine phases were

evaluated qualitatively. Process wastewater from copper mines that use froth flotation for milling is not allowed to be discharged to state surface waters except in two circumstances: 1) in areas of net precipitation (where precipitation and surface runoff within the paste tailings facility area exceeds evaporation), or 2) when the buildup of contaminants in the process water circuit significantly interferes with ore recovery (bleed-off water). Because precipitation and surface runoff within the paste tailings facility area would not consistently exceed evaporation, the paste tailings facility in all alternatives would be designed as a zero-discharge facility. If an MPDES permit were issued, RCR would have to demonstrate that the discharge of bleed-off water was necessary and could not be eliminated through appropriate treatment before discharging any process water.

The analyses include a discussion of the monitoring described in Appendix K and mitigation that would be implemented to avoid or minimize adverse effects on surface water quality. In addition, there would be no uncontrolled, untreated discharges to surface water during exploration, construction, or production. Any treated water discharge to surface water would be in accordance with MPDES permitted effluent limits and would not exceed water quality standards and applicable nondegradation criteria outside of an approved mixing zone. Because adverse effects on water quality would be avoided, quantitative analyses of effects on water quality would not provide useful information.

The KNF ran the WATSED model for the projected life of the mine facilities (30 years) and an additional 10 years beyond mine closure to review project impacts on both sediment and water yield recoveries (Appendix N). Forest-specific data were used in the WATSED model to estimate peak flows for the affected watersheds, assuming a fully forested watershed. The calculations used elevation-based precipitation values by soil land type; hydrologic regime (reflected through a representative gaged stream); and a natural runoff function (conversion of precipitation to annual discharge, taking into account changes in evapotranspiration, interception, and snow accumulation and storage resulting from past activities in the drainage) to produce peak flow increases. The natural runoff function and the existing disturbed areas, calculated using ECA for roaded and other disturbed acreage, were used in the model, then an equation based on reductions of infiltration due to roads and increased drainage efficiency (from soil compaction) was used in WATSED to determine the runoff increases resulting from proposed new roads and harvest activities. The KNF used vegetative habitat type groups to determine vegetative/hydrologic recovery following logging, site preparation, and fire activities. The recovery rate was used in the model in conjunction with the above information to help estimate peak flow increases.

Uncertainties and potential inaccuracies associated with the WATSED model are similar to those that are inherent in all models of natural systems, including the representativeness and accuracy of the baseline data used in the model, modeling of natural variability, and the simplification of complex systems. The greatest uncertainty associated with the WATSED model is that it is very difficult to validate, primarily because the model estimates sediment yield at the watershed scale. Model validation would require a very large data collection effort over many years to account for the complexity of sediment production, transport, and delivery processes within a watershed. The utility of the model is that it provides a consistent method for comparing alternatives. The values generated by the model are used, in concert with other water resource information, to interpret the potential effects on a stream channel as a result of implementing a proposed land management activity on NFS lands (Appendix N).

Uncertainty associated with variables used in the WATSED model may not capture the full range of natural variability, resulting in an oversimplification of the system. For example, the WATSED model:

- incorporated delivery from out-of-channel sources, such as roads and ditches, but not in-channel sediment generation
- was based on a 30-year normalized precipitation regime for the forest areas managed by the KNF and did not take into account wet or dry years

- did not account for specific sediment sources, such as landslide areas
- assumed normal vegetation recovery after mine disturbance based on elevation

To address the modeling uncertainties associated with WATSED, and to ensure that sediment effects were adequately mitigated, the estimated sediment generated by Alternative V was doubled in the 2001 FEIS analysis to cover uncertainties with the sediment production capabilities of the model. This value was then doubled again to help ensure that the beneficial uses of the watershed would be fully protected. These beneficial uses include water quality and a federally listed fish species, the bull trout. During the 2001 FEIS analysis process, the KNF fisheries biologist decided on the final amount of sediment mitigation levels required to maintain or improve conditions for bull trout. It is expected that the required sediment mitigation (Appendix N) would be adequate to mitigate the expected sediment yield to streams from Alternative V given the safety measure of quadrupling the original modeled sediment yields.

Stream temperature is an important criterion for aquatic life and Montana has surface water aquatic life standards for temperature that restrict temperature changes (Table 3-1). For bull trout, water temperatures ranging from 36°F to 59°F are needed, with adequate thermal refugia available for temperatures at the upper end of this range. Constant temperatures greater than 60°F have been shown to be intolerable for bull trout (Maret et al. 2005). Direct solar radiation is the primary contributor to daily fluctuations in stream temperature, but stream temperature is influenced by many factors: air temperature, topography, weather, shade, streambed substrate (bedrock versus gravel or sandy bottoms), stream morphology, amount of subsurface streamflow, and groundwater inflows (USDA Pacific Northwest Research Station 2005). The Rock Creek Project could potentially affect stream temperatures by discharge of treated water from the wastewater treatment plant, changes in groundwater discharge to area streams, and vegetation clearing along streams. Due to the numerous factors affecting stream temperatures and the constantly changing stream temperature regime that occurs, it is difficult to predict how mine project effects may alter stream temperature, or to what magnitude and extent stream temperatures may be changed. Effects on stream temperature were evaluated qualitatively. As described in the Water Resources Monitoring Plan (Appendix K), stream temperature would be monitored at all surface water monitoring sites, including benchmark sites, during water resources and aquatic biology monitoring.

4.7.3 Alternative V

The following sections describe the potential impacts of Alternative V on groundwater quantity, surface water quantity, groundwater quality, and surface water quality. In addition to the use of paste tailings, Alternative V includes mitigation measures described in Section 2.3.1, *Alternative V — Rock Creek Project with Tailings Paste Deposition and Alternate Water Treatment (Preferred Alternative)*, such as not mining within 1,000 feet of Cliff Lake and ore outcrop zones or within 100 feet of the Copper Lake and Moran Faults; installing monitoring wells at the base of the evaluation adit portal pad; and installing monitoring wells around the paste tailings facility that could be converted to pumpback wells, if necessary; possibly plugging the adits at closure; and implementing a sediment mitigation plan. The collection of additional data, model verification, and monitoring described in Appendix K would be designed to reduce uncertainties in the analysis of effects on water quantity or water quality and increase the effectiveness of any mitigation.

4.7.3.1 Groundwater Quantity

The following discussion describes the potential impacts of Alternative V on the study area groundwater hydrology through the five mining and closure periods. The five mining periods are Phase I Evaluation, Phase II Construction, Phase II Production/Operations, Phase II Closure, and Phase II Post-Closure. During Phase I Evaluation, an adit would be driven to the north end of the ore body. Construction of service and conveyor adits and other facilities would occur during Phase II Construction. Phase II

Production/ Operation represents the period in which ore mining and milling would occur. Phase II Closure would start at the end of mining and would continue through reclamation. Phase II Post-Closure starts at the end of reclamation and does not have a specified duration. Section 2.3.1, *Alternative V — Rock Creek Project with Tailings Paste Deposition and Alternate Water Treatment (Preferred Alternative)* discusses the sequencing of Alternative V in more detail. To be consistent with project years used in the 3D model report, the project years used in this section are slightly different than those reported in Table 2-2. Various mining periods are combined in this section because there are no predicted hydrologic differences between some of them. For example, the Phase II service and conveyor adit construction period is combined with the Production/Operations Phases, as are the Phase II Closure and Post-Closure Phases.

In general, the effects on the groundwater hydrology and related changes in stream baseflow would gradually increase through the various mining periods, as mine inflow increased due to increased mine void volume. Also, because of the low overall permeability of the bedrock, the groundwater system would be somewhat slow to respond to dewatering. Impacts on groundwater hydrology, as indicated by drawdown and related changes in stream baseflow, are predicted by the 3D model to reach a maximum within about 35 years after mine closure (Hydrometrics 2014c).

4.7.3.1.1 Phase I Evaluation Adit (Year 1 through Year 2)

Evaluation Adit Portal Pad

A portal pad would be constructed at the evaluation adit primarily from nonalteration zone rock removed from the adit, as described in more detail in Section 2.3.1.2, *Evaluation Adit*. The pad would cover about 10.6 acres on an existing steep slope mostly covered in talus. The pad would be subject to precipitation, some of which would infiltrate the pad. Because of the high permeability of the underlying talus and the waste rock used in pad construction and the low permeability of the underlying bedrock, it is likely any water that infiltrated into the pad would quickly drain into the underlying talus and then flow toward an unnamed drainage as surface water (Section 3.7.3, Groundwater Hydrology). Potential impacts from portal pad infiltration are discussed in Section 4.7.3.3, *Groundwater Quality*.

Adit Inflows

As construction of the adit progressed, the average adit inflow rate would increase, with possible short-term high-flow increases as water-bearing structures were encountered (Figure 2-2). At the completion of the evaluation adit (Phase I), average inflows are predicted by the 3D model to be 13 gpm (for a bulk hydraulic conductivity value of 10^{-6} cm/sec). Groundwater drawdown due to construction of the adit is predicted to be limited to the area adjacent to the constructed adit and is not predicted to affect stream baseflow.

4.7.3.1.2 Phase II Construction of Service and Conveyor Adits and Production/Operations (Year 3 through Year 35)

Mine Area

Mine and adit inflows would gradually increase over the 30 years of mining as RCR developed the service and conveyor adits, and developed and enlarged the mine void. Completion of service and conveyor adits during Phase II Construction is predicted to increase inflows to 97 (for a bulk hydraulic conductivity value of 10^{-6} cm/sec). Groundwater drawdown due to construction of the adits is predicted to be limited to the area adjacent to the constructed adits (Figure 4-1). Stream baseflow is predicted to be unaffected by adit construction. Ongoing adit inflow during mining would contribute to the overall groundwater drawdown and potential reduction in stream baseflow.

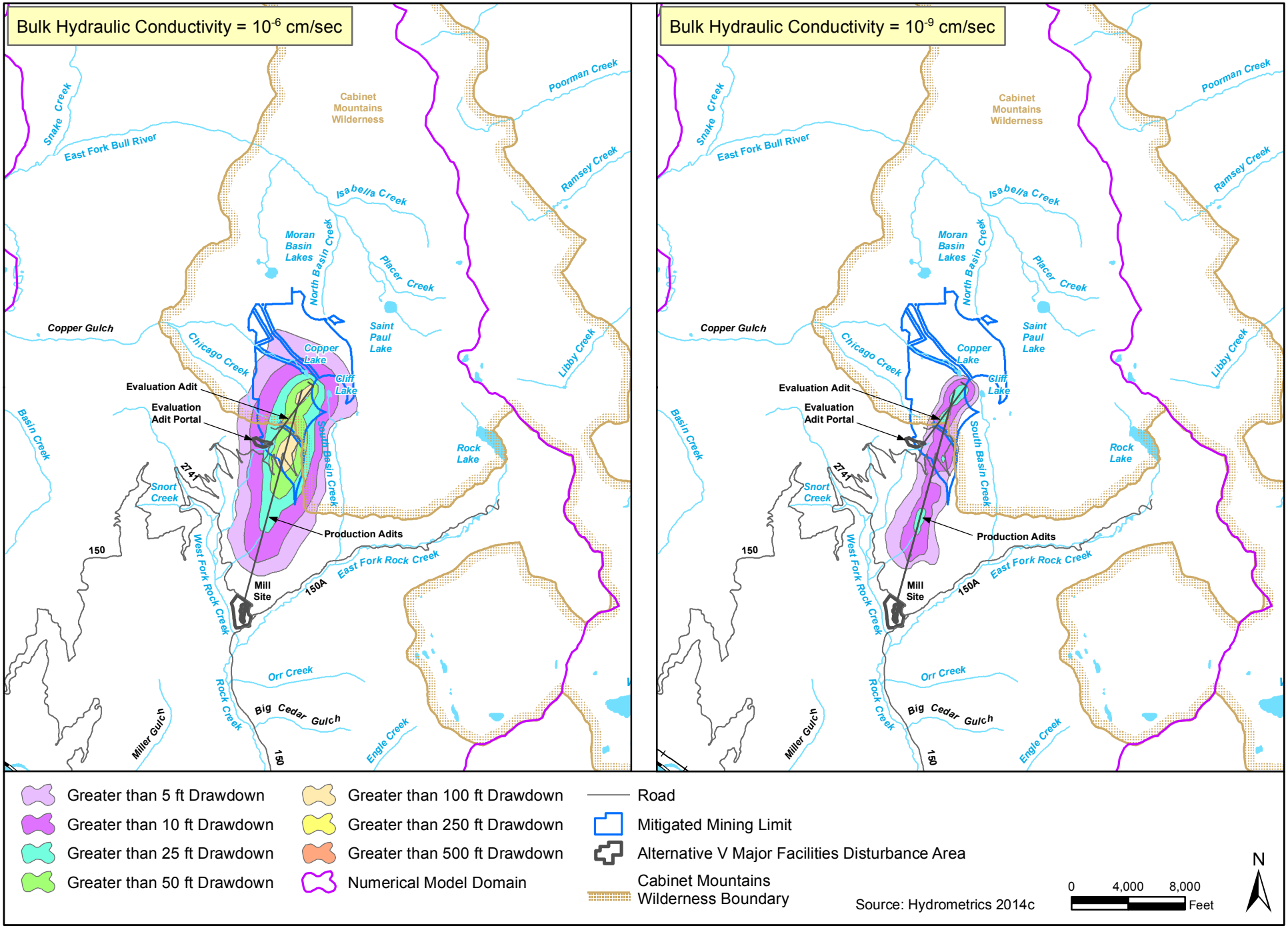


Figure 4-1. Predicted Groundwater Drawdown Following Mine Adit Development

At full mine buildout, the 3D model predicted that the average inflow to the mine and adits at Year 30 would be 479 gpm (for a bulk hydraulic conductivity value of 10^{-6} cm/sec). The average mine inflow would reach a maximum value of 531 gpm in Year 23 (Table 2-5). Higher rates of mine inflows may occur when water-containing fractures were encountered during mining. The higher mine flow rates presented in the 2001 FEIS were based on an analytical solution, rather than modeling, and included a factor of safety for design purposes. Blasting during development of the adits and mine void and the presence of a mine void may redistribute stress that could affect local groundwater flow in fractures around the mine and adits. The stress redistribution may open some fractures and close others, depending on the actual stress regime. It is unlikely this would change average inflows to the mine and adits. It is possible that changes to the fracture network resulting from the stress redistribution could affect (increase or decrease) drawdown beneath local areas and alter inflow to specific portions of the mine void and adits, but it is not possible to predict if or where this may occur.

RCR would store excess water in a reservoir constructed in a mined-out portion of the mine void designed and/or located to minimize infiltration into the bedrock. The location for the proposed reservoir has not been determined and it is not known which portions of the mine void would be above the pre-mine water table or below the water table. If the proposed reservoir were located below the pre-mine water table, the hydraulic gradient would be toward the dewatered mine and no seepage losses would be expected from the reservoir. If the proposed reservoir were located above the pre-mine water table, there could be seepage losses from the reservoir. The rate of seepage loss would depend on the occurrence and frequency of more permeable fractures in the otherwise very low permeability bedrock. If the reservoir were to be located above the pre-mine water table, seepage losses from the reservoir could be minimized by selecting an area with a minimum number of fractures and maintaining a shallow water depth in the reservoir. Siting the reservoir below the pre-mine water table would eliminate risk of any seepage from the reservoir.

Groundwater Drawdown

The 3D model predicts that groundwater inflow to the adits and mine void would reduce groundwater levels in the vicinity of the mine (Figure 4-2). The mine would be near the top of the regional saturated zone or aquifer beneath Chicago and St. Paul peaks (Figure 3-10). As a result, the extent of drawdown would be limited by the elevation of the ore body. The ore body is at an elevation of 5,600 to 6,000 feet along its eastern boundary and slopes gently downward to the northwest to an elevation of about 4,700 feet along the western boundary of the proposed mine, averaging about 5,200 feet (Hydrometrics 2014c). Because dewatering of the mine void would reduce groundwater levels only to the bottom of the void, the maximum drawdown would, therefore, be limited to that elevation, which would, in turn, limit the extent of drawdown. Although not confirmed, portions of the ore body may be above the potentiometric surface (Figure 3-10). At the end of operations, maximum drawdown of about 500 feet would occur directly over the mine void, as predicted by the 3D model (Figure 4-2).

The 3D model predicted that groundwater drawdown would be greatest in groundwater overlying the adits and along fault and fracture trends (generally northwest-southeast) that would be intersected by the mine and adits (Figure 4-2). “Trend” is a general term for the direction or bearing of a linear feature, such as a fault or fracture. For the 10^{-6} cm/sec bulk hydraulic conductivity scenario, the 3D model predicted that drawdown would extend about 2 miles from the mine void in a northwest- southeast direction due to the structural trend of the area. The extent of drawdown would be less if the bulk hydraulic conductivity was in the range of 10^{-9} cm/sec. The actual extent of drawdown may be greater along structural trends and less in other directions than predicted by the model. Data collected during Phase I Evaluation may provide additional information regarding drawdown along fracture trends. Groundwater drawdown is unlikely to extend very far from the mine void in directions with little or no fracture connections. Hydrometrics (2014c) provides a discussion of model sensitivity to various parameters used in the model.

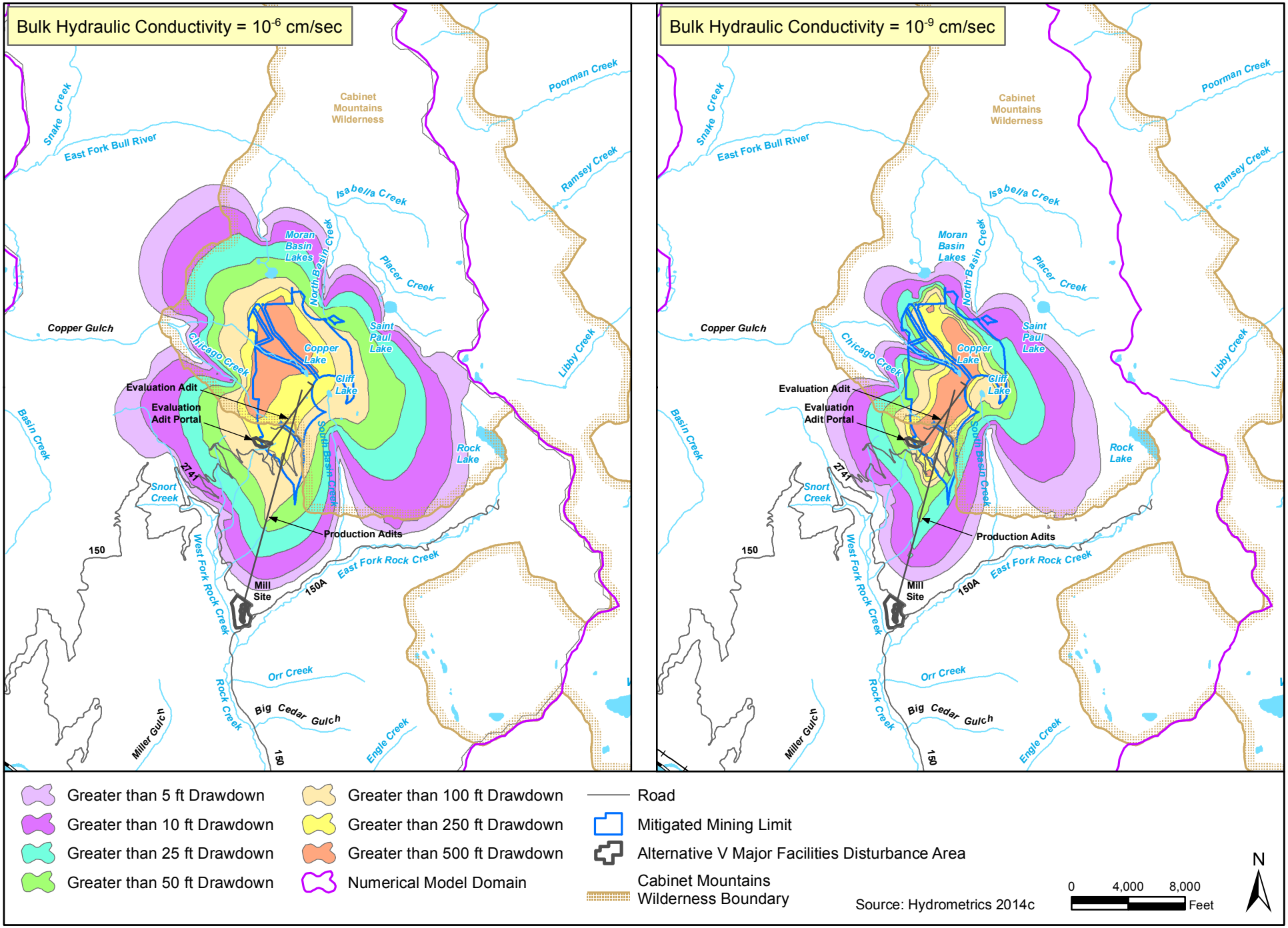


Figure 4-2. Predicted Groundwater Drawdown at End of Mining

Changes in Baseflow

Table 4-8 and Table 4-9 provide a summary of predicted changes to the various drainages for two periods: Year 35 (end of mining) and Year 70 (maximum drawdown), respectively. The tables provide a list of key locations along three major drainages: Rock Creek, East Fork Bull River, and Bull River (Figure 4-4).

Baseflow reduction in area streams is predicted by the 3D model to start during Phase II Production/ Operation (Hydrometrics 2014c). Because of the characteristics of the site groundwater hydrology, dewatering of the mine and adits would decrease groundwater levels and create a groundwater drawdown cone that would slowly expand away from the mine openings, intercepting groundwater that would otherwise discharge to area streams. At the end of production/operations, year 35, the 3D model predicted reductions in baseflow of 4% or less as estimated at the mouths of Rock Creek, Bull River, and East Fork Bull River (Table 4-8). As discussed in Section 4.7.2, *Analysis Methods*, there is uncertainty in the predicted changes in baseflow for the upper watersheds, but the predicted values provide a general sense of how baseflow in the upper watersheds could be affected by mine dewatering. It has not been confirmed whether there is baseflow in the upper watersheds, or if bedrock groundwater contributes to baseflow. The site conceptual model and numerical model indicate the regional water system has the potential to maintain baseflow in each of the upper watersheds, but because of the heterogeneities associated with fractured groundwater flow, it is not known if bedrock groundwater actually discharges in these areas. Data collected during baseline monitoring and Phase I Evaluation and subsequent model refinement may reduce the uncertainty of these predictions.

The predicted mine inflows during the life of the mine would intercept groundwater that would otherwise have discharged to drainages in the vicinity of the mine void. Because the premining contribution of groundwater to area streams, as baseflow, has not been fully defined, it is difficult to determine specifically where baseflow reductions might occur and by how much. The 3D model identified the stream reaches that may have the largest predicted changes in baseflow proportional to pre-mine baseflow. These reaches are East Fork Bull River upstream of St. Paul Lake, North Basin Creek, South Basin Creek, and Chicago Creek (Figure 4-3). The geology, topography, and hydrology suggest that most, if not all, of the reduction in baseflow would occur in the upper watersheds that drain the mine area. RCR would collect data in these drainages during the Evaluation and Construction Phases (see Appendix K).

The discussion below and Table 4-8 and Table 4-9 concerning predicted baseflow change is for the variable K fault and both the 10^{-6} and 10^{-9} cm/sec bulk K scenario. Hydrometrics (2014c) reported the results of the 10^{-6} cm/sec bulk K scenario "are within the range of the established conceptual model," whereas "the 10^{-9} scenario results in a water table that is unrealistically high and inconsistent with field data."

East Fork Bull River – During operations, the predicted change in baseflow within the East Fork Bull River watershed is due to a predicted change along North Basin Creek, which drains the northernmost portion of the study area, and along tributaries to the East Fork Bull River upstream from St. Paul Lake (Figure 4-3). In the East Fork Bull River above the confluence with the Bull River, a total baseflow change of 0.3 cfs (3% of a model-predicted pre-mining baseflow of 10.4 cfs) is predicted by the 10^{-6} cm/sec scenario and 0.1 cfs (1%) by the 10^{-9} cm/sec scenario (Table 4-8 and Figure 4-4).

Table 4-8. Predicted Changes to Baseflow – End of Operations (Year 35).

Drainage (Figure 4-4)	Measured Baseflow within Model Domain (cfs)	Baseflows with Variable K Fault, Bulk K = 10^{-6} cm/sec			Variable K Fault, Bulk K = 10^{-9} cm/sec		
		Model-Predicted Pre-mining Baseflow (cfs)	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Model-Predicted Pre-mining Baseflow (cfs)	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)
Rock Creek (above confluence with Clark Fork River)	6-7	7.8	7.5	-0.3	7.6	7.4	-0.2
East Fork Bull River (above confluence with Bull River)	10	10.4	10.1	-0.3	10.4	10.3	-0.1
Bull River (above confluence with Clark Fork River)	Not measured	20.6*	20.0	-0.6	20.6*	20.4	-0.2

Source: Hydrometrics 2014c.
With the data currently available, the model results provide a potential range of dewatering and streamflow impacts. They are the best available estimates of impacts that can be obtained using currently available data in the groundwater models. The 3D model would be refined and rerun after data from Phase I Evaluation were incorporated into the model (see the *Water Resources Monitoring Plan* in Appendix K). Following additional data collection and modeling, the predicted impacts on surface water resources in the study area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See Section 4.7.2, *Analysis Methods* for more discussion of model uncertainty.
cfs = cubic feet per second. "cfs" is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (i.e., reported to 0.1 cfs). If the results were converted to gpm, they would be reported to the nearest 50 gpm. Streamflow variability and measurability are discussed in Section 4.7.3.2, *Surface Water Quantity*.
* 20.6 cfs reported by Hydrometrics is only the portion of the baseflow at the mouth of the Bull River that is derived from groundwater contributions from within the modeled area; measured baseflow at the mouth is about 100 cfs (Hydrometrics 2014c).

Table 4-9. Predicted Changes to Baseflow – Maximum Drawdown (approximately Year 70).

Drainage (Figure 4-4)	Measured Baseflow within Model Domain (cfs)	Variable K Fault, Bulk K = 10^{-6} cm/sec				Variable K Fault, Bulk K = 10^{-9} cm/sec		
		Model-Predicted Pre-mining Baseflow (cfs)	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)		Model-Predicted Pre-mining Baseflow (cfs)	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)
Rock Creek (above confluence with Clark Fork River)	6-7	7.8	7.4	-0.4		7.6	7.4	-0.2
East Fork Bull River (above confluence with Bull River)	10	10.4	10.0	-0.4#		10.4	10.1	-0.3#
Bull River (above confluence with Clark Fork River)	Not measured	20.6*	19.9	-0.7		20.6*	20.2	-0.4

With the data currently available, the model results provide a potential range of dewatering and streamflow impacts. They are the best available estimates of impacts that can be obtained using currently available data in the groundwater models. The 3D model would be refined and rerun after data from Phase I Evaluation were incorporated into the model (see the *Water Resources Monitoring Plan* in Appendix K). Following additional data collection and modeling, the predicted impacts on surface water resources in the study area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See Section 4.7.2, *Analysis Methods* for more discussion of model uncertainty.
cfs = cubic feet per second. "cfs" is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (*i.e.*, reported to 0.1 cfs). If the results were converted to gpm, they would be reported to the nearest 50 gpm. Streamflow variability and measurability are discussed in Section 4.7.3.2, *Surface Water Quantity*.
* 20.6 cfs reported by Hydrometrics is only the portion of the baseflow at the mouth of the Bull River that is derived from groundwater contributions from within the modeled area; measured baseflow at the mouth is about 100 cfs (Hydrometrics 2014c);
# The apparent discrepancy between the reported baseflow change at this location when compared with the total of the upstream baseflow changes (-0.4 versus -0.5 and -0.1 versus -0.3, 10^{-6}, and 10^{-9}, respectively) may be due to rounding or related to water entering or leaving the alluvium. For the purpose of disclosing potential impacts, the higher of the two values is used.
Source: Hydrometrics 2014c.

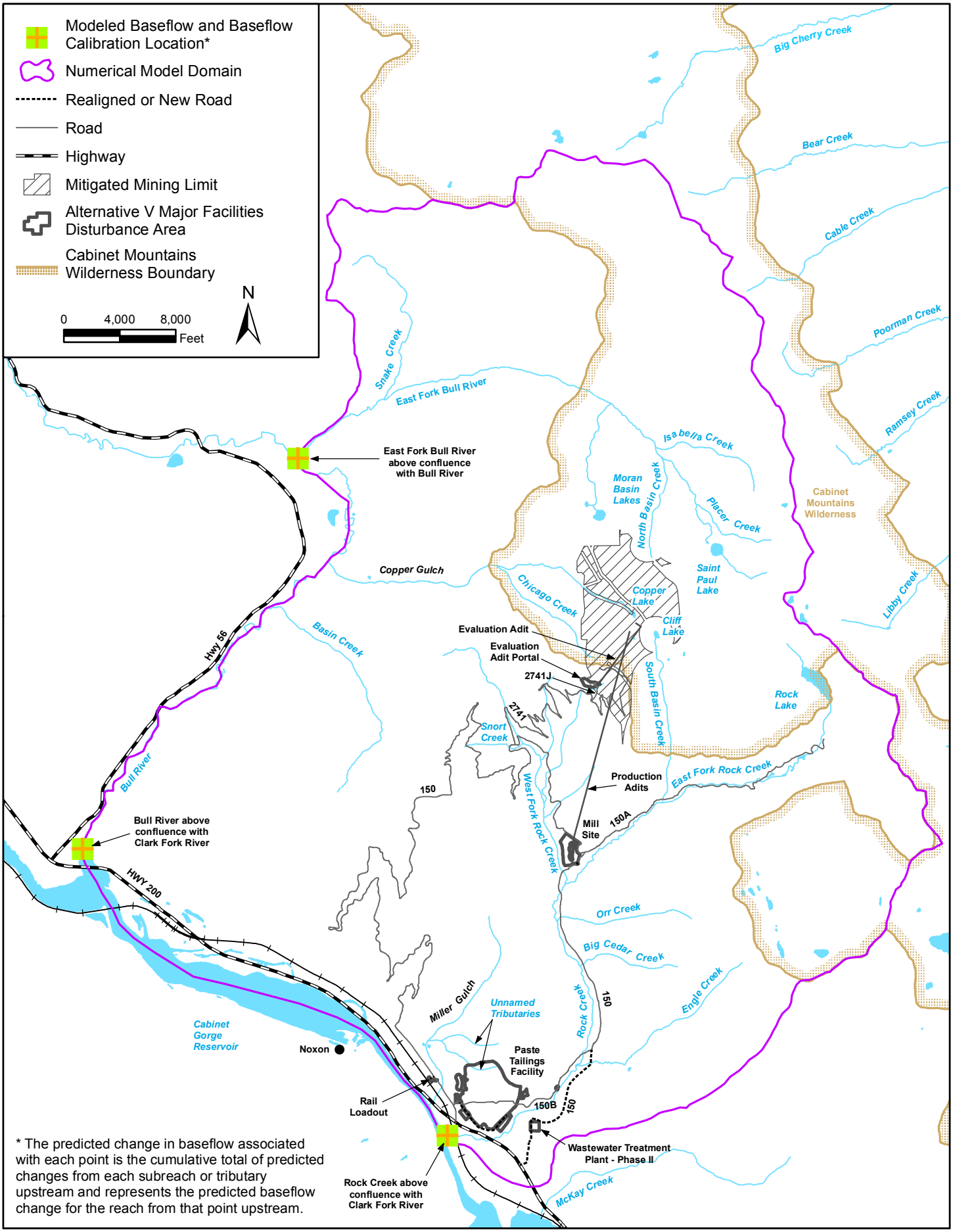
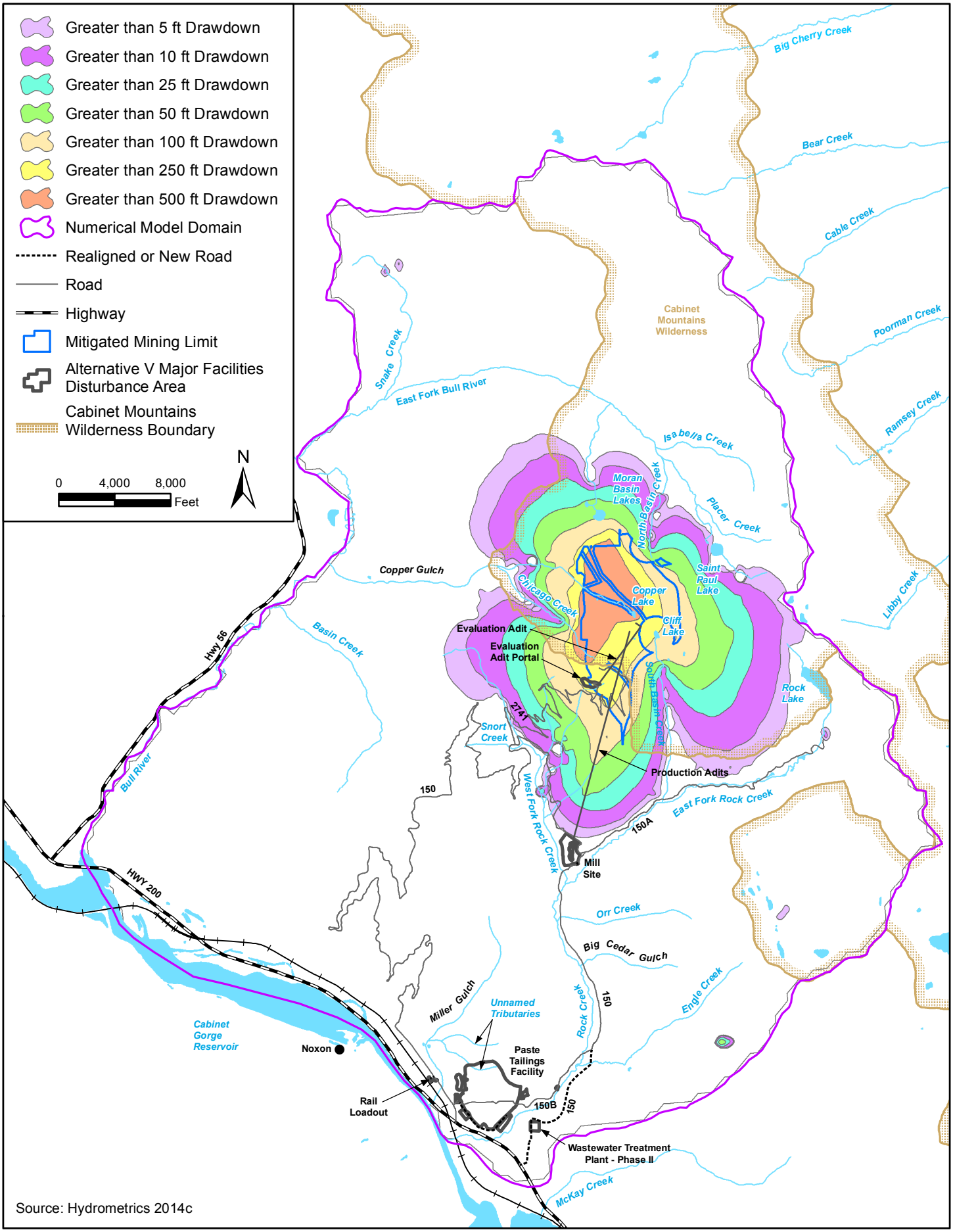


Figure 4-3. Groundwater Hydrology Study Area and Reported Baseflow Locations



Source: Hydrometrics 2014c

Figure 4-4. Predicted Maximum Groundwater Drawdown Extent, Year 70

Bull River – Baseflow reductions to the Bull River are predicted to occur along tributaries to the Bull River that drain the study area. These tributaries are the East Fork Bull River (and its tributaries) and Copper Gulch (and its tributary Chicago Creek). The predicted decrease in the baseflow is about 0.6 cfs in the Bull River at its mouth for the 10^{-6} cm/sec scenario and 0.2 cfs for the 10^{-9} cm/sec scenario. As discussed, the characteristics of groundwater contribution to baseflow in these upper drainages are not known. The predicted decreases in baseflow at the mouth of the Bull River would represent a change of less than 1% of the measured baseflow in the Bull River. The Bull River drainage is only partially within the modeled area, and as a result, the tables only report the portion of the 3D model-predicted baseflow that is derived from groundwater contributions from within the modeled area. The baseflow of the Bull River at the mouth was determined by KNF from flow measurements collected at that location. Therefore, the 3D model-predicted change in baseflow is compared with the measured baseflow in the Bull River, which is on the order of 100 cfs.

Rock Creek– The model predicted that mine dewatering would have no impact on the upper reaches of East Fork Rock Creek, but would reduce baseflow in South Basin Creek and an unidentified reach of either the West Fork Rock Creek or the East Fork Rock Creek for a total baseflow reduction of 0.3 cfs, or about 4% of the modeled baseflow at the mouth of Rock Creek for the 10^{-6} cm/sec scenario and 0.2 cfs for the 10^{-9} cm/sec scenario. The measured baseflow shown in Table 4-8 is greater than some of the streamflow measurements reported in Section 3.7.4.2, *Rock Creek, West Fork Rock Creek, and East Fork Rock Creek* because during low-flow periods, much or all of the baseflow is subsurface flow.

Mine Area Springs and Seeps

Based on the results of the 3D model, groundwater drawdown would occur around the mine as a result of dewatering of the mine void and adits. Flow from springs hydraulically connected to the regional groundwater flow path may be reduced. Springs located above the regional potentiometric surface (about 5,000 to 5,500 feet) would not be affected by mine dewatering. Because some springs may derive their water from both shallow and deep groundwater flow paths at various ratios, it is not possible to predict the amount (if any) of flow reduction for any one spring. Many springs and seeps in the mine area have been inventoried, but the inventory did not identify the specific groundwater source for each spring or seep. As explained in the description of the GDE inventory and monitoring in Appendix K, RCR would conduct surveys, monitoring, and data analyses to determine the source of water to specific springs.

Wilderness Lakes

The exact nature of the hydrologic conditions around and beneath the wilderness lakes located above the proposed mine, specifically Cliff Lake, is unknown. However, during three of the years in which Copper Lake was visited by agency personnel, it was observed to be nearly dry, suggesting the lake is perched above the regional groundwater table and recharges the local shallow groundwater system. The 3D model results and the overall conceptual model indicate that Cliff Lake is also perched above the regional potentiometric surface. Based on this conceptualization, Cliff Lake would not be affected by mine dewatering. As described in Section 4.7.2, *Analysis Methods*, an expanded vertical 2D model of the Cliff Lake area (which uses the 3D model as its basis) was used to evaluate the hydrologic conditions that would be necessary to connect the lake to the regional potentiometric surface. Under certain modeled conditions, Cliff Lake could be connected to the regional potentiometric surface (Hydrometrics 2014c). With the 1,000-foot buffer included in Alternative V, the 2D model predicted no impact on Cliff Lake from mining, regardless of which modeled condition proved to be most representative. A buffer of 1,000 feet around Cliff Lake would remain unmined until the hydrogeology of this area was better characterized through monitoring and updated modeling. RCR could mine closer than 1,000 feet to Cliff Lake only after approval of the KNF and DEQ.

The 3D model report indicated that St. Paul Lake may be affected by mine dewatering (Hydrometrics 2014c). Because St. Paul Lake is located on permeable glacial material, the lake level fluctuates seasonally, filling in the spring and draining through the summer months. Deep bedrock groundwater may provide year-round flow to the lake from tributaries upstream of the lake, but the existing flow rate from bedrock appears to be insufficient to maintain the lake level after surface water inflow ceases.

Paste Tailings Facility

The Alternative V paste tailings facility would be within 500 feet of Rock Creek near its confluence with the Clark Fork River and within 2,100 feet of the Clark Fork River (Figure 3-7). As described in Section 3.7.3.2, *Paste Tailings Facility Site*, the paste tailings facility would overlie up to 100 feet of unconsolidated sediments that overlie Wallace Formation, an inter-bedded limestone, argillite, and quartzite. The unconsolidated sediments consist of up to 85 feet of lacustrine clay, silty clay, and sandy silt with thin sand layers, and up to 25 feet of basal sand and gravel, which overlie the bedrock (Dames & Moore 1989). Within the paste tailings facility footprint, sand layers up to 15 feet thick occur in the upper part of the lacustrine clays in some areas, such as in the vicinity of Miller Gulch and an unnamed tributary to Rock Creek.

The paste tailings facility would be designed to store paste (dewatered) tailings and would not be used to store excess water. The paste tailings facility design would include a seepage collection system (finger drains) connected to a lined stormwater collection pond (Figure 2-7). Water from the stormwater collection pond would be sent to the mill for reuse. Section 2.3.1.7, *Tailings Deposition* provides a more detailed description of the proposed paste tailings facility. As described in Section 4.6, *Geotechnical Engineering*, most of the seepage from the tailings would be in response to infiltration of precipitation rather than water from consolidation of the tailings. According to various analyses completed for the 2001 FEIS, including Klohn-Crippen (1998), all but 20 to 30 gpm of seepage would be collected by the seepage collection system and would either be treated and released or reused in the process circuit. However, depending on the design of the underdrain system and the actual hydrogeologic conditions, the rate of seepage collected by the underdrain system could vary considerably (Schafer 2014). Golder (1996) concluded that a phreatic surface may not develop in the tailings above the underdrain system due to the low overall permeability and the expected rate of net infiltration. If saturated conditions did not develop at the base of the tailings, the effectiveness of the undersystem to capture seepage would be reduced. To address this issue, Schafer (2014) included a range of possible seepage rates into the underlying sediments as part of a water quality analysis (see Section 4.7.3.3, *Groundwater Quality*).

As described in Appendix K, groundwater quality would be monitored in wells located downgradient of the paste tailings facility. If monitoring indicated paste tailings facility seepage exceeded action levels established in the Water Resources Monitoring Plan in Appendix K, monitoring wells would be converted to a pumpback well system designed to capture all affected groundwater for treatment or mill reuse. The pumpback well system would include water quality and water level monitoring to document capture. Monitoring wells that could be converted to pumpback wells would be installed. Details of a pumpback well system, such as number of pumping wells and total pumping rate necessary to achieve capture of all affected groundwater, have not been developed, and would be determined if needed. Additional pumping wells at locations other than the monitoring wells may be required to demonstrate and maintain groundwater capture. A pumpback well system would potentially reduce groundwater levels in the alluvium of Rock Creek and the Clark Fork River. The pumpback well system would reduce groundwater contributions to Miller Gulch, Rock Creek, and the Clark Fork River equal to the total pumping rate, but assuming an equivalent rate of water produced by the pumpback well system was treated and discharged to the Clark Fork River, there would be no net loss of water to the Clark Fork River at and below the point of discharge.

Reduction in groundwater levels may reduce yield from private wells and springs, depending on their distance from the pumpback well system. RCR would have to obtain a beneficial water use permit before appropriating any water for beneficial use, such as surface water runoff to Miller Gulch or the pumpback or makeup water wells. The beneficial water use permit application would describe the location, volume, and rate of the diversion and the location, purpose, and period of use. A mitigation plan required for any beneficial water use permit obtained by RCR would contain mitigation for any adverse effects on existing permitted water users.

Springs and Seeps near Paste Tailings Facility

The proposed paste tailings facility would permanently cover spring SP-11 (Figure 3-8), which has an estimated flow of less than 10 gpm. Water from this spring would report to the underdrain system and become part of the seepage collection system. Springs SP-12, 25, 28, and 30 are outside of the proposed paste tailings facility area and could be impacted if a pumpback well system was operated. Because the source of water to each of these springs has not been identified, it is unknown whether pumping below the paste tailings facility would reduce flow to any one or all of these springs. Appendix K discusses monitoring requirements for these springs.

Makeup Well

If other water sources were inadequate for mill operational needs, a water well would be installed in the alluvium of the Clark Fork River (Figure 2-2) to provide makeup water for use in the milling process. The well would be operated in accordance with DNRC regulations. Because the alluvium is very permeable, the extent of significant drawdown due to pumping would be limited to the area around the well. A mitigation plan may be required for any beneficial water use permit obtained by RCR that would contain mitigation for any adverse effects on existing permitted water users.

4.7.3.1.3 Phase II Closure/Post-Closure (Year 36 through Year 38/Year 39 through at least Year 70)

Mine Area

Phase II Closure would start at the end of operations (Year 36) and includes completion of site reclamation (about 2 years). The years discussed in this and other sections are used for analysis purposes and may vary from actual mining periods. In addition, the following discussion is based on the results of the 3D model that analyzed groundwater drawdown after mine closure to determine approximately when the maximum drawdown would occur. The maximum drawdown is predicted to occur about 35 years after mine closure, or 70 years after Phase I Evaluation began (Figure 4-4) and is included in Phase II Post-Closure.

The KNF requested that Hydrometrics consider three mine closure options for analysis of groundwater impacts: 1) no adit plugs, which would allow drainage of mine and adit inflows from the mine and adits; 2) plugs near the intersection of the adits and mine void, which would allow drainage from the adits only; and 3) plugs near the intersection of the adits and mine void and along the adits, including at the entrances and no drainage. Although RCR would select the mine closure option after obtaining more hydrologic data, updating the 3D model, and obtaining agency approval, the 3D model simulated options 1 and 2 only. Option 3 was not simulated, but would likely be similar to option 2 except that groundwater levels would fully recover in the vicinity of the adits and there would be no ongoing mine discharge. Based on the 3D model, post-recovery groundwater levels in option 1 would stabilize at an elevation of about 5,450 feet (the elevation of the service adit at the ore body or about 300 feet below model-predicted pre-mining water levels) with mine drainage of about 110 gpm. For option 2, the post-recovery groundwater levels are predicted to recover to pre-mining levels, except in the vicinity of the adits, and the adits would continue to drain at the rate of about 75 gpm. Option 3 was not simulated, but would likely be similar to option 2 except that groundwater levels would also fully recover in the vicinity of the adits and there

would be no ongoing mine discharge. For options 2 and 3, the mine void would permanently store an additional 26,700 acre-feet of groundwater from what is currently stored in fractures. If portions of the mine void were above the pre-mining regional water table, the amount of water permanently stored in the mine void would be somewhat less.

Full recovery of water levels was incomplete at the end of the model simulations (about 300 years). The 3D model assumes average recharge conditions that may or may not be representative of the actual conditions. The actual recovery rate of water levels would depend on seasonal recharge conditions overlying the mine. Two examples of existing recharge conditions (the Troy Mine and Montanore's Libby Adit) provide some insight as to possible recovery rates for mine voids in the mine area. During a shutdown of mine operations between 2004 and 2008, water levels in the Troy Mine reached equilibrium in about 1 to 1.5 years (CDM 2010). The Troy Mine recovery was much quicker than the model-predicted rates for the Rock Creek Mine because the Troy Mine experiences large seasonal inflows (CDM 2010). The Rock Creek model simulated annual average conditions and did not consider the possibility of high seasonal inflow rates. Another example in the general vicinity of the Rock Creek Mine area is Montanore's Libby Adit, which does not experience the large seasonal inflows observed at the Troy Mine (MMC 2012). It is not known whether the Rock Creek Mine would be subject to large seasonal inflows like the Troy Mine or would not be subject to substantial seasonal variation in inflow like the Libby Adit.

Mine Area Springs and Seeps

If mine area springs and seeps that derived all or most of their water from bedrock groundwater were affected by mine dewatering during the Operation Phase, their flow rate would recover as the mine void refilled and residual drawdown decreased.

Changes in Baseflow

Table 4-9 provides a summary of predicted changes to the major drainages during the period of maximum drawdown. The predicted changes at maximum drawdown are similar to those discussed for end of operations, but slightly greater.

East Fork Bull River – The predicted change in baseflow within the East Fork Bull River watershed is due to a predicted change along North Basin Creek, which drains the northernmost portion of the study area and is located along tributaries to the East Fork Bull River upstream from St. Paul Lake (Figure 4-3). In the East Fork Bull River above the confluence with the Bull River, a total baseflow change of 0.4 cfs (4% of a model-predicted pre-mining baseflow of 10.4 cfs) is predicted by the 10^{-6} cm/sec scenario and 0.3 cfs (3%) by the 10^{-9} cm/sec scenario (Table 4-8 and Figure 4-4).

Bull River – Baseflow reductions to the Bull River are predicted to occur along tributaries to the Bull River that drain the study area. These tributaries are the East Fork Bull River (and its tributaries) and Copper Gulch (and its tributary Chicago Creek). The predicted decrease in the baseflow is about 0.7 cfs in the Bull River at its mouth for the 10^{-6} cm/sec scenario and 0.4 cfs for the 10^{-9} cm/sec scenario. As discussed, the characteristics of groundwater contribution to baseflow in these upper drainages are not known. The predicted decreases in baseflow at the mouth of the Bull River would represent a change of less than 1% of the measured baseflow in the Bull River. The Bull River drainage is only partially within the modeled area, and as a result, the tables only report the portion of the 3D model-predicted baseflow that is derived from groundwater contributions from within the modeled area. The baseflow of the Bull River at the mouth was determined by KNF from flow measurements collected at that location. Therefore, the 3D model-predicted change in baseflow is compared with the measured baseflow in the Bull River, which is on the order of 100 cfs.

Rock Creek– The model predicted that mine dewatering would have no impact on the upper reaches of East Fork Rock Creek, but would reduce baseflow in South Basin Creek and an unidentified reach of either the West Fork Rock Creek or the East Fork Rock Creek for a total baseflow reduction of 0.4 cfs, or about 5% of the modeled baseflow at the mouth of Rock Creek for the 10^{-6} cm/sec scenario and 0.2 cfs for the 10^{-9} cm/sec scenario. The measured baseflow shown in Table 4-9 is greater than some of the streamflow measurements reported in Section 3.7.4.2, *Rock Creek, West Fork Rock Creek, and East Fork Rock Creek*. This is because during low-flow periods, much or all of the baseflow is subsurface flow.

Wilderness Lakes

The previous operations/production section discusses wilderness lakes. During the period of maximum drawdown, the 3D model predicts a change in baseflow above St. Paul Lake. Refer to Section 4.7.3.1.2, *Phase II Construction of Service and Conveyor Adits and Production/Operations (Year 3 through Year 35)*, for a discussion of potential effects on St. Paul Lake.

Paste Tailings Facility

At the beginning of Phase II Closure, the mill would cease operation and the paste tailings facility would no longer receive tailings. RCR would continue to treat and discharge any seepage collected by the paste tailings facility underdrain system until the applicable water quality standards were met without treatment. The surface topography would be regraded to a variable natural-appearing surface and vegetated. Infiltration of precipitation would likely continue at a rate similar to what occurred during the pre-mining period. The net infiltration rate would likely control the long-term rate of total seepage from the paste tailings facility. The long-term fraction of the seepage collected by the underdrain system would depend on the conditions described in Section 4.7.3.1.2, *Phase II Construction of Service and Conveyor Adits and Production/Operations (Year 3 through Year 35)*. As long as water required treatment during and after Phase II Closure, the agencies would require a bond for the operation and maintenance of the water treatment plant. The length of time that these closure activities would occur is not known, but may be decades or more. If a pumpback well system was operated during Phase II Operations, it would continue operating until water quality standards were met, as described in Section 2.3.1.7.4, *Paste Tailings Deposition*, and Appendix K. Any effects of the pumpback well system operation would continue as long as it operated.

4.7.3.1.4 Influence of Climate Change

Due to the range in possible effects of climate change on the water resources and the many factors that could affect that outcome, quantifying the influence of climate change on Alternative V effects was not feasible. It is difficult to predict how the hydrologic systems in the study area would respond to the forecasted regional effects of climate change. The Bureau of Reclamation (2011c) states that “the projected changes have geographic variation; they vary through time, and the progression of change through time varies among climate projection ensemble members” and “some geographic complexities of climate change emerge over the Columbia River Basin when climate projections are inspected location by location.” The KIPZ Climate Change Report (USFS 2010) described several key sources of uncertainty associated with estimating hydrologic responses of individual subbasins and watersheds to projected climate changes, including:

- “Hydrologic models often rely on output from global and regional climate models to evaluate potential hydrologic effects. Global climate models have relatively poor skill in simulating regional and local-scale precipitation, due in part to their coarse spatial resolution and limited ability to account for local topographic influences on the hydrologic processes of small to medium sized watersheds (e.g., 6th and 5th hydrologic unit codes).

- There is limited availability of locally-specific field data and analyses on the relative influence of temperature, precipitation, elevation, dust, and black soot on observed snowmelt and runoff trends in mountainous areas.
- We currently lack multiple, high-resolution regional climate models that can resolve fine-scale circulation patterns, snow-albedo feedback, and other environmental features that influence hydrologic processes."

The following paragraph describes potential effects of Alternative V and climate change for a range of trends.

Depending on the extent and location of reduced snowpack, groundwater infiltration could decrease in some parts of the study area, which could lower the groundwater table and potentially reduce groundwater flow to wilderness lakes. Decreased groundwater infiltration could reduce Alternative V mine and adit inflows, but because baseflow to streams would also decrease, the percentage change to stream baseflow could remain the same. Discharges to the Clark Fork River would be less if mine and adit inflows decreased. As described above, the Bureau of Reclamation (2011c) predicted that climate change would reduce the accumulation of snow, increase runoff in the winter, and reduce summer and fall runoff and baseflow in the Columbia River Basin. If climate change did not reduce infiltration enough to change mine and adit inflows from those projected without climate change, any increase in winter flows due to climate change would moderate the effect of mine inflows during winter low-flow periods, and any decrease in fall flows would magnify the effect of mine inflows during fall low-flow periods. As described in Appendix K, RCR would monitor streamflows and water temperatures at potential impact area sites and benchmark sites (similar to study area sites, but outside the area of potential mine impacts) to evaluate trends due to mining compared with trends due to nonmining effects such as climate change.

4.7.3.2 Surface Water Quantity

4.7.3.2.1 Effects on Floodplains and Streams

The diffuser in Alternative V would be in the FEMA-designated 100-year floodplain of the Clark Fork River. The diffuser would be about 750 feet above the confluence of the river and Rock Creek and would run the entire width of the river. No other mine facilities, including proposed roads, would be located within a FEMA-designated 100-year floodplain. The reconstructed NFS road #150 would be located south of Rock Creek and would cross Engle Creek near its mouth. There would be no other new stream crossings.

4.7.3.2.2 Mine Inflows – Effects on Streamflows

Effects on baseflows would not be measurable when streamflows are dominated by snowmelt runoff or large runoff-producing rain events. In some years, runoff from snowmelt or runoff-producing rain events would occur throughout the year and streamflows would not reach baseflow. Large channel-forming flows would not be affected by mine inflows and stream morphology or sediment movement would not be affected.

The ability to measure streamflow accurately and precisely depends on a number of factors, reviewed by Harmel et al. (2006). Potential errors in streamflow measurement are introduced in the measurement of stream depth, velocity, and channel dimensions. Accuracy varies over the distribution of flows, ranging from a few percent for low flows measured with an accurately calibrated weir to 10% to 15% or more for high flows measured by standard stage-to-discharge techniques and calibrated against periodic wading discharge measurements (Grant et al. 2008). 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%; changes in peak flow that fall in this range are within the error of peak flow measurement and cannot be ascribed to an effect.

Harmel et al. (2006) reported measurement error in overall streamflow measurement for a “typical” scenario, a “best-case” scenario, and a “worst-case” scenario. The best-case scenario represented measurement procedures used with a concentrated effort in QA/QC unconstrained by financial and personnel resource limitations and in ideal hydrologic conditions. The typical scenario represented measurement procedures conducted with a moderate effort at QA/QC and under typical hydrologic conditions. For a typical scenario, the estimated measurement error averaged 10% and ranged from 6% to 19% for a range of conditions. The estimated measurement error was 3% for the best-case scenario, which included flow measurement under ideal hydrologic conditions, specifically a precalibrated flow-control structure (stable bed and channel) and a stilling well for stage measurement. A recent improvement in streamflow measurement for streams that are at least a foot deep is the use of acoustic Doppler current profilers to measure streamflow. The advantages are that this method is much faster and more accurate than mechanical current meters as it allows measurements where mechanical current meters are inappropriate or unreliable, and it measures continuous profiles of water velocity, providing more accurate streamflow measurements (Hirsch and Costa 2004).

The natural variability in streamflow influences the ability to detect a mining-induced change in streamflow. Based on an analysis of streamflow data from streams near gaging stations located at the periphery of the study area on the KNF, Wegner (2007) reported a 20% average variability in low-flow values. In stream reaches where the only source of water to streams is deep bedrock groundwater, it is expected that flow variability would be less. Because the deep bedrock groundwater flowpath is relatively long through low-permeability materials, the bedrock groundwater system is typically not sensitive to seasonal variations in recharge. As described in Appendix K, a sufficient number of streamflow measurements would be collected to determine if streamflow after mining began is statistically different from the natural variability of flow that occurred pre-mining, regardless of measurement error. Although mining-induced streamflow changes would likely initially be small and gradually increase, any trend should be observable given adequate streamflow monitoring before mining began, during all mining periods, and after mining ceased.

As described in detail in Appendix K, baseline streamflow monitoring would be collected at least 1 year prior to the initiation of evaluation adit construction in the area where surface water or groundwater may be affected by Phase I Construction and Operations. At least 1 year of surface water baseline data would be collected prior to the initiation of Phase II in the area where surface water or groundwater may be affected by Phase II Construction and Operations. Monitoring would include previously monitored sites; sites that might be impacted by construction and mining activities; new surface water sites (streams, springs, and seeps) near the ore body that would be added based on the 3D model results and area surveys; and a benchmark stream site. All surface water sites would be monitored for flow and water quality monthly, including storm flows. Streamflow monitoring would continue during all mining periods, and after mine closure. Monitoring would occur, to the extent possible, to determine seasonal trends. As described in Appendix K, investigations would be completed to determine if and where streams are connected to the regional groundwater system. The 3D model would be refined and rerun after data from Phase I Evaluation were incorporated into the model. Following additional data collection and modeling, the predicted impacts on surface water resources in the study area may change and the model uncertainty would decrease.

Phase I - Evaluation Adit

The proposed evaluation adit area is adjacent to an unnamed tributary to West Fork Rock Creek. The evaluation adit would be about 2,000 feet south and 500 vertical feet below the drainage divide that separates the West Fork Rock Creek and Copper Gulch. As described in the 2001 FEIS, the unnamed tributary is ephemeral near the proposed adit location and becomes perennial about 0.8 mile below the proposed adit location where two springs provide perennial flows of 20 to 100 gpm. The ephemeral

section of the stream above the springs flows during the spring snowmelt period. The 3D model predicted that during Phase I Evaluation, baseflow would not be affected (Hydrometrics 2014c).

Phase II - Operations

Changes in baseflow would occur throughout the year during mining. Because streams in the area may be at baseflow only from mid-July to early October, as well as periodically from November through March, effects on baseflows may be measurable only during those times of the year. In addition, when higher than normal precipitation occurs in late summer/early fall and/or when residual snowpack continues to melt through late summer/early fall, streamflow in the study area would contain surface runoff in addition to baseflow, so in wetter years, effects on baseflow may be measurable only for short periods or may not be measurable during the entire year.

The effects on baseflows for Rock Creek, the East Fork Bull River, and the Bull River are provided in Table 4-8 (Figure 4-2) and discussed in Section 4.7.3.1, *Groundwater Quantity*. Baseflows for most of the streams in the study area have not been measured, and the proportion of streamflow from bedrock groundwater discharge in all study area streams is unknown. The 3D model identified the stream reaches that may have the largest predicted changes in baseflow proportional to pre-mine baseflow as Chicago Creek in the Bull River watershed, South Basin Creek in the Rock Creek watershed, North Basin Creek in the East Fork Bull River watershed, and the East Fork Bull River above St. Paul Lake. RCR would collect data in the study area drainages during the evaluation and construction time periods (see Appendix K). Although a reduction in baseflow may not be observable in any particular year, impacts from dewatering the mine and adits may be expressed in other ways, such as a change in the elevation at which streams have perennial flow. Mine dewatering may result in a trend toward perennial flow beginning at a lower elevation in the affected drainages. Another potential effect would be that in stream reaches where surface flow is intermittent, baseflow reduction may result in periods with no surface flow occurring more frequently and lasting longer.

Rock Creek and Rock Creek Meadows

The predicted changes in baseflow are cumulative from the uppermost point where effects are predicted to the mouth of each stream. Baseflow is predicted to decrease in Rock Creek as a result of decreases in South Basin Creek and an unidentified reach of either the East Fork Rock Creek or the West Fork Rock Creek (Figure 4-2). Streamflow measurements have not been collected in South Basin Creek, but as described in Section 3.7.4.2, *Rock Creek, West Fork Rock Creek, and East Fork Rock Creek*, creek flow has been observed to be intermittent. The estimated baseflow reduction may be manifested as a reduction in both surface and subsurface flow, or as only surface or subsurface flow in the creek. An effect of the predicted baseflow reduction may be that where the stream is intermittent, periods with no surface flow may occur more frequently and last longer.

As discussed in Section 3.7.4.2, *Rock Creek, West Fork Rock Creek, and East Fork Rock Creek*, the East Fork Rock Creek is a perennial stream that loses surface flow to channel alluvium near the confluence of the West Fork Rock Creek. The estimated baseflow reduction may be manifested as a reduction in both surface and subsurface flow in the creek. Based on streamflow measurements by Hydrometrics in the East Fork Rock Creek above the confluence with the West Fork (ERC-1, Figure 3-7), which occasionally showed no surface flow, there may be very low-flow periods when baseflow reduction would be only to subsurface flow at this location. Rock Creek Meadows is located within the reach of the East Fork Rock Creek that is predicted to not be affected by mine inflows.

In Rock Creek at the gage located about 100 feet upstream of Montana Highway 200 (RC-1), the creek is often dry or nearly dry in late summer, fall, and winter. The model-estimated baseflow at this location is 7.8 cfs, which indicates that during low-flow periods, much or all of the baseflow is only subsurface flow.

The estimated baseflow reduction may be manifested as a reduction in both surface and subsurface flow, or as only surface or subsurface flow in the creek.

East Fork Bull River

As described in Section 3.7.4.3, *East Fork Bull River*, bedrock groundwater may be a source of water to the East Fork Bull River upstream of St. Paul Lake. The 3D model predicted that baseflow would decrease in the East Fork Bull River from above St. Paul Lake to the mouth. The largest predicted changes in baseflow proportional to pre-mine baseflow would occur in upper East Fork Bull River above St. Paul Lake (Figure 4-2). In the East Fork Bull River downstream of North Basin Creek, the baseflow decrease would be the sum of the decrease above St. Paul Lake and the decrease from North Basin Creek. Flows have not been measured in the upper East Fork Bull River or North Basin Creek. North Basin Creek is steep and becomes perennial where two tributaries join, so bedrock groundwater may be the only source of water to the creek when there is no snowpack in the upper basin.

Bull River

Baseflow is predicted to be reduced in Chicago Creek, Copper Gulch, and the Bull River from its confluence with the East Fork Bull River to the mouth (Figure 4-2). The largest predicted change in baseflow proportional to pre-mine baseflow would occur in Chicago Creek. Flows have not been measured in Chicago Creek and Copper Gulch. Bedrock groundwater may be the source of water to Chicago Creek and Copper Gulch when there is no snowpack in the upper basin, but a colluvial/glacial deposit in the Copper Gulch and Chicago Creek headwaters may also be a source of water to the creek later in the summer and early fall. Impacts from dewatering the mine and adits may be expressed as a change in the elevation at which Chicago Creek and Copper Gulch have perennial flow. Mine dewatering may result in perennial flow beginning at a lower elevation in these drainages.

Phase II - Closure

The maximum predicted reductions to stream baseflows would occur about 35 years after mine closure, and are provided in Table 4-9 and discussed in Section 4.7.3.1, *Groundwater Quantity* (Figure 4-4). The effects on streamflows are predicted to be slightly greater than effects during mining. When mining activities ceased, the adits may or may not be plugged. The possible closure options are described in Section 4.7.3.1.3, *Groundwater Quantity - Phase II Closure/Post-Closure (Year 36 through Year 38/Year 39 through at least Year 70)*. Any mine discharge water would be conveyed to, treated, and then discharged from the wastewater treatment plant until the water no longer required treatment to meet applicable standards. In all cases, as described in Section 4.7.3.1.3, *Groundwater Quantity - Phase II Closure/Post-Closure (Year 36 through Year 38/Year 39 through at least Year 70)*, the model predicted no effects due to mine dewatering on CMW lakes or to surface water flows in streams or springs.

Phase II - Post-Closure

As discussed in the groundwater section, with plugging at the top of the adits, groundwater levels and surface flows would nearly return to pre-mining conditions. Without any plugs, the model predicted reduced streamflow in the East Fork Bull River and less bedrock baseflow in South Basin Creek (Hydrometrics 2014c).

4.7.3.2.3 Wilderness Lakes

As discussed in Section 4.7.3.1, *Groundwater Quantity*, the 3D model predicted no effects on lakes within the CMW due to mine inflows, except St. Paul Lake. St. Paul Lake may be affected by mining, but effects may be difficult to separate from the large natural lake level variations. If deep groundwater is a component of the inflow to St. Paul Lake, mine dewatering is predicted to reduce this source of water to

the lake, and the lake level may lower more quickly during dry years when the only source of water to the lake is bedrock groundwater.

Additional modeling of Cliff Lake using a 2D model (Hydrometrics 2014c) showed a potential saturated connection between Cliff Lake and the mine void under specific hydrologic conditions. The 2D model predicted that with a 1,000-foot buffer around Cliff Lake, the lake would not be affected by mine inflows. A buffer of 1,000 feet around Cliff Lake and ore outcrop zones and a buffer of 100 feet around the Copper Lake and Moran Faults would remain unmined until the hydrogeology of this area is better characterized through monitoring and updated modeling. RCR could mine closer than 1,000 feet to these features only after approval of the KNF and DEQ.

As described in Appendix K, a long-term water monitoring plan for Alternative V includes monitoring the water balance of Cliff, Copper, St. Paul, and Moran Basin lakes. Monitoring of the lakes and streams for early detection of impacts, underground monitoring of mine inflows, avoiding high permeability geologic structures that intersect the ore body, grouting mine inflows, and avoiding outcrops and areas underlying lakes would minimize possible impacts on wilderness lakes.

4.7.3.2.4 Use of Runoff Water from the Evaluation Adit Pad for Exploration Drilling

Groundwater inflow into the adit (estimated to be 13 gpm) and surface runoff from the evaluation adit pad would be captured at the toe of the pad and used for exploration drilling. The reduction in runoff to the unnamed tributary to the West Fork Rock Creek located below the evaluation adit pad would slightly reduce flow in the tributary and West Fork Rock Creek. Water would also be hauled to the evaluation adit and stored in a lined pond for drilling.

4.7.3.2.5 Use of Runoff Water during Phase II Construction

Groundwater inflow in the adit (estimated to be 97 gpm) would be used for drilling the second adit and as needed for construction purposes. Any unused water would be treated at the wastewater treatment plant and discharged to the Clark Fork River. If additional water were needed during construction, it would be hauled in to a lined storage pond such as the mill reservoir.

4.7.3.2.6 Discharge of Treated Water

The water balance for the Rock Creek Project is provided in Table 2-5. The water balance provides estimated average annual discharges from the wastewater treatment plant to the Clark Fork River of up to 364 gpm (0.81 cfs) during construction to 651 gpm (1.45 cfs) during mine closure. The average annual flow of the Clark Fork River near the point of discharge is 20,000 cfs. DEQ estimated a $7Q_{10}$ flow of 3,610 cfs at this location (DEQ 1997). The lowest daily flow in recent years is 220 cfs. Discharges from the wastewater treatment plant would increase the flow of the Clark Fork River by much less than 1% of the average annual flow and $7Q_{10}$ flow of the river, and by less than 1% at an extremely low river flow of 220 cfs.

If the adits were not plugged during mine closure, mine water would be treated and discharged to the Clark Fork River until MPDES permit effluent limits were met, which may be in perpetuity. The estimated average discharge rate of treated water post-mining (Table 2-5) would be 110 gpm from the mine and an estimated 27 gpm from tailings seepage (0.31 cfs), potentially in perpetuity, which would be a small flow increase compared with average flows in the Clark Fork River. If plugs were placed near the intersection of the adits and mine void, allowing drainage from the adits only, then the estimated average discharge rate of treated water post-mining would be 75 gpm and there would be 27 gpm from tailings seepage (0.23 cfs), which would be treated and discharged potentially in perpetuity. If plugs were placed near the intersection of the adits and mine void and along the adits, including at the entrances, then no mine or water would be treated and discharged post-mining to the Clark Fork River. The estimated 27

gpm (0.06 cfs) of seepage from the tailings facility would be treated and released to the Clark Fork River, potentially in perpetuity.

4.7.3.2.7 Mill Facility and Makeup Water Requirements

Alternative V mill facility and makeup water requirements are described on page 4-107 of the 2001 FEIS. The 2001 FEIS indicated 5% to 10% of the flow in the process loop would be diverted to the wastewater treatment system and fresh water added to the circuit on an ongoing basis to prevent buildup of excess constituents in the process water. Federal regulations at 40 CFR 440.104(a)(2)(ii) require that a discharge permittee (RCR) demonstrate that such discharges were necessary and could not be eliminated through appropriate treatment. RCR would make the required demonstration concurrent with submittal of a final Plan of Operations. It is estimated that 67 gpm (0.15 cfs) of runoff intercepted at the mill facility and used at the mill would not reach Rock Creek. This flow reduction would be in addition to the flow reduction that would occur in Rock Creek at the confluence of the East and West forks due to mine inflows. The makeup well, if needed, would be installed in the alluvium of the Clark Fork River and would not be expected to measurably affect the flow of the Clark Fork River.

4.7.3.2.8 Effects of the Tailings Facility on Flows in the Miller Gulch and Rock Creek Basins

If pumpback wells were used in Alternative V, groundwater that would otherwise contribute to flows in Rock Creek, Miller Gulch, and the Clark Fork River would be intercepted by the pumpback wells at a rate equivalent to the rate of pumping of the pumpback wells, which has not been quantified. Assuming all water produced by the pumpback well system was treated and discharged to the Clark Fork River, there would be no net loss of water to the Clark Fork River below the point of discharge. Other effects of the paste tailings facility to flows in the Miller Gulch and Rock Creek basins are described on pages 4-77 and 4-107 of the 2001 FEIS. In addition, the tailings facility would alter the topography and drainage characteristics of 21 acres in the Rock Creek basin, which may slightly reduce streamflow in lower Rock Creek. It is estimated that the maximum interception of runoff at the paste fill active area to be returned to the mill reservoir would be, on an average annual basis, 61 gpm (0.14 cfs) during operations. In the paste fill reclaimed and partially reclaimed area, the estimated maximum intercepted runoff (also returned to the mill reservoir) is estimated to be 86 gpm (0.19 cfs) during mining. The total maximum interception of runoff during mining from the active, partially reclaimed, and reclaimed areas is estimated to occur during production Year 30 and 1 year after closure, and would be 133 gpm (0.30 cfs). This is water that would not flow primarily to Miller Gulch, with a small reduction to Rock Creek, both resulting in a flow reduction in the Clark Fork River. RCR would have to obtain a beneficial water use permit before appropriating any water for beneficial use, such as surface water runoff to Miller Gulch, or the pumpback or makeup water wells. The beneficial water use permit application would describe the location, volume, and rate of the diversion and the location, purpose, and period of use. Any beneficial water use permit obtained by RCR would require mitigation for any adverse effects on existing permitted water users.

4.7.3.2.9 Effects of Forest Clearing

Forest clearing for roads or other activities can alter normal streamflow dynamics, particularly the volume of peak flow. The degree to which streamflow changes depends 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 considerable soil disturbance and compaction, rain falling on the soil would infiltrate less than normally occurs. Due to the loss of tree cover, evapotranspiration (the loss of water by plants to the atmosphere) would be lower than before. The combination of decreased water infiltration into the soil and decreased uptake of water by tree cover results in higher streamflow. In general, timber clearing and soil compaction on a watershed scale results in water moving more quickly through the watershed because of decreased soil infiltration and evapotranspiration. The removal of vegetation on a landscape also increases annual water yields. Effects on peak flow for Alternative V are provided in Table 4-29 in the 2001 FEIS.

4.7.3.2.10 Influence of Climate Change

The potential influence of climate change on Alternative V effects on surface water quantity are described in the groundwater quantity effects analysis in Section 4.7.3.1.4, *Influence of Climate Change*.

4.7.3.3 Groundwater Quality

4.7.3.3.1 Phase I - Evaluation Adit

Evaluation Adit Water Quality

The estimated quality of evaluation adit water is provided in the second column of Table 4-10. Estimates of wastewater quality relied on monitored water quality from the Montanore Libby Adit, the waste rock stockpiled at the Libby Adit, the Troy Mine underground workings, and Troy Mine reclaim water from the tailings. All adit water would be piped to a temporary wastewater treatment system at the support facilities site near the proposed paste tailings facility area.

Table 4-10. Estimated Adit, Mine, and Tailings Wastewaters for All Alternatives.

Parameter	Construc-tion Adit Water	Post-Construction Adit Water	Mine Water Operations	Mine Water Post-Operations	Tailings Water [1]
Total dissolved solids	122	114	121	108	266
Ammonia, as N	<0.65	<0.050	<1.6	<0.16	4.4
Nitrate, as N	<37	<0.12	**3.1**	**0.76**	**13**
Total Phosphorus	**<0.026**	**<0.0073**	**0.096**	**<0.10**	**0.086**
Aluminum	<0.014	<0.011	0.075	**<0.050**	0.1
Antimony	<0.00069	<0.00032	<0.0088	<0.0094	0.023
Arsenic	<0.0057	<0.0011	<0.018	<0.0031	0.002
Barium	<0.014	0.012	0.068	**0.043**	0.11
Beryllium	<0.00080	<0.00080	**<0.0010**	**<0.0010**	0.001
Cadmium	<0.000080	<0.000080	0.0015	**0.00040**	0.00097
Chromium	<0.00047	<0.00054	<0.0010	**<0.0010**	0.001
Copper	<0.0012	<0.0010	0.042	0.065	0.026
Iron	<0.017	<0.017	<0.15	<0.020	0.05
Lead	<0.00010	<0.00017	0.0080	**0.0060**	0.003
Manganese	<0.0050	<0.0050	0.21	0.067	0.51
Mercury	<0.000022	<0.000017	<0.0000050	**0.00059**	0.00001
Nickel	<0.00075	<0.00055	<0.010	**<0.010**	0.01
Selenium	<0.0010	<0.0010	0.0020	**<0.0010**	--
Silver	<0.00020	<0.00025	**0.075**	**0.0040**	0.0018
Zinc	<0.010	<0.012	<0.012	<0.013	0.01

All concentrations are in mg/L. All metal concentrations are dissolved metals unless otherwise noted.

[1] Selenium not listed for tailings water was not simulated because it was not detected in similar process solutions from Rock Creek at concentrations equal to or greater than background concentrations. Iron was simulated in the model because it plays an important role in determining the chemical characteristics of the water, including its oxidation-reduction status. Also, when water at a neutral pH is oxidized, iron precipitates from solution and has the ability to remove many other metals through sorption.

For concentrations with no below detection limit results, the representative summary statistic was determined by calculating the median of the data.

For datasets with greater than 0% below detection limit results and less than or equal to 70% below detection limit results, the representative summary statistic was determined by calculating the mean of the data. A "<" sign was provided in front of the values to signify that one or more below detection limit results were included in the mean determination, indicating that the concentration shown in Table 4-10 would be expected to be less than the value provided.

For datasets with greater than 70% below detection limit results, the representative summary statistic was determined by calculating the median of the data. A "<" sign was provided in front of the values to signify that one or more below detection results were included in the median determination, indicating that the concentration shown in Table 4-10 would be expected to be less than the value provided.

Bolded nitrate concentrations indicate analyses were for nitrate plus nitrite.

Bolded metal concentrations are total results due to either lack of dissolved data or dissolved data that were below the laboratory detection limit with the detection limit being greater than the lowest water quality standard.

Source: USFS and DEQ (2015), Schafer (2014).

Adit Area

During Phase I, groundwater would flow toward the adit, so the quality of groundwater surrounding the adit would not be adversely affected by the mine. Springs located near the adit that have a bedrock component of flow may be affected by drawdown from dewatering the evaluation adit. Because bedrock groundwater has higher dissolved solids concentrations, a reduction in groundwater discharge may cause spring water to become more dilute.

Evaluation Phase Infiltration Ponds

During Phase I, water from the evaluation adit would be treated and discharged at an estimated rate of 13 gpm to groundwater infiltration ponds located within the footprint of the proposed paste tailings facility (Figure 2-9). Among the categories or classes of activities not subject to nondegradation review is mineral exploration that does not result in a discharge to surface water and that is permitted under the MMRA (75-5-317(2)(q), MCA). Treated discharge water quality would be required by DEQ to meet groundwater standards and nondegradation criteria, if applicable, at the end of the pipe prior to discharge (DEQ 2008). Treated water would be monitored before discharge to the infiltration ponds, and groundwater would be monitored near the infiltration ponds, as described in Section 1.6.4 of Appendix K. RCR did not request, and DEQ has not granted, a mixing zone for discharges to the Phase I infiltration pond (Hydrometrics 2008; DEQ 2008).

Evaluation Adit Pad Infiltration

The proposed portal pad would be constructed from development or waste rock from the adit construction. With the exception of the mineralized rock and ore, the waste rock would consist of rock similar to rock that is currently exposed at the surface, either as outcrop or talus. The primary concern would be residual nitrate residue from blasting that would be mobilized by infiltration of precipitation. RCR would implement several measures to minimize the potential impact on groundwater quality. The mineralized rock and ore would be placed on lined pads and covered to prevent contact with precipitation until the mineralized rock was removed from the adit pad and the ore was removed for processing. No seepage from the stockpiles to groundwater is expected. RCR would develop and implement an explosive handling and use plan that would be designed to minimize residual nitrate in the waste rock. Snow would be removed from the pad and stormwater runoff diverted from the pad to reduce the total infiltration through the pad. Excess water from the evaluation adit would be pumped through a temporary 6-inch polyethylene pipeline to a temporary wastewater treatment system that would consist of biotreatment and/or ion-exchange systems for removal of nitrate (RCR 2010).

As described in Section 3.7.3, *Groundwater Hydrology*, the permeability of the waste rock and underlying talus would likely be very high, so the talus is unlikely to have a saturated zone except possibly during periods of high infiltration resulting from snowmelt runoff or large precipitation events. Any groundwater in the talus probably responds quickly to these events and drains quickly after such events. When water percolated through the waste rock during these events, it would mobilize nitrate from the waste rock into groundwater; however, a large amount of dilution would occur. It is expected that due to measures that RCR would implement to reduce nitrate concentrations in the waste rock and due to dilution, nitrate concentrations would be well below the nitrate groundwater standard of 10 mg/L. Concentrations of other parameters, such as ammonia, which is less soluble and less likely to migrate than nitrate, and sulfate and metals, the concentrations of which are expected to be very low, would not be expected to increase in groundwater (Schafer 2013). Precipitation that infiltrated the talus from the pad would be collected in a lined ditch along the bottom perimeter of the talus slope and routed to a lined sediment basin designed to contain runoff from a 10-year/24-hour storm event. During the initial Phase I construction, water in the sediment basin would discharge through Outfall 006. Any discharges from the collection ditch would be regulated under draft renewal permit MT0030287 at Outfall 006. Two groundwater monitoring wells

would be installed on the downgradient side of the lined ditch to monitor potential impacts on groundwater from underflow and/or leakage from the ditch or sediment basin (Figure 2-4).

Closure and Reclamation of Evaluation Adit

If Phase II of the mine project were not implemented, the excavated ore and waste rock stockpiled at the evaluation adit would be backfilled in the adit, the adit plugged, and the portal pad surface reclaimed. Effects on groundwater quality during closure and reclamation of the evaluation adit are not expected.

4.7.3.3.2 Phase II Construction

Adit Water Quality

Construction adit water quality would be the same as discussed for the evaluation adit in Section 4.7.3.1, *Groundwater Quantity*. The evaluation adit would remain open, but because explosives would no longer be used in the evaluation adit, it is expected that nitrate and ammonia concentrations would decrease to those shown in the third column of Table 4-10.

Adit and Mine Area

During the Construction Phase, groundwater would flow toward the adits and mine area, so the quality of groundwater surrounding the adits and mine void would not be adversely affected by the mine. Springs located near the adits that have a bedrock component of flow may be affected by drawdown from dewatering the adits. Because bedrock groundwater has higher dissolved solids concentrations than other potential sources of water to springs, a reduction in groundwater discharge may cause spring water to become more dilute.

Mill Site Pad Infiltration

During construction, water that infiltrated into the subsurface from the mill pad and waste rock stockpile would be intercepted by underdrains, stored in a lined pond, and reused as needed, so there would be no effect on groundwater quality.

Tailings Facility Toe Buttresses

The tailings facility toe buttresses would be constructed from geochemically tested waste rock and/or borrow material from the paste tailings facility area. The paste tailings facility would be underlain with a blanket drain near the downstream toe. Effects on groundwater quality are discussed in Section 4.7.3.3.3, *Tailings Facility Seepage*.

4.7.3.3.3 Phase II Operations

Adit and Mine Area

Effects on groundwater quality would be expected to be the same as those described in Section 4.7.3.3.2, *Adit and Mine Area*.

Mill Site Pad Infiltration

During operations, water that infiltrated into the subsurface from the mill pad and waste rock stockpile would be intercepted by underdrains, stored in a lined pond, and reused, so there would be no effect on groundwater quality. A sewage treatment facility would be constructed at the mill site. Effluent would be directed to the mill reservoir makeup water pond before being piped to the wastewater treatment plant, and sludge would be disposed of at an approved off-site facility. There would be no discharge of untreated sewage to groundwater.

Tailings Facility Seepage

The estimated quality of the tailings water is provided in the Rock Creek Paste Tailings Seepage Model (Schafer 2014) and Table 4-10. The water chemistry of the Rock Creek tailings could be slightly different from that found at the Troy Mine because the change in the overall process water balance would virtually eliminate decant water, should reduce evapoconcentration, and may increase the percentage of process water recycled. A mass load model of the paste tailings facility was developed to predict potential effects on groundwater chemistry underlying and downgradient of the facility. The tailings facility would be underlain with a blanket drain near the downstream toe and a series of finger drains in the natural depressions under the facility footprint to collect some of the tailings seepage. The proportion of seepage that the drain system collected would depend on the drain system design, the hydraulic properties of foundation materials, and the seepage rate. Seepage from the tailings facility not collected by the drains and deep percolation of meteoric water from surrounding portions of the upland area may move vertically through the lacustrine silts and clays and mix with groundwater in the basal gravel unit, or may move horizontally via shallow sand layers within the lacustrine deposits, or a combination of the two pathways.

The mass load model predicted groundwater concentrations assuming the underdrain system captured between 10 and 90% of the seepage from the paste tailings and the attenuation flow path was between 5 and 50 feet. Estimated average groundwater quality is provided in Table 4-11. In general, chemical loading would increase throughout the operations period as the tailings footprint expanded, reaching a peak near the end of operations. Nitrate would have the largest relative increases in concentration. Other parameters for which concentrations would increase are sodium, potassium, chloride, sulfate, ammonia, and aluminum. The model predicted virtually no changes in concentrations of the attenuated metals (arsenic, antimony, cadmium, copper, lead and silver). This is due to the significant sorption capacity for these parameters in the lacustrine system. None of the estimated groundwater quality concentrations would exceed Montana groundwater quality standards (Table 4-11).

Table 4-11. Predicted Average Groundwater Quality Downgradient of the Paste Tailings Facility.

Parameter	Ambient Concentrations	Operations Year 20	Post-Closure Year 13
Chemically Conservative Ions			
Calcium	64	47	50
Magnesium	26	19	21
Sodium	5.5	12	11
Potassium	2.3	9	7
Bicarbonate	370	265	287
Chloride	1.0	1.7	1.5
Sulfate	6.2	17	14
Fluoride	0.13	0.15	0.15
Nitrate + Nitrite as N	0.032	4.8	3.6
Total Ammonia (NH_3+NH_4 as N)	0.11	1.6	1.2
Total Phosphorus	0.28	0.20	0.22
Aluminum	0.033	0.054	0.049
Iron	0.20	0.13	0.14
Manganese	0.39	0.38	0.37
Sorbed Metals			
Arsenic	0.0018	0.0018	0.0018
Antimony	0.0030	0.0031	0.0031
Cadmium	0.00013	0.00013	0.00013
Copper	0.0010	0.0010	0.0010
Silver	0.00030	0.00030	0.00030
Lead	0.0017	0.0017	0.0017

Concentrations are vertically averaged within the various subsurface deposits downgradient of the tailings facility. All concentrations are in mg/L. All metal concentrations are dissolved metals. Groundwater standards are shown in Table 3-15.

Source: Schafer 2014.

Discharges to groundwater from mining operations subject to operating permits under the MMRA are not subject to groundwater permit requirements (75-5-401(5), MCA). Because predicted groundwater quality for some parameters would be greater than ambient concentrations, RCR would have to apply to DEQ for a mixing zone or an authorization to degrade. RCR has not made such an application. A mixing zone is a limited area of a surface waterbody or a portion of an aquifer where initial dilution of a discharge takes place, where water quality changes may occur, and where certain water quality standards may be exceeded (ARM 17.30.502(6) and 75-5-103(21), MCA). RCR would have to submit information concerning the biological, chemical, and physical characteristics of the receiving water, as specified in ARM 17.30.506 or as requested by DEQ. After submittal of the required information, DEQ would determine if a mixing zone beneath and downgradient of the paste tailings facility would be granted in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ granted a mixing zone, water quality changes might occur, but would have to be below applicable nondegradation criteria outside of the mixing zone.

Groundwater monitoring of the paste tailings facility would be initiated prior to placing tailings in the facility. All monitoring wells located along the perimeter and downgradient from the paste tailings facility would be installed at locations approved by DEQ for water quality compliance, and would serve as potential pumpback wells if water quality monitoring indicated action levels (discussed in Appendix K) were reached. Water quality and water level data would be collected from the monitoring wells. If groundwater quality monitoring action levels listed in Appendix K (Table K-10) were reached, RCR would notify the agencies within 5 working days. RCR would review the mitigation measures described in the Contingency Action Plan and propose to implement one or more of the measures described therein to ensure that groundwater quality concentrations near the paste tailings facility would not exceed water quality standards and applicable nondegradation criteria outside of an approved mixing zone. If RCR developed alternative contingency actions not described in the Contingency Action Plan, RCR would revise the Contingency Action Plan with a new or modified measure along with a proposed schedule for implementation and submit it to the agencies for approval. If the measures to be implemented included a proposal to convert the monitoring wells to pumpback wells, the pumpback well system would be designed to capture all groundwater affected by tailings seepage. RCR would be required to demonstrate full capture of any affected groundwater through monitoring. Several private domestic wells are located downgradient of the proposed tailings facility (Figure 3-9). Downgradient domestic wells would be monitored as described in Appendix K.

Underground Storage Reservoir

If technically feasible, the underground reservoir would be located below the pre-mining water table to avoid seepage to groundwater. If the underground reservoir was located above the pre-mining water table, underground monitoring wells would be installed to monitor seepage to groundwater. To prevent or minimize leakage to springs if the underground reservoir was located above the pre-mining water table, RCR would be required to maintain a low hydrostatic head for the impounded water to minimize seepage losses, or line, seal, or grout the underground storage reservoir to prevent seepage losses. Details of monitoring the underground storage reservoir are provided in Appendix K.

4.7.3.3.4 Phase II - Closure/Post-Mining

Mine Area

The estimated quality of the mine water post-mining is provided in Table 4-9. If the adits were not plugged after mine closure, groundwater would flow toward the adit openings and mine void, so the quality of groundwater surrounding the adits and mine would not be adversely affected by the mine. If the adits were plugged after mine closure, when the mine void filled, groundwater would move downgradient from the mine void via fractures. If the area to be mined is currently hydraulically connected to area springs and/or streams, then as the mine void refilled with water, those connections would be

reestablished. However, because of the complexity of the fracture flow system, it may not be possible to predict where and if these connections occur. The 2001 FEIS stated that two springs located about 0.8 mile below the proposed adit location flow perennially, which indicates that bedrock groundwater may be a source of supply to the springs. The flowpath from the mine void to all of the identified springs downgradient of the mine void is at least 3,000 feet. The distance from the proposed mine void to the nearest stream channel where baseflow is presently known to occur (upper East Fork Bull River) would be along a groundwater flow path that is about 1 mile long, as shown in Figure 4-14 in the 3D model report (Hydrometrics 2014). The volume of groundwater moving along fractures from the mine void would be small and subject to dilution by groundwater along the path. Major ions and nitrate would likely not attenuate along the path, but metals (particularly arsenic and copper, and to a lesser extent antimony) would undergo attenuation. Iron concentrations would be controlled by the oxidation-reduction conditions in the bedrock groundwater system, and likely would not change in the springs. It is unlikely there would be measurable effects on spring water quality downgradient of the mine void, particularly in springs with little or no bedrock groundwater source. If groundwater originating from within the mine void were to reach the upper East Fork Bull River, any water from the mine void would be further diluted by other baseflow entering the East Fork Bull River from the north and east. It is unlikely there would be measurable effects on baseflow water quality in the stream. Additional site data would be collected in each of the streams draining the proposed mine area prior to and during the Evaluation Phase to determine if there would be effects on surface water quality where baseflow occurs in each of these streams.

Mill Site Pad Infiltration

After mine closure, water that infiltrated into the subsurface from the mill site pad would be intercepted by underdrains and sent to the wastewater treatment plant until it met surface water standards.

Tailings Facility Seepage

Seepage to groundwater from the tailings facility would decline after mine closure due to a transition to reclaimed conditions when net infiltration would decrease as the final portions of the tailings facility were reclaimed. The predicted post-closure groundwater quality downgradient of the paste tailings facility is provided in Table 4-11. Post-closure groundwater concentrations would decrease, but would remain above pre-mining concentrations for sodium, potassium, sulfate, chloride, nitrate, and ammonia. None of the estimated post-mining groundwater quality concentrations would exceed Montana groundwater quality standards.

4.7.3.4 Surface Water Quality

4.7.3.4.1 Phase I Evaluation

Adit Area

Stream water quality and temperature would not be affected due to reductions in bedrock groundwater discharges to streams during Phase I based on the 3D model's prediction that no changes to streamflows would occur during this phase.

Erosion and Sedimentation

The disturbed area associated with Phase I is 18.5 acres (RCR 2010). Applying the proportion of disturbed area for Phase I Evaluation to the disturbed area for all mining periods of Alternative V to the 400 tons per year of needed mitigation for the entire mine operation results in a required sediment reduction of 16 tons per year for the Phase I activities. The Washington Road Surface Erosion Model (Washington model) has been used extensively in Montana to estimate sediment production from forest roads and was approved by the KNF (Wegner, pers. comm. 2005) as an appropriate tool to evaluate site-specific sediment production and mitigation for Phase I of the project. Appendix N provides details on the Washington model, its implementation, and model results for Phase I. Based on the Washington model

results, BMPs would be implemented at 20 locations on NFS roads #150 and #2741 for sediment mitigation (Figure 2-19). These mitigation measures are described in Chapter 2, Appendix N, and for Phase I, the Rock Creek Evaluation Adit License Application (RCR 2010).

Implementation of Phase I sediment mitigation would reduce the current sediment load by about 234 tons per year, which would be about 218 tons per year more than required to mitigate Phase I effects. Data collected at the 20 sites would be used to help determine road improvements and other measures required to mitigate for the predicted increase in sediment. After the road improvements were completed, sediment levels at the mitigation sites would be remeasured and the estimated reduction in sediment from the improvement work reevaluated using the Washington model. In some instances, road BMPs and instream sediment monitoring (streambed core sampling) would also be used to monitor the implementation and effectiveness of the sediment mitigation program. In summary, mitigation measures (BMPs) based on the Washington model would be implemented to control and reduce sediment production by 218 tons per year more than determined to be needed from the WATSED modeling. The measures would ensure there would be no stream degradation because sediment production would not increase during Phase I.

Stormwater Control

In April 2013, RCR applied for coverage under an individual stormwater permit (MT0031763) for road construction, utility installation, and construction of the Phase I adit portal. The application requested 26 stormwater outfalls in Miller Gulch, Rock Creek, and tributaries to Rock Creek. A determination and public notice for the Phase I construction stormwater permit was issued by DEQ on July 31, 2015. Public comments were received and DEQ is preparing a final permit. As required for the stormwater permit, RCR submitted a Stormwater Pollution Prevention Plan (SWPPP) to DEQ in April 2013 that addresses sediment control on existing access roads by installing sediment-control measures associated with development of a borrow material site in a previously disturbed area adjacent to NFS road #150, installing a buried powerline and water pipeline in the access road to avoid disturbing new areas, and installing arch culverts at three locations. As described in Section 2.3.1.2, *Evaluation Adit*, construction activities covered by this permit would occur within the existing road right-of-way except at a 0.6-acre borrow pit located immediately adjacent to the road, drill pad sites (0.9 acre) located adjacent to the Rock Creek bridge crossings to be used for boring utility pipelines beneath the stream channel, and the adit site footprint (10.4 acres). The Evaluation Adit construction would include areas that discharge to the 26 proposed stormwater outfalls, as well as areas along the access road where discharge to state waters would not occur. The total area of disturbance is estimated to be 19.5 acres. An approved individual stormwater permit from DEQ would include a monitoring plan for discharges at the outfalls and effluent limits for each of the 26 outfalls.

RCR's 2013 SWPPP outlines measures to control stormwater runoff, erosion, and sediment delivery from the site using BMPs. The document provides a description of sediment-control steps that would be taken in advance of and concurrent with construction activities to prevent sediment impacts on surface waters. These measures may include installation of fabric silt fences, coir/straw logs, straw bale dikes, outlet protection, brush and slash filter rows, rolling dips, sediment traps, and check dams in roadside ditches. BMPs would be installed, maintained, and inspected in accordance with the guidelines presented in the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USFS 2012) and MDT's erosion and sediment control manual (2004).

Erosion control at the adit site would include both revegetation and surface covers of gravel or rock to limit erosion. Structural controls described in the SWPPP would be used during road and utility construction activities and construction of the evaluation adit pad to reduce sediment yield to streams. At the adit, berms and drainage ditches would be used to capture stormwater runoff. Clean stormwater would be diverted around the site flows to level-spreaders that would disperse stormwater onto existing vegetated slopes. Runoff ditches would collect stormwater from disturbed areas. The stormwater would

be stored in a lined containment pond and then pumped through a pipeline to the temporary wastewater treatment system. Runoff from the dump slope would be captured by a lined ditch system at the toe of the slope. Water captured in the toe ditch would flow to a sump or sumps and pumped back to the pond on the pad for transfer to the wastewater treatment plant. Nonstructural controls would also be used to minimize runoff from disturbance areas. The completed portal pad would be graded to the lined surge pond to collect runoff. A natural vegetative buffer would remain intact between the toe of the adit portal pad slope and the adjacent ephemeral channel.

After construction was completed, stormwater-control structures such as berms, ditches, silt fence, coir/straw logs, straw bales, check dams, and sediment traps installed for the construction activities would remain to avoid sediment releases to streams prior to and after a vegetation cover was reestablished. In the roads, rolling dips, roadside ditches, and culverts would direct flows and control stormwater. At the adit site, the peripheral ditches and berms would remain in place until reclamation was completed in accordance with the approved reclamation plan. Where possible, the adit site would be topsoiled and revegetated (except areas of rock outcrop and talus).

Evaluation Adit Pad

The proposed portal pad would be constructed from development or waste rock from the adit construction. With the exception of alteration-zone rock and ore, the waste rock would consist of rock similar to what is currently exposed at the surface, either as outcrop or talus. The expected water quality of the adit water is provided in Table 4-10. The primary concern would be residual nitrate residue from blasting. RCR would implement several measures to minimize metal and nutrient concentrations in water leaving the portal pad via surface flow or infiltration, and reduce the volume of water leaving the adit pad. The alteration-zone and ore rock would be placed on lined pads and covered to prevent contact with precipitation until they are eventually removed for processing or returned underground. RCR would be required to provide an explosive handling and use plan that would minimize residual nitrate in the waste rock. Snow would be removed from the pad and stormwater runoff diverted from the pad to reduce the total infiltration through the pad. Excess water from the evaluation adit would be pumped to a temporary wastewater treatment system that would consist of biotreatment and/or ion-exchange systems for removal of nitrate (RCR 2010).

Draft renewal permit MT0030287 includes Outfalls 006 and 007, which consist of storm water discharge from the evaluation adit site. Runoff from the adit pad, including precipitation that infiltrated the talus from the pad, would be collected in a lined ditch along the bottom perimeter of the talus slope and routed to a lined sediment basin designed to contain runoff from a 10-year/24-hour storm event. During the initial Phase I construction, water in the sediment basin would discharge through Outfall 006. During adit development, all of the captured stormwater would be pumped to the 600,000-gallon portal pad pond and used in adit development or piped from the pond to the water treatment plant. Runoff from the soil stockpile would be collected in a ditch at the base of the pile and routed to a sediment basin designed to contain runoff from a 10-year/24-hour storm, where it would infiltrate, evaporate, or be discharged at Outfall 007. Draft renewal permit MT0030287 states that discharges would not be allowed from Outfalls 006 and 007 unless the measured precipitation exceeds the 10-year/24-hour storm event (2.8 inches) or equivalent amount of snowmelt runoff, so discharges during large precipitation or snowmelt events would result in considerable dilution in the unnamed drainage below the portal pad. The 10-year/24-hour precipitation event is the maximum 24-hour precipitation event with a probable recurrence interval of once in 10 years as established by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, or equivalent regional or rainfall probability information. As indicated in the draft renewal permit MT0030287, 10-year/24-hour precipitation events are generally infrequent and discharges are intermittent in western Montana. Discharges from Outfalls 006 and 007 would be required to meet MPDES permitted effluent limits and could not create

concentrations toxic or harmful to human, animal, plant, or aquatic life, or create conditions that produce undesirable aquatic life. Any water that would seep from the sediment basin at Outfall 007 would not adversely affect water quality in the unnamed drainage below the portal pad because the soil would be native soil stockpiled prior to any adit construction activities at the adit, and sediment in runoff from the soil stockpile would be captured in the sediment basin.

Monitoring of any discharges from Outfalls 006 and 007 would be required as described in draft renewal permit MT0030287. Monitoring of the unnamed drainage below the adit pad would be required, as described in Appendix K. Section 1.6.10 of Appendix K also describes possible actions should monitoring action level criteria be reached. If feasible, monitoring wells would be installed near the toe of the talus slope and would be designed to collect groundwater samples under site-specific conditions (see Appendix K). If monitoring indicates action is required, appropriate mitigation would be implemented.

Infiltration Ponds

During Phase I, water from the evaluation adit would be treated and discharged at an estimated average rate of 13 gpm to groundwater infiltration ponds located in the Miller Gulch drainage about 1,500 feet upgradient of Miller Gulch (Figure 3-12). DEQ determined that the path of discharged water could not be traced from the percolation pond to the Clark Fork River and that a surface water permit (MPDES permit) was not applicable for the discharge to the infiltration ponds (DEQ 2008).

The measured surface water flow rate in Miller Gulch ranges from 2 to 760 gpm. The discharge to the infiltration ponds would mix with groundwater downgradient of the infiltration ponds as it flowed toward Miller Gulch. If the treated discharge water reached the alluvium in the channel of Miller Gulch, it would mix with water in the alluvium. If any of this water discharged to surface water in Miller Gulch, it would then mix with the surface water. Due to dilution and dispersion, effects on surface water quality would likely be negligible, particularly during periods of higher streamflow. Monitoring of Miller Gulch upgradient and downgradient of the infiltration ponds would be conducted as described in Section 1.6.4 of Appendix K.

4.7.3.4.2 Phase II Construction

Adit and Mine Water Quality

The estimated quality of the mine and adit water is provided in Table 4-10. The 3D model estimated the mine would discharge about 100 to 200 gpm during construction. Some of this water would be used for drilling and the rest would be piped to and treated at the wastewater treatment plant. The potential for acid mine drainage to develop is not anticipated based on geochemical testing.

Mine Area

Stream water quality and temperature would not be affected due to reductions in bedrock groundwater discharges to streams during the construction period based on the 3D model's prediction that no changes to streamflows would occur during construction.

Waste Rock Water Quality

Estimated waste rock water quality is provided in Table 4-12. The data were collected at the Montanore Libby Adit waste rock sump located outside the Libby Adit, where waste rock was stockpiled on a liner. The waste rock sump samples represent a small volume of waste rock excavated from the existing Libby Adit when MMC began dewatering the adit. Concentrations of ammonia and nitrate plus nitrite in Table 4-12 illustrate, using Libby adit data, how nutrient release has been associated with prior blasting of waste rock. Emulsions were not used by MMC during the blasting that created the waste rock. Water samples from the waste rock sump were collected from 2008 through 2012. After initially high ammonia and nitrate plus nitrite concentrations were measured, water samples from the waste rock sump were collected

at an increased frequency, with 6 nitrate plus nitrite samples and 10 ammonia samples collected during the month of October 2008. During that time, ammonia and nitrate plus nitrite concentrations were at their peak, ranging from 1.47 to 12.1 mg/L for ammonia and from 118 to 419 mg/L for nitrate plus nitrite. Sampling was decreased in frequency the following month to only 3 sample events, and the ammonia decreased to a low of 0.64 mg/L and nitrate plus nitrite concentrations decreased to a low of 21.7 mg/L. From 2009 to 2012, ammonia concentrations averaged about 0.05 mg/L and nitrate plus nitrite concentrations averaged about 0.9 mg/L, and sample frequency was reduced to about monthly. Consequently, "representative" nitrate plus nitrite and ammonia concentrations are biased high because of the frequency of sampling when their concentrations were high due to blasting. RCR would implement an Explosive Handling and Blasting Plan described in Appendix K to minimize the potential for elevated nitrate plus nitrite or ammonia concentrations occurring in surface water. It is expected that waste rock water quality nitrate plus nitrite and ammonia concentrations would be substantially lower than the representative concentrations provided in Table 4-12.

Waste rock that was geochemically tested and determined to be suitable for construction would be used to construct the mill pad and the paste tailings facility toe buttresses. Surface runoff from the toe buttresses would be captured in lined stormwater retention ponds and treated at the wastewater treatment plant. Surface runoff from the mill site would be intercepted by ditches, stored in the stormwater retention pond, and used in drilling or discharged to Outfall 004 if it met effluent limits and other conditions of the MPDES permit. As discussed in Section 4.7.3.4.1, *Phase I Evaluation*, the same stormwater-control measures would be designed for the 10-year/24-hour storm event for the mill pad, so for storms of this magnitude or smaller, there would be no effects on surface water quality. Based on geochemical analyses, the ARD risk from waste rock is low. The only rock with acid generation potential occurs where sulfide minerals, such as pyrite, are present in much greater abundance than carbonate minerals. Acid-generating waste rock would not be used for construction of the mill pad. To the extent feasible, all waste rock unsuitable for construction would be disposed of in the underground mine below the groundwater table to prevent oxidation. If unsuitable waste rock was encountered before appropriate underground storage was available, it would be stored in an approved waste storage area within the paste tailings facility footprint and covered until adequate underground storage became available. Any unsuitable waste rock not disposed of underground would be disposed of off-site under governing solid waste regulations.

Based on results of SPLP and HCTs, most metal concentrations were low in test results, particularly iron, manganese, and aluminum. Higher copper solubility was noted in early stages of some HCTs. Antimony, and occasionally arsenic, concentrations were also measurable in some tests. Copper, antimony, and arsenic would be included in monitoring programs to ensure that water quality is protected in downgradient surface water and groundwater.

Table 4-12. Estimated Waste Rock Water Quality.

Parameter	Minimum Detected Concentration	Maximum Detected Concentration	Representative Concentration†
Field pH	7.1	9.48	8.2
Ammonia§	0.010	22	<1.8
Nitrate + Nitrite, as N§	0.010	419	<54
Aluminum	0.0052	0.062	<0.017
Antimony	0.00037	0.0090	<0.0012
Arsenic	0.0012	0.058	<0.012
Cadmium	0.000016	0.00029	<0.000043
Copper	0.00042	0.0075	<0.0024
Iron	0.0043	0.088	<0.020
Lead	0.000031	0.0080	<0.00035
Manganese	0.00022	0.043	<0.0066
Silver	-	-	<0.00020
Zinc	0.0015	0.025	<0.0077

Metals data based on dissolved sample fraction in units of mg/L; pH in standard testing units; - = no data above detection limit. For concentrations with no below detection limit results, the representative concentration was determined by calculating the median of the data.

For datasets with greater than 0% below detection limit results and less than or equal to 70% below detection limit results, the representative concentration was determined by calculating the mean of the data. A "<" sign was provided in front of the values to signify that one or more below detection limit results were included in the mean determination, indicating that the concentration shown in Table 4-12 would be expected to be less than the value provided.

For datasets with greater than 70% below detection limit results, the representative concentration was determined by calculating the median of the data. A "<" sign was provided in front of the values to signify that one or more below detection results were included in the median determination, indicating that the concentration shown in Table 4-12 would be expected to be less than the value provided.

§See text regarding sample bias and representative concentrations.

Source: Montanore Project FEIS Appendix K-10 (USFS and DEQ 2015).

Discharges from the Wastewater Treatment Plant

Depending on the timing of construction, the discharge of treated water (which may be up to about 100 gpm) would be to either the infiltration ponds described in Section 4.7.3.3.1, *Phase I - Evaluation Adit*) or to the permitted outfall in the Clark Fork River. The effects of discharges from the wastewater treatment plant are further described in Section 4.7.3.4.3, *Phase II - Operations*.

Water Quality Effects of Forest Clearing

An unaltered vegetation buffer would be left between Rock Creek and the road and utility corridors where possible, and impacts on RHCAs between the mill site and the east and west forks of Rock Creek would be avoided. Some vegetation along streams would be cleared for the powerline at utility corridor crossings on Rock Creek and West Fork Rock Creek and for construction of the new bridge over Engle Creek. Streamside vegetation clearing may increase stream temperature in localized areas by exposing the stream to increased warming by sunlight, but because less than a fraction of 1% of the affected streamside habitat along Engle Creek, Rock Creek, and West Fork Rock Creek would be cleared, the effect would likely be negligible.

Erosion and Sedimentation

Possible effects on streams due to the movement of sediment from roads and mine facilities during construction are described in the 2001 FEIS and Appendix N. The WATSED model used to quantify sediment impacts is described in the 2001 FEIS and in Appendix N. The WATSED model results and sediment monitoring that validates the model results suggest that sediment mitigation of 400 tons per year

reduction in fine sediment would result in no net increase, or an actual long-term reduction, in fine sediment in Rock Creek. The proposed Alternative V sediment mitigation would reduce sediment yield to streams to less than existing conditions. To achieve the total estimate of 400 tons per year needed for mitigation of the entire mine project, additional sediment mitigation of about 165 tons per year would be required during Phase II of the project. Because conditions may change before the start of Phase II of the Rock Creek Project, specific sites for sediment mitigation for Phase II would be chosen late in Phase I Evaluation of the project. At that time, a field survey would be completed and the Washington model or other similar model would be used to quantify the baseline sediment loads and the expected sediment reduction for each site. Before Phase II Construction began, RCR would submit a final Phase II mitigation plan for offsetting in aggregate 400 tons of annual fine sediment loading to Rock Creek by mitigating sediment sources in the Rock Creek watershed to the KNF, DEQ, and USFWS for approval.

Rock Creek is on DEQ's list for impaired waters as a result of substrate alterations due to silviculture practices that have impaired aquatic life. The reduction in fine sediment in Rock Creek due to sediment mitigation would improve aquatic life habitat in the creek. It is not expected that Alternative V would further alter the substrate in Rock Creek because other than construction of new or improved stream crossings, no project facilities would be constructed or operated within Rock Creek. During construction of new or improved stream crossings, BMPs would be used to minimize effects on the creek channel. Proposed instream activities would be subject to three permitting processes: a 310 permit, a 318 authorization, and a 404 permit. Installation, replacement, or upgrades of culverts, bridges, or other structures at perennial stream crossings would be specified in accordance with a 310 permit following on-site inspections with DEQ, Forest Service, FWP, landowners, and the local conservation district. Installation or removal of culverts or other structures in a water of the United States would be in accordance with DEQ 318 authorization conditions. All installation or removal of culverts or other structures in a water of the United States, if they resulted in a discharge of fill, would be in accordance with the Corps' 404 permit conditions.

Stormwater Control

Stormwater runoff and control is described in Section 4.7.3.4.3, *Phase II - Operations*.

4.7.3.4.3 Phase II - Operations

Adit and Mine Water Quality

The estimated quality of the mine and adit water is provided in Table 4-10 in Section 4.7.3.3.1, *Phase I - Evaluation Adit*. The 3D model estimated that the mine would discharge about 500 gpm during operations. Some of this water would be used for milling and the rest would be piped to and treated at the wastewater treatment plant. The potential for acid mine drainage and metal leaching from waste rock is discussed in Section 4.7.3.4.2, *Phase II Construction*, and would be the same during operations.

Mine Area

Mine dewatering and the resulting drawdown of bedrock groundwater may subtly change the water quality of streams in which flow is predicted to be reduced as a result of mining, as described in Section 4.7.3.2.1, *Effects on Floodplains and Streams*. Reducing the source of deeper groundwater may reduce the concentration of some anions and cations in surface water such as sodium, calcium, potassium, bicarbonate, magnesium, chloride, and sulfate. The affected surface water may become more dilute. If such a water quality change occurred, it would be detectable only during low-flow periods when bedrock groundwater is the major source of supply to surface water. Even at low flows, the changes in water quality may be difficult to measure due to the naturally low dissolved solids concentrations in both surface water and groundwater. Benchmark surface water sites would be used to develop trend analyses to determine if flow or water quality changes were due to mine dewatering and other activities or to natural variability and climate change.

The reduction in bedrock groundwater discharges to study area streams due to mine inflows may increase stream temperatures where bedrock groundwater is the major component of baseflow. Bedrock groundwater flow to streams is fracture controlled and does not occur uniformly along any stream reach. It is difficult to predict how, when, and where reduced bedrock inflows may affect stream temperatures, or if such changes would be measurable. Given all of the factors that affect stream temperature, as well as the constantly changing stream temperature regime, it may not be possible to separate any effect of mine inflows on stream temperature from other effects.

Discharges from the Wastewater Treatment Plant

An estimated 305 to 364 gpm (0.7 to 0.8 cfs) of wastewater would be treated and discharged to the Clark Fork River during operations. Treated discharge would be required to meet MPDES permitted effluent limits. During the MPDES permitting process, DEQ would determine if a mixing zone in any stream receiving a discharge would be allowed and, if so, would determine its size, configuration, and location. The design and operation of the wastewater treatment plant is described in Section 2.3.1.9.2, *General Wastewater Treatment*. There would be no adverse effects on the quality of the Clark Fork River except possibly during unexpected wastewater treatment plant upsets. Any wastewater treatment plant upsets would be mitigated as quickly as possible by RCR. The discharge would likely not affect the temperature of the Clark Fork River or other factors contributing to the impaired status of the Clark Fork River from the Noxon Reservoir to the Noxon Bridge because the discharge rate would be less than 1% of even the lowest flows measured in the last 20 years (220 cfs) in the Clark Fork River near Noxon and the outfall and diffuser would not be a barrier to fish passage, alter the flow regime, or increase dissolved gas saturation in the river. The 2010 temperature and sediment TMDLs developed by DEQ for five tributaries to the lower Clark Fork River do not apply to the Rock Creek Project because none of the five tributaries are in the study area.

The Clark Fork River has low total inorganic nitrogen (TIN) and low TP concentrations (Table 3-9). Low nutrient concentrations contribute to limited aquatic productivity. RCR has not applied for a new MPDES permit for discharges to the Clark Fork River and DEQ has not calculated MPDES permitted effluent limits. The remanded MPDES permit had an average monthly limit for TIN of 232 pounds per day, resulting in a predicted concentration of 0.067 mg/L, slightly greater than the existing concentration. The nutrient loading target for the Clark Fork River at the Montana/Idaho state line is 259,500 kilograms per year of TP. Allocated target load exceedances occurred in 2006, 2008, 2011, and 2012; the estimated TP loads in 2011 and 2012 were greater than 110% of the target load. In 2013, the estimated TP load was less than the allocated target load. The border agreement between Idaho and Montana identifies a short-term exceedance of the target as 3 consecutive years greater than 110% of the target load. A short-term TP load exceedance in a consecutive 3-year period has not occurred (HydroSolutions Inc. 2014). DEQ would consider all TMDL requirements during MPDES permitting. MPDES permit effluent limitations would prevent further impairment of the Clark Fork River at the Montana/Idaho border and Lake Pend Oreille in Idaho.

Effects on algal growth and other aquatic life due to possible increases in TIN or TP concentrations downstream of the wastewater treatment plant discharge point to the Clark Fork River are discussed in Section 4.11, *Aquatic Life and Fisheries*. 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 any MPDES permit issued by DEQ can be modified at any time if nuisance algal growth caused by RCR’s discharge was observed or lower numeric standards for nutrients were adopted. To address the uncertainty regarding the response of area streams to increased TIN concentrations, RCR would implement the water quality and aquatic biology monitoring described in Appendix K.

As stated previously, RCR has not applied for a new MPDES permit for discharges to the Clark Fork River. Effluent discharges would need to meet Montana surface water standards for metals (Table 3-1) at the end of a mixing zone. In 2007, the IDEQ developed TMDLs for cadmium, copper, zinc, and total dissolved gas for the mainstem of the lower Clark Fork River (IDEQ 2007). The entire flow-based load capacities for these metals are allotted as total load allocations at the Montana-Idaho border. It is the responsibility of the state of Montana to meet the load capacity and Idaho water quality numeric standards at the border. Load capacities are calculated using the cadmium, copper, and zinc standards, which are based on water hardness and the flow of the river. In 2012, when metal concentrations were most recently measured in the Clark Fork River near the state line, cadmium, copper, and zinc concentrations were well below the most stringent standards (using a hardness of 10 mg/L for cadmium and 25 mg/L for copper and zinc) (DEQ 2015c). Because of these very low concentrations, it is assumed that the load capacities in 2012 were below the TMDLs for the Clark Fork River at the state line. MPDES permit effluent limitations would prevent impairment of the Clark Fork River at the Montana/Idaho border.

Erosion and Sedimentation

Possible effects on streams due to the movement of sediment from roads and mine facilities during mine operations, and the mitigation of effects, are described in the 2001 FEIS, Appendix N, and in Section 4.7.3.4.2, *Phase II Construction*.

Stormwater Runoff and Control

Proposed stormwater control measures for Alternative V were modified from those proposed for the other alternatives. All detention and retention ponds would be lined with a 30-mil HPDE liner to provide primary seepage containment and reduce impacts on groundwater underlying and adjacent to the proposed facility. All detention and retention ponds would be sized to contain the 10-year/24-hour storm event, thus reducing impacts on surface waters in the area. The proposed paste tailings facility would include an underdrain and collection system to provide secondary containment of stormwater seepage through the paste tailings facility, again reducing potential impacts on groundwater underlying and adjacent to the proposed facility.

Stormwater collected at the adit portal and mill site would be used at the mill. Stormwater collected from the outer slopes of the mill pad and the mill site underdrains would only be allowed to discharge as specified by the MPDES permit. Stormwater collected at other locations would be pumped to the mill for reuse.

Proposed surface water-control structures associated with the paste tailings facility would significantly reduce potential sediment movement to surface waters and drainages during Phase II Operations. The proposed stormwater control measures for the paste tailings facility area would include two lined stormwater ponds constructed at lower elevations in the paste tailings facility disposal site and sized to handle the runoff from the active portion of the paste tailings facility site during a 10-year/24-hour storm event. Settling ponds would be constructed on the upper portion of the paste tailings facility and lined to prevent seepage into the paste. Limiting unreclaimed areas to the active disposal areas would minimize sediment-laden runoff. Water collected in the stormwater pond could be pumped to the paste plant and then to the mill as process water or used to irrigate reclaimed portions of the paste tailings facility. Stormwater from undisturbed lands above the paste tailings facility would be diverted around active portions of the paste tailings facility to the North Fork of Miller Gulch and to Rock Creek during mine operations. Runoff from reclaimed areas of the paste tailings facility would be routed to settling basins before mixing with runoff from undisturbed areas.

Waste Rock Water Quality

The effects of storing and using waste rock on surface water quality would be similar to those described in Section 4.7.3.4.2, *Phase II Construction*. For storms equal to or smaller than the 100-year/24-hour storm event, there would be no runoff from waste rock to surface water, so there would be no effect on surface water quality. The 100-year/24-hour precipitation event is the maximum 24-hour precipitation event with a probable recurrence interval of once in 100 years as established by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, or equivalent regional or rainfall probability information.

Mill Site Activities

The milling process would involve five major steps: crushing, grinding, flotation, concentrate dewatering, and tailings storage. Chemical reagents would be added during the flotation process to separate the ore concentrate from the tailings (Appendix I of the 2001 FEIS provides a list of reagents, physical characteristics and toxicity of each reagent, the addition points in ore processing, and the estimated annual consumption). Water generated at the mill site would be collected and used in the mill, and mill water bleed would be sent to the wastewater treatment plant, so there would be no discharge to surface water and no effect on surface water quality.

A sewage treatment facility would be constructed at the mill site. Effluent would be directed to the mill reservoir makeup water pond before being piped to the wastewater treatment plant, and sludge would be disposed of at an approved off-site facility. There would be no discharge of untreated sewage to surface water.

Accidental Spills and Ruptures

The effects of accidental ruptures of supply or tanker trucks, as well as several mitigations to reduce potential impacts, are described in the 2001 FEIS. Parts of the Phase I Spill Plan (RCR 2010) would be used and updated in a Phase II Spill Plan provided by RCR to the Forest Service prior to commencing Phase II. All pipelines would be encased in a larger steel pipe at creek crossings to prevent spills to streams in the event of a pipeline leak or rupture. The effect on surface water quality from an accidental spill or rupture could be large, but a quick response to spills or ruptures would reduce the magnitude and extent of effects. A spill material recovery plan would be developed by RCR for each stream in the mine area. RCR would store on-site the materials and supplies required to conduct the appropriate level of first response to spills, such as silt fence, oil booms, spill response supplies, and excavation equipment. Spill monitoring of the pipelines would consist of weekly scheduled inspections of the pipeline route. If a leak or spill was confirmed, the pump would be shut off, the pipeline allowed to drain, the trench opened up so the pipe could be thoroughly inspected, and the ground surface around the leak inspected to determine if pipeline contents were reaching a stream. Once the location of the leak was determined, that portion of the pipeline would be repaired. If it was determined that the spilled material may be reaching a stream, mine personnel would immediately construct sumps to collect the spilled material. Material from these sumps would be pumped into tanks and transported for proper disposal or to the wastewater treatment plant.

Paste Tailings Facility Failure

The estimated quality of the tailings water is provided in Table 4-10. The effects on surface water quality due to failure of the paste tailings facility are described in the 2001 FEIS.

4.7.3.4.4 Phase II - Closure/Post-Mining

Mine Area

The effects on stream and spring water quality and temperature would be the same as described for the Operations Phase, but would be greatest during the maximum period of drawdown at about Year 70

(Table 3-2). The affected surface water may become more dilute because of the decrease in groundwater bedrock contribution, which has higher dissolved solids concentrations. If water quality or temperature changes occurred, they would be detectable only during low-flow periods when bedrock groundwater is the major source of supply to surface water.

Discharges from the Wastewater Treatment Plant

The effects on nutrient concentrations in the Clark Fork River below the wastewater treatment plant discharge point to the Clark Fork River would continue for as long as the wastewater treatment plant operated after mine closure. The estimated discharge from the wastewater treatment plant to the Clark Fork River during closure and post-mining is described in Section 4.7.3.2.5, *Use of Runoff Water during Phase II Construction*. The effects on water quality of the Clark Fork River in Montana and Idaho and to Lake Pend Oreille would be the same as described for the Operations Phase.

Paste Tailings Facility Failure

The estimated quality of the tailings water is provided in Table 4-10. The effects on surface water quality due to failure of the paste tailings facility are described in the 2001 FEIS.

Influence of Climate Change

It is difficult to predict how the hydrologic systems in the Rock Creek study area would respond to the forecasted regional effects of climate change. Decreased groundwater contribution to baseflow in rivers and groundwater flow to wilderness lakes could change the chemistry of the streams and lakes, as could a seasonally altered runoff pattern. If climate change reduced groundwater infiltration enough to reduce mine and adit inflows, less water would contact exposed mineralized rock, which could reduce metal mobility and the potential for metal leaching in the mine. Discharges to the Clark Fork River would be less if mine and adit inflows decreased. Any effect on water quality from the project, combined with the effects of climate change, may be different than those effects estimated to occur with the Rock Creek Project alone. As described in Appendix K, RCR would monitor streamflows and water temperatures.

4.7.4 Alternatives III and IV

The following sections describe the potential impacts of Alternatives III and IV on groundwater and surface water resources. The effects are described for groundwater quantity, surface water quantity, groundwater quality, and surface water quality. Alternatives III and IV, including mitigation and monitoring, are described on pages 2-17 through 2-85 of the 2001 FEIS.

4.7.4.1 Groundwater Quantity

The 3D model developed by Hydrometrics (2014c) simulated the Alternative V adit configuration and is described in detail in Section 4.7.2, *Analysis Methods*. The adit configuration for Alternatives III and IV is slightly different than Alternative V, but would not significantly change the Alternative V simulations. The mine configuration would be the same in all alternatives with the exception that Alternative V would include a 1,000-foot buffer between the mine and Cliff Lake in addition to 100-foot buffers adjacent to the Copper Lake and Moran Faults and other major faults (Figure 3-2). As described for Alternative V, Cliff Lake may be perched above the regional water table and, therefore, would not be subject to effects from mine dewatering. If Cliff Lake was perched above the water table, mine dewatering in Alternatives III and IV would not impact Cliff Lake. If this was not the case and buffers were not used, Cliff Lake could be impacted by mine dewatering. Approval of the mine plan would be contingent on demonstrating that the risk to Cliff Lake would be minimized, based on hydrogeologic and applicable engineering analyses. If faults were mined through and the overall mine inflow was greater in Alternatives III and IV than estimated for Alternative V, reductions in stream baseflow would be greater than predicted for Alternative V. The effects of climate change in Alternatives III and IV would be the same as described for Alternative V.

The tailings facility for Alternatives III and IV would be in the same location as in Alternative V, but the tailings would be deposited as a slurry for Alternatives III and IV. This would result in a much higher total seepage rate than predicted for Alternative V, but the seepage that would not be collected by the underdrain system would likely be similar to Alternative V. Therefore, the potential impacts of Alternatives III and IV on groundwater quantity would be similar to Alternative V.

4.7.4.2 Surface Water Quantity

The effects of Alternatives III and IV on surface water quantity due to mine inflows are discussed in Section 4.7.4.2, *Surface Water Quantity*. The effect of the diffuser on the FEMA-designated 100-year floodplain of the Clark Fork River would be the same as Alternative V. No other mine facilities for either alternative, including proposed roads, would be located within a FEMA-designated 100-year floodplain. New stream crossings would be constructed across Engle Creek in both alternatives, and also a new crossing would be constructed over the West Fork Rock Creek near the mill site in Alternative III.

Pumpback wells at the tailings facility would be implemented in Alternatives III and IV to capture seepage from the tailings not intercepted by the underdrains and seepage collection trenches; in Alternative V pumpback wells would be implemented, if needed. The effects of the wells are described under Alternative V. RCR would have to obtain a beneficial water use permit before appropriating any water for beneficial use, such as the pumpback or makeup water wells. The effect of a makeup well would be the same as described in Alternative V. Other impacts of Alternatives III and IV on surface water quantity are described on pages 4-99 and 4-102 of the 2001 FEIS. Without the 100-foot buffers around the Copper Lake and Moran Faults, there may be increased effects on baseflows in CMW streams.

4.7.4.3 Groundwater Quality

The updated estimates of adit, mine, and tailings water quality for all alternatives are provided in Table 4-10 in Section 4.7.3.3.1, *Phase I - Evaluation Adit*. The effects of Alternatives III and IV on groundwater quality are discussed in the 2001 FEIS on pages 4-99 through 4-102.

4.7.4.4 Surface Water Quality

The effects of Alternatives III and IV on surface water quality are discussed in the 2001 FEIS on pages 4-99 through 4-102. The effect on surface water quality due to mine inflows would be the same as described in Section 4.7.3.4.3, *Phase II - Operations* for the mine area in Alternative V. The influence of climate change on surface water quality would be the same as Alternative V.

4.7.5 Alternative II

Alternative II is RCR's mine proposal and is described in detail in the 2001 FEIS. The effect of the diffuser on the FEMA-designated 100-year floodplain of the Clark Fork River would be the same as Alternative V.

4.7.5.1 Groundwater Quantity

Potential impacts of Alternative II on groundwater quantity would be the same as described for Alternatives III and IV.

4.7.5.2 Surface Water Quantity

The effects on surface water due to mine inflows would be similar to those described for Alternatives III and IV. None of the mine facilities, including proposed roads, would be located within a FEMA-designated 100-year floodplain. New stream crossings would be constructed across Rock Creek at two locations and the West Fork Rock Creek near the mill site. Impacts of the pumpback wells at the tailings

facility would be the same as under Alternatives III and IV. Other impacts of Alternative II on surface water quantity are described on pages 4-75 through 4-77 of the 2001 FEIS.

4.7.5.3 Groundwater Quality

The updated estimates of adit, mine, and tailings water quality for all alternatives are provided in Table 4-10 in Section 4.7.3.3.1, *Phase I - Evaluation Adit*. The effects of Alternative II on groundwater quality are discussed on pages 4-71 through 4-75 of the 2001 FEIS. As discussed in Section 4.7.4.3, *Groundwater Quality*, it is expected that the effects on groundwater quality due to seepage from the tailings facility would be different from the results provided in Table 4-20 of the 2001 FEIS.

4.7.5.4 Surface Water Quality

The effects of Alternative II on surface water quality are discussed on pages 4-77 through 4-96 of the 2001 FEIS. The effect on surface water quality due to mine inflows would be the same as described in Section 4.7.3.4.3, *Phase II - Operations* for the mine area in Alternative V.

4.7.6 Alternative I

Under Alternative I, impacts on surface water and groundwater could result from land development activities in the Rock Creek drainage, such as timber harvest and home building.

4.7.6.1 Groundwater and Surface Water Quantity

The effects of Alternative I on groundwater and surface water quantity are described on pages 4-63 and 4-64 of the 2001 FEIS.

4.7.6.2 Groundwater and Surface Water Quality

The effects of Alternative I on groundwater and surface water quantity are described on pages 4-63 and 4-64 of the 2001 FEIS.

4.7.7 Effectiveness of Agencies' Proposed Mitigation

In Alternative V, RCR would implement measures described in Chapter 2 to mitigate potential effects on groundwater and surface water quality and quantity. Appendix K describes Alternative V water resources monitoring. Alternative V mitigation measures and their expected effectiveness are summarized in Table 4-13 and Table 4-14 below.

Table 4-13. Evaluation of Effectiveness of Monitoring and Mitigation for Effects on Surface and Groundwater Quantity.

Resource	Potential Effect	Mitigation Goal	Mitigation	Monitoring	Effectiveness of Mitigation
Surface water in the CMW	Reductions in stream baseflows or lake levels.	Reduce impacts on surface water resources in the CMW.	Maintain buffers between mine void and water-bearing faults and Cliff Lake.	Measure streamflow every 2 weeks when accessible, measure spring flows and lake levels as described in Appendix K, and assess connection to regional groundwater system.	Based on the 3D model results, the 1,000-foot buffer around Cliff Lake would be highly effective in preventing predicted effects on surface water in the Cliff Lake basin. At the Troy Mine, the use of 30- to 40-foot buffers around water-bearing faults has been shown to be highly effective in isolating the faults hydraulically from the mine void (Thompson, pers. comm. 2013).
			To protect against leakage to the surface, leave a minimum of 450 feet of overburden over the mine workings.	Same as above.	Highly effective in preventing effects on surface water in the CMW.
Stream baseflows	Reduction in stream baseflows.	Reduce impacts on stream baseflows.	Grouting ahead of blasting to minimize groundwater inflows to the mine and adits.	Same as above.	Moderately effective in reducing effects on streamflows, but long-term effectiveness is unknown.

Table 4-14. Evaluation of Effectiveness of Mitigation for Effects on Surface Water and Groundwater Quality.

Resource	Potential Effect	Mitigation Goal	Mitigation	Monitoring	Contingency Mitigation Trigger	Effectiveness of Mitigation
Surface water quality in study area	Increased sedimentation due to construction and mine operations.	Minimize sediment delivery to streams from roads and mine facilities.	See Appendix N for list of proposed mitigations.	Monitor sediment at instream locations.	NA	Very effective in reducing sediment loading to streams.
Springs in study area	Change in water quality due to reduced bedrock water supply.	Minimize change in spring water quality.	Maintain buffers between mine void and water-bearing faults.	Monitor springs, as described in Appendix K, determined by GDE inventory to be connected to regional groundwater system.	NA	Highly effective in preventing effects on spring water quality.
Streams in study area	Change in water quality due to reduced bedrock water supply.	Minimize change in stream water quality.	Maintain buffers between mine void and water-bearing faults.	Monitor stream water quality in areas of importance for aquatic life.	NA	Highly effective in preventing effects on spring water quality.
Unnamed drainage below evaluation adit portal pad	Increased nitrate/ ammonia concentrations.	Prevent nitrate/ ammonia exceedances in surface water and reduce infiltration through pad.	Minimize residual nitrate/ammonia in waste rock by using explosive techniques and management selected for this purpose.	Monitor nitrate/ ammonia concentrations at Outfall 006 as required in draft renewal permit MT0030287; assure that discharges from Outfall 006 could not create concentrations toxic or harmful to human, animal, plant, or aquatic life, or create conditions that produce undesirable aquatic life .	Treat water to meet draft renewal permit MT0030287 requirements	Very effective in minimizing available nitrate/ammonia for leaching and transport.

Resource	Potential Effect	Mitigation Goal	Mitigation	Monitoring	Contingency Mitigation Trigger	Effectiveness of Mitigation
			Remove snow accumulation and divert all stormwater runoff from pad.	Monitor nitrate/ ammonia concentrations at Outfall 006 as required in draft renewal permit MT0030287 permit; assure that discharges from Outfall 006 could not create concentrations toxic or harmful to human, animal, plant, or aquatic life, or create conditions that produce undesirable aquatic life.	Treat water to meet draft renewal permit MT0030287 requirements.	Moderately effective in reducing infiltration of precipitation through the pad.
			Lined collection ditch around toe of talus and waste rock; water routed to a lined sediment basin designed to contain runoff from a 10-year/24-hour storm event; discharges from sediment basin would be regulated by draft renewal permit MT0030287 conditions for Outfall 006.	Monitor nitrate/ ammonia concentrations in groundwater downgradient of lined collection ditch.	NA	A properly designed and maintained, collection ditch and sediment basin would be highly effective. To be effective, the ditch would have to be excavated to bedrock.
Groundwater and surface water in the vicinity of the paste tailings facility	Increased nitrate/ dissolved metals concentrations.	Prevent increases in nitrate/ dissolved metals in surface and groundwater downgradient of the paste tailings facility.	Contingency mitigation to install and operate pumpback wells to capture affected groundwater.	Groundwater monitoring well system designed to detect increases in nitrate/dissolved metals.	See Appendix K Table K-10 for groundwater quality action levels.	If properly designed and maintained, a pumpback well system would be highly effective in capturing affected groundwater downgradient of the paste tailings facility.

Resource	Potential Effect	Mitigation Goal	Mitigation	Monitoring	Contingency Mitigation Trigger	Effectiveness of Mitigation
Groundwater downgradient of paste tailings facility	Changes to groundwater quality from tailings seepage.	Prevent exceedances of groundwater quality action levels.	Turn on pumpback wells or take other action to mitigate potential effects on groundwater quality.	Monitor water quality quarterly during baseline period, Construction, Operation, and Reclamation Phases, as well as during temporary facility shutdowns.	See Appendix K Table K-10 for groundwater quality action levels.	Highly effective in preventing groundwater quality standards exceedances.

4.7.8 Cumulative Impacts

4.7.8.1 Groundwater Quantity

The Rock Creek Project and the Montanore Project would mine the same formation, separated by the Rock Lake Fault. Proponents of both mines would be required to maintain dewatered conditions for their respective mines and adits until closure (Figure 2-25). The cumulative impact analysis for effects on groundwater assumed that both mines would be in operation at the same time and the period of maximum drawdown would coincide. The predicted cumulative reductions in stream baseflow from the two mines are shown in Table 4-15 and were estimated by adding the results from the Montanore and Rock Creek 3D models for the respective periods of greatest groundwater drawdown (Geomatrix 2011; Hydrometrics 2014c). Because the two models present results for slightly different scenarios, Table 4-15 includes results for only one bulk hydraulic conductivity scenario (10^{-6} cm/sec) from the Rock Creek model. The Montanore model provided results for an unmitigated and mitigated scenario. Only the unmitigated scenario is shown in Table 4-15. The Montanore model predicted that with mitigation, the baseflow reduction at the mouth of Rock Creek would be 0.2 cfs, rather than 0.7 cfs for the unmitigated scenario. This would result in a mitigated cumulative reduction of 0.6 cfs versus an unmitigated baseflow reduction of 1.1 cfs.

Table 4-15. Predicted Changes to Baseflow (Bulk K 10^{-6} scenario) – Cumulative Impacts (Maximum Drawdown without Mitigation).

Drainage (see Figure 4-4)	Model-Predicted Pre-mining Baseflow (cfs)	Model-Predicted Baseflow (cfs)	Predicted Cumulative Change in Baseflow (cfs)
Rock Creek (above confluence with Clark Fork River)	7.8	6.7	-1.1
East Fork Bull River (above confluence with Bull River)	10.4	9.5	-0.9
Bull River (above confluence with Clark Fork River)	20.6*	19.6	-1.0

cfs = cubic feet per second. "cfs" is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (i.e., reported to 0.1 cfs). If the results were converted to gpm, they would be reported to the nearest 50 gpm. Streamflow variability and measurability are discussed in Section 4.7.3.2, *Surface Water Quantity*.
* 20.6 cfs reported by Hydrometrics is only the portion of the baseflow at the mouth of the Bull River that is derived from groundwater contributions from within the modeled area; measured baseflow at the mouth is about 100 cfs.
Source: Hydrometrics 2014c.

During the period of maximum drawdown, based on the Montanore 3D model, the Montanore Mine is predicted to reduce baseflow in East Fork Rock Creek at the wilderness boundary by 0.29 cfs (100% of the predicted baseflow) and reduce storage in Rock Lake at the rate of 0.15 cfs. If the actual baseflow at the wilderness boundary were higher than that predicted by the Montanore model (as predicted by the Rock Creek 3D model), then the cumulative baseflow reduction at this location would be greater than predicted by the Montanore model. In this scenario, cumulative baseflow would decrease by up to 0.44 cfs (0.29 plus 0.15), because with a higher pre-mining baseflow, the Montanore reduction would be only from creek baseflow, rather than reducing Rock Lake storage. If this were the case, then the baseflow reduction at the mouth of Rock Creek would be 1.3 cfs (17%), rather than what is reported in Table 4-15.

Using the unmitigated results from the two models, the predicted baseflow reductions at the mouth of the three main drainages would be about 14% at the mouth of Rock Creek, 9% at the mouth of East Fork Bull River, and 1% at the mouth of the Bull River.

None of the other reasonably foreseeable actions listed below would affect groundwater conditions:

- Libby Creek Ventures drilling plans
- Wayup Mine
- Miller-West Fisher Vegetation Management Project
- Forestwide herbicide weed control
- Timber harvest of private lands in the Rock Creek drainage
- Continued development of private lands within the study area

Therefore, these other reasonably foreseeable actions would not contribute to cumulative effects on groundwater flow.

4.7.8.2 Surface Water Quantity

Private timber harvest could increase peak flows in study area streams. The potential volume peak flow increases in Rock Creek or other study area streams cannot be quantified and would depend on when timber harvesting occurred and site-specific information that is currently unknown. Development of private lands within the study area that resulted in land clearing may also increase peak flows in study area streams. Streambank stabilization that might occur on private lands could affect streamflow by altering stream channels.

Based on the Montanore and Rock Creek model results, the Montanore Project includes underground mining that would affect stream baseflows in the East Fork Rock Creek, East Fork Bull River, and Bull River. If the two mine operations occurred simultaneously, cumulative effects on stream baseflows would be limited to these watersheds (Table 4-15). As the mine voids filled and groundwater levels above the mines and adits reached steady-state conditions, the effects on streamflow would decrease. Cumulative effects at steady-state conditions were not quantified. No other aspects of the two projects would have cumulative effects on surface water quantity.

There would be cumulative effects on St. Paul Lake, but no other wilderness lakes. Mine dewatering from both mines is predicted to reduce bedrock groundwater flow to the lake, and the lake level may lower more quickly during dry years if and when the only source of water to the lake is bedrock groundwater. The maximum effects on Rock Creek and the East Fork Bull River would occur after both mines ceased operations, assuming a worst-case scenario that both mines operated and closed simultaneously. It is unlikely that the maximum effect of both mines would occur in the same year, so the effects on

streamflow in the streams listed in Table 4-15 would not occur at the same time and the cumulative effects would be smaller.

The maximum cumulative effects of the Montanore and Rock Creek projects to baseflows for Rock Creek, the East Fork Bull River, and the Bull River, without mitigation, are provided in Table 4-15. The stream sections that may be affected by both mines are based on where the effects begin in the upper sections of the creeks down to the mouths. The Bull River would not be directly affected by either mine project, but minor indirect effects could result from baseflow reductions to some of its tributaries. In the East Fork Rock Creek, cumulative baseflow reductions would occur downstream of South Basin Creek. In Rock Creek, cumulative baseflow reductions would occur from its confluence with the East and West forks to its mouth. In the East Fork Bull River, cumulative baseflow reductions would occur along its entire length. Cumulative baseflow reductions would occur in the Bull River from its confluence with the East Fork Bull River to its mouth.

Reasonably foreseeable future actions that would not affect streamflows or lake levels in the study area include the following:

- Libby Creek Ventures drilling plan, which would disturb about 1 acre adjacent to the Upper Libby Creek Road
- Wayup Mine and Fourth of July Road Access, which would involve reconstruction of roads in the upper West Fisher Creek drainage
- Miller-West Fisher Vegetation Management Project, which would involve timber harvest and other vegetation treatments in the Miller and West Fisher Creek drainages
- Forestwide herbicide weed control, which would treat noxious weeds in the KNF

4.7.8.3 Groundwater Quality

Cumulative effects on groundwater quality are not expected because other land uses, climate change, and the Montanore Mine Project would not affect groundwater quality in the Rock Creek study area.

4.7.8.4 Surface Water Quality

Private timber harvest and continued development of private lands in the study area may increase sediment transport to study area streams. Streambank stabilization projects may temporarily increase sediment transport to streams but, when completed, would reduce sediment transport to streams. The potential sediment increases in Rock Creek or other study area streams cannot be quantified and would depend on when timber harvesting occurred and site-specific information that is currently unknown. Implementation of Alternative V sediment mitigation would reduce sediment transport in the Rock Creek drainage and would counteract any increase in the drainage from other activities.

It is possible that the forestwide herbicide weed control project could affect surface water quality during aerial and ground applications of herbicides. In the Final EIS for invasive plant management, the KNF concluded that herbicide application associated with forestwide herbicide weed control projects would “present a low risk, if any, of herbicides threatening the health of aquatic ecosystems, animal species, or the general public” (USFS 2007b). The effects of herbicide application on study area stream water quality would be negligible.

Because there would be cumulative baseflow reductions due to the Rock Creek and Montanore Mine projects, there would be cumulative effects on surface water quality at the locations described in Section 4.7.8.2, *Surface Water Quantity*. Mine dewatering and the resulting drawdown of bedrock groundwater may subtly change the water quality of the East Fork Rock Creek and East Fork Bull River.

Reasonably foreseeable future actions that would not affect surface water quality in the study area include the following:

- Libby Creek Ventures drilling plan, which would disturb about 1 acre adjacent to the Upper Libby Creek Road, would not affect water quality in study area streams or sediment transport in the Rock Creek drainage.
- Miller-West Fisher Vegetation Management Project, which would involve timber harvest and other vegetation treatments in the Miller and West Fisher Creek drainages, would not affect water quality in study area streams or sediment transport in the Rock Creek drainage.
- Wayup Mine and Fourth of July Road Access, which would involve reconstruction of roads in the upper West Fisher Creek drainage, would not affect water quality in study area streams or sediment transport in the Rock Creek drainage.
- Herbicide application associated with forestwide herbicide weed control projects would "present a low risk, if any, of herbicides threatening the health of aquatic ecosystems, animal species, or the general public" (USFS 2007b). Therefore, effects on study area stream water quality would be negligible.

4.7.9 Regulatory Compliance

4.7.9.1 Groundwater and Surface Water Quality

This section discusses compliance with applicable laws and regulations regarding changes in groundwater and surface water quality

4.7.9.1.1 Organic Administration Act and Forest Service Mineral Regulations

The Forest Service is responsible for ensuring that mine operations on NFS lands comply with Forest Service locatable minerals regulations (36 CFR 228 Subpart A) for environmental protection. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on NFS surface resources. 36 CFR 228.8 also requires that mining operators comply with applicable state and federal water quality standards, including the Clean Water Act; comply with applicable federal and state standards for the disposal and treatment of solid wastes; take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations; construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values; and reclaim the surface disturbed in operations by taking such measures as preventing or controlling on-site and off-site damage to the environment and forest surface resources.

Minimize Adverse Environmental Impact (36 CFR 228.8)

Alternative V would have a disturbance area of 445 acres. Alternative V would include the use of BMPs to minimize erosion and effects on surface water quality. Alternative V would comply with 36 CFR 228.8 because the modifications to the disturbance area are feasible and would minimize adverse environmental impacts on surface water quality.

The agencies' analysis indicated that seepage from the paste tailings facility not collected by the drains may move vertically through the lacustrine silts and clays and commingle and mix with groundwater flows in the basal gravel unit, or may move horizontally via shallow sand layers within the lacustrine deposits, or a combination of the two paths. The Water Resources Monitoring Plan described in Appendix K includes action levels for specific water quality parameters in groundwater at the paste tailings facility. If changes in groundwater quality concentrations were detected in nearby monitoring wells in concentrations exceeding groundwater action levels listed in Appendix K, RCR would notify the

agencies, develop a Work Plan, and implement measures to ensure that groundwater quality concentrations near the paste tailings facility would not exceed water quality standards and applicable nondegradation criteria outside of an approved mixing zone.

In Alternative V, the ditches and sediment ponds would be designed for a 10-year/24-hour storm event. This conveyance capacity would capture all or most stormwater containing process water or mine drainage during the life of the project and would minimize water quality effects on east side streams and fisheries habitat.

Waste rock management would comply with 36 CFR 228.8 in Alternative V. Evaluation adit ore and alteration waste zone rock would be separated and temporarily stockpiled at the adit. Alteration waste zone rock and ore would be covered with an impermeable material to minimize infiltration from precipitation. After Phase I was completed, the alteration waste zone rock would be removed from the site and placed underground. If geochemical testing indicated that waste rock was suitable for use as construction material, waste rock would be used to construct the mill site pad. Any additional suitable waste rock would be used to construct the foundation of the paste tailings facility and the paste tailings facility toe buttresses. If geochemical testing indicated that waste rock was unsuitable for construction, the mill pad and paste tailings facility would be constructed from borrow material from within the paste tailings facility area. To the extent feasible, all unsuitable waste rock would be disposed of in the underground mine below the groundwater table to prevent oxidation. If unsuitable waste rock were encountered before appropriate underground storage was available, it would be stored in an approved waste storage area within the paste tailings facility footprint with stormwater controls and an appropriate cap. Any unsuitable waste rock not disposed of underground would be disposed of off-site under governing solid waste regulations. Alternative V would comply with 36 CFR 228.8 because the proposed waste rock management is feasible and would minimize adverse environmental impacts on surface water quality and fisheries habitat.

Federal Water Quality Standards (36 CFR 228.8(b))

Compliance with state and federal water quality standards is discussed below under the Clean Water Act.

Solid Waste Disposal (36 CFR 228.8(c))

Alternative V would comply with applicable federal standards for the disposal and treatment of solid wastes. All mine alternatives would dispose of tailings and reclaim the paste tailings facility in a manner to minimize adverse impacts on the environment and forest surface resources. Alternative V would comply with the applicable portions of 36 CFR 228.8(c) regarding compliance with state and federal standards for solid waste and tailings disposal. In all alternatives, RCR would comply with Forest Service policies when disposing of demolition debris during closure. It is Forest Service policy (FSM 2130) to discourage the disposal of solid waste on NFS lands unless such use is the highest and best use of the land. No wastes would be buried underground in mined-out areas. Reinforced concrete foundation materials may be buried on NFS lands only under certain conditions. All other wastes would be removed and disposed of at a disposal facility authorized by the county solid waste district or recycled. These measures would minimize the impact on the environment and forest surface resources. The plans for waste disposal in the Agencies' alternatives would comply with 36 CFR 228.8(c).

Fisheries and Wildlife Habitat (36 CFR 228.8(e))

Compliance with the fisheries and wildlife habitat requirements of 36 CFR 228.8(e) are discussed in Section 4.11, *Aquatic Life and Fisheries* and Section 4.13, *Threatened and Endangered Species*. Compliance with state and federal water quality standards is discussed below under the Clean Water Act. Alternative V would comply with 36 CFR 228.8(e) as it relates to water quality.

Roads (36 CFR 228.8(f))

All road improvements, realignments, or modifications, including stream crossings, would be constructed in compliance with INFS standards, and all new or improved bridges or culverts would be built to accommodate a 100-year flood event. Roads would be constructed and maintained in Alternative V to ensure adequate drainage and to minimize or, where practicable, eliminate, damage to soil, water, and other resource values. Compliance with the fisheries requirements of 36 CFR 228.8(f) are discussed in Section 4.11, *Aquatic Life and Fisheries*.

In 1997, Watershed Consulting prepared a report, *1996 Field Data Summary Report for Rock Creek Near Noxon, Montana*, that addressed aquatic habitat issues raised during the environmental review for the proposed Rock Creek Mine pursuant to the ESA, NEPA, NFMA, and MEPA. The Watershed Consulting (1997) report addressed streamflows, substrate composition, sediment sources, LWD, fish populations and distribution, and potential bull trout spawning habitat. In 2012, Salmon Environmental Services prepared a report, *Rock Creek Fisheries and Aquatic Habitat Assessment Supplement*, which incorporates data collected in the Rock Creek drainage since 1997 and provides information that addresses changes in management and legal direction implemented since 1997. The Watershed Consulting (1997) and Salmon Environmental Services (2012) reports meet the intent of INFS watershed analysis direction. To evaluate pre-and post-project riparian conditions, RCR would, in consultation with the Rock Creek Watershed Council, Forest Service, and USFWS, update the watershed assessment with any new data collected prior to the initiation of Phase II Construction and update mitigation and monitoring plans, if appropriate.

The predicted delivery of sediment from roads to streams in the mine alternatives would be less in Alternative V than the other alternatives. Implementation of the sediment mitigation plan described in Section 2.3.1.16, *Monitoring and Mitigation Plans*, would minimize sediment delivery from roads to streams. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USFS 2012). At the end of operations, all mine alternatives would consider decommissioning of roads no longer needed for operations. Alternative V would comply with 36 CFR 228.8(f) as it relates to water quality.

Reclamation (36 CFR 228.8(g))

The following discussion applies to the reclamation requirements of 36 CFR 228.8(g) as they apply to surface water quality. Compliance with 36 CFR 228.8(g) regarding reclamation requirements is discussed in Section 4.9, *Soils*. Alternative V would comply with the requirements of 36 CFR 228.8(g) regarding controlling erosion, controlling surface water runoff, and isolating toxic materials. Alternative V would include developing and implementing a final RMP and a VMP; maximizing the salvage and replacement of suitable soil materials for reclamation; implementing interim and post-mine stabilization of most disturbed areas; using primarily native species in revegetation; removing a majority of coniferous forest debris removed before soil removal; consolidating soil stockpiles and reclaiming them incrementally, when feasible; and, after mining, reclaiming all disturbed areas by recontouring and redistributing soil and revegetating according to the Revegetation Plan in Appendix J. These measures would minimize erosion and ensure reclamation success. Alternative V would comply with 36 CFR 228.8(g) as it relates to water quality.

4.7.9.1.2 Clean Water Act and Montana Water Quality Act

The Forest Service is responsible for ensuring that mine operations on NFS lands comply with Forest Service locatable minerals regulations (36 CFR 228 Subpart A) for environmental protection. Operators must comply with applicable federal and state water quality standards, including regulations issued pursuant to the Clean Water Act. DEQ is responsible for ensuring all mine operations comply with the Montana Water Quality Act and its implementing rules.

Alternative V includes practicable measures to reduce nonpoint source pollution. BMPs would be implemented to minimize erosion and effects on surface water quality. Alternative V would comply with the USDA Nonpoint Source Water Quality Policy Directive 9500-007.

During Phase I, water from the evaluation adit would be treated and discharged to groundwater infiltration ponds. Among the categories or classes of activities not subject to nondegradation review is mineral exploration that does not result in a discharge to surface water and that is permitted under the MMRA (75-5-317(2)(q), MCA). Treated discharge water would be required by DEQ to meet groundwater standards and nondegradation criteria, if applicable, at the end of the pipe (DEQ 2008). During Phase II, wastewater would be treated and discharged to the Clark Fork River, subject to MPDES-permitted effluent limits. Wastewater treatment plant discharges would comply with the Clean Water Act.

The Water Resources Monitoring Plan described in Appendix K includes action levels for specific water quality parameters in groundwater at the paste tailings facility. Should action levels be exceeded, RCR would implement measures to ensure that any seepage from the paste tailings facility would not exceed water quality standards and applicable nondegradation criteria, if applicable, outside of an approved mixing zone.

DEQ would discuss compliance with applicable water quality regulations including the ELGs and nondegradation rules in the Statement of Basis for the MPDES permit required for any discharges to surface water. 36 CFR 228.8(h) states that “certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations.” DEQ’s permit decision and associated conditions in the MPDES permits, and any other state water quality permits, would constitute compliance with Montana water quality requirements and Clean Water Act requirements regarding water quality.

4.7.9.1.3 Kootenai Forest Plan

All mine wastewater would be treated at a water treatment plant before discharge and would be required to meet water quality standards outside of an approved mixing zone. Seepage from the paste tailings facility could not exceed water quality standards outside of a mixing zone. Alternative V is consistent with 2015 KFP components pertaining to water resources. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record.

4.7.9.2 Groundwater Quantity

4.7.9.2.1 Organic Administration Act and Forest Service Mineral Regulations

The Forest Service is responsible for ensuring that mine operations on NFS lands comply with Forest Service locatable minerals regulations (36 CFR 228 Subpart A) for environmental protection. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on NFS surface resources, including watersheds. Alternative V would incorporate feasible measures to minimize adverse environmental impacts. The measures may include increasing mining buffer zones, installing one or more adit plugs at closure, grouting, and leaving mine void barriers. The agencies’ proposed monitoring plans include baseline groundwater monitoring, GDE monitoring, benchmark monitoring, action levels, and a corrective action plan.

4.7.9.2.2 Wilderness Act

Alternative V has the potential to indirectly affect wilderness qualities. Mitigation monitoring required for Alternatives V (Appendix K) would be implemented to minimize changes in wilderness character. Mitigation measures such as a 1,000-foot buffer around ore outcrop zones and a buffer of 100 feet around the Copper Lake and Moran Faults, and the agencies’ monitoring coupled with final design criteria

submitted for the agencies' approval, would reduce the risk of subsidence and measurable hydrological indirect effects within the wilderness.

4.7.9.3 Surface Water Quantity and Floodplains

This section discusses compliance with applicable laws and regulations regarding surface water flow and floodplains.

4.7.9.3.1 Organic Administration Act and Forest Service Mineral Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on NFS surface resources, comply with applicable state and federal water quality standards including the Clean Water Act, take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations, and reclaim the surface disturbed in operations by taking such measures as preventing or controlling on-site and off-site damage to the environment and forest surface resources.

Changes in streamflow in Alternative V would be minimized by incorporating feasible and practicable measures to minimize adverse environmental impacts on NFS surface resources and to maintain and protect fisheries habitat. The measures may include increasing mining buffer zones, installing one or more adit plugs at closure, grouting, and leaving mine void barriers. The agencies' expanded monitoring plan (Appendix K) would include baseline streamflow monitoring, GDE monitoring, benchmark monitoring, and a corrective action plan. The use of paste tailings would reduce the area of disturbance within the Rock Creek and Miller Gulch watersheds, and paste would store and release less water. Process water at the mill facility would remain in a closed loop, reducing water needs and, thus, effects on streamflows. Through these mitigations to reduce impacts on surface water resources, Alternative V would comply with 36 CFR 228.8 to minimize adverse environmental impacts on NFS surface resources.

4.7.9.3.2 Wilderness Act

Alternative V has the potential to indirectly affect wilderness qualities. Mitigation measures identified in Chapter 2 monitoring required for Alternative V (Appendix K) would be implemented to minimize changes in wilderness character. Mitigation measures such as a 1,000-foot buffer around Cliff Lake and ore outcrop zones and a buffer of 100 feet around the Copper Lake and Moran Faults, and the agencies' monitoring coupled with final design criteria submitted for the agencies' approval, would reduce the risk of subsidence and measurable hydrological indirect effects on the surface within the wilderness.

Mitigation measures and monitoring requirements in Alternative V are reasonable stipulations for protection of the wilderness character and are consistent with the use of the land for mineral development. Alternative V would be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act. Alternative V would comply with the Wilderness Act. Alternative V would minimize adverse environmental impacts on surface resources within the wilderness, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on NFS lands.

4.7.9.3.3 Clean Water Act and Montana Water Quality Act

DEQ is responsible for ensuring all mine operations comply with the Montana Water Quality Act and its implementing rules. The DEQ could only issue a Hard Rock Operating Permit for the Rock Creek Project if it determined water quality, including streamflow, changes were not significant degradation, unless RCR obtained an authorization to degrade. The KNF would rely on DEQ regarding compliance with the Montana Water Quality Act and would not allow RCR to proceed with mining until DEQ issued the

permit. 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DEQ's permit decision and associated conditions on the Hard Rock Operating Permit, an MPDES permit or any other state water quality permits would constitute compliance with Montana water quality requirements and Clean Water Act requirements regarding water quality.

4.7.9.3.4 Kootenai Forest Plan

The agencies conducted a floodplain analysis on all mine alternatives and the KNF completed a peak flow analysis on all mine alternatives. The estimated peak flow increases in all mine alternatives would fall within reference conditions per FW-DC-WTR-03 (USFS 2015b).

Alternative V is consistent with 2015 KFP components pertaining to water resources. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record.

4.7.9.3.5 Executive Order 11988 and Montana Floodplain and Floodway Management Act

The diffuser in Alternative V would be in the FEMA-designated 100-year floodplain of the Clark Fork River. The diffuser would be about 750 feet above the confluence of the river and Rock Creek and would run the entire width of the river. The Forest Service identified alternatives for the location and design of the diffuser in the Clark Fork River floodplain (USFS 2001). During final design, RCR would be required to avoid or minimize, to the extent practicable, locating facilities in a floodplain. If locating the diffuser in the Clark Fork River floodplain could not be avoided, an application for a floodplain permit would be submitted to the DNRC that provides details on the obstruction or use of a floodway floodplain and a permit would be required before construction. DNRC's permit issuance is based on the danger to life and property downstream, availability of alternate locations, possible mitigation to reduce the danger, and the permanence of the obstruction or use (76-5-405, MCA). DNRC's permit decision and associated conditions on the floodplain permit, if required, would constitute compliance with the requirements of EO 11988.

4.8 Water Rights

4.8.1 Introduction

Effects on surface water and groundwater rights were discussed in several locations in the *Surface Water Quantity* and *Groundwater Quality* sections of the 2001 FEIS. This SEIS has been restructured to include this separate *Water Rights* section. This section describes analysis methods, effects (including cumulative effects) of the alternatives on water rights, and regulatory compliance.

RCR would have to apply for, and the DNRC would have to issue, a beneficial use permit before RCR could appropriate water from the following sources:

- Surface water by intercepting precipitation at any mine facilities
- Groundwater by intercepting mine or adit inflows
- Groundwater by pumping from a makeup well located in the alluvium of the Clark Fork River
- Groundwater by pumping from pumpback wells around the tailings facility
- Groundwater by pumping from a potable water supply well at the evaluation adit site during Phase I or the mill site during Phase II.

As discussed in Section 3.8.1, *Regulatory Framework*, RCR would have to demonstrate that it avoided or mitigated any adverse effect that could reduce water availability to senior water users before receiving a beneficial use permit. An adverse effect would be the inability of a senior water rights holder to divert their permitted maximum flow rate or maximum annual volume due to a decrease in streamflow, decrease in spring flow, or reduction in groundwater availability.

4.8.2 Analysis Methods

Possible impacts on surface water rights due to changes in streamflow were evaluated quantitatively for all potentially affected streams by comparing existing flow and existing permitted diversions with the potential change in streamflow. Potential impacts on groundwater rights due to the possible use of pumpback wells near the paste tailings facility, from a makeup well near the Clark Fork River, and from a well proposed for water supply at the mill site were evaluated qualitatively. A well proposed for use as a potable water supply at the evaluation adit would not be located near any existing groundwater rights and is not discussed further.

4.8.3 Alternative V

4.8.3.1 Surface Water Rights

Changes to the flow of the Clark Fork River would occur due to streamflow reductions in tributaries to the river resulting from mine inflows, pumping from the makeup well in the alluvium of the river, and possible pumping from pumpback wells downgradient of the paste tailings facility. These effects on the Clark Fork River flow would be expected to be small and likely would not affect nearby downstream water rights for power generation or other downstream water rights. In addition, flow decreases would be offset by the discharge of treated water from the water treatment plant to the Clark Fork River.

One surface water right is in Rock Creek downstream of the confluence of the East and West forks, on RCR property and upstream of the tailings facility that is a domestic right for 10 gpm or 1 acre-foot per year. Flow reductions in Rock Creek at this location may occur due to mine inflows, potable water use, or

interception of precipitation that would report to Rock Creek. Low flow at the point of diversion for the domestic right has not been measured. Some portions of Rock Creek have only subsurface flow during drier parts of the year. Although unlikely, it is possible during dry years when streamflow is low that RCR's appropriations may reduce flows to less than 10 gpm at the point of diversion. RCR has submitted a change of ownership request to DNRC to change ownership of the water right to RCR.

Surface flow from Miller Gulch is currently appropriated for irrigation and power generation. The measured flow of Miller Gulch above the confluence with the Clark Fork River ranges between 2 and 763 gpm, the maximum permitted diversion rate for the two existing water rights totals 652.4 gpm, and the maximum annual volume permitted for these two rights is 983.3 acre-feet per year. The use of pumpback wells at the tailings facility, if implemented, and the interception of precipitation and any resulting reduction in surface water runoff to Miller Gulch may reduce flow for the existing rights if their points of diversion were on the unnamed tributary to Miller Gulch below the paste tailings facility, or if they were on the mainstem Miller Gulch below the confluence of the unnamed tributary. The rate and volume of RCR's appropriations have not been quantified. If the existing rights were adversely affected, RCR would need to reduce or curtail appropriations whenever Miller Gulch flow at the existing rights' point of diversion was less than 652.4 gpm, or develop an augmentation plan to find water from another source or sources for these water users to replace any water appropriated by RCR up to the maximum permitted rate of the existing permitted users.

Surface water rights on Copper Gulch and its tributaries for irrigation, stock watering, domestic use, fire protection, fish and wildlife, and power generation may be affected during low flows due to mine inflows that are estimated to reduce baseflow in the creek. All but one of the surface water rights are located on a tributary to Copper Gulch that would not be affected by mine inflows. The right located on Copper Gulch is for a maximum flow rate of 60 gpm and maximum annual volume of 24.5 acre-feet (15 gpm from April 1 to October 15). The flow of Copper Gulch has not been measured. The 3D model estimated a baseflow of 0.9 cfs (314 gpm) at the CMW boundary, which is upstream of the existing right's point of diversion. The model-predicted maximum baseflow reduction of 90 gpm would leave an estimated 224 gpm of baseflow available in Copper Gulch, so flow in Copper Gulch should always be adequate to supply the existing senior surface water right.

Surface water rights on other study area streams on Engle Creek and its tributaries and Government Creek would not be affected by the Rock Creek Project.

4.8.3.2 Groundwater Rights

Numerous groundwater rights are located in and near the study area, some of which are wells, and others that divert from springs. The springs used for domestic use, commercial use, irrigation, and fish and wildlife in Sections 20 and 29 (in Miller Gulch and near the Clark Fork River) would not be affected by mine inflows. The makeup well would be located, if possible, far enough from existing permitted groundwater wells and springs and completed and operated in a manner to prevent adverse effects on existing groundwater rights. RCR would complete a pumping test to evaluate whether nearby wells would be adversely affected by pumping from the makeup well or that flows from springs used for water supply would not be adversely affected. If it were not possible to locate the well far enough from existing wells or completed and/or operated in a manner to prevent adverse effects on senior groundwater rights, RCR would have to reduce or curtail appropriations whenever groundwater conditions at the existing rights' points of diversion prevented diversion of maximum flow rates, or find water from another source or sources for these water users to replace any water appropriated by RCR up to the maximum permitted rate of all existing permitted users.

Pumpback wells may be used as a contingency around the paste tailings facility in Alternative V. If pumping from the pumpback wells resulted in adverse effects on senior groundwater rights, RCR would

have to reduce or curtail appropriations whenever groundwater conditions at the existing rights' points of diversion prevented diversion of maximum flow rates, or find water from another source or sources for these water users to replace any water appropriated by RCR up to the maximum permitted rate of the existing permitted users. RCR's existing wells at the proposed paste tailings facility would be abandoned before facility construction (Parker, pers. comm. 2013).

4.8.4 Alternatives III and IV

The effects on surface water and groundwater rights would be similar to those described for Alternative V, except that pumpback wells are proposed to be used around the tailings impoundment.

4.8.5 Alternative II

The effects on nearby water rights would be the same as described for Alternatives III and IV.

4.8.6 Alternative I

Alternative I, or no action, would result in a continuation of the existing conditions. Any land development activities in the study area, such as home building and developing new surface water or groundwater rights, would not adversely affect any existing water rights.

4.8.7 Cumulative Impacts

Because any new RCR water rights could not injure existing water rights, no water rights would be cumulatively affected.

4.8.8 Regulatory Compliance

Following RCR's acquisition of water rights for all surface water and groundwater appropriations, all action alternatives would comply with the Montana Water Use Act and the Montana Reserved Water Rights Compact. Mine and adit inflows would not be used beneficially during any mine phase and treatment and discharge of all mine and adit inflows would not require a beneficial use permit. Mitigations described in Table 4-13 and Table 4-14 would be implemented, if necessary, to prevent adverse effects on surface water rights and groundwater rights. Any new water right issued pursuant to Montana law for water use associated with any action alternative must be consistent with the terms of any approved Plan of Operations and would terminate when the Plan of Operations terminated.

36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DNRC's permit decision and associated conditions on any beneficial water use permit would constitute compliance with Montana water use requirements.

Alternative V is consistent with the 2015 KFP components pertaining to water rights. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record.

4.9 Soils

This section updates the *Environmental Consequences* section for soils and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously included in the 2001 FEIS. The remainder of the analysis in the 2001 FEIS (pages 4-40 through 4-58) is unchanged.

4.9.1 Alternative V

Surface disturbances would remain essentially the same as shown in Table 2-2 of the 2001 FEIS, except for minor changes in Alternative V. Minor modifications were made to Alternative V since the 2001 FEIS was issued, primarily to reduce impacts on RHCAs. Minor modifications include a reconfiguration of the evaluation adit, mill site, and paste tailings impoundment layouts, a slight change in the NFS road #150 realignment, and minor changes in improvements to NFS road #2741. These minor modifications, refined design of some facilities, such as the water treatment facility, tailings contingency pond and stormwater retention and seepage collection pond, and increased mapping accuracy associated with GIS would result in a small decrease in the Alternative V disturbance area. Decreases in the disturbance area would mainly include 4 acres at the paste tailings facility, 6 acres at the paste plant and tailings contingency pond, 4 acres at the stormwater retention and seepage collection pond, and 15 acres in transportation and pipelines corridors. In the 2001 FEIS, 8 acres of road disturbance around the tailings impoundment were counted separately but are included in the paste tailings facility footprint in this SEIS. Increases in disturbance area would include 2 acres at the evaluation adit site, 12 acres at the mill site, 3 acres at the evaluation adit support facility, and 1 acre at the infiltration ponds. The total decrease in disturbance for Alternative V from the 2001 FEIS is 37 acres.

Soil losses would be less than what was described in the 2001 FEIS with the incorporation of additional reclamation practices proposed by the KNF and DEQ. These additional reclamation practices are described in Section 2.3.1.15, *Reclamation*. Section 4.7.3.4, *Surface Water Quality*, describes impacts of and mitigation for increased sediment from road and facility construction. Other soil losses and analysis of soil impacts would be the same as described in the 2001 FEIS.

4.9.2 Alternatives I, II, III, and IV

The disturbance areas and reclamation plans in Alternatives I, II, III, and IV have not changed and the impacts of these alternatives are described in the 2001 FEIS.

4.9.3 Effectiveness of Agencies' Proposed Mitigation

Alternative V would employ the reclamation methods described in Section 2.3.1.15, *Reclamation*. With these additional reclamation methods, Alternative V would be the most effective of the action alternatives in controlling erosion and ensuring reclamation success. Key additional reclamation methods for Alternative V and their effectiveness are summarized below.

Alternative V would use double-lift salvage and replacement at most facilities, including at the evaluation adit site and along road segments where adequate space for soil storage was available. These soil-handling procedures would help ensure that the replaced surface soils are the most chemically and physically suitable in providing favorable conditions for revegetation establishment. This practice is designed to salvage and replace some of the natural soil profile characteristics that developed over the past several thousand years.

In Alternative V, more disturbed areas (including the paste tailings facility) would receive 24 inches of respread soils in a double-lift than the other action alternatives. Other reclaimed sites in Montana have shown that 24 inches of respread soil provides sufficient rooting depth and a better plant growth medium.

Surface soils would be amended before seeding with Agency-approved wood-based organic amendment to raise soil organic matter levels to a minimum of 1% by volume. This would increase the water-holding capacity of the soil, enhance nutrient levels, provide better protection against erosional forces, and stimulate biological activity in the soil.

RCR would minimize soil compaction during soil replacement operations. To the extent practicable, soil would be handled only when precipitation is low and when the soil is moderately dry. Because biological and physical changes may occur in soils stored in stockpiles for prolonged periods, stored soil would be tested from samples collected deep within stockpiles before respreading to identify deficiencies that may affect plant growth. A reclamation specialist would determine the appropriate soil amendments. These practices would help ensure the long-term success of vegetation reestablishment.

Slope stabilization methods on slopes greater than 3:1, such as cellulose fiber hydromulch or geotextile fabric, may be applied. KNF or DEQ representatives would periodically inspect erosion-control measures to ensure they are implemented according to the approved plans and are functioning properly. These practices would help reduce erosion and sedimentation during the life of the operation.

Waste rock would be used for construction of the tailings paste facility key buttresses. This would eliminate the waste rock dump at the mine site and reduce the overall area of disturbance. In addition, the temporary adit water discharge pipeline would be buried under access roads to minimize disturbances.

Because metal leaching has been documented from soil stockpiles containing large amounts of coniferous vegetation at other mine sites in Montana, coniferous forest debris would be removed as much as possible before soil salvage, and stockpiles within 300 feet of surface water or less than 6 feet above groundwater levels would be limed to minimize contamination from runoff and seepage through the soil stockpiles. These practices would minimize adverse effects on surface water and groundwater and would help protect water quality.

Rather than planting trees and shrubs along strips, they would be planted by hand in random patterns to better resemble natural surroundings. Trees and shrubs would be planted in random patterns also at the evaluation adit site and on slopes greater than 3:1. Planting in random patterns along with woody plant densities would return reclaimed sites to more natural conditions in less time.

The minimum vegetation cover after a 3- to 5-year monitoring period would be 80% of the total plant cover of a specific control site. Sufficient trees and shrubs would be planted to achieve 400 trees per acre and 200 shrubs per acre after 15 years of planting. Achieving these goals would assist in returning reclaimed disturbances to a more natural appearance.

These additional reclamation and monitoring methods would help ensure long-term reclamation success and would be more effective at achieving reclamation success than the other action alternatives. Monitoring described in Appendix H, including corrective action if reclamation requirements are not met, would increase the effectiveness of Alternative V mitigation.

4.9.4 Cumulative Impacts

Cumulative impacts on soils would result from the Rock Creek Project and from past, present, and other reasonably foreseeable activities described in Section 2.5, *Part IV: Description of Past, Present, and Reasonably Foreseeable Actions*. Present activities that could contribute to soil impacts include timber harvests, several gravel pit operations, and stream restoration projects. Reasonably foreseeable activities that could affect soils include several gravel mining operations; timber harvests; numerous special use permits for various activities including water and drainages, roads, buildings, and powerlines for private services; trail and access road construction; and several mining operations. The cumulative effects of the

action alternatives for the Rock Creek Project would not change substantially from the effects described in the 2001 FEIS.

4.9.5 Regulatory Compliance

4.9.5.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources; construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values; and reclaim, where practicable, the surface disturbed in operations by taking such measures as preventing or controlling onsite and off-site damage to the environment and forest surface resources.

4.9.5.1.1 Minimize Adverse Environmental Impact (36 CFR 228.8)

Alternative V would comply with 36 CFR 228.8 because it would incorporate feasible and practicable measures to minimize adverse environmental impacts. These measures include developing and implementing a final RMP and VMP; maximizing the salvage and replacement of suitable soil materials for reclamation; consolidating soil stockpiles and reclaiming them incrementally, when feasible; implementing interim and post-mine stabilization of most disturbed areas; using primarily native species in revegetation; removing a majority of coniferous forest debris removed before soil salvage; and, after mining, reclaiming all disturbed areas by recontouring and redistributing soil, and revegetating according to the Revegetation Plan in Appendix J.

4.9.5.1.2 Roads (36 CFR 228.8(f))

In Alternative V, roads would be constructed and maintained to ensure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values. In Alternative V, RCR would develop for the KNF's and DEQ's approval and implement a RMP for Phase II that would describe for all new or reconstructed roads used for the mine 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
- Analysis of any new road constructed in a RHCA, documenting it was the minimum necessary for the approved mineral activity

The plan would describe management of road surface materials during plowing, such as snow and methods to control road ice. Sidecasting of soils or snow would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs. Details of the RMP are provided in Section 2.3.1.10, *Transportation*. At the end of operations, the KNF would consider decommissioning of roads no longer needed for operations. Alternative V would comply with 36 CFR 228.8(f) as it relates to soils.

4.9.5.1.3 Reclamation (36 CFR 228.8(g))

The Alternative V reclamation plan is described in Section 2.3.1.15, *Reclamation*. RCR would be required to submit an updated, detailed reclamation plan for all mine facilities that would be submitted for Agency review and approval before mine construction. Alternative V would include developing and implementing

a final RMP and VMP; maximizing the salvage and replacement of suitable soil materials for reclamation; consolidating soil stockpiles and reclaiming them incrementally, when feasible; implementing interim and post-mine stabilization of most disturbed areas; using primarily native species in revegetation; removing a majority of coniferous forest debris removed before soil salvage; and, after mining, reclaiming all disturbed areas by recontouring and redistributing soil, and revegetating according to the Revegetation Plan in Appendix J. These measures would minimize erosion and ensure reclamation success. Alternative V would comply with the requirements of 36 CFR 228.8(g) as it relates to soils.

4.9.5.2 Kootenai Forest Plan

Lands proposed for use by the action alternatives would be reallocated to non-timber production land. Consequently, the only standards in the 2015 KFP that would apply to these lands would be the implementation of BMPs to control erosion and sedimentation. Alternative V would be designed in accordance with the 2015 KFP guideline to incorporate site-specific BMPs to protect soil resources, control nonpoint pollution sources, and meet soil and water goals (FW-GDL-SOIL-03 and FW-GDL-WTR-03). For the proposed Rock Creek Project, the KNF emphasizes protection of the soil resources and implementation of restoration practices where necessary on NFS lands. Standards and BMPs identified in the 2015 KFP would be included as mitigation measures where appropriate and would be used to guide RCR’s implementation of this project with respect to soil resources.

4.10 Wetlands and Nonwetland Waters of the U.S.

4.10.1 Introduction

This section updates the *Environmental Consequences* section for wetlands and nonwetland waters of the U.S. and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously in the 2001 FEIS. The effects on wetlands and nonwetland waters of the U.S. have changed from the 2001 FEIS due to revised mapping completed in 2011 (Westech Environmental Services Inc. 2012a), the Corps' 2013 issuance of an approved JD (Corps 2013b), and avoidance measures. Wetlands were assessed for functions and services (Westech Environmental Services Inc. 2012b) using the MDT method (Berglund and McEldowney 2008). The KNF determined the area of impacts on wetlands by functional categories along with the impacts of area streams (nonwetland waters). Indirect impacts on wetlands affected by changes in groundwater and streamflow from hydrologic impacts are discussed qualitatively.

4.10.2 Alternative V

4.10.2.1 Direct Effects

All direct impacts on wetlands for Alternative V would be within the paste tailings facility or within the realigned portion of NFS road #150 adjacent to the paste tailings facility (Figure 4-5). The boundary of the paste tailings facility was modified in 2013 to avoid all wetland impacts on NFSL; wetland impacts within the paste tailings facility are on RCR's property. A total of 3.5 acres of isolated low-quality wetlands would be directly affected by the placement of fill (Table 4-16). Category I or II wetlands would not be affected by Alternative V and 3.1 acres of Category III and 0.4 acre of Category IV wetland would be affected by Alternative V (Table 4-16). Direct impacts on wetlands have been reduced from 5.2 acres since the 2001 FEIS because of the 2011 revised mapping and proposed avoidance measures. During Phase I, Alternative V would include installing open bottom arch culverts on two proposed crossings (NFS road #2741) on a tributary to West Fork Rock Creek, avoiding 50 linear feet of impacts on jurisdictional nonwetland waters. If during final design another culvert type is proposed, authorization for impacts on the nonwetland waters would be requested from the Corps. Culverts on Orr Creek, Big Cedar Creek, and West Fork Rock Creek may need to be replaced, which would result in temporary impacts during construction, but the existing disturbance footprint would likely remain the same. A discharge diffuser pipe would be placed across the width of the Clark Fork River. Impacts from six concrete anchors on the pipe and riprap below the ordinary high water mark placed around the pipe for protection would require the placement of fill material into less than 0.1 acre of nonwetland waters of the U.S. If, after final design the effects on jurisdictional wetlands could not be avoided, the appropriate authorization would be requested from the Corps and any required compensatory mitigation would be implemented.

Most impacts on jurisdictional wetlands and nonwetland waters would be avoided through the avoidance measures described in Section 2.3.1.16, *Monitoring and Mitigation Plans*. Examples of avoidance measures for road crossings on streams would be to use the same disturbance footprint as the existing road corridor or to bridge the crossing. Impacts on wetlands and other waters from pipelines would be avoided by spanning the wetland or nonwetland water, constructing pipelines using directional boring, or burying the pipeline within the road disturbance corridor. Powerline towers would be placed to avoid all wetlands and nonwetland waters.

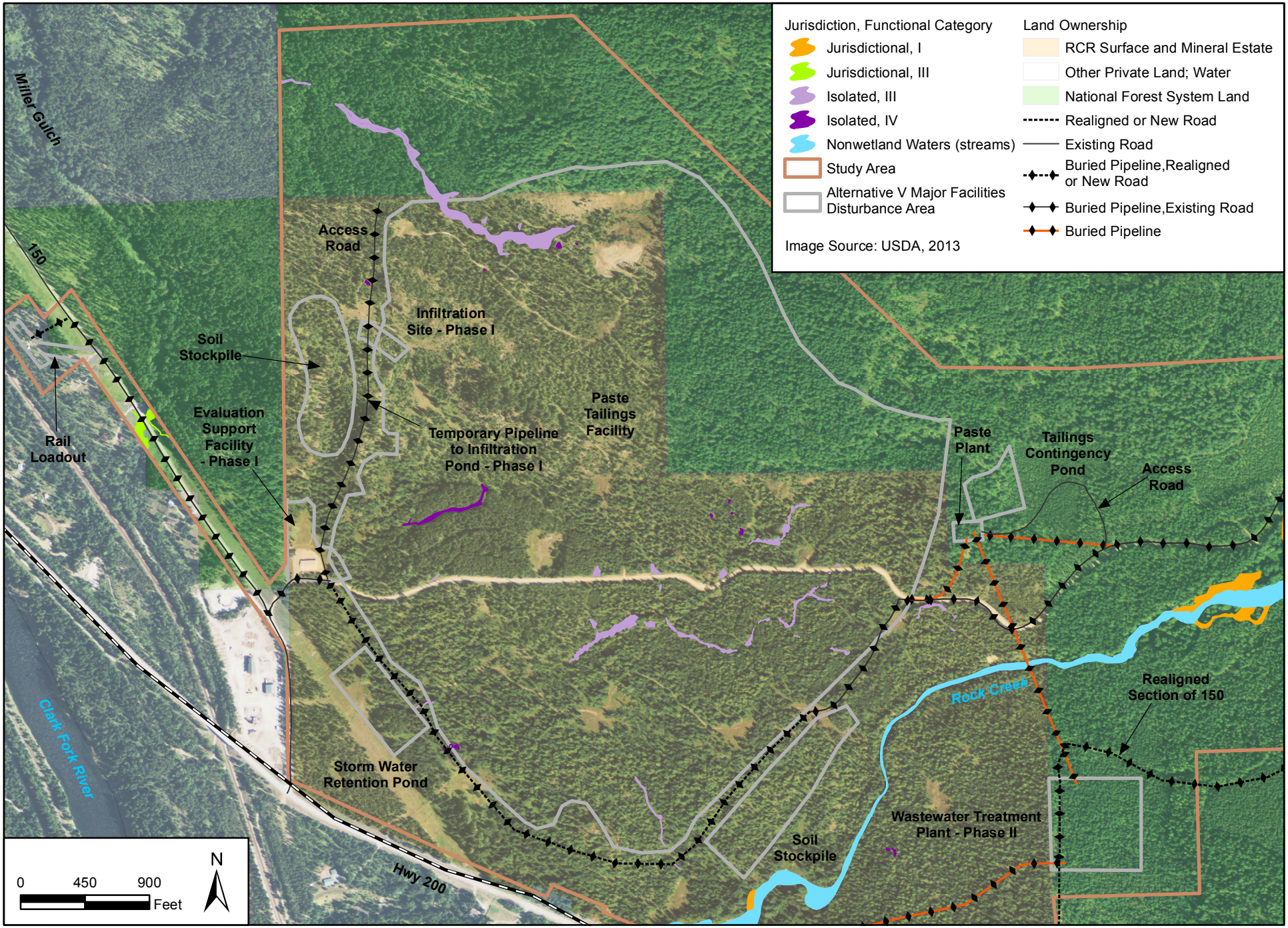


Figure 4-5. Alternative V Permit Area Wetlands and Other Waters in the Paste Tailings Facility Vicinity

Table 4-16. Impacts on Wetlands.

Wetland Resource	Alternative II	Alternative III	Alternative IV	Alternative V
Wetlands - Jurisdictional	0.5	0.5	0.6	0.0
Wetlands - Isolated	3.8	3.8	3.9	3.5
Total Wetland Impacts	4.3	4.3	4.5	3.5
Functional Category				
Category I	0.4	0.2	0.2	0.0
Category II	0.0	0.0	0.1	0.0
Category III	3.5	3.7	3.8	3.1
Category IV	0.4	0.4	0.4	0.4
Total Wetland Impacts	4.3	4.3	4.5	3.5

All units are acres.
The jurisdictional status of the wetlands and other waters of the U.S. is based on an approved JD from the Corps (2013b).
Units for areas are rounded to the nearest 0.1 acre; subtotals may vary by 0.1 acre due to rounding.
Source: GIS analysis by ERO Resources Corporation using wetland data in Westech 2012a.

Final impacts on jurisdictional nonwetland waters may be revised, and possibly reduced, during final design after the type of crossing (bridge or culvert) is determined. Impacts on jurisdictional nonwetland waters would be authorized under an appropriate NWP (Corps 2013a). Because jurisdictional wetlands that are subject to the Corps' jurisdiction would not be impacted, authorization from the Corps would not be needed for the placement of dredged or fill material into wetlands associated with the paste tailings facility. Although not required by the Corps and Section 404 of the Clean Water Act, RCR has committed to implementing the mitigation plan in Appendix L to compensate for the loss of 3.5 acres of isolated wetlands. The mitigation sites would be on private lands owned by RCR. The final design of the wetland mitigation would be approved by the KNF, and construction of the mitigation would be concurrent with Rock Creek Project impacts.

4.10.2.2 Indirect Effects

Indirect effects on wetlands from construction of Rock Creek Project components described on pages 4-116 through 4-118 of the 2001 FEIS have not changed. Additional indirect effects on wetlands could occur from pumpback wells, if implemented, and mine dewatering.

If the contingency pumpback wells around the paste tailings facility were used and if pumping from these wells changed hydrological conditions currently supporting these wetlands, pumping from these wells could result in indirect impacts on 0.2 acre of isolated wetlands. Jurisdictional wetlands adjacent to Rock Creek are not likely to be impacted by the pumpback wells.

The indirect effects on wetlands, springs, and seep habitat overlying the mine would be the same in all mine action alternatives and difficult to predict. Indirect impacts on wetlands due to mine dewatering were estimated using the 3D model to assess changes in baseflow of streams and springs near the mine. The greatest changes in baseflows are predicted to occur during the Production/Operations Phase and Closure Phase to the upper reaches of headwater streams that are tributary to the East Fork Bull River, Bull River, and East Fork Rock Creek (Section 4.7, *Water Quantity and Quality*). These headwater streams have steep gradients and are deeply entrenched (Figure 3-13). Although baseflows on these streams would be reduced (Table 4-8 and Table 4-9), in most years, surface runoff and precipitation would continue to provide the primary hydrologic support for wetland vegetation. The reduction in baseflows would be most notable in dry years and would likely occur only in late summer to early fall. The effects from the reduction in baseflows on wetland vegetation along these stream reaches would be negligible because of the continued hydrologic support from surface runoff and precipitation.

During the Production/Operations Phase and Closure Phase, reduced baseflows that are predicted on the West Fork and East Fork Rock Creek are unlikely to affect wetland vegetation. Small changes in baseflows (between 1 and 5%) are predicted to occur at the mouths of Rock Creek, East Fork Bull River, and Bull River. Vegetation along these streams is mostly dominated by woody species, some of which occur in uplands with equal or greater frequency, that typically have a wide tolerance for soil moisture gradients, and would not be noticeably affected by the predicted reduction in baseflow. Surface runoff from snowmelt, precipitation, and peak flows are not expected to change and would continue to provide supportive hydrology for wetland vegetation along the channels.

No changes in groundwater levels or lake levels are predicted (Section 4.7, *Water Quantity and Quality*) at the high-elevation lakes (Copper, Cliff, Moran Basin, and Rock) and wetlands associated with these lakes are not anticipated to be affected. The establishment of a 1,000-foot buffer around Cliff Lake from mining activity would ensure that the small amount of wetland vegetation around Cliff Lake would not be affected. Wetlands at Rock Creek Meadows are not expected to be affected by mining or dewatering. A perennially high water table and other tributaries that flow into Rock Creek Meadows that would not be affected by mining provide the primary hydrologic support for wetlands at Rock Creek Meadows.

The effect on plant species, functions, and services associated with the affected wetlands, springs, or seeps by a change in water level would be best determined by relating plant species with water abundance and quality for monitoring and evaluation. As described in the *Water Resources Monitoring Plan* (Appendix K), in Alternative V, RCR would complete a GDE inventory and conduct GDE monitoring in an area overlying the proposed mine and adits to evaluate indirect wetland effects. The inventory includes a vegetation survey to describe and document existing vegetation characteristics and establish a prevalence index used by the Corps to determine wetland vegetation (Corps 2008). The prevalence index would be used to assess changes in vegetation composition and if a loss of wetland species was occurring. The monitoring would not alter the effect of Alternative V but would assist in determining if an impact was occurring and the scale of any impact. If impacts on wetlands were identified during monitoring, RCR would implement the Contingency/Corrective Action Plan described in the *Water Resources Monitoring Plan* in Appendix K.

4.10.3 Alternative IV

4.10.3.1 Direct Effects

Alternative IV would directly affect 3.9 acres of isolated wetlands and 0.6 acre of jurisdictional wetlands. Wetland impacts were reduced by 0.7 acre from the 2001 FEIS because of the revised 2011 wetland mapping. Of the four functional categories, 0.2 acre of Category I, 0.1 acre of Category II, 3.8 acres of Category III, and 0.4 acre of Category IV would be affected. The effects on jurisdictional nonwetland waters have not changed since the 2001 FEIS.

4.10.3.2 Indirect Effects

Alternative IV indirect effects on wetlands from the tailings facility would be the same as described on pages 4-116 through 4-118 of the 2001 FEIS, except that Alternative IV does not include a survey of plant species abundance (all species) prior to activity and subsequent plant species abundance and water monitoring of GDEs overlying the mine. Without this type of monitoring, mining-induced changes in water level or quality may result in an unidentified loss of species, functions, and services associated with the affected wetlands, springs, or seeps. Indirect effects on wetlands from mine dewatering would be the same as under Alternative V.

4.10.4 Alternative III

4.10.4.1 Direct Effects

Alternative III would directly affect 3.8 acres of isolated wetlands and 0.5 acre of jurisdictional wetlands. Wetland impacts were reduced by 0.9 acre since the 2001 FEIS because of the revised 2011 wetland mapping. Alternative III would directly affect 0.2 acre of Category I, 3.7 acres of Category III, and 0.4 acre of Category IV wetlands. No Category II wetlands would be affected under this alternative. Nonwetland jurisdictional waters effects are described on pages 4-116 through 4-118 of the 2001 FEIS.

4.10.4.2 Indirect Effects

Alternative III indirect effects on wetlands from the tailings facility would be the same as described on pages 4-116 through 4-118 of the 2001 FEIS. Alternative III indirect effects on wetlands from mine dewatering would be the same as under Alternative V.

4.10.5 Alternative II

4.10.5.1 Direct Effects

Alternative II would directly affect 4.3 acres of wetlands; 0.5 acre is jurisdictional and 3.8 acres are isolated. About 1.5 acres less of wetland area would be affected compared with the 2001 FEIS because of the revised 2011 wetland mapping. Of the 4.3 acres of wetlands, 0.4 acre of Category I, 3.5 acres of Category III, and 0.4 acre of Category IV wetlands would be directly affected. Impacts on nonwetland waters would be same as in the 2001 FEIS.

4.10.5.2 Indirect Effects

Alternative II indirect effects on wetlands from the tailings facility would be the same as described on pages 4-116 and 4-117 of the 2001 FEIS. Alternative II indirect effects on wetlands from mine dewatering would be the same as under Alternative V.

4.10.6 Alternative I

A discussion of wetland and nonwetland waters of the U.S. effects from Alternative I is provided on page 4-115 of the 2001 FEIS.

4.10.7 Effectiveness of Agencies' Proposed Mitigation

RCR's wetland mitigation plan for Alternative V is summarized in Section 2.3.1.16, *Monitoring and Mitigation Plans* and described in Appendix L. The Groundwater Dependent Ecosystem Monitoring Plan includes monitoring of wetlands in the CMW. Mitigation measures and their expected effectiveness are summarized in Table 4-17 below.

Table 4-17. Effectiveness of Mitigation for Impacts on Wetlands and Waters.

Resource	Potential Effect	Mitigation	Mitigation Objectives	Monitoring	Mitigation Trigger	Contingency Mitigation	Effectiveness of Mitigation
Wetlands and nonwetland waters	Effects on jurisdic-tional wetlands and other waters of the U.S. on NFSL have been avoided and minimized through construction methods and BMPs. 3.5 acres of isolated wetlands would be directly affected.	RCR would implement mitigation for effects on 3.5 acres of isolated wetlands (see Appendix L).	Avoid and minimize effects so that functions and services of wetlands are not lost. Replace functions and services of impacted isolated wetlands.	See Appendix L for RCR's wetland mitigation plan. The plan includes measures such as: As-built reports of mitigation sites with planting plans submitted to agencies; and Site visits conducted annually for 5 years after construction to evaluate the success of the establishment of wetland functions and services.	Unavoidable impacts on jurisdictional wetlands are >0.1 acre as determined during final design.	Submit a work plan for unavoidable wetland impacts determined during final design within 30 days of agency request. KNF and DEQ would approve the plan or direct RCR to revise the plan within 30 days.	Avoidance of wetland impacts is highly effective. Mitigation for isolated wetlands would be highly effective. Test plots established in 1990 documented a high likelihood of success of wetland mitigation at the Upper Rock Creek site (location of the proposed mitigation site) if similar methods are used.

4.10.8 Cumulative Impacts

Past actions in the study area, particularly road construction, have resulted in the placement of culverts and other fill material in streams and adjacent wetlands. Past actions, after the passage of the Clean Water Act in 1977, were subject to Section 404 permitting and mitigation requirements. Cumulative direct and indirect effects on waters of the U.S. may result from other reasonably foreseeable actions in the study area such as other mining operations and road construction. All present and reasonably foreseeable future actions would be subject to Corps' permitting and mitigation requirements. With appropriate mitigation, cumulative direct wetland effects would be negligible. Cumulative indirect effects from reasonably foreseeable future actions in the area may include small amounts of increased sedimentation in wetlands from new roads associated with construction and ground-disturbing activities.

4.10.9 Regulatory Compliance

Alternative V would not require the discharge of fill material into wetlands subject to Corps' jurisdiction. Alternatives II and III would result in 0.5 acre of jurisdictional wetland impacts that would require authorization under Section 404 of the Clean Water Act. Alternative IV would require authorization for impacts on 0.6 acre of jurisdictional wetlands. Impacts on nonwetland waters have been avoided and minimized in Alternative V. Any unavoidable impacts on wetlands and other waters of the U.S. would be determined during final design. If necessary, authorization under Section 404 of the Clean Water Act would be requested from the Corps. RCR would comply with and implement conditions in the Section 404 authorization. Plans for avoidance, minimization, and mitigation of effects on wetlands would be required prior to permit issuance. KNF identified Alternative V as the least environmentally damaging practicable alternative because it would have the least impacts on wetlands and nonwetland waters of the U.S. and wound not have other significant adverse environmental consequences (40 CFR 230.10(a)). As the permitting authority, the Corps will determine if Alternative V is the least environmentally damaging practicable alternative. The Corps also will determine if the proposed Rock Creek Project complies with the Guidelines. The Corps' findings regarding the least environmentally damaging practicable alternative and compliance with the Guidelines is subject to the EPA's review. Any alternative permitted by the Corps would comply with the 2015 KFP.

Alternative V would require the discharge of fill material into isolated wetlands not subject to the Corps' jurisdiction. In compliance with EO 11990, the KNF finds that there is no practicable alternative to new construction located in isolated wetlands, and that Alternative V includes all practicable measures to minimize effects on wetlands.

4.11 Aquatic Life and Fisheries

4.11.1 Introduction

This section updates the 2001 FEIS analysis of potential environmental consequences to aquatics and fisheries resources based on modifications to the preferred alternative (Alternative V) and new information. Modifications to Alternative V potentially affecting aquatics and fisheries resources primarily consist of measures that would result in additional avoidance and mitigation of potential environmental consequences and a more detailed water resources and aquatic resources monitoring plan for Phase I and Phase II of mine development. Phase I and Phase II sediment mitigation plans have been clarified since the 2001 FEIS and are described in Section 2.3.1.12, *Erosion and Sediment Control*. The analysis of environmental consequences to aquatics and fisheries has also been updated to incorporate new information since the 2001 FEIS, such as development of a 3D groundwater model, additional baseline data, and additional discussion of surface water quality (nutrients).

This section also includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections, including an evaluation of consistency with the 2015 KFP, not previously in the 2001 FEIS. The remainder of the analysis has not changed and is provided in the 2001 FEIS (pages 4-120 through 4-135).

4.11.2 Alternative V

4.11.2.1 Aquatic Habitat

Modifications to Alternative V do not substantially change the analysis of impacts on aquatic habitat from potential spills (slurry, wastewater, reclaimed water, and mining reagents) and paste tailings facility failures described on pages 4-121 to 4-125 of the 2001 FEIS. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on aquatics and fishery resources in the study area. A detailed discussion of the adequacy of baseline groundwater and surface water data is provided in Section 4.7.2.1, *Water Quantity and Quality - Baseline Data Adequacy*. The following subsections describe Alternative V effects on aquatic habitat and fisheries from potential changes in streamflows and lake levels, and potential impacts on riparian areas.

4.11.2.2 Water Quantity

Section 4.7.3.1, *Groundwater Quantity*, provides an analysis of predicted changes to bedrock groundwater levels due to mine inflows. Mine inflows in Alternative V would result in reductions in stream baseflow that would not be measurable when streamflows are dominated by snowmelt runoff or large runoff-producing rain events. Because streams in the area may be at baseflow only from mid-July to early October, as well as periodically from November through March, effects on baseflows may be measurable only during those times of the year. In wetter years, effects on baseflow may be measurable only for short periods or may not be measurable during the entire year. As discussed in detail in Section 4.7.3.2, *Surface Water Quantity*, other Alternative V activities that may affect baseflow conditions include interception of precipitation at mine facilities, use of stormwater runoff collected from the mine facilities, discharges from the wastewater treatment plant, vegetation clearing, potable water use, makeup water use from a well located near the Clark Fork River, and the possible use of pumpback wells at the paste tailings facility and evaluation adit portal pad.

The largest predicted changes in baseflow proportional to pre-mine baseflow would occur in Chicago Creek in the Bull River watershed, South Basin Creek in the Rock Creek watershed, North Basin Creek in the East Fork Bull River watershed, and the East Fork Bull River above St. Paul Lake. Due to uncertainties associated with the 3D model and baseflow conditions in these stream reaches and an

unquantified relationship between streamflow conditions and aquatic habitat availability and quality, specific effects of surface flow changes on aquatic habitat are not known. The effects of potential baseflow reductions to fish habitat are discussed qualitatively in Section 4.13.3.1, *Bull Trout*.

Aquatic habitat in Chicago Creek, South Basin Creek, and North Basin Creek is limited in quality and quantity; reductions in baseflow may have a localized adverse effect on aquatic habitat where it occurs in these drainages. Water quantity-related effects on aquatic habitat in Chicago Creek, South Basin Creek, and North Basin Creek would be minor relative to total habitat quantity and quality in the East Fork Bull River and Rock Creek drainages because these tributaries provide limited aquatic habitat quantity and quality to their overall respective watersheds. Water level impacts on Cliff Lake (headwaters of South Basin Creek) aquatic habitat are not anticipated due to implementation of a 1,000-foot buffer around the lake.

Stream intermittency in the lower and middle reaches of Rock Creek frequently creates natural barriers to fish movement during low-flow conditions. A perched culvert at Montana Highway 200 may also inhibit fish movement during low-flow periods. Partial and temporary barriers to migration may increase in frequency or be longer in duration as a result of mine-related baseflow reductions. As described in the bull trout discussion in Section 3.13.2, *Bull Trout*, this may further prevent hybridization of native and nonnative fish and resource competition by nonnative species that are virtually absent from West Fork Rock Creek and East Fork Rock Creek below Rock Lake (one westslope cutthroat trout-rainbow trout hybrid was documented in East Fork Rock Creek in 2010). Therefore, a decrease in baseflow may have a mixed, but unpredictable, effect on native fish populations in Rock Creek.

Generally, the impact of reductions in baseflow on aquatic habitat in East Fork Bull River would be lower than in Rock Creek because East Fork Bull River has fewer migratory barriers and intermittency concerns. Aquatic habitat effects related to reduced baseflow as a result of mine inflows would be lower in the Bull River than the East Fork Bull River and Rock Creek drainages because the relative proportion of baseflow affected by the mine would be small.

The 3D model predicted no effects on lakes within the CMW due to mine inflows, except St. Paul Lake. St. Paul Lake may be affected by mining, but effects may be difficult to separate from the large natural lake level variations. The lake level may lower more quickly during dry years if and when the only source of water to the lake is bedrock groundwater. St. Paul Lake fish populations have been supported by stocking in previous years. Extremely low lake levels may result in fish mortality due to direct and indirect effects of dewatering. Assuming that FWP continues to stock St. Paul Lake as in previous years, any fish mortality in St. Paul Lake would likely be mitigated by stocking.

As described in Section 4.7.3.2, *Surface Water Quantity*, the mine void would fill over time following the period of maximum groundwater drawdown. With plugging at the top of the adits, surface flows would nearly return to pre-mining conditions; fisheries and aquatic resources would also be expected to nearly return to pre-mining conditions. Without any plugs, baseflows would be permanently reduced in the East Fork Bull River and South Basin Creek, but to a lesser extent than during mining. In either case, effects on fisheries and aquatic resources would be less following the period of maximum groundwater drawdown, and would be greater if the adits were not plugged.

RCR would monitor impacts on benthic macroinvertebrates, fish populations, and periphyton, as described in Appendix K. To ensure early detection of any surface water reductions potentially caused by the mine, springs and the mouth of Rock Creek would be periodically monitored as specified in the Groundwater Dependent Ecosystem Inventory and Water Resources Monitoring Plan in Appendix K. Implementation of the Contingency Action Plan described in the Water Resources Monitoring Plan in Appendix K would ensure that effects on aquatic resources were minimized. If any monitoring action

levels were exceeded, RCR would review the mitigation measures described in the Contingency Action Plan and propose to implement one or more of the measures described therein to ensure that the parameter of concern did not exceed action levels. If RCR developed alternative contingency actions not described in the Contingency Action Plan, RCR would revise the Contingency Action Plan with a new or modified measure along with a proposed schedule for implementation and submit it to the agencies for approval. RCR would be required to implement contingency actions as specified in the original, or if applicable, revised and approved Contingency Action Plan.

4.11.2.3 Water Quality

The effects of potential sediment delivery and mitigation measures in Rock Creek on bull trout are similar to effects on other salmonid species found in the Rock Creek drainage and are described in Section 4.13.3.1, *Bull Trout*. Before Phase II Construction began, RCR would submit to the KNF, DEQ, and USFWS for approval a final Phase II mitigation plan for offsetting in aggregate 400 tons of annual fine sediment loading to Rock Creek by mitigating sediment sources in the Rock Creek watershed. With the required mitigation, changes in sediment would not affect aquatic life in the Rock Creek watershed. As discussed in Section 4.7.3.4, *Surface Water Quality*, Rock Creek is on DEQ's list for impaired waters as a result of substrate alterations due to silviculture practices that have impaired aquatic life. Implementation of Alternative V sediment mitigation would improve aquatic life habitat in the creek and with the implementation of BMPs; other Alternative V activities would not be expected to further alter the substrate in Rock Creek.

Nitrate residue from blasting during Phase I could be mobilized by infiltration of precipitation into the evaluation adit portal pad, potentially entering an unnamed tributary to West Fork Rock Creek and increasing nitrate concentrations above ambient. RCR would be required to prepare an Explosive Handling and Blasting Plan that would minimize residual nitrate in the waste rock. The unnamed drainage would be monitored for elevated nutrient concentrations. Wastewater from the mill site would be intercepted by ditches, stored in a lined pond, and used for drilling or treated at the wastewater treatment plant. The primary concern would be residual nitrate residue from blasting that would be mobilized by infiltration of precipitation and would eventually discharge to the unnamed drainage below the portal pad. It is possible that nitrate may be detected at concentrations greater than ambient in the unnamed drainage, particularly when flow in the drainage is low.

Depending on the timing of construction, treated wastewater would be discharged into infiltration ponds or a permitted outfall in the Clark Fork River. The treated discharge would meet MPDES permitted effluent limits protective of aquatic life.

In 2014, water quality standards were adopted in Montana to address and prevent degradation of aquatic life and natural stream conditions by setting in-stream total nitrogen and TP standards (DEQ 2014b). The standards are based on reference streams, scientific literature, and stressor-response studies examining the effect of nutrient concentrations on nuisance algal concentrations/species composition and aquatic invertebrate communities. For the Northern Rockies Ecoregion, all wadeable streams have a seasonal TN standard of 275 µg/L and a seasonal TP standard of 25 µg/L between July 1 and September 30. These numeric standards do not apply to the Clark Fork River. RCR has not applied for a new MPDES permit for discharges to the Clark Fork River and the DEQ has not calculated MPDES permitted effluent limits. Compliance with the MPDES nutrient and other water quality requirements for the discharge permit would ensure that aquatic life and aquatic habitat changes from water quality impacts were minimized. 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 any MPDES permit issued by DEQ can be modified at any time if nuisance algal growth caused by RCR's discharge was observed or lower numeric standards for nutrients were adopted. To address the uncertainty regarding the response of area streams to increased TIN concentrations, RCR would implement the water quality and aquatic biology monitoring described in Appendix K.

Mine dewatering and the resulting decrease in bedrock groundwater discharge to Rock Creek Project study area streams and lakes may subtly change the water quality of surface water bodies where bedrock groundwater is a source of supply. A reduction in bedrock groundwater may reduce nutrient concentrations in streams and lakes, but the change may be detectable only during low-flow periods when bedrock groundwater is the major source of supply to surface water. Even at low flows, the changes in water quality may be difficult to measure.

As described in Section 4.7.3.3, *Groundwater Quality*, if the adits were plugged after mine closure, when the mine void filled, groundwater would move downgradient from the mine void via fractures. If the area to be mined is currently hydraulically connected to area springs and/or streams, then as the mine void refilled with water, those connections would be reestablished. However, because of the complexity of the fracture flow system, it may not be possible to predict where and if these connections occur. Additional site data would be collected in each of the streams draining the proposed mine area prior to and during the Evaluation Phase to determine if there would be effects on aquatic life due to possible changes in water quality where baseflow occurs in each of these streams.

As described above for water quantity effects, RCR would monitor impacts on benthic macroinvertebrates, fish populations, and periphyton, as well as metals accumulations in fish tissues (Appendix K). Implementation of the Contingency Action Plan, as described in the Water Resources Monitoring Plan in Appendix K, would ensure that effects on aquatic resources were minimized.

4.11.2.4 Riparian Areas

Alternative V effects on RHCAs would be less extensive than the other three action alternatives due to project design that avoids RHCAs described in Section 2.3.1, *Alternative V — Rock Creek Project with Tailings Paste Deposition and Alternate Water Treatment (Preferred Alternative)*. Impacts on RHCAs in mine disturbance areas and utility corridors are described below.

4.11.2.4.1 Mine Disturbance Areas

Approximately 2 acres of RHCA would be affected within the mine disturbance areas (Table 4-18). Most effects would occur on stream-associated RHCAs where riparian vegetation would be removed along reconstructed or improved access routes and bridges. Less than 1 acre of RHCA within a 100-foot buffer of jurisdictional wetlands would be cleared for construction of the bridge over Engle Creek and at the junction of the reconstructed NFS road #150 with Montana Highway 200 (Figure 4-6). No RHCAs would be affected in the disturbance footprint of the paste tailings facility or other mine facilities (Neesvig 2010b).

4.11.2.4.2 Utility Corridors

About 10 acres of powerline corridor would be within RHCAs (Table 4-18; Figure 4-7), but clearing would not occur in the entire 10 acres. RHCAs would primarily be affected where stream-associated riparian vegetation was cleared. Streamside vegetation clearing may increase stream temperature in localized areas by exposing the stream to increased warming from sunlight, but because less than a fraction of 1% of the affected streamside habitat along Engle Creek, Rock Creek, and West Fork Rock Creek would be cleared, the effect would likely be negligible. Impacts on RHCAs from constructing powerlines would be minimized through implementation of the following measures:

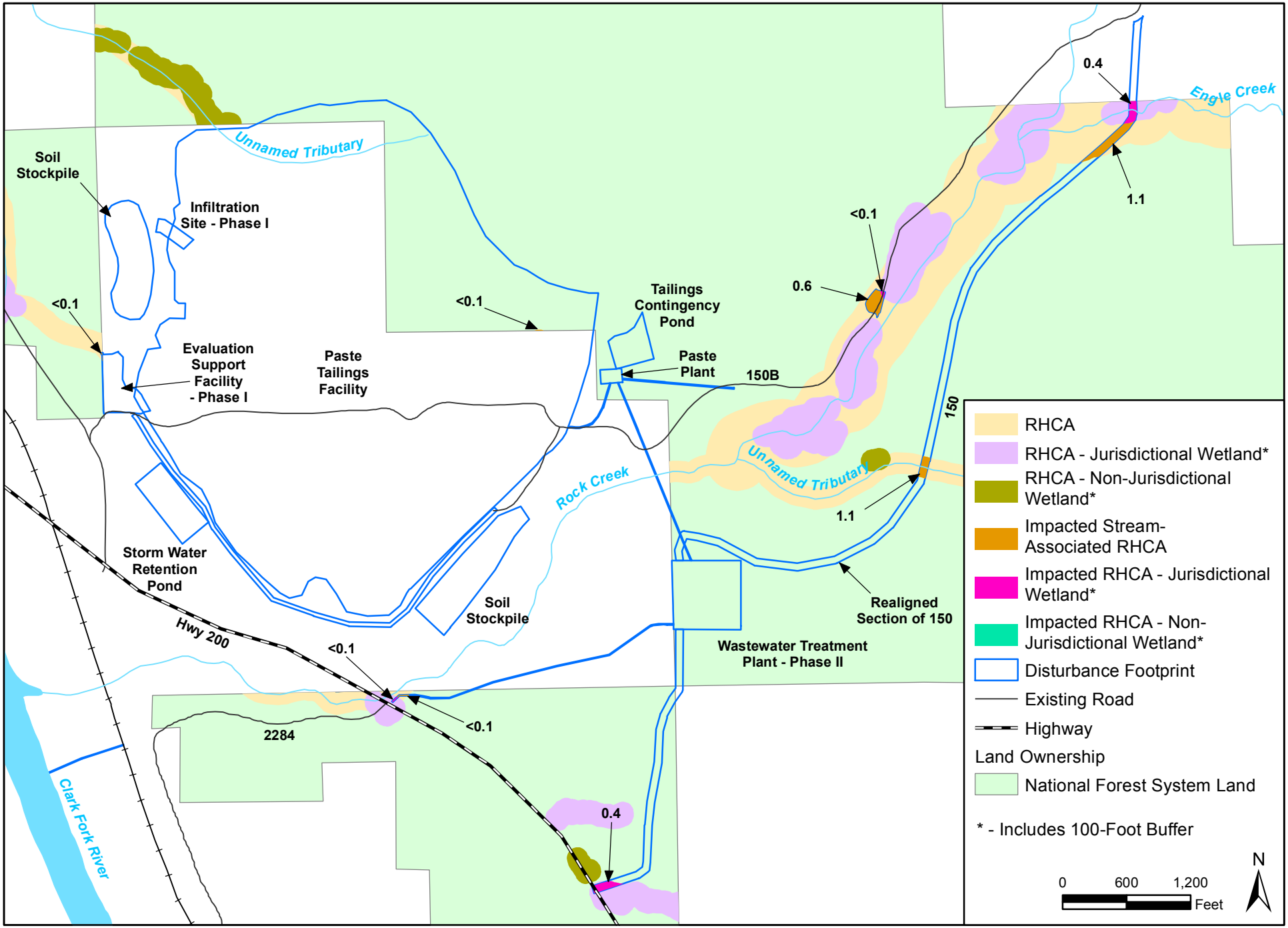


Figure 4-6. Riparian Habitat Conservation Area (RHCA) in Alternative V Disturbance Area

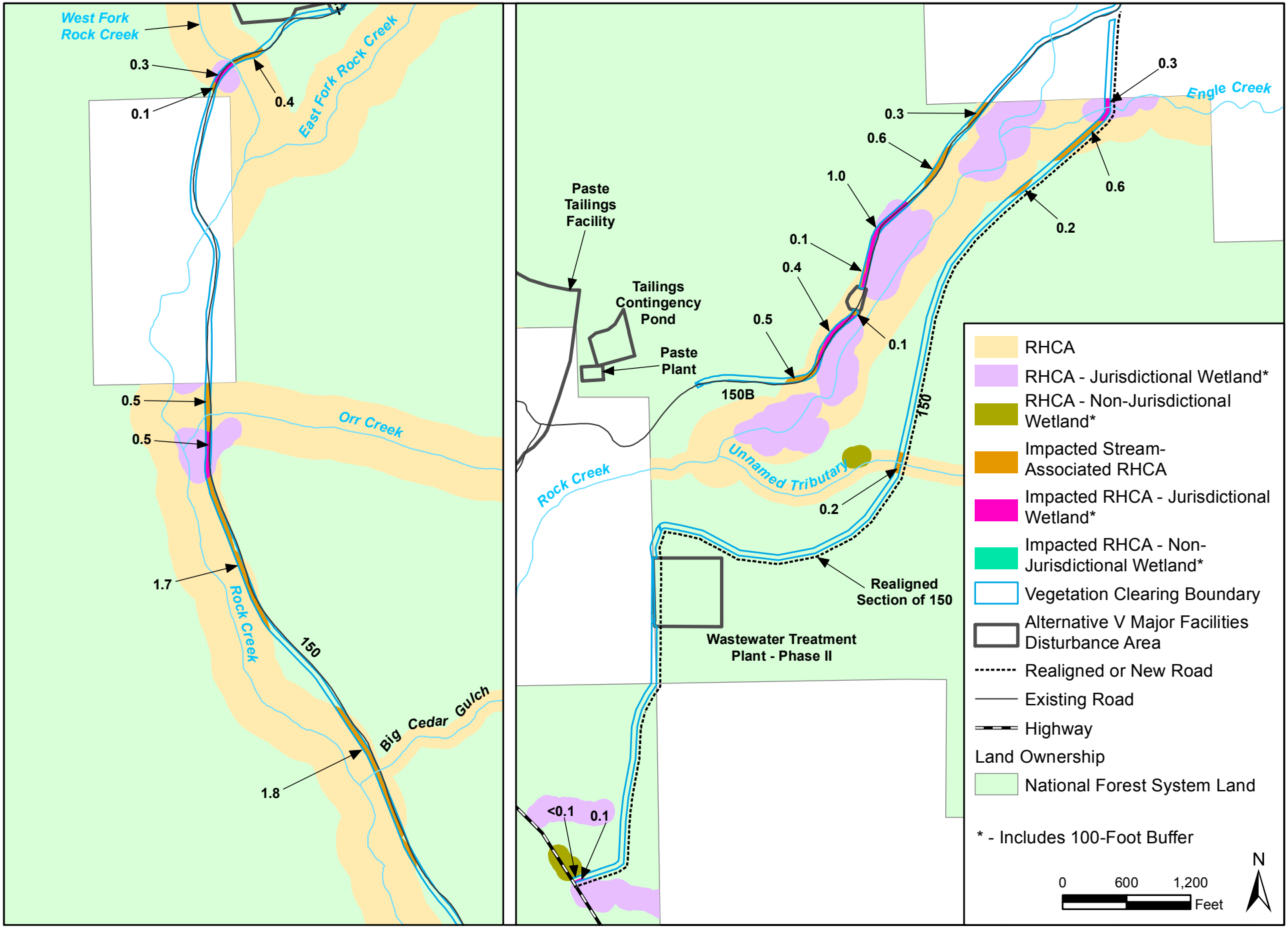


Figure 4-7. Riparian Habitat Conservation Area (RHCA) in Alternative V Transmission Line Clearing Area

- An unaltered vegetation buffer would be left between Rock Creek and the road and utility corridors where possible.
- Impacts on RHCAs at the Alternative V mill site and between the mill site and streams would be avoided (Figure 3-16). Any change to the Alternative V mill site would be evaluated for consistency with INFS standards and guidelines for RHCAs applicable to minerals management.
- Removal of large trees would be primarily limited to hazardous trees (trees that could fall on the power line).
- Ground disturbance, such as grubbing and grading, would be limited to the minimum necessary to access construction sites.
- Clearing of nonhazardous trees, brush, and herbaceous vegetation would be limited to the minimum necessary for construction and would be temporary.
- Powerline footings would be placed outside of wetlands and the ordinary high water mark of streams.

Table 4-18. Effects on RHCAs by Alternative.

RHCA Type	Alternative I (No Action) (acres)	Alternative II (Proposed Rock Creek Project) (acres)	Alternative III (Project with Mitigations) (acres)	Alternative IV (Modified Project with Mitigations) (acres)	Alternative V (Paste Facility and Alternative Water Treatment) (acres)
Stream-associated RHCAs	0	48	42	17	2
RHCAs that are Jurisdictional Wetlands (plus 100-foot buffer)	0	6	6	3	<1
RHCAs that are Nonjurisdictional Wetlands (plus 100-foot buffer)	0	1	2	5	0
Total RHCAs Affected in Mine Disturbance Areas[1]	0	55	50	25	2
Powerline clearing within RHCAs[2]	0	12	7	8	10

[1]Includes surface disturbance from tailings facility, adit portal, mill, wastewater treatment plant, paste plant, pipelines, and roads.
[2]Impacts are based on the following assumptions:

- The total clearing width would be 100 feet.
- Where the powerline was parallel to a road, 50 feet of the clearing width would be included in the road corridor and 50 feet adjacent to the road would be cleared.
- Powerline footings would be placed outside of wetlands and the ordinary high water mark of streams. Wetlands in powerline clearing areas would not be affected.

4.11.2.5 Aquatic Invertebrates

The effects on aquatic invertebrates under Alternative V are described on page 4-134 of the 2001 FEIS and are largely unchanged.

Baseflow reductions may result in a reduction in available habitat, although the amount of habitat reduction has not been quantified due to uncertainties in the hydrologic predictions. Surface water depletions occurring in the uppermost steep perennial drainages may adversely affect aquatic invertebrate assemblages at the reach level by causing streams to become intermittent at lower elevations and to dry up more frequently.

Reductions in nutrient concentrations in the Rock Creek and East Fork Bull River drainages may result where bedrock groundwater discharge to the streams is reduced, but the changes may be subtle and not large enough to affect periphyton or aquatic invertebrate communities. Wastewater discharge into the lower Clark Fork River would be treated in compliance with MPDES permitted effluent limits to protect aquatic life. Reduction of sediment loading to streams using sediment mitigation measures may generally improve the health of aquatic invertebrate communities throughout the Rock Creek drainage and promote the establishment of sensitive invertebrate species.

4.11.2.6 Fish

As described above in Section 4.11.2.1, *Aquatic Habitat*, stream baseflow reductions can result in a reduction of fish habitat, limit stream connectivity for migrating fish species during low-flow conditions by creating or extending migration barriers, and affect important groundwater/stream water interactions such as upwelling necessary for redd incubation and moderation of surface water temperatures.

A description of the estimated effects of water quantity changes on bull trout habitat in East Fork Rock Creek, West Fork Rock Creek, mainstem Rock Creek, East Fork Bull River, and mainstem Bull River is provided in Section 4.13.3, *Threatened and Endangered Species*, and applies to other fish habitat as well as bull trout habitat. Westslope cutthroat trout generally inhabit the same stream reaches as bull trout in these streams, although westslope cutthroat trout habitat extends upstream of bull trout habitat in West Fork Rock Creek and East Fork Rock Creek (FWP 2014g). Potential baseflow reductions may be less detrimental to westslope cutthroat trout habitat than to bull trout habitat because westslope cutthroat trout spawning and migration does not typically coincide with baseflow conditions (Muhlfeld et al. 2009) as it does for bull trout.

4.11.2.7 Influence of Climate Change

Due to the range in possible effects of climate change on the aquatic resources and the many factors that could affect that outcome, quantifying the influence of climate change on the Rock Creek Project was not feasible. It is difficult to predict how aquatic resources in the Rock Creek study area would respond to the forecasted regional effects of climate change. Within regions and across species, the effects of predicted climate trends are anticipated to differ among streams and fish populations (USFS 2010). Additionally, many studies have not been conducted over sufficient time periods or diverse locations to determine the outcome of small incremental changes on fish and invertebrate populations, and the complex responses of aquatic organisms to such changes is further confounded by changes in land use (Barbour et al. 2010; USFS 2010; Isaak et al. 2012). Because long-term data are not available for northwestern Montana streams, the magnitude and extent of the effects of climatic and hydrologic trends on fish and other aquatic organisms and their habitat are unclear (USFS 2010). The following paragraph describes potential effects of the Rock Creek Project on aquatic resources and climate change for a range of scenarios.

As discussed in Section 4.7, *Water Quantity and Quality*, climate change could reduce groundwater infiltration, increase cool season runoff, decrease warm season runoff, and ultimately decrease stream baseflows. The Rock Creek study area is in the northern part of the Columbia River, where increased precipitation is predicted to offset the effects of decreased warm season runoff due to warming, at least to some degree (Reclamation 2011c). In certain circumstances, decreased groundwater infiltration could reduce the Rock Creek Project's mine and adit inflows, but because baseflow to streams would also

decrease, the percentage change to stream baseflow could remain the same. Discharges to the Clark Fork River would be less if mine and adit inflows decreased.

If climate change did not change mine and adit inflows, and if decreased warm season runoff due to climate change was not neutralized by increased precipitation, the effects of any reduced fall low flows from the Rock Creek Project, such as a reduction in thermally suitable habitat and increased habitat fragmentation, on aquatic resources combined with the effects of climate change may be magnified. Alternatively, the effects of any increase in winter flows associated with climate change on baseflow would moderate the effect of inflows to the Rock Creek Mine during the winter low-flow periods.

As described in Section 4.7.3.4, *Surface Water Quality*, climate change could reduce groundwater contribution to baseflow in rivers and groundwater flow to wilderness lakes and alter runoff patterns, which could change the chemistry and temperature of streams and lakes. Changes in stream and lake temperatures and chemistry could affect aquatic resources, although the magnitude and type of effects are difficult to predict. For example, if thermally suitable habitat decreased as a result of climate change, some fish populations could become more fragmented, especially in streams with low-flow barriers such as Rock Creek and upper East Fork Bull River. As described in Section 4.7.8.4, *Surface Water Quality*, if climate change reduced groundwater infiltration enough to reduce mine and adit inflows, it could reduce the potential for metal leaching and any subsequent water quality effects on aquatic resources. As described in Appendix K, RCR would monitor streamflows and water temperatures. For all discharges, the DEQ would determine effluent limits that were protective of aquatic life during the MPDES permitting for each outfall.

4.11.3 Alternative IV

The effects on aquatic resources and fisheries under Alternative IV are described on page 4-131 of the 2001 FEIS and are largely unchanged since the 2001 FEIS. Potential effects on aquatic habitat, aquatic invertebrates, and fish resulting from decreases in bedrock groundwater discharge to surface water would be similar to Alternative V.

4.11.4 Alternative III

The effects on aquatic resources and fisheries under Alternative III are described on page 4-128 to 4-131 of the 2001 FEIS and are largely unchanged since the 2001 FEIS. Potential effects on aquatic habitat, aquatic invertebrates, and fish resulting from decreases in bedrock groundwater discharge to surface water would be similar to Alternative V.

4.11.5 Alternative II

The effects on aquatic resources and fisheries under Alternative II are described on pages 4-121 through 4-127 of the 2001 FEIS and are largely unchanged since the 2001 FEIS. Potential effects on aquatic habitat, aquatic invertebrates, and fish resulting from decreases in bedrock groundwater discharge to surface water would be similar to Alternative V.

4.11.6 Alternative I

The effects on fisheries and aquatic resources under Alternative I are described on page 4-121 of the 2001 FEIS and are unchanged since the 2001 FEIS. Alternative I would have no adverse effect on fisheries and aquatic resources.

4.11.7 Effectiveness of Agencies' Proposed Mitigation

The existing culvert on the West Fork Rock Creek above the last bridge on NFS road #150 has been identified as a barrier to fish migration; RCR would improve or replace this culvert based on future consultation with the Forest Service. Alternative V includes measures to mitigate mine impacts on surface water quantity and quality that will benefit fisheries and aquatics resources. Table 4-13 and Table 4-14 in Section 4.7, *Water Quantity and Quality*, describe mitigation measures to reduce impacts on surface water resources in the CMW, reduce impacts on stream baseflows, minimize sediment delivery to streams, and reduce or minimize adverse effects on surface water quality. Section 4.6.2, *Geotechnical Engineering-Alternative V*, describes the proposed mine paste tailings facility that would greatly reduce the risk of surface water quality impacts from a failure compared with other tailings disposal options. Section 4.13.8.1, *Effectiveness of Agencies' Proposed Mitigation - Bull Trout* discusses mitigation measures for bull trout that will be implemented to meet the Terms and Conditions of the 2007 BO Supplement (USFWS 2007a). Implementation of these measures will also effectively mitigate effects on fisheries and aquatics resources.

RCR would monitor impacts on benthic macroinvertebrates, fish populations, and periphyton, as well as metals accumulations in fish tissues (Appendix K). To ensure early detection of any surface water reductions potentially caused by the mine, springs and the mouth of Rock Creek would be periodically monitored as specified in the Groundwater Dependent Ecosystem Inventory and Water Resources Monitoring Plan in Appendix K. If any monitoring action levels were exceeded, RCR would review the mitigation measures described in the Contingency Action Plan and propose to implement one or more of the measures described therein to ensure that the parameter of concern did not exceed action levels. If RCR developed alternative contingency actions not described in the Contingency Action Plan, RCR would revise the Contingency Action Plan with a new or modified measure, along with a proposed schedule for implementation, and submit it to the agencies for approval. RCR would be required to implement contingency actions as specified in the original, or if applicable, revised and approved Contingency Action Plan. Implementation of the Contingency Action Plan as described in the Water Resources Monitoring Plan in Appendix K would ensure that effects on aquatic resources were minimized.

4.11.8 Cumulative Effects

4.11.8.1 Streamflow

Various activities have been completed, are ongoing, or are planned to occur in the study area that have had potentially adverse or beneficial effects on fisheries and aquatic resources. These activities include timber harvest, residential development, road construction, mining, livestock grazing, agriculture, restoration projects, placement of land in conservation easements, stream restoration and bank stabilization, nonnative fish suppression, and fish passage programs.

An analysis of the effects of simultaneous operation of the Rock Creek and Montanore mines on groundwater and surface water is provided in Section 4.7.8, *Cumulative Impacts*. The cumulative impact analysis for effects assumed that both mines would be in operation at the same time and the period of maximum drawdown would coincide. As shown in Table 4-15, for Rock Creek at the mouth at the time of maximum groundwater drawdown, the predicted change in baseflow would be -1.1 cfs for both projects. For the East Fork Bull River at the mouth, the predicted change would be -0.9 cfs for both projects. For the Bull River at the mouth, the predicted change would be -1.0 cfs for both projects. Although the relationship between changes in surface flow and aquatic habitat has not been quantified, surface water reductions would have an additional effect on loss of aquatic habitat. This could result in subsequent reductions in native fish populations including bull trout and westslope cutthroat trout, as well as macroinvertebrates.

Montanore Project mitigation actions would include creating bull trout genetic reserves through transplantation, habitat restoration, and nonnative fish suppression. As described in Section 3.11.4.3, *East Fork Bull River - Fish*, a nonnative fish-suppression program has been implemented by Avista in the East Fork Bull River and a shift toward more native species has been documented (Horn and Tholl 2011). Similar beneficial effects would be projected for both native salmonids (bull trout and westslope cutthroat trout) in the study area under the Montanore Project mitigation plan from removal of nonnative fish species that currently pose a risk to native populations through hybridization and increased competition.

As discussed in Section 4.7, *Water Quantity and Quality*, private timber harvest and development of private lands in the study area that resulted in land clearing could increase peak flows in study area streams, but the potential volume peak flow increases in Rock Creek or other study area streams cannot be quantified.

Reasonably foreseeable future actions that would not affect aquatic habitat in the study area include the following:

- Libby Creek Ventures drilling plan, which would disturb about 1 acre adjacent to the Upper Libby Creek Road
- Wayup Mine and Fourth of July Road Access, which would involve reconstruction of roads in the upper West Fisher Creek drainage
- Miller-West Fisher Vegetation Management Project, which would involve timber harvest and other vegetation treatments in the Miller and West Fisher Creek drainages
- Forestwide herbicide weed control, which would treat noxious weeds in the KNF

4.11.8.2 Water Quality

As described in Section 4.7.8.4, *Cumulative Impacts - Surface Water Quality*, there is a possibility that cumulative baseflow reductions resulting from the Rock Creek Project and Montanore Project would result in subtle changes to surface water quality, but quantifying such changes and the effects such changes may have on aquatic life and fisheries is not feasible. Private timber harvest and continued development of private lands in the study area may increase sediment transport to study area streams. Streambank stabilization projects may temporarily increase sediment transport to streams, but when completed, would reduce sediment transport to streams. The potential sediment increases in Rock Creek or other study area streams cannot be quantified and would depend on when timber was harvested and site-specific information that is currently unknown. Implementation of Alternative V sediment mitigation would reduce sediment transport in the Rock Creek drainage and would counteract any increase in the drainage from other activities.

Reasonably foreseeable future actions that would not affect the water quality of aquatic habitat in the study area include the following:

- Libby Creek Ventures drilling plan, which would disturb about 1 acre adjacent to the Upper Libby Creek Road, would not affect baseflows in study area streams or sediment transport in the Rock Creek drainage.
- Miller-West Fisher Vegetation Management Project, which would involve timber harvest and other vegetation treatments in the Miller and West Fisher Creek drainages, would not affect baseflows in study area streams or sediment transport in the Rock Creek drainage.
- Wayup Mine and Fourth of July Road Access, which would involve reconstruction of roads in the upper West Fisher Creek drainage, would not affect baseflows in study area streams or sediment transport in the Rock Creek drainage.

- Herbicide application associated with forestwide herbicide weed control projects would "present a low risk, if any, of herbicides threatening the health of aquatic ecosystems, animal species, or the general public" (USFS 2007b). Therefore, effects on study area stream water quality would be negligible.

As discussed in Section 4.7, *Water Quantity and Quality*, private timber harvest and development of private lands in the study area that resulted in land clearing could increase peak flows in study area streams, but the potential volume peak flow increases in Rock Creek or other study area streams cannot be quantified. Although Alternative V minimizes effects on RHCAs, development of lands or private timber harvest could contribute to disturbance of RHCAs and other riparian areas.

4.11.9 Regulatory Compliance

4.11.9.1 Endangered Species Act

Alternative V compliance with the ESA is discussed in Section 4.13.2.1, *Threatened and Endangered Species - Bull Trout*.

4.11.9.2 Organic Administration Act and Forest Service Mineral Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on NFS surface resources; comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations; and construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

4.11.9.2.1 Minimize Adverse Environmental Impact (36 CFR 228)

Mine Alternative V would comply with 36 CFR 228.8. Adverse environmental impacts on aquatic resources were minimized by avoiding impacts on RHCAs to the greatest extent feasible, minimizing road disturbance areas and addressing potential sediment sources associated with new and existing roads, burying pipes in roads and sheathing pipelines at stream crossings, and providing the highest standard feasible of wastewater treatment.

Although the groundwater model may be used to estimate total mine inflows, it is not suitable for assessing changes in streamflow at the scale of individual stream reaches. The 3D model would be refined and rerun after data collected during the Phase I Evaluation were incorporated into the model (see the Water Resources Monitoring Plan in Appendix K). Following additional data collection and modeling, the predicted impacts on surface water resources in the study area, including simulation of mitigation measures, would likely change and may have greater certainty. The Water Resources Monitoring Plan in Appendix K also includes intensive long-term monitoring of stream temperatures and seasonal instream flows to detect any mining-induced changes in the groundwater system. The KNF anticipates the updated model, when coupled with Phase I monitoring, would be sufficient to determine if a causal link between the Rock Creek Project and any effect on bull trout or bull trout critical habitat is reasonably certain.

4.11.9.2.2 Fisheries and Wildlife Habitat (36 CFR 228.8(e))

Compliance with state and federal water quality standards, specifically changes in streamflow and floodplains, is discussed in Section 4.7.9, *Water Quantity and Quality - Regulatory Compliance*.

Implementation of the sediment mitigation plan described in Section 2.3.1.16, *Monitoring and Mitigation Plans* would minimize sediment delivery from roads to streams. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's

National Best Management Practices for Water Quality Management on National Forest System Lands (USFS 2012).

Aquatics and fisheries mitigation plans were prepared and implemented in cooperation with the FWP, USFWS, KNF, and DEQ. Term and Condition 1c of the 2007 BO Supplement for bull trout (USFWS 2007a) required that RCR conduct a watershed assessment to better define bull trout populations and better define habitat conditions. In 1997, Watershed Consulting prepared a report, *1996 Field Data Summary Report for Rock Creek Near Noxon, Montana,* that addressed aquatic habitat issues raised during the environmental review for the proposed Rock Creek Mine pursuant to ESA, NEPA, NFMA, and MEPA. The Watershed Consulting (1997) report addressed streamflows, substrate composition, sediment sources, LWD, fish populations and distribution, and potential bull trout spawning habitat. In 2012, Salmon Environmental Services prepared a report, *Rock Creek Fisheries and Aquatic Habitat Assessment Supplement*, that incorporates data collected in the Rock Creek drainage since 1997 and provides information that addresses changes in management and legal direction implemented since 1997. The Watershed Consulting (1997) and Salmon Environmental Services (2012) reports meet the intent of INFS watershed analysis direction.

RCR would be required to submit an evaluation of operational options of the proposed diffuser at the proposed location and alternate sites below the Noxon Reservoir. The KNF, DEQ, and USFWS would review the report to determine if additional recommendations could be implemented, including a possible relocation of the diffuser, which would further minimize potential impacts on migratory or resident bull trout using the Clark Fork River habitats adjacent to the mouth of Rock Creek and the spring area immediately upstream.

RCR would also be required to submit a risk assessment of potential accidents related to haul routes for mine-related risks to bull trout and make recommendations for additional measures to minimize the risk. To reduce the risk of vehicles and their contents from reaching Rock Creek in the event of an accident, barriers would be installed at two bridges and one culvert along NFS road #150.

RCR would monitor impacts on benthic macroinvertebrates, fish populations, and periphyton (Appendix K). Metals accumulations in fish tissues and sediments, and increases in sediment loads, would also be monitored. To ensure early detection of any surface water reductions potentially caused by the mine, springs and the mouth of Rock Creek would be periodically monitored as specified in the Groundwater Dependent Ecosystem Inventory and Water Resources Monitoring Plan in Appendix K. Implementation of the Contingency Action Plan described in the Water Resources Monitoring Plan in Appendix K would ensure that effects on aquatic resources were minimized. If any monitoring action levels were exceeded, RCR would review the mitigation measures described in the Contingency Action Plan and propose to implement one or more of the measures described therein to ensure that the parameter of concern did not exceed action levels. If RCR developed alternative contingency actions not described in the Contingency Action Plan, RCR would revise the Contingency Action Plan with a new or modified measure, along with a proposed schedule for implementation, and submit it to the agencies for approval. RCR would be required to implement contingency actions as specified in the original, or if applicable, revised and approved Contingency Action Plan.

RCR would be required to implement a stream habitat enhancement program to improve the ability of bull trout to move throughout the year in Rock Creek and increase habitat availability and diversity for migratory and resident bull trout populations. RCR would improve or replace the existing culvert on the West Fork Rock Creek above the last bridge on NFS road #150 that has been identified as a barrier to fish migration as determined in consultation with the Forest Service.

Alternative V would comply with 36 CFR 228.8(e) because the mitigation plan is practicable and would minimize adverse environmental impacts on surface water quality and fisheries habitat. In summary, Alternative V would comply with 36 CFR 228.8 because it includes measures that minimize the mine disturbance area and adverse environmental impacts on fisheries and aquatic systems to the extent feasible.

4.11.9.2.3 Roads (36 CFR 228.8(f))

In Alternative V, roads would be constructed and maintained to ensure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values. RCR would minimize impacts from road crossings in RHCAs and would implement BMPs to minimize sediment delivery to crossed streams. RCR would develop for the KNF's and DEQ's approval and implement a RMP for Phase II that would describe for all new or reconstructed roads used for the mine 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
- Analysis of any new road constructed in a RHCA, documenting it was the minimum necessary for the approved mineral activity.

The plan would describe management of road surface materials during plowing, such as snow, and methods to control road ice. Sidecasting of soils or snow would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs. All road improvements, realignments, or modifications, including stream crossings, would be constructed in compliance with INFS standards (USFS 2015b) and all new or improved bridges or culverts would be built to accommodate a 100-year flood event. Reconstructed bridges over Rock Creek would be realigned nearly perpendicular to the stream. The existing culvert on the West Fork Rock Creek above the last bridge on NFS road #150 has been identified as a barrier to fish migration; RCR would improve or replace this culvert as determined in consultation with the Forest Service. Details of the RMP are provided in Section 2.3.1.10, *Transportation*.

Implementation of the sediment mitigation plan described in Section 2.3.1.16, *Monitoring and Mitigation Plans*, would minimize sediment delivery from roads to streams. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USFS 2012). At the end of operations, all mine alternatives would consider decommissioning of roads no longer needed for operations.

4.11.9.3 National Forest Management Act/Kootenai Forest Plan

4.11.9.3.1 Forest Service Sensitive Species Statement of Findings

This analysis serves as the BE for effects of Alternative V on Forest Service sensitive aquatic species. Implementing Alternative V *may impact westslope cutthroat trout individuals or habitat within the study area, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species*. Alternative V *would have no impact on the western pearlshell* because suitable habitat conditions are not available in study area streams.

The baseflow reductions in East Fork Rock Creek and the East Fork Bull River would reduce habitat availability for westslope cutthroat trout, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species. Most subpopulations in the study area are currently hybridized to some extent, and this would continue to be a risk to westslope cutthroat trout populations. Partial and temporary barriers to migration in the lower and middle reaches of Rock Creek may increase in frequency or be longer in duration as a result of flow depletions at baseflow conditions. The natural migratory barriers caused by seasonal dewatering in reaches of mainstem Rock Creek may further prevent hybridization of native and nonnative fish and resource competition by nonnative species that are virtually absent from West Fork Rock Creek and East Fork Rock Creek below Rock Lake. Therefore, a decrease in flows may have a mixed, but unpredictable, effect on aquatic resources. The impact of reductions in baseflow on westslope cutthroat trout habitat in the Bull River and East Fork Bull River would be lower than in Rock Creek because baseflow is higher in these streams and they have fewer migratory barriers and intermittency concerns. Potential baseflow reductions may be less detrimental to westslope cutthroat trout habitat than to bull trout habitat because westslope cutthroat trout spawning and migration does not typically coincide with baseflow conditions (Muhlfeld et al. 2009) as it does for bull trout.

Clearing of trees and vegetation and soil disturbance during Phase I Evaluation and Phase II Construction would increase the risk of sediment delivery to Rock Creek. Potential sediment loading would be expected to decrease following these activities as vegetation is reestablished and exposed surfaces are stabilized. While increased sediment loading to habitat is a risk of Alternative V, sediment mitigation and monitoring would ensure that westslope cutthroat trout habitat was protected from elevated fine sediments in stream substrates.

4.11.9.3.2 Riparian Habitat Conservation Areas

Alternative V would be consistent with 2015 KFP components pertaining to riparian habitat. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record. This section discusses consistency with 2015 KFP riparian standards and guidelines relevant to Alternative V, as listed below.

INFS standards for RHCAs:

- Minerals management (MM-3)
- General riparian area management (RA-4)

Three additional standards for RHCAs:

- General riparian area management (RIP-01)
- General riparian area management (RIP-02)
- General riparian area management (RIP-03)

INFS guidelines for RHCAs:

- Roads management (RF-1 through RF-5)
- Minerals management (MM-1, MM-2, and MM-6)
- Lands (LH-3 and LH-4)
- General riparian area management (RA-1 through RA-4)
- Watershed and habitat restoration (WR-1 and WR-2)
- Fisheries and wildlife restoration (FW-1 and FW-4)

Road Management Guideline RF-1

Cooperate with federal, tribal, state, and county agencies, and cost-share partners to achieve consistency in road design, operation, and maintenance necessary to attain RMOs.

Alternative V was designed in a accordance with this guideline. As described in the Aquatics and Fisheries Mitigation Plan in Section 2.3.1.16, *Monitoring and Mitigation Plans*, Alternative V includes restoration components to contribute toward achieving forestwide desired conditions for riparian habitat. The Rock Creek Project would avoid adverse effects on inland native fish and avoid effects that would retard or prevent attainment of the RMOs. The Rock Creek Project cooperated with federal and state fish management agencies for the development of the fisheries mitigation plan associated with the project. To evaluate pre- and post-project riparian conditions, RCR would, in consultation with the Rock Creek Watershed Council, Forest Service, and USFWS, update the watershed assessment with any new data collected prior to the initiation of Phase II Construction and update mitigation and monitoring plans, if appropriate. RCR would be required to implement a stream habitat enhancement program to improve the ability of bull trout to move throughout the year in Rock Creek and increase habitat availability and diversity for migratory and resident bull trout populations. Whenever possible, these mitigations would be coordinated with work being done by Avista or the local watershed council to avoid duplication of efforts. Tribal consultation conducted until 2003 is described on pages 25-27 of the 2003 ROD. The tribes would be provided an opportunity to participate in Technical Advisory groups that evaluated monitoring.

Road Management Guideline RF-2

For each existing or planned road, meet the Riparian Management Objectives and avoid adverse effects to inland native fish by:

a. Completing watershed analyses prior to construction of new roads or landings in Riparian Habitat Conservation Areas within priority watersheds.

b. Minimizing road and landing locations in Riparian Habitat Conservation Areas.

c. Initiating development and implementation of a Road Management Plan or a Transportation Management Plan. At a minimum, address the following items in the plan:

1. Road design criteria, elements, and standards that govern construction and reconstruction.

2. Road management objectives for each road.

3. Criteria that govern road operation, maintenance, and management.

4. Requirements for pre-, during-, and post-storm inspections and maintenance.

5. Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives.

6. Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control.

7. Mitigation plans for road failures.

d. Avoiding sediment delivery to streams from the road surface.

1. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe.

2. Route road drainage away from potentially unstable stream channels, fills, and hillslopes.

e. Avoiding disruption of natural hydrologic flow paths.

f. Avoiding sidecasting of soils or snow. Sidecasting of road material is prohibited on road segments within or abutting RHCAs in priority watersheds.

Alternative V was designed in accordance with all RF-2 guidelines. In 1997, Watershed Consulting prepared a report (*1996 Field Data Summary Report for Rock Creek Near Noxon, Montana*) that addressed aquatic habitat issues raised during the environmental review for the proposed Rock Creek Project pursuant to the ESA, NEPA, NFMA, and MEPA. The Watershed Consulting (1997) report addressed streamflows, substrate composition, sediment sources, LWD, fish populations and distribution, and potential bull trout spawning habitat. In 2012, Salmon Environmental Services prepared a report (*Rock Creek Fisheries and Aquatic Habitat Assessment Supplement*) that incorporates data collected in the Rock Creek drainage since 1997 and provides information that addresses changes in management and legal direction implemented since 1997. The Watershed Consulting (1997) and Salmon Environmental Services (2012) reports meet the intent of INFS watershed analysis direction.

Road widths in all new and reconstructed roads would be the minimum necessary to provide for safe and efficient use.

In Alternative V, the rerouting of a segment of NFS road #150 away from Rock Creek would improve riparian conditions. The NFS road #150 realignment was further modified from the original design described in the 2001 FEIS to avoid RHCAs. In Alternative V, RCR would minimize impacts from road crossings in RHCAs and would implement BMPs to minimize sediment delivery to crossed streams. RCR would develop for the KNF's and DEQ's approval and implement a RMP for Phase II that would describe for all new or reconstructed roads used for the mine 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
- Analysis of any new road constructed in a RHCA, documenting it was the minimum necessary for the approved mineral activity

The RMP would describe management of road surface materials during plowing, such as snow, and methods to control road ice. Sidecasting of soils or snow would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs. All road improvements, realignments, or modifications, including stream crossings, would be constructed in compliance with INFS standards (USFS 1995) and all new or improved bridges or culverts would be built to accommodate a 100-year flood event. Reconstructed bridges over Rock Creek would be realigned nearly perpendicular to the stream. The existing culvert on the West Fork Rock Creek above the last bridge on NFS road #150 has been identified as a barrier to fish migration; RCR would improve or replace this culvert as determined in consultation with the Forest Service. Details of the RMP are provided in Section 2.3.1.10, *Transportation*.

Implementation of the sediment mitigation plan described in Section 2.3.1.16, *Monitoring and Mitigation Plans*, would minimize sediment delivery from roads to streams. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USFS 2012).

Road Management Guideline RF-3

Determine the influence of each road on the Riparian Management Objectives. Meet Riparian Management Objectives and avoid adverse effects on inland native fish by:

a. Reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or that have been shown to be less effective than designed for controlling sediment delivery, or that retard attainment of Riparian Management Objectives, or do not protect priority watersheds from increased sedimentation.

b. Prioritizing reconstruction based on the current and potential damage to inland native fish and their priority watersheds, the ecological value of the riparian resources affected, and the feasibility of options such as helicopter logging and road relocation out of Riparian Habitat Conservation Areas.

c. Closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to inland native fish in priority watersheds, and the ecological value of the riparian resources affected.

Alternative V would avoid impacts on RHCAs to the extent practicable and was designed in accordance with this guideline. In Alternative V, the rerouting of a segment of NFS road #150 away from Rock Creek would improve riparian conditions. The Alternative V mill site disturbance boundary and the NFS road #150 realignment were modified from the original design described in the 2001 FEIS to avoid RHCAs. Compliance with RF-3 would be achieved by controlling sediment delivery through BMPs on new or reconstructed roads, reconstructing drainage features on existing roads if necessary, and, if determined by the KNF to be necessary, obliterating and reclaiming a portion of NFS road #150B after mine closure. Road design features and BMPs designed to INFS riparian goals include paving a reconstructed segment of the main access road and paste tailings facility service road; gravelling improved segments of main access roads; performing regular maintenance of unimproved roads, to be specified in the RMP to be developed by RCR; constructing bridges on main stream crossings versus culverts; and, where the Phase I powerline and pipeline would cross Rock Creek, jacking or drilling the conduit under the stream. Implementation of the sediment mitigation plan described in Section 2.3.1.16, *Monitoring and Mitigation Plans* would minimize sediment delivery from roads to streams. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USFS 2012). Phase I sediment mitigation measures would include:

- Installing water diversion structures (e.g., rolling dips, open tops, or rubber flaps)
- Implementing sediment delivery mitigation in the form of slash filter windrows or settling basins installed at the outfall of each newly constructed water diversion structure
- Installing two new culverts on the Chicago Peak Road (NFS road #2741) at current stream ford locations
- Applying new 4- to 6-inch gravel surface to road segments between the new diversion structures and stream crossings
- Installing ditch relief culverts or cross drains to alleviate excess road drainage to streams
- Installing erosion-control fabric and rock-lined ditches
- Hydromulching disturbed ground to ensure quick revegetation

All road improvements, realignments, or modifications, including stream crossings, would be constructed in compliance with 2015 KFP INFS direction and all new or improved bridges or culverts would be built to accommodate a 100-year flood event. Reconstructed bridges over Rock Creek would be realigned

nearly perpendicular to the stream. The existing culvert on the West Fork Rock Creek above the last bridge on NFS road #150 has been identified as a barrier to fish migration; RCR would improve or replace this culvert as determined in consultation with the Forest Service.

Road Management Guideline RF-4

Construct new, and improve existing, culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those improvements would/do pose a substantial risk to riparian conditions. Substantial risk improvements include those that do not meet design and operation maintenance criteria, or that have been shown to be less effective than designed for controlling erosion, or that retard attainment of Riparian Management Objectives, or that do not protect priority watersheds from increased sedimentation. Base priority for upgrading on risk in priority watersheds and the ecological value of the riparian resources affected. Construct and maintain crossings to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

In Alternative V, all road improvements, realignments, or modifications, including stream crossings, would be constructed in compliance with 2015 KFP INFS direction and all new or improved bridges or culverts would be built to accommodate a 100-year flood event. Reconstructed bridges over Rock Creek would be realigned nearly perpendicular to the stream. The existing culvert on the West Fork Rock Creek above the last bridge on NFS road #150 has been identified as a barrier to fish migration; RCR would improve or replace this culvert as determined in consultation with the Forest Service.

Implementation of the sediment mitigation plan described in Section 2.3.1.16, *Monitoring and Mitigation Plans* would minimize sediment delivery from roads to streams. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USFS 2012). Therefore, Alternative V was designed in accordance with this guideline.

Road Management Guideline RF-5

Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.

Alternative V compliance with RF-5 would be the same as RF-4 (see previous discussion).

Minerals Management Guideline MM-1

Minimize adverse effects to inland native fish species from mineral operations. If a Notice of Intent indicates that a mineral operation would be located in a Riparian Habitat Conservation Area, consider the effects of the activity on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. For operations in a Riparian Habitat Conservation Area ensure operators take all practicable measures to maintain, protect, and rehabilitate fish and wildlife habitat which may be affected by the operations. When bonding is required, consider (in the estimation of bond amount) the cost of stabilizing, rehabilitating, and reclaiming the area of operations.

Alternative V incorporates modifications and mitigations for RCR's proposed alternative (Alternative II) that are alternatives to siting facilities in RHCAs. In Alternative V, the rerouting of a segment of NFS road #150 away from Rock Creek would improve riparian conditions. The Alternative V mill site disturbance boundary and the NFS road #150 realignment were modified from the original design described in the 2001 FEIS to avoid RHCAs. The Alternative V paste tailings facility disturbance footprint was also modified to eliminate impacts on isolated wetlands on NFS land, which reduced impacts on RHCAs. Approximately 2 acres of RHCA would be affected within the Alternative V mine disturbance areas (Figure 4-6). Most effects would occur where riparian vegetation would be cleared along reconstructed or improved access routes and bridges. Less than 1 acre of RHCA within a 100-foot buffer of jurisdictional

wetlands would be cleared for construction of the bridge over Engle Creek and at the junction of the reconstructed NFS road #150 with Montana Highway 200. RHCAs would not be affected at the Alternative V mill site. As described in Chapter 2, an unaltered vegetation buffer would be left between Rock Creek and the road and utility corridors where possible to protect bull trout habitat, and there would be a 300-foot buffer between the mill site and streams. Clearing associated with the powerline would affect about 10 acres of RHCAs. Although hazardous trees would be cleared in the powerline corridor, impacts on nonhazardous trees, brush, and herbaceous vegetation would be temporary. This SEIS considers the effects of all alternatives on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. The KNF would share responsibility with DEQ to monitor and inspect the Rock Creek Project, and the KNF has authority to approve a Plan of Operations that includes all necessary modifications to ensure that impacts on surface resources would be minimized. These modifications are incorporated in Alternative V.

The KNF and DEQ would collect a reclamation bond from RCR to ensure the land affected by the mining operation was properly reclaimed. The joint reclamation bond would be held by DEQ to ensure compliance with the reclamation plan associated with the DEQ Operating Permit and the Plan of Operations. The KNF may require an additional bond if it is determined that the bond held by DEQ was not adequate to reclaim NFS land or was administratively unavailable to meet KNF requirements. Therefore, Alternative V was designed in accordance with this guideline.

Minerals Management Guideline MM-2

Locate structures, support facilities, and roads outside Riparian Habitat Conservation Areas. Where no alternative to siting facilities in Riparian Habitat Conservation Areas exists, locate and construct the facilities in ways that avoid impacts on Riparian Habitat Conservation Areas and streams and adverse effects on inland native fish. Where no alternative to road construction exists, keep roads to the minimum necessary for the approved mineral activity. Close, obliterate and revegetate roads no longer required for mineral or land management activities.

Alternative V incorporates modifications and mitigations for RCR's proposed alternative (Alternative II) that are alternatives to siting facilities in RHCAs. In Alternative V, the rerouting of a segment of NFS road #150 away from Rock Creek would improve riparian conditions. The Alternative V mill site disturbance boundary and the NFS road #150 realignment were modified from the original design described in the 2001 FEIS to avoid RHCAs. The Alternative V paste tailings facility disturbance footprint was also modified to eliminate impacts on isolated wetlands on NFS land, which reduced impacts on RHCAs. No alternatives exist that eliminate the need to site facilities in RHCAs. Alternative V would minimize effects on RHCAs and inland native fish. Because no alternative to road construction existed, RCR would develop a RMP that analyzes any new road constructed in a RHCA, documenting that it was the minimum necessary for the approved mineral activity. Roads no longer required for mineral or land management activities would be placed into intermittent stored service or decommissioned (see INFS guideline RF-3). Therefore, Alternative V was designed in accordance with this guideline.

Minerals Management Standard MM-3

Prohibit solid and sanitary waste facilities in Riparian Habitat Conservation Areas. If no alternative to locating mine waste (waste rock, spent ore, tailings) facilities in Riparian Habitat Conservation Areas exists, and releases can be prevented and stability can be ensured, then:

a. Analyze the waste material using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics.

b. Locate and design the waste facilities using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. If the best conventional technology is not sufficient to prevent such releases and ensure stability over the long term, prohibit such facilities in Riparian Habitat Conservation Areas.

c. Monitor waste and waste facilities to confirm predictions of chemical and physical stability, and make adjustments to operations as needed to avoid adverse effects to inland native fish and to attain Riparian Management Objectives.

d. Reclaim and monitor waste facilities to assure chemical and physical stability and revegetation to avoid adverse effects to inland native fish, and to attain the Riparian Management Objectives.

e. Require reclamation bonds adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities.

Alternative V was designed in exact accordance with standard MM-3. Section 2.4, *Part III: Alternatives Considered but Dismissed from Further Study* discusses the KNF's and DEQ's analysis of alternative tailings disposal methods and locations. Compliance with INFS was a key criterion in the alternatives analysis. The KNF and DEQ developed Alternative V to minimize the extent to which RHCAs would be affected. As described for MM-2, no alternatives exist that eliminate the need to site facilities in RHCAs.

The Alternative V mill site would be constructed from nonalteration zone waste rock and tailings would be deposited in a paste tailings facility. The waste material (waste rock and tailings) has been analyzed using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics. The waste analysis results are discussed in Section 3.6, *Environmental Geochemistry*. In Alternative V, RCR would evaluate waste rock and tailings geochemistry and tailings seepage water quality, as described in detail in the Geochemistry Sampling and Analysis Plan and the Water Resources Monitoring Plan in Appendix K.

The paste tailings facility in all mine alternatives would be located and designed using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. Acid generation of the tailings would be unlikely, but tests of metal mobility and monitoring at the Troy Mine suggest that some metals would be mobile in tailings effluent at a near-neutral pH. The Geochemistry Sampling and Analysis Plan and the Water Resources Monitoring Plan in Appendix K include monitoring alert levels and trigger values and contingency and corrective action measures in the event alert levels or trigger values were reached.

As described in Appendix P of the 2001 FEIS, the Failure Modes Effects Analysis addressed the stability of the paste tailings facility dams through a series of minimum allowable safety factors against failure for static and dynamic loading conditions of the facilities. Alternative V design criteria are industry design standards for dam design and construction and have been established as measures of certainty for the design of safe earth and rock fill dams.

The Alternative V reclamation plan is described in Section 2.3.1.15, *Reclamation*. RCR would be required to submit an updated detailed reclamation plan for all mine facilities that would be submitted for the Agencies' review and approval before mine construction. Short-term reclamation objectives are to stabilize disturbed areas and prevent air and water pollution. The long-term reclamation objective is to establish a post-operational environment compatible with existing land uses and consistent with the 2015 KFP. Specific reclamation objectives include: 1) Permanent protection for air, surface water, and groundwater resources; 2) Protection of public health and safety by removing potential hazards; 3) Maintenance of public access through the Rock Creek Project study area; 4) Restoration of wildlife

habitat; 5) Design of a land configuration compatible with the watershed; 6) Reestablishment of an aesthetic environment allowing for visual quality and recreational opportunities; and 7) Reestablishment of post-operation biological resources suitable for supporting vegetative cover appropriate to the area. To accomplish these objectives in Alternative V, RCR would develop and implement a final RMP and a VMP; implement interim and post-mine stabilization of most disturbed areas; follow measures described under Sediment and Erosion Control; and, after mining, reclaim all disturbed areas by recontouring and redistributing soil and revegetating.

If geochemical testing indicated that waste rock was suitable for use as construction material, as defined in Appendix K, the 1 million tons of waste rock would be used to construct the mill site pad. Any additional suitable waste rock would be used to construct the foundation of the paste tailings facility and the paste tailings facility toe buttresses. If geochemical testing indicated that waste rock was unsuitable for construction, as defined in Appendix K, the mill pad and paste tailings facility would be constructed from borrow material from within the paste tailings facility area. To the extent feasible, all unsuitable waste rock would be disposed of in the underground mine below the groundwater table to prevent oxidation. If unsuitable waste rock was encountered before appropriate underground storage was available, it would be stored in an approved waste storage area within the paste tailings facility storage footprint with stormwater controls and an appropriate cap. Any unsuitable waste rock not disposed of underground would be disposed of off-site under governing solid waste regulations.

The KNF and DEQ would require a reclamation bond adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities (see discussion of INFS standard MM-1).

Minerals Management Guideline MM-6

Develop inspection, monitoring, and reporting requirements for mineral activities. Evaluate and apply the results of inspection and monitoring to modify mineral plans, leases, or permits as needed to eliminate impacts that prevent attainment of Riparian Management Objectives and avoid adverse effects on inland native fish.

Alternative V was designed in accordance with MM-6. Alternative V would follow all inspection, monitoring, and reporting requirements for mineral activities developed by the KNF and DEQ. RCR would evaluate and apply the results of inspection and monitoring described in Appendix K to modify mineral plans, leases, or permits as needed to eliminate impacts that prevent attainment of RMOs and avoid adverse effects on inland native fish.

Lands Guideline LH-3

Issue leases, permits, rights-of-way, and easements to avoid effects that would retard or prevent attainment of the Riparian Management Objectives and avoid adverse effects on inland native fish. Where the authority to do so was retained, adjust existing leases, permits, rights-of-way, and easements to eliminate effects that would retard or prevent attainment of the Riparian Management Objectives or adversely affect inland native fish. If adjustments are not effective, eliminate the activity. Where the authority to adjust was not retained, negotiate to make changes in existing leases, permits, rights-of-way, and easements to eliminate effects that would prevent attainment of the Riparian Management Objectives or adversely affect inland native fish. Priority for modifying existing leases, permits, rights-of-way, and easements would be based on the current and potential adverse effects on inland native fish and the ecological value of the riparian resources affected.

Alternative V was designed in accordance with this guideline (see discussion of consistency with MM-1 above) and would be consistent with LH-3. The KNF issuance of any permit or approval associated with

the Rock Creek Project would avoid effects that would retard or prevent attainment of the RMOs and avoid adverse effects on inland native fish.

Lands Guideline LH-4

Use land acquisition, exchange, and conservation easements to meet RMOs and facilitate restoration of fish stocks and other species at risk of extinction.

Alternative V was designed in accordance with LH-4. Alternative V was designed in accordance with this guideline because it contributes to the recovery of threatened and endangered species through mitigation described in Section 2.3.1.16, *Monitoring and Mitigation Plans*, that includes land acquisition and road decommissioning.

General Riparian Area Management Guideline RA-1

Identify and cooperate with federal, tribal, state and local governments to secure instream flows needed to maintain riparian resources, channel conditions, and aquatic habitat.

Alternative V was designed in accordance with this guideline. Section 4.8, *Water Rights* describes consistency of Alternative V with this guideline.

General Riparian Area Management Guideline RA-2

Trees may be felled in Riparian Habitat Conservation Areas when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives.

In Alternative V, RCR would minimize disturbance during clearing and construction, prepare a VMP, and retain nonhazardous trees and brush in the utility corridor right-of-way. Consistency with RA-2 would be achieved through minimizing tree cutting in RHCAs and favoring riparian species and hardwoods. Although some trees in RHCAs may be removed in the Alternative V disturbance area, timber harvest is not among the objectives of Alternative V. Alternative V was designed in accordance with RA-2.

General Riparian Area Management Guideline RA-3

Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.

Alternative V was designed in accordance with RA-3. RCR submitted a Weed Management Plan that addresses all Phase I and Phase II disturbances to Sanders County in April 2007. The plan would be modified as described in Section 2.3.1.15, *Reclamation*, and submitted to the KNF and DEQ during final design for their approval. Following KNF's and DEQ's approval of the final Weed Management Plan, RCR would submit it to the Sanders County Weed Control District. These measures would be applied to all permit areas.

Measures outlined in RCR's Weed Management Plan approved by the Sanders County Weed Control District would be followed during operations and reclamation. All herbicides used in the study area would be approved for use in the KNF, and would be applied according to the labeled rates and recommendations to ensure the protection of surface water, ecological integrity, and public health and safety. RCR also would implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS (USFS 2007b) for all weed-control measures. These measures would ensure that herbicides, pesticides, and other toxicants and chemicals were used in a manner that would not retard or prevent attainment of RMOs and would avoid adverse effects on inland native fish.

General Riparian Area Management Standard RA-4

Prohibit storage of fuels and other toxicants within Riparian Habitat Conservation Areas. Prohibit refueling within Riparian Habitat Conservation Areas unless there are no other alternatives. Refueling sites within a Riparian Habitat Conservation Area must be approved by the Forest Service or Bureau of Land Management and have an approved spill containment plan.

As described on page 2-100 of the 2001 FEIS, fuel would be stored in a 500-gallon aboveground storage tank in a lined containment structure in the paste tailings facility disturbance footprint. No fuel would be stored within a RHCA. Alternative V was designed in exact accordance with RA-4.

Watershed and Habitat Restoration Guideline WR-1

Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species and contributes to attainment of Riparian Management Objectives.

The Alternative V aquatics and fisheries mitigation and monitoring plans, described in Section 2.3.1.16, *Monitoring and Mitigation Plans*, and the Aquatics and Fisheries Monitoring Plan described in Appendix K, would promote the long-term ecological integrity of ecosystems, conserve the genetic integrity of native species, and contribute to attainment of the RMOs. Implementation of the sediment mitigation plan would reduce sediment to area creeks and contribute to attainment of the RMOs. Therefore, Alternative V was designed in accordance with this guideline.

Watershed and Habitat Restoration Guideline WR-2

Cooperate with federal, state, local, and tribal agencies, and private landowners to develop watershed-based Coordinated Resource Management Plans (CRMPS) or other cooperative agreements to meet RMOs.

Alternative V was designed in accordance with WR-2 for the reasons described above for RF-1.

Fisheries and Wildlife Restoration Guideline FW-1

Design and implement watershed fish and wildlife habitat restoration and enhancement actions in a manner that contributes to attainment of the Riparian Management Objectives.

Alternative V was designed in accordance with FW-1 for the reasons described above for WR-1.

Fisheries and Wildlife Restoration Guideline FW-4

Cooperate with federal, tribal, and state fish management agencies to identify and eliminate adverse effects on inland native fish associated with habitat manipulation, fish stocking, fish harvest, and poaching.

Alternative V was designed in accordance with FW-4 for the reasons described above for RF-1.

Riparian (FW-STD-RIP-01)

When RHCAs are intact and functioning at desired condition, then management activities shall maintain or improve that condition. Short-term effects (effects that occur during, or immediately following, implementation of activity) from activities in the RHCAs may be acceptable when those activities support long-term benefits (benefits that occur following completion of the activity) to the RHCAs and aquatic resources.

Of the 20,743 acres of RHCAs in the Rock Creek watershed, about 2 acres, or less than 0.01%, would be within the Alternative V disturbance footprint. Most effects would occur where riparian vegetation would be removed along reconstructed or improved access routes and bridges. About 10 acres of powerline corridor would be within a RHCA. Clearing associated with the powerline would consist of removal of hazardous trees; minimum ground disturbance would occur in the clearing area and impacts on nonhazardous trees, brush, and herbaceous vegetation would be temporary. The minimal vegetation removal does not affect the overall functionality of the RHCAs within the affected stream reaches. Implementation of BMPs, the NFS road #150 realignment, and improved stream crossings all support long-term benefits to aquatic resources. Therefore, Alternative V was designed in exact accordance with this standard.

Alternative V incorporates modifications and mitigations for RCR's proposed alternative (Alternative II) that are alternatives to siting facilities in RHCAs. The Alternative V mill site disturbance boundary and the NFS road #150 realignment were modified from the original design described in the 2001 FEIS to avoid RHCAs. The Alternative V paste tailings facility disturbance footprint was also modified to eliminate impacts on isolated wetlands on NFS land, which reduced impacts on RHCAs. No alternatives exist that eliminate the need to site facilities in RHCAs. Alternative V would minimize effects on RHCAs and inland native fish. An unaltered vegetation buffer would be left between Rock Creek and the road and utility corridors where possible to protect bull trout habitat, and there would be a 300-foot buffer between the mill site and streams. RCR would minimize impacts from road crossings in RHCAs and would implement BMPs to minimize sediment delivery to crossed streams. RCR would develop for the KNF's and DEQ's approval and implement a Road Management Plan for Phase II. The rerouting of a segment of NFS road #150 away from Rock Creek would also improve riparian conditions.

This SEIS considers the effects of all alternatives on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. The KNF would share responsibility with DEQ to monitor and inspect the Rock Creek Project, and the KNF has authority to approve a Plan of Operations that includes all necessary modifications to ensure that impacts on surface resources would be minimized. These modifications are incorporated into Alternative V.

Riparian (FW-STD-RIP-02)

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

Where RHCAs in the study area are not intact and not functioning at the desired condition, Alternative V was designed in exact accordance with this standard for the reasons described above for FW-STD-RIP-01.

FW-STD-RIP-03

The INFS direction in the Decision Notice (USDA Forest Service, 1995) and terms and conditions in the Biological Opinion (US Fish and Wildlife Service, 1998) shall be applied, with the following clarifications (see appendix B):

INFS Priority Watersheds have been added to and adapted into Conservation and Restoration Watersheds;

The description of Standard Widths Defining Interim RHCAs is consistent for all Category 4 streams or water bodies: The area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest;

Site-specific widths can be changed (increased where necessary to achieve management goals and objectives, or decreased where interim widths are not needed to attain RMOs or avoid adverse effects) and requires documentation of rationale supporting the change, but does not require watershed analysis or an amendment; and

These INFS "standards and guidelines" are defined as standards: TM-1, MM-3, MM-4, MM-5, and RA-4. All others are defined as guidelines.

This standard incorporates and clarifies the 1995 INFS into the 2015 KFP. Alternative V is consistent with the standards and guidelines in the INFS, including these clarifications, as discussed above. Priority watersheds and standard RHCA widths are discussed in Section 3.11, *Aquatic Life and Fisheries*. Therefore, Alternative V is designed in exact accordance with this standard.

4.12 Biodiversity of Wildlife Habitat/Vegetation and Wildlife Species (Biodiversity)

The analysis of effects on biodiversity was updated to include new information since the 2001 FEIS was issued: the current Forest Service Region 1 list of sensitive plant and animal species, MNHP list of species of special concern, changes in the state and county noxious weed lists, 2015 KFP direction, and population information for several species, as well as modifications to Alternative V. Updated maps have been included for elk security and for elk, white-tailed deer, bighorn sheep, and mountain goat winter range in the study area. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on biodiversity in the study area. The Agencies did not identify any incomplete or unavailable information. This section updates the *Environmental Consequences* section for wildlife habitat, vegetation, and wildlife species and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously in the 2001 FEIS. The remainder of the analysis in the 2001 FEIS (pages 4-137 through 4-173) is unchanged.

4.12.1 Summary

Impacts on biodiversity from Alternative V would generally be the same as described in the 2001 FEIS, with a few exceptions. Minor modifications were made to Alternative V since the 2001 FEIS was issued, primarily to reduce impacts on RHCAs and wetlands, including reconfigured evaluation adit, mill site, and paste tailings impoundment layouts and a slight change in the NFS road #150 realignment. Under Alternative V, 445 acres of wildlife habitat would be lost and 36 acres cleared for the powerline. Relative to effects disclosed in the 2001 FEIS, minor modifications to Alternative V would slightly increase disturbance to wildlife habitat and vegetation communities at the evaluation adit, mill site, and along the realigned section of NFS road #150 and slightly decrease disturbance to wildlife habitat and vegetation communities at the paste tailings facility. After taking into account slight increases in disturbance due to these modifications, Alternative V remains the alternative with the least impact on biodiversity, with the exception of Alternative I.

As described in the 2001 FEIS, Alternatives II, III, and IV would have greater impacts on biodiversity than Alternative V, including two Forest Service sensitive species (harlequin duck and fisher) and/or their habitats, and old growth habitat. Alternatives II, III, and IV are unchanged since the issuance of the 2001 FEIS. Pages 4-142 through 4-160 of the 2001 FEIS provide a detailed discussion of the effects of these four alternatives.

As described on pages 4-138 through 4-132 of the 2001 FEIS, Alternative I would have the least impact on biodiversity, including wildlife and vegetation resources, except for impacts resulting from the potential sale of RCR lands to the United States.

4.12.2 Alternative V

4.12.2.1 Wildlife Habitat/Vegetation

4.12.2.1.1 Plant Species of Special Concern

Impacts on plant species of special concern would be the same as described for Alternative V on page 4-161 of the 2001 FEIS, except that impacts on species added to the Forest Service sensitive species list since 2001 were not addressed. Suitable habitat for tapertip onion, Washington monkey flower, and bank money flower is present in the study area. Additional surveys for species added to the sensitive species list after the 2001 FEIS would be conducted prior to any project ground disturbance. If these species occur in the study area and they cannot be avoided during construction, additional mitigation measures would be needed. Minor increases in surface disturbance due to minor modifications of Alternative V would result

in a slightly greater potential for impacts on plant species of special concern at the evaluation adit, mill site, and along the NFS road #150 alignment. Mitigation measures described in the 2001 FEIS on pages 4-156 and 4-157 would be implemented to reduce impacts.

4.12.2.1.2 Plant Species Changes at Springs and Seeps

Potential effects of Alternative V on plant species associated with springs and seeps are discussed in Section 4.10, *Wetlands and Nonwetland Waters of the U.S.*

4.12.2.1.3 Noxious Weeds

Impacts from noxious weeds would be the same for Alternative V as described on page 4-162 of the 2001 FEIS, except that slightly more area would be disturbed. The minor modifications to Alternative V would result in a small increase in the Alternative V disturbance to vegetation at the evaluation adit, mill site, and along the NFS road #150 realignment. Additional ground disturbance could increase the potential for the spread of noxious weeds. Four additional noxious weed species (white briony, meadow knapweed, dwarf snapdragon, and cheatgrass) that may potentially occur in the study area were added to the Montana noxious weed list, and additional weed control measures would be required prior to project ground disturbance if any of these species were identified in the study area during monitoring. Noxious weed monitoring is described in Section 2.3.1.15, *Reclamation*.

4.12.2.1.4 Wildlife Habitat/Vegetation Communities

Impacts on wildlife habitat and vegetation communities are described on page 4-162 of the 2001 FEIS. Relative to effects disclosed in the 2001 FEIS, minor modifications to Alternative V would slightly increase disturbance to wildlife habitat and vegetation communities at the evaluation adit, mill site, and along the realigned section of NFS road #150 and slightly decrease disturbance to wildlife habitat and vegetation communities at the paste tailings facility.

4.12.2.1.5 Old Growth Habitat

In Alternative V, less than 1 acre of old growth along NFS road #150 would be lost. Minor modifications to Alternative V such as slight increases in the area of disturbance at the exploration adit, mill site, and realignment of NFS road #150 would not affect old growth habitat.

4.12.2.2 Wildlife Species

4.12.2.2.1 Wildlife Species in General

Effects on wildlife species in general from Alternative V are described on page 4-163 of the 2001 FEIS. Relative to effects disclosed in the 2001 FEIS, minor modifications to Alternative V would slightly increase disturbance to wildlife habitat and vegetation communities at the evaluation adit, mill site, and along the realigned section of NFS road #150 and slightly decrease disturbance to wildlife habitat and vegetation communities at the paste tailings facility. Overall, changes in habitat affected would be negligible. Impacts on sensitive wildlife species and other selected wildlife groups are described below.

4.12.2.2.2 Forest Service Sensitive Wildlife Species

Peregrine Falcon. Potential impacts on peregrine falcons are described on page 4-167 of the 2001 FEIS. As described in Section 3.12.3.1, *Forest Service Sensitive Wildlife Species*, the number of peregrine falcons in Montana and in the Cabinet Ranger District is increasing. Alternative V would not create a significant trend toward federal listing of the peregrine falcon. The slight increases in Alternative V surface disturbance would have no effect on peregrine falcons because no peregrine falcon nesting or foraging habitat would be affected by the Rock Creek Project.

Bald Eagle. The potential effects on bald eagles and mitigation measures under Alternative V are described on pages 4-187 and 4-188 of the 2001 FEIS. Changed conditions since the 2001 FEIS include a continued increase in bald eagle use of the Clark Fork River and establishment of a bald eagle nest 1.5 miles from the mouth of Rock Creek in 2007. The Bald Eagle Management Guidelines require timing restrictions for certain activities within a ½-mile buffer of an active bald eagle nest (Montana Bald Eagle Working Group 2010). Because the nearest bald eagle nest is 1.5 miles away, impacts on nesting eagles are expected to be negligible. As described in Section 3.12.3.1, *Forest Service Sensitive Wildlife Species*, bald eagle populations along the Clark Fork River near the study area have been increasing. Alternative V would not affect this upward population trend. The negligible changes in habitat disturbance associated with minor modifications to Alternative V would not substantially add to impacts on bald eagles because eagles in the study area are mostly found along the Clark Fork River corridor.

Gray Wolf. Impacts on gray wolves under Alternative V are described on page 4-188 of the 2001 FEIS. As described in Section 3.12.3.1, *Forest Service Sensitive Wildlife Species*, the number of wolves in the KNF has increased since the 2001 FEIS was issued. As described in the 2001 FEIS, the study area does not contain suitable denning or rendezvous sites. Minor modifications to Alternative V since the 2001 FEIS was issued would not affect the regional upward trend in wolf populations.

Wolverine. As described above in Section 3.12, *Biodiversity of Wildlife Habitat/Vegetation and Wildlife Species (Biodiversity)*, wolverine habitat conditions in the Rock Creek Project study area are unchanged since the 2001 FEIS, thus no additional analysis was needed. Direct and indirect impacts on wolverines and their habitat under Alternative V are described on page 4-166 of the 2001 FEIS. The slight increase in disturbance area at the evaluation adit in the modified Alternative V would slightly reduce the amount of habitat available for wolverines. The increased disturbance at the mill site and along NFS road #150 would not substantially affect wolverines because these areas are low-quality habitat for wolverines. Alternative V grizzly bear mitigation measures also would benefit wolverines by potentially protecting wolverine habitat from development and would compensate for the slight increases in impacts.

Bighorn Sheep. The direct effect on bighorn sheep would be a minor loss of habitat at the evaluation adit. Potential impacts on bighorn sheep from all action alternatives would be similar, with the exception that Alternative V would impact an additional 2.3 acres as a result of modifications to avoid RHCAs near the evaluation adit. The majority of the study area is heavily forested and is not suitable habitat for bighorn sheep. It is possible that sheep from the Berray Mountain herd could occasionally occur in the Rock Creek Project study area. Indirect effects on sheep entering the Rock Creek Project study area may include disturbance from mine activities, primarily during the Construction Phase, that potentially could displace bighorn sheep from suitable habitat or reduce their ability to effectively use available habitat. During the Operations Phase, effects on bighorns from activity at the adit would decrease from the Evaluation Phase. Mortality risks from poaching and legal harvest of sheep would probably increase with the greater human accessibility and use of the area. Effects on bighorn sheep winter range are discussed below in Section 4.12.2.2.3, *Native Ungulates*.

Legal harvest of bighorn sheep is managed by the FWP in accordance with FWP's Bighorn Sheep Conservation Strategy (FWP 2010) and would continue to be in all alternatives. Following mine closure, any disturbance or displacement resulting from mine activities would cease. Because the majority of the Rock Creek Project study area is not suitable bighorn sheep habitat, and because the overall population trend for bighorns in the Cabinet Mountains since reintroduction has been increasing, Alternative V would not create a significant trend toward federal listing of the bighorn sheep.

Harlequin Duck. Potential effects on harlequin ducks from Alternative V are described on pages 4-163 through 4-166 of the 2001 FEIS. Proposed measures to mitigate effects are described in Section 2.3.1.16, *Monitoring and Mitigation Plans* of this SEIS. Modifications to Alternative V since the 2001 FEIS

includes realigning the Alternative V access road to reduce impacts on RHCAs. This modification would reduce effects on harlequin ducks by reducing impacts from traffic noise and the presence of humans and dogs near harlequin habitat, and would reduce the potential for a spill of mill reagents, petroleum products, or pipeline rupture that could directly affect harlequin ducks. Realigning the access road also would reduce the potential for indirect effects from a spill that could result in toxic effects on invertebrates that provide food for harlequin ducks.

As described in the 2001 FEIS, implementation of the design features and mitigations of Alternative V would reduce the indirect effects of a mine-related increase in human development. As described in Section 3.12.3.1, *Forest Service Sensitive Wildlife Species*, the lower Clark Fork River and tributaries support a small but stable population of harlequin ducks. Alternative V would not affect population trends and would not likely result in a significant trend toward federal listing of harlequin ducks.

Fisher. Potential effects on fishers and their habitat from Alternative V are described on page 4-166 of the 2001 FEIS. Minor modifications to Alternative V would not change the 2001 FEIS analysis of effects on fisher.

4.12.2.2.3 Native Ungulates

Elk Security

Elk security habitat makes up 36% of the Rock planning subunit (USFS 2013b). Elk security habitat would be unchanged during Phase I of Alternative V (KNF 2015c). Due to closure of NFS road #150B to the public during Phase II, elk security would increase by 30 acres. This increase would not change the percent of elk security habitat within the Rock planning subunit.

Ungulate Winter Range

Elk, Mule Deer, and White-Tailed Deer. Losses of winter range for elk and deer as a result of the Rock Creek Project would mostly occur within the footprint of the paste tailings facility, which is predominantly on private land, where the 2015 KFP guidelines do not apply. The remaining loss of winter range for elk and deer would occur within the disturbance footprint of the wastewater treatment plant, paste plant, and realigned section of NFS road #150 on KNF-managed lands. The winter range in these areas is affected by existing disturbance, such as fragmentation by Montana Highway 200, existing Forest Service roads, a powerline, train tracks, and Noxon Reservoir. Other human activity in the area includes the Rock Creek Gravel Pit on lower Rock Creek and a sawmill near Montana Highway 200.

Increased traffic along NFS road #150 and NFS road #150B associated with mine operations during the winter could disturb wintering elk, resulting in decreased use of winter range near the roads. Direct loss of winter range habitat would also occur from construction of the realigned section of NFS road #150, the paste tailings facility, and wastewater treatment plant. Increased human presence in these areas also could result in less winter use of these areas by elk.

After the realigned segment of NFS road #150 was built, the existing segment of NFS road #150 from just west of the Rock Creek crossing to Government Mountain Road would become NFS road #150B, would be gated at both ends, and would be restricted to mine-related traffic. NFS road #150B from the junction with realigned NFS road #150 to the paste tailings facility would be upgraded as a gravel road and used only for pipeline maintenance after mine production begins, substantially reducing traffic on this segment. Vehicle use of NFS road #150 during the winter could disturb wintering elk and deer, resulting in decreased use of winter range near the road. Direct loss of winter range habitat would also occur from construction of the realigned section of NFS road #150, the paste tailings facility, and wastewater

treatment plant. Increased human presence in these areas also could result in less winter use of these areas by elk and deer.

The area of elk, mule deer, and white-tailed deer winter range that would be disturbed (57 acres on NFS land and 288 acres on non-NFS land) is minimal relative to the amount of elk, mule deer, and white-tailed deer winter range available forestwide (367,465 acres, 354,883 acres, and 284,173 acres, respectively) (KNF 2015a).

Bighorn Sheep. The reroute of NFS road #150 would disturb 1.6 acres of bighorn sheep winter range, which would be a very small proportion of the 13,690 acres of bighorn sheep winter range available forestwide (KNF 2015a). The specific block of winter range impacted is bisected by the Clark Fork River below Noxon Reservoir. Approximately 542 acres of winter range (336 acres non-Forest Service and 206 acres of Forest Service) is northeast of the river, and 353 acres of winter range (245 acres non-Forest Service and 108 acres of Forest Service) is southwest of the river. The area impacted would be 0.3% of the block of winter range located northeast of the river, leaving much of this block of winter range unaffected by the rerouting of NFS road #150. Traffic along this section of NFS road #150 in the winter also could result in less winter use of the area by bighorn sheep. The new section of NFS road #150 is adjacent to the existing Montana Highway 200, which already experiences substantial traffic. The surrounding area is affected by existing disturbance, such as fragmentation by Montana Highway 200, existing NFS roads, a powerline, train tracks, and Noxon Reservoir. Other human activity in the area includes the Rock Creek Gravel Pit on lower Rock Creek and a sawmill near Montana Highway 200. Overall, additional disturbance to wintering bighorn sheep would likely be minimal when compared with existing disturbance in the area.

Mountain Goat. Mountain goat winter range would not be affected by Alternative V. The increased disturbance at the evaluation adit and mill site would not substantially affect known mountain goat winter range along the cliffs in the East Fork Rock Creek drainage because these sites are more than 1 mile from the winter range.

4.12.2.2.4 Selected Wildlife Groups

Impacts on other species of interest such as boreal owl, northern goshawk, black bear, mule deer, moose, and mountain lion are described on pages 4-167 (northern goshawk) and 4-167 through 4-170 of the 2001 FEIS. Impacts on these species would remain the same as described in the 2001 FEIS. No known active raptor nests would be affected because no raptor nests are known within the study area. Impacts on other selected wildlife groups including furbearers, small mammals, birds, amphibians, and reptiles are described on pages 4-170 and 4-171 of the 2001 FEIS. Impacts on these species would also remain the same as described in the 2001 FEIS.

4.12.3 Alternative IV

This section describes impacts of Alternative IV on wildlife, habitat, and vegetation resources where information has been updated since the 2001 FEIS was issued. Alternative IV impacts on wildlife, habitat, and vegetation resources that have not changed since the 2001 FEIS was issued would be the same as described in the 2001 FEIS on pages 4-159 and 4-160.

4.12.3.1 Wildlife Habitat/Vegetation

4.12.3.1.1 Plant Species of Special Concern

Impacts on plant species of special concern would be the same as described under Alternative IV on page 4-159 of the 2001 FEIS, except that impacts on species added to the Forest Service sensitive species list since the 2001 FEIS was issued were not evaluated. Additional surveys for species added to the sensitive species list after the 2001 FEIS was issued would be completed prior to ground disturbance.

4.12.3.1.2 Plant Species Changes at Springs and Seeps

The impacts on habitat and vegetation associated with springs and seeps that may be potentially affected by this alternative would be the same as described for Alternative V.

4.12.3.1.3 Noxious Weeds

The effects from noxious weeds under Alternative IV are described on page 4-159 of the 2001 FEIS. The effects would be the same as Alternative V.

4.12.3.2 Wildlife Species

4.12.3.2.1 Forest Service Sensitive Wildlife Species

Effects on bald eagles and gray wolves from Alternative IV are described on pages 4-186 of the 2001 FEIS. Effects on harlequin ducks, peregrine falcons, and fishers are described on pages 4-159 and 4-160 of the 2001 FEIS. Expected effects on peregrine falcons, bald eagles, gray wolves, and fishers have not changed since the 2001 FEIS was issued because there have been no changes in habitat for these species in the study area and there have been no modifications to Alternative IV. Direct impacts on wolverine habitat under Alternative IV would be the same as impacts under Alternative V, except that direct loss of habitat at the evaluation adit would be about 2 acres less than Alternative V. Alternative IV could result in greater potential for mortality to wolverines than Alternative V because it does not include busing of mine employees. Effects on bighorn sheep under Alternative IV would be the same as under Alternative V, except that direct loss of habitat at the evaluation adit would be about 2.3 acres less. Impacts on bighorn sheep from all action alternatives would be similar. The 2001 FEIS disclosed that Alternative IV would likely affect individual harlequin ducks and could result in a trend toward listing under the ESA. Expected effects on harlequin ducks have not changed since the 2001 FEIS was issued because habitat conditions for harlequin ducks have not changed, a stable breeding population is present, and there have been no modifications to Alternative IV.

4.12.3.2.2 Native Ungulates

Effects on elk, deer, bighorn sheep, and mountain goats from Alternative IV are described on page 4-160 of the 2001 FEIS and have not changed since the 2001 FEIS was issued because habitat conditions have not changed and there have been no modifications to Alternative IV. In addition, mountain goat numbers are stable in the Rock Creek area.

4.12.3.2.3 Other Species of Interest

Effects on northern goshawks from Alternative IV are described on page 4-160 of the 2001 FEIS and have not changed since the 2001 FEIS was issued because habitat conditions for this species have not changed and there have been no modifications to Alternative IV. Effects to other species of interest, such as black bear, mule deer, and moose, would be similar to impacts under Alternative V, as described on pages 4-169 and 4-170 in the 2001 FEIS, and have not changed since the 2001 FEIS was issued.

4.12.3.2.4 Selected Wildlife Groups

Effects on other selected wildlife groups, such as furbearers, small mammals, birds, reptiles, and amphibians, would be similar to effects under Alternative V, as described on pages 4-170 to 4-171 in the 2001 FEIS, and have not changed since the 2001 FEIS was issued.

4.12.4 Alternative III

Except for wolverine and bighorn sheep, impacts of Alternative III on wildlife, habitat, and vegetation resources (where information has been updated since the 2001 FEIS was issued) would be the same as described for Alternative IV. Alternative III impacts on wildlife, habitat, and vegetation resources that

have not changed since the 2001 FEIS was issued would be the same as described in the 2001 FEIS on pages 4-156 through 4-158. The impacts of Alternative III on bighorn sheep are described below.

Wolverine. Direct impacts on wolverine habitat under Alternative III would be the same as impacts under Alternative IV, except that in Alternative III, the mill site would be located at a higher elevation and could potentially have slightly greater impacts on wolverines.

Bighorn Sheep. Effects on bighorn sheep under Alternative III would be the same as under Alternative V, except that direct loss of habitat at the evaluation adit would be about 2.3 acres less.

4.12.5 Alternative II

Except for wolverine and bighorn sheep, impacts of Alternative II on wildlife, habitat, and vegetation resources (where information has been updated since the 2001 FEIS was issued) would be the same as described for Alternative IV. As described on pages 4-149 and 4-150 of the 2001 FEIS, Alternative II has the most impacts on wolverines of all of the action alternatives. Alternative II impacts on wolverines have not changed since the 2001 FEIS was issued and would be the same as described in the 2001 FEIS. Alternative II impacts on bighorn sheep would be the same as Alternative III. Alternative II impacts on wildlife, habitat, and vegetation resources that have not changed since the 2001 FEIS was issued would be the same as described in the 2001 FEIS on pages 4-142 through 4-156.

4.12.6 Alternative I

4.12.6.1 Wildlife Habitat/Vegetation

Effects on plant species of special concern, noxious weeds, wildlife habitat/vegetation communities, and old growth under Alternative I are described on pages 4-138 and 4-139 of the 2001 FEIS, and have not changed since the 2001 FEIS was issued. Additional species have been added to the Forest Service sensitive plant species list; there would be no effect on these species because there would be no new ground disturbance under Alternative I. No plant species changes at springs and seeps are expected under Alternative I.

4.12.6.2 Wildlife Species

Effects on Forest Service sensitive wildlife species, other species of interest, and selected wildlife groups under Alternative I are discussed on pages 4-139 through 4-142 of the 2001 FEIS. Expected effects on these resources have not changed since the 2001 FEIS was issued because baseline conditions for these species have not substantially changed, with the exception that the downward trend of amphibian abundance and occurrence is expected to continue.

4.12.7 Effectiveness of Agencies' Proposed Mitigation

Before mine construction, RCR would develop mitigation plans for resources including plant species of special concern, springs and seeps vegetation, reclamation, wildlife, and T&E species as described in Section 2.3.1.16, *Monitoring and Mitigation Plans*.

Conducting surveys for new plant species of concern prior to ground disturbance would allow minor changes in the Operating Permit and the Plan of Operations to avoid impacts, where possible. Avoiding impacts on newly discovered populations of plant species of special concern would effectively mitigate impacts on these species. If avoidance could not be achieved, the KNF would require a conservation assessment. The plant species of special concern monitoring plan would help KNF track the effectiveness of mitigation. The effectiveness of mitigation for plant species of special concern would be the same for all action alternatives.

Ongoing weed control measures and surveys for noxious weeds would reduce the potential for spread of weeds. Controlling or eliminating populations of noxious weeds prior to ground disturbance would effectively mitigate the spread of noxious weeds. Continuing monitoring would track the effectiveness of weed control measures. Noxious weed control measures and their effectiveness would be the same for all action alternatives.

Grizzly bear mitigation measures in Alternative V would benefit many other species. Road access changes (installation of gates or barriers and public access restrictions, as shown on Figure 2-20) would increase habitat security for species sensitive to the effects of roads, and reduce the risk of vehicle-caused mortality. Although securing private land through habitat acquisition would not create any additional habitat, it would improve habitat by increasing habitat effectiveness where road access changes occurred, and would secure acquired sites from habitat alteration that would likely occur as a result of regional increases in human development unrelated to the Rock Creek Project. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve or contribute suitable habitat for other species if the acquired parcels provided appropriate habitat characteristics and could be managed to improve habitat. Fisher, wolverine, gray wolf, mountain goat, elk, and white-tailed deer are among the other species likely to benefit from grizzly bear mitigation. Alternative V road access changes and land acquisition would effectively mitigate impacts on wildlife. Funding for FWP law enforcement personnel to protect mountain goats and other wildlife species, development and implementation of informational and educational programs for the public about wildlife species, and removal of carcasses killed by vehicles from roadsides would partially mitigate impacts on wildlife species by reducing the potential for poaching and harassment of wildlife and mortality risk, but would not eliminate all impacts. The effectiveness of these mitigation measures for grizzly bears is discussed in Section 4.13.8, *Effectiveness of Agencies' Proposed Mitigation*.

Mitigation measures outlined in the Fish and Wildlife Mitigation Plan would reduce the potential for poaching and harassment of wildlife by prohibiting hunting and use of firearms on RCR property. Enforcing speed limits and encouraging carpooling would be partially effective at reducing the potential for wildlife fatalities from collisions with vehicles, but would not eliminate the potential for collisions. Conspicuously posting regulations, cooperating with other agencies, and discouraging wildlife harassment would reduce the potential for impacts, but would not completely eliminate impacts on wildlife. The Wildlife Monitoring Program would help track the effectiveness of mitigation measures. Mitigation effectiveness would be greater under Alternative V than the other action alternatives because Alternative V includes additional mitigation measures and more detailed wildlife and T&E species monitoring plans than Alternative II.

Creation of bat habitat in the evaluation adit or wilderness ventilation adit following mine closure, if implemented, would effectively enhance bat habitat. This mitigation measure would be implemented only under Alternative V.

Using selection criteria for the air-intake ventilation adit site in the CMW would help minimize impacts on mountain goats. The wildlife monitoring program would include monitoring of mountain goat populations and wolverine denning activity and would assist the KNF in determining the effectiveness of mitigation.

Constructing powerlines following Avian Power Line Interaction Committee recommendations (2006) would effectively mitigate impacts on bald eagles from electrocution. Ongoing monitoring through annual bald eagle counts would assist the KNF in determining the effectiveness of mitigation. This mitigation measure would be implemented only under Alternative V.

Additional mitigation measures to protect harlequin ducks under Alternative V would effectively mitigate impacts by reducing human presence and vehicle traffic near duck habitat and by reducing the risk of hazardous materials spills into Rock Creek. These measures would also provide mitigation for impacts on other riparian-dependent species. Water quality monitoring would help determine the effectiveness of spill prevention. These mitigation measures would reduce impacts, but some increase in human presence, traffic, and risk of hazardous spill would still occur. The wildlife monitoring program includes monitoring for harlequin ducks and would help document the effectiveness of harlequin duck mitigation measures. The additional mitigation measures for harlequin ducks would only be implemented under Alternative V.

Constructing wildlife crossing structures along NFS road #150 would reduce, but not eliminate, road impacts on fishers. Crossing structures would reduce the habitat fragmentation effect of the road by providing an opportunity for fishers to pass under the road. Crossing structures would be maintained for the life of the project. Crossing structures would reduce, but not completely eliminate, the potential for fisher mortality due to vehicle collisions. The additional mitigation measures for fishers would only be implemented under Alternative V.

Reduced or redirected lighting incorporated at the mill site would reduce impacts on night migrating songbirds by reducing the potential for the birds to be attracted to and collide with mine facilities. The additional lighting mitigation measures for night migrating songbirds would be implemented only under Alternative V.

Implementation of the Alternative V Wetlands Mitigation Plan would create 7.3 acres of wetlands at three mitigation sites. The created wetlands would be effective in reestablishing habitat for wildlife species, including riparian-dependent species such as many migratory birds and amphibians and reptiles. The effectiveness of the Wetland Mitigation Plan would be monitored in cooperation with the Corps as part of the Section 404 permit. Mitigation for wetland impacts would be required under each action alternative, and would be expected to be equally effective.

Implementation of each mitigation plan described above would be monitored for effectiveness as described in Appendix K. Monitoring plans would include the Plant Species of Concern Monitoring Plan, Springs and Seeps Vegetation Monitoring Plan, Reclamation Monitoring Plan, Wildlife Monitoring Plan, and Threatened and Endangered Species Monitoring Plan. For each monitoring plan, adjustments would be made to the mitigation plans if monitoring found that the mitigation was not effective.

4.12.8 Cumulative Impacts

Section 2.5, *Part IV: Description of Past, Present, and Reasonably Foreseeable Actions* provides updated past, current, and reasonably foreseeable actions that may contribute to cumulative impacts, including new mining activities, KNF land management activities, activities on private land, and other government agency activities. This section describes cumulative impacts of the Rock Creek alternatives on wildlife, habitat, and vegetation resources where information has been updated since the 2001 FEIS was issued. Cumulative impacts on wildlife, habitat, and vegetation resources that have not changed since the 2001 FEIS was issued would be the same as described on pages 4-171 through 4-173 of the 2001 FEIS.

Plant species of special concern in the study area would not likely be cumulatively affected by past, present, or reasonably foreseeable actions, with the exception of potential beneficial effects from future prescribed burning and weed control. Future activities on NFS lands would require surveys and possibly mitigation for impacts on plant species of special concern.

Past, present, and reasonably foreseeable actions that involve vegetation clearing or ground disturbance could increase the potential for invasion by noxious weeds. Actions such as timber clearing, mining, development, and other surface-disturbing activities would result in cumulative impacts on noxious weeds

when combined with the increased potential for the spread of weeds resulting from disturbance associated with the Rock Creek Project. Forestwide and project-specific weed-control efforts would reduce the potential for cumulative impacts from weeds.

Wildlife habitat/vegetative communities would be affected by past, present, and reasonably foreseeable activities such as timber harvests, mining activities, and forestwide weed control. Timber harvests and additional mining activities could result in cumulative impacts on wildlife habitat and vegetation communities when added to the effects of the Rock Creek Project. Forestwide weed control would result in beneficial cumulative effects.

Old growth habitat could be adversely affected by timber harvests on private lands. No information on the location or timing of potential future timber harvests on private land is available. The loss of 1 acre of old growth under Alternative V would not result in significant cumulative effects when added to the loss of old growth on private lands.

Although many wildlife species would benefit from actions that regulate access to their habitat or improve habitat for grizzly bears such as the Access Amendment, District MVUM 2015, Grizzly Bear Management Plan for Western Montana, and DNRC HCP; wildlife species in general would be adversely affected by past, present, and reasonably foreseeable activities such as development on private lands. Wildlife species could be adversely affected by increased human activity and vehicle traffic associated with activities such as recreation, mining, and timber harvests. These impacts could result in cumulative impacts when added to the impacts of the Rock Creek Project.

Forest Service sensitive species would be affected, both beneficially and adversely, by past, present, and reasonably foreseeable actions. Bald eagles would benefit from activities that improve fish habitat such as stream restoration, Avista-funded bull trout recovery activities, and the Tri-State Implementation Council. Sensitive species such as the gray wolf and fisher would benefit from actions that regulate access to their habitat or improve habitat for grizzly bears such as the Access Amendment, District MVUM 2011, Grizzly Bear Management Plan for Western Montana, and DNRC HCP. Mining, gravel operations, and recreational activities would result in increased traffic and human presence in the area, which would adversely affect gray wolves, fishers, and harlequin ducks. Development and timber harvest on private lands could adversely affect fishers if old growth habitat is removed. These impacts could result in cumulative impacts when added to the impacts of the Rock Creek Project.

Native ungulates could be affected, both beneficially and adversely, by past, present, and reasonably foreseeable activities. Species such as mountain goats, elk, and white-tailed deer would benefit from actions that regulate access to their habitat or improve habitat for grizzly bears such as the Access Amendment, District MVUM 2011, Grizzly Bear Management Plan for Western Montana, and DNRC HCP. Mining, gravel operations, and recreational activities would result in increased traffic and human presence in the area, which would adversely affect these species. These impacts could result in cumulative impacts when added to the impacts of the Rock Creek Project.

Potential cumulative effects on seep and spring vegetation from Montanore Project to be discussed when groundwater analysis available

4.12.9 Regulatory Compliance

This section describes consistency with 2015 KFP components that are of particular concern or that required additional analysis since the 2001 FEIS, and compliance with other laws and regulations applicable to vegetation, wildlife, and biodiversity. A detailed analysis of the consistency of Alternative V with all 2015 KFP applicable components relevant to vegetation, wildlife, and biodiversity is available in the project record.

Because the Rock Creek Project is a minerals development project, 2015 KFP components that direct vegetation management activities do not apply. Where the land would be cleared for mine facility development, there would be no site-specific movement toward forestwide vegetation goals and desired conditions. Considering the footprint of the project compared with forestwide vegetation management practices and natural disturbance processes, Alternative V would generally be neutral in regard to progress toward forestwide 2015 KFP desired conditions.

Over the long term, reclaimed plant communities would eventually reestablish. Planting would follow silvicultural prescriptions designed to address forestwide desired conditions for species composition. Although initial vegetation diversity would be less than the original plant communities, other Agency mitigation would aid in facility reclamation consistent with 2015 KFP goals and desired conditions. In the long term, plant communities in the study area would trend toward the forestwide desired conditions for composition, structure, patterns, and processes.

Alternative V may impact individuals or their habitat, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for American peregrine falcon, bald eagle, gray wolf, wolverine, bighorn sheep, black-backed woodpecker, flammulated owl, harlequin duck, fisher, northern bog lemming, Townsend's big-eared bat, Coeur d'Alene salamander, northern leopard frog, and western toad. This determination is based on: 1) degradation or loss of habitat would be minor relative to habitat available in surrounding areas, 2) for Alternative V, road access changes and land acquisition included in the grizzly bear mitigation measures would potentially offset habitat and disturbance effects, 3) funding for FWP law enforcement personnel to protect mountain goats and other wildlife species, development and implementation of informational and educational programs for the public about wildlife species, and removal of carcasses killed by vehicles from roadsides would partially mitigate impacts on wildlife species by reducing the potential for poaching and harassment of wildlife and mortality risk, 4) implementation of the Fish and Wildlife Mitigation Plan and the Wildlife Monitoring Plan would minimize effects of the Rock Creek Project, and 5) for Alternative V, mitigation measures to protect harlequin ducks would mitigate impacts by reducing human presence and vehicle traffic near duck habitat.

Management direction in the 2015 KFP under FW-GDL-WL-10 states that management activities should maintain existing levels of elk security and, where possible, management activities in high- and medium-emphasis planning subunits should improve elk security. As directed in FW-OBJ-WL-02, over the life of the 2015 KFP, the objective is to increase by one the number of planning subunits that provide at least 30% elk security and increase by one the number of high-emphasis planning subunits that provide at least 50% elk security. The Rock Creek Project would contribute to FW-OBJ-WL-02 and was designed in accordance with FW-GDL-WL-10 because existing levels of elk security would be maintained and slightly increase.

The 2015 KFP also contains direction related to ungulate winter range. FW-GDL-WL-08 states that management activities should avoid or minimize disturbance to native ungulates on winter range between December 1 and April 30, with the exception of routes identified on MVUM as open to motor vehicle use. Management activities that occur on winter range during the winter period should concentrate activities to reduce impacts on native ungulates. Alternative V was designed in accordance with guideline FW-GDL-WL-08.

FW-GDL-WL-09 states that management activities should be avoided on native ungulate winter range areas during the critical mid-winter period (January and February) when snow depths most likely influence movement and availability of forage. Although the area of disturbance is minimal relative to the amount of elk, mule deer, and white-tailed deer winter range available forestwide, the Rock Creek Project would operate year-round in elk, mule deer, and white-tailed deer winter range. Because it would not be

practicable to avoid or minimize construction and operation activities during January and February, the Rock Creek Project could not be designed in accordance or designed with a variance that would meet the intent of FW-GDL-WL-09 unless the 2015 KFP was amended. The Forest Service's locatable minerals regulations (36 CFR 228.8) require mine operators to minimize or, where practicable, eliminate damage to soil, water, and other surface resource values. When a project or activity is not designed to comply with the intent or purpose of a guideline, an amendment to the forest plan is required. Thus, a project-specific amendment is necessary for Alternative V for it to be consistent with the 2015 KFP. A detailed analysis of the consistency of Alternative V with the 2015 KFP guidelines for ungulate winter range is available in a memorandum prepared by the KNF (2015a).

With the proposed amendment described in Section 4.2, *Kootenai Forest Plan*, Alternative V would be consistent with FW-GDL-WL-09 and the 2015 KFP components pertaining to plant species of concern, noxious weeds, wildlife habitat, old growth habitat, and Forest Service sensitive species. Alternative V would be in compliance with the Montana Local County Weed Act because it would implement an approved weed management plan to address noxious weeds.

By evaluating the effects of federal actions on migratory birds as part of the NEPA process and promoting conservation of and minimizing adverse impacts on migratory birds, Alternative V would comply with the Migratory Bird Treaty Act, EO 13186, and associated MOU. The effects of Alternative V on migratory birds are discussed on page 4-170 of the 2001 FEIS. Although the Rock Creek Project would convert 445 acres of forested land to non-forested land, bird populations would not be measurably impacted. Reclamation of mine facilities after mine closure would restore some bird habitat. No known active raptor nests have been identified in the study area. Alternative V would result in minimal impacts on the bald eagle, and would be in compliance with the Bald and Golden Eagle Protection Act.

4.13 Threatened and Endangered Species

4.13.1 Introduction

The analysis of effects on T&E species was updated to include new information since the 2001 FEIS was issued, specifically, updated baseline information for grizzly bear habitat, 2015 KFP standards and guidelines (including incorporation of standards and guidelines in the grizzly bear Access Amendment, the NRLMD, and INFISH), designation of critical bull trout habitat, development of a 3D groundwater model, clarification of Phase I and Phase II sediment mitigation, and modifications to Alternative V. This section updates the *Environmental Consequences* section for T&E species and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously in the 2001 FEIS. The remainder of the analysis has not changed and is provided in the 2001 FEIS (pages 4-173 through 4-194).

4.13.2 Analysis Methods

4.13.2.1 Bull Trout

Since the 2001 FEIS, the study area for effects on bull trout was modified to include the East Fork Bull River and its tributaries, as well as the mainstem Bull River downstream of the confluence with the East Fork Bull River. In addition, the following new information is available since the 2001 FEIS was issued that affects the analysis of potential Rock Creek Project effects on bull trout:

1. The 3D model was used to estimate changes in baseflow for drainages within the study area, as described in Section 4.7, *Water Quantity and Quality*. Any baseflow reduction in the upper drainages would also affect surface water quantity in downstream reaches.
2. Phase I and Phase II sediment mitigation plans have been clarified since the 2001 FEIS and are described in Section 2.3.1.16, *Monitoring and Mitigation Plans* of this SEIS.
3. More detailed water resources and aquatic resources monitoring plans for Phase I and Phase II of mine development have been developed (see Appendix K of this SEIS).
4. The analysis of effects on water quality was updated (Section 4.7.3.4, *Surface Water Quality*) to take into account recent water quality data, changes in water treatment and discharge, and analysis of seepage from the paste tailings facility.
5. A discussion of effects on stream temperature was added (Section 4.7.3.4, *Surface Water Quality*).
6. The October 18, 2010 revision of bull trout critical habitat expanded critical habitat in the Rock Creek watershed from five distinct segments totaling 2.9 miles to a continuous stream reach extending from the mouth upstream 8.4 miles (see Figure 3-15). Bull trout critical habitat is also designated in East Fork Bull River, mainstem Bull River, and lower Clark Fork River.

Due to uncertainty associated with mine-related ground and surface water effects described in Section 4.7, *Water Quantity and Quality*, and because streamflow-habitat relationships have not been defined for study area streams, the following discussion of Rock Creek Project effects on bull trout is largely qualitative. The rationale for the qualitative analysis is described in two memos available in the Rock Creek Project record (KNF 2014b, 2014c). The predicted water quantity effects, related aquatic habitat effects, and subsequent effects on bull trout presented in this section represent the best currently available estimates of Alternative V effects on aquatic resources. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on bull trout in the study area. A detailed discussion of the adequacy of baseline groundwater and surface water data is provided in Section 4.7.2.1,

Water Quantity and Quality - Baseline Data Adequacy. See Section 4.7.2.3.2, *Groundwater Quantity - Model Uncertainty* for additional discussion related to groundwater modeling uncertainties. The qualitative approach is consistent with the 2007 BO Supplement for bull trout (USFWS 2007a), which indicated:

"it is difficult to determine with any certainty whether a risk to bull trout would exist under project implementation because of the lack of data or pertinent scientific information on the relationship of underground mining effects on aquatic species. The potential changes of water quality and quantity are unpredictable and the only way to determine this risk is to monitor the appropriate streamflow parameters and if new information reveals that the risk to Rock Creek bull trout is anticipated, re-initiation of consultation would be warranted, and the Service would request it."

4.13.2.2 Terrestrial Species

Currently, grizzly bear standards are established by the 2015 KFP, which incorporates the 2011 Access Amendment, as described above in Section 3.13, *Threatened and Endangered Species*. In addition to direct and indirect impacts on grizzly bear habitat, the analysis considers several measures to assess the condition of grizzly bear habitat: core area, OMRD, and TMRD. Direct and indirect effects on grizzly bear habitat were discussed on pages 4-179 through 4-181 and pages 4-188 and 4-189 of the 2001 FEIS. Impacts on grizzly bear habitat were updated for the SEIS to address updated information on existing conditions for core area, OMRD, and TMRD. Calculation of these measures is described in Section 3.13, *Threatened and Endangered Species*. Impacts on lynx were analyzed following the standards and guidelines for lynx management established in the NRLMD (USFS 2007a). The NRLMD analyzes lynx habitat based on LAUs as described in Section 3.13, *Threatened and Endangered Species*. The NRLMD was not in place when the 2001 FEIS was issued. The 2001 FEIS analysis was revised and updated in accordance with the NRLMD as described in Section 3.13, *Threatened and Endangered Species*. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on grizzly bear and Canada lynx in the study area. The Agencies did not identify any incomplete or unavailable information.

4.13.3 Alternative V

4.13.3.1 Bull Trout

4.13.3.1.1 Streamflow

Baseflow is defined as the volume of flow in a stream channel that is not derived from surface runoff, but rather from groundwater seepage into the channel. Streams in the area may be at baseflow for about 1 to 2 months between mid-July and early October; periods of baseflow may also occur from November through March. Baseflow is maintained during the driest part of each year in the upper perennial reaches of each drainage by groundwater flowing from bedrock fractures. Streams located below 5,000 to 5,500 feet generally are perennial and are supplied by surface runoff, shallow groundwater, and groundwater from deeper bedrock fractures that intersect the ground surface. Baseflow reductions may occur in these stream reaches due to adit and mine inflows that would reduce the inflow of deeper bedrock groundwater to the streams, which would also decrease flow in reaches downstream by the amount of surface flow that is lost upstream. Based on the location of subsurface mining activities, reduced baseflows are possible in designated bull trout critical habitats including mainstem Rock Creek, East Fork Rock Creek, East Fork Bull River, and Bull River downstream of East Fork Bull River. Baseflow reductions could also occur in West Fork Rock Creek, where bull trout presence has been verified. Baseflow conditions typically coincide with the seasonal timing of bull trout upstream migration, spawning, and incubation, although there are years when higher snowpack and/or summer or fall precipitation results in higher surface flows during these periods due to runoff.

Changes in baseflow may directly affect the amount of aquatic habitat available to bull trout at different life stages (Al-Chokhachy et al. 2010). The relationship between instream habitat availability and bull trout distribution is reach-specific (Al-Chokhachy et al. 2010) as the degree that habitat areas change in response to changes in baseflow is dependent on specific channel geometry and habitat conditions such as stream substrates and cover (Rich et al. 2003). The modeling analysis cannot be used to quantify exact changes in baseflow and aquatic habitat at specific locations because a number of model input parameters are not well defined and because it is not currently possible to verify the accuracy of the results (KNF 2014b, 2014c).

Baseflow reductions may magnify or create new seasonal migration barriers in stream reaches in the study area. Shallow and wide riffle-stream segments can be impassable by bull trout at low flow, particularly larger migratory life stages of bull trout, because movement is restricted in shallow water (Maret et al. 2005, 2006). Reduction in baseflow could increase the length of impassable stream reaches as well as the frequency and/or duration that existing passage restrictions occur. This impact would be less severe for resident bull trout that are generally smaller and therefore able to pass through narrower and shallower restrictions. As described in Section 3.13.2.2, *Resident and Migratory Life Histories*, migration barriers may be beneficial to resident bull trout populations such as those predominantly found in the Rock Creek drainage, but detrimental to migratory bull trout.

Several potential migration barriers are found in the Rock Creek drainage, as described in Section 3.11.2.1, *Rock Creek Watershed - Habitat*. Natural flow intermittency in lower to middle reaches of mainstem Rock Creek is frequently described as the primary factor preventing bull trout migration during periods of low flow. Mine-related baseflow reductions may increase the frequency and/or duration of periods of intermittent flow in Rock Creek. Baseflow reductions may also further restrict fish passage around partial or temporary migratory barriers in the study area such as the potential upstream barrier in East Fork Bull River (1 mile upstream of the CMW boundary) and a perched culvert in Rock Creek (at Montana Highway 200). There are no anticipated bull trout migration issues in East Fork Bull River or Bull River related to stream intermittency and no known migratory barriers for bull trout passing through the Bull River.

Baseflow reduction can also indirectly affect bull trout habitat and migration by reducing flows through alluvium and stream substrates, affecting spawning habitats and egg incubation that depend on localized areas of groundwater upwelling to provide fresh flowing water over redds. However, potential changes in localized movement from groundwater to surface water cannot be identified from model-predicted baseflow changes.

Baseflow reduction may affect stream temperature in those stream reaches where bedrock groundwater contributes a significant proportion of the total flow. The greatest reduction in bedrock contribution to streams and, therefore, the greatest potential effect on stream temperature, would occur during the maximum period of drawdown at about Year 70. Due to the numerous factors affecting stream temperatures and the constantly changing stream temperature regime, it is difficult to predict how mine project effects may alter stream temperature, or to what magnitude and extent stream temperatures may change. Prior to the start of mining activities not related to the evaluation adit stage, RCR would submit a plan to monitor groundwater effects as they relate to bull trout habitat requirements that would be subject to USFWS approval.

Clearing of streamside vegetation has the potential to affect stream temperatures. However, an unaltered vegetation buffer would be left between Rock Creek and the road and utility corridors where possible, and impacts on RHCAs between the mill site and the east and west forks of Rock Creek would be avoided. About 10 acres of riparian habitat would be cleared for the powerline at utility corridor crossings on Rock Creek and West Fork Rock Creek and for construction of the new bridge over Engle Creek. Streamside

vegetation clearing may increase stream temperature in localized areas by exposing the stream to increased warming by sunlight, but because less than a fraction of 1% of the affected streamside habitat along Engle Creek, Rock Creek, and West Fork Rock Creek would be cleared, the effect would likely be negligible. The 2007 BO Supplement (USFWS 2007a) concluded that the loss of stream shading from vegetation clearing would not cause a dramatic temperature change, or even a slight change that could be measurable, and that stream temperature is "expected to be maintained as functioning appropriately for bull trout after clearing of vegetation in the right-of-way utility corridor."

Other Alternative V activities that may affect bull trout by potentially modifying surface flow in Rock Creek, and to a much lesser degree in the lower Clark Fork River, are described in Section 4.7.3.1, *Water Quantity and Quality - Alternative V*. These activities include interception of precipitation at mine facilities, use of stormwater runoff collected from the mine facilities, discharges from the wastewater treatment plant, vegetation clearing, potable water use, makeup water use from a well located near the Clark Fork River, and the possible use of pumpback wells at the paste tailings facility and evaluation adit portal pad.

4.13.3.1.2 Habitat

The USFWS has designated bull trout critical habitat in mainstem Rock Creek, East Fork Rock Creek, East Fork Bull River, mainstem Bull River, the lower Clark Fork River, and Cabinet Gorge Reservoir. Alternative V may affect critical habitat in East Fork Rock Creek, Rock Creek, East Fork Bull River, and mainstem Bull River. Changes in streamflow may affect bull trout habitat and create barriers by reducing baseflow within these drainages. Because bull trout spawn from August through November when baseflow conditions often occur, available spawning and rearing habitat in these streams may decrease. The 2010 revision of bull trout critical habitat expanded critical habitat in the study area by 5.5 miles in the Rock Creek watershed and 3.3 miles in the Bull River (see Figure 3-15). The entire East Fork Bull River and the Clark Fork River were also included in the 2010 revision of bull trout critical habitat. While critical habitat designations have expanded since the 2001 FEIS and 2007 BO Supplement, the Rock Creek Project effects on critical habitat previously considered would not change.

The potential changes in surface water quantity described above are unlikely to affect critical habitat in the lower Clark Fork River and Cabinet Gorge Reservoir based on the streamflow and volume of these waterbodies (respectively) compared with possible surface water reductions. However, potential impacts on bull trout critical habitat related to changes in water quantity from Alternative V cannot be quantified.

Loss of riparian habitat in bull trout critical habitat would be limited to 2 acres in Rock Creek (Table 4-18 in Section 4.11, *Aquatic Life and Fisheries*). Impacts on RHCAs are described in detail in Section 4.11, *Aquatic Life and Fisheries*.

4.13.3.1.3 Water Quality

Section 4.7.2.6, *Surface Water Quality* describes sediment delivery to Rock Creek and its tributaries under Alternative V, as well as revisions to sediment mitigation plans. Implementation of Phase I sediment mitigation would reduce the current sediment load by about 234 tons per year, which would be about 218 tons per year more than required to mitigate Phase I effects. To achieve the total estimate of 400 tons per year needed for mitigation of the entire mine project, additional sediment mitigation of about 165 tons per year would be required during Phase II of the Rock Creek Project. RCR would submit a final sediment mitigation plan to the KNF, DEQ, and USFWS for approval, and offset in aggregate 400 tons of annual fine sediment loading to Rock Creek by mitigating sediment sources in the West Fork Rock Creek basin and in the mainstem floodplain of Rock Creek before the end of the Rock Creek Project construction period. As discussed in Section 4.7.3.4, *Surface Water Quality*, Rock Creek is on DEQ's list for impaired waters as a result of substrate alterations due to silviculture practices that have impaired aquatic life. Implementation of Alternative V sediment mitigation would improve bull trout habitat in the creek and

with implementation of BMPs, other Alternative V activities would not be expected to further alter the substrate in Rock Creek.

Nutrient concentrations are relatively low in the Rock Creek drainage and are not considered a risk to bull trout in the drainage according to the 2007 BO Supplement (USFWS 2007a). Potential sources of aquatic nutrients from implementation of Alternative V include sediment loading, blasting in the mine, and the discharge of treated wastewater to a permitted outfall in the Clark Fork River during Phase II. In addition to measures implemented by RCR to minimize increased nutrients in study area streams, potentially affected drainages would be monitored as part of the Water Resources Monitoring Plan (Appendix K). Wastewater discharge to the Clark Fork River would be treated to meet MPDES permitted nutrient effluent limits.

Potential sources of metals to Rock Creek include waste rock, mine tailings, and potential pipeline failures. Surface runoff from any waste rock would be captured and reused at the mill or treated at the wastewater treatment plant. Discharge from the wastewater treatment plant may increase metal concentrations below the Clark Fork River effluent outfall about 750 feet upstream of the mouth of Rock Creek, and concentrations would not exceed aquatic life standards outside of the mixing zone. Elevated metal concentrations may cause bull trout to avoid use of Rock Creek as a spawning or rearing area. Pipelines would be encased in a larger steel pipe at creek crossings to prevent ruptures that could contaminate the creeks. In addition, pipelines would be monitored weekly and a spill recovery plan would be implemented by RCR to minimize the potential effects of a pipeline rupture on bull trout. The potential effects of Alternative V on nutrient conditions and dissolved metals in Rock Creek are discussed in more detail in Section 4.11, *Aquatic Life and Fisheries*. The results of a potential paste tailings facility failure is described in the 2001 FEIS.

4.13.3.1.4 Climate Change

Potential effects of the Rock Creek Project and climate change on bull trout would be similar to those described in Section 4.11, *Aquatic Life and Fisheries*. As discussed in Section 4.7, *Water Quantity and Quality*, climate change could reduce groundwater infiltration, increase cool-season runoff, decrease warm season runoff, and ultimately reduce stream base flows. The Rock Creek study area is in the northern part of the Columbia River, where increased precipitation may offset the effects of decreased warm season runoff due to warming, at least to some degree (Reclamation 2011c). In certain circumstances, decreased groundwater infiltration could reduce the Rock Creek Project's mine and adit inflows, but because baseflow to streams would also decrease, the percentage change to stream baseflow could remain the same. Discharges to the Clark Fork River would be less if mine and adit inflows decreased.

Because long-term data are not available for northwestern Montana streams, the magnitude and extent of the effects of climatic and hydrologic trends on fish and other aquatic organisms and their habitat are unclear (USFS 2010). If climate change did not change mine and adit inflows and if decreased warm season runoff due to climate change was not neutralized by increased precipitation, the effects of any reduced fall low flows from the Rock Creek Project on bull trout, such as a reduction in suitable habitat and increased habitat fragmentation, combined with the effects of climate change, may be greater than those estimated to occur with the Rock Creek Project alone. Alternatively, the effects on baseflow of any increase in winter flows associated with climate change would moderate the effect of inflows to the Rock Creek Mine during winter low-flow periods. Any changes in stream temperatures and chemistry from climate change and the Rock Creek Project combined could affect bull trout, although the magnitude and type of effects are difficult to predict. For example, if thermally suitable habitat decreased as a result of climate change, some bull trout populations could become more fragmented, especially in streams with

low-flow barriers such as Rock Creek and upper East Fork Bull River. As described in Appendix K, RCR would monitor streamflows and water temperatures.

4.13.3.2 Grizzly Bear

Direct physical loss of grizzly bear habitat is described on page 4-188 of the 2001 FEIS. Minor modifications were made to Alternative V since the 2001 FEIS was issued, primarily to reduce impacts on RHCAs by reconfiguring evaluation adit, mill site, and paste tailings facility layouts and slight changing the NFS road #150 realignment. Minor modifications to Alternative V would slightly increase disturbance to grizzly bear habitat at the evaluation adit, mill site, and along the realigned section of NFS road #150 and slightly decrease disturbance to grizzly bear habitat at the paste tailings facility.

Overall, the minor modifications to Alternative V since the 2001 FEIS would slightly reduce the direct physical loss of grizzly bear habitat from the 482 acres of grizzly bear habitat originally stated in the 2001 FEIS to 445 acres lost plus 36 acres cleared for the powerline. Potential grizzly bear habitat lost due to Alternative V would be less than the other action alternatives.

4.13.3.2.1 Core Area

Alternative V effects on core habitat are presented in Table 4-19. As described in Section 3.13, *Threatened and Endangered Species*, existing conditions for core habitat are slightly (1 to 2%) below Access Amendment standards. In addition, the Access Amendment does not allow a decrease in core habitat in any BMU. Alternative V would not change existing conditions for core habitat in BMUs 4 and 6. Within BMU 6, installing a berm on NFS road #2285 (Orr Creek Road) under Alternative V would slightly increase core area, improving core habitat conditions, but the change would not be substantial when core values are rounded to the nearest percent. Within BMU 5, constructing a berm across NFS road #4784 (Upper Bear Creek Road) under Alternative V would increase core habitat area during the life of the mine. To be considered effective core the Access Amendment requires grizzly bear core habitat to remain in place for at least 10 years after it is created. After mine reclamation, approximately 35 years after the start of the Rock Creek Project, NFS road #4784 would be reopened and core habitat would return to preconstruction conditions.

Table 4-19. Existing Conditions and Alternative V Effects on Percent Core Habitat in BMUs 4, 5, and 6.

BMU	Percent Core Habitat		
	Existing Conditions[2]	Alternative V[1]	
		Construction and Operation	Post-reclamation[3]
4	62	62	62
5	58	60	58
6	54	54	54

[1]Effects in this table incorporate changes in road status associated with Alternative V mitigation, but do not reflect potential improved conditions that could result from required land acquisitions associated with mitigation for each alternative.
[2]Source: KNF moving windows model results for the 2009 bear year monitoring report, as modified with data for BMUs 5 and 6 available as of August 2012. Data for BMUs 5 and 6 were updated for this analysis so that roads temporarily opened for harvest activity, road repair, or other temporary activities were assigned their long-term access status to more accurately reflect baseline conditions.
[3]Approximately 35 years after start of project.

4.13.3.2.2 OMRD

Alternative V effects on OMRD are presented in Table 4-20. As described in Section 3.13, *Threatened and Endangered Species*, existing conditions either meet or are within 1% of Access Amendment standards. Gating a portion of NFS road #150 (Government Mountain Road) would decrease OMRD within BMU 4 for the mine life. Within BMU 5, constructing a berm across NFS road #4784 (Upper Bear

Creek Road) under Alternative V would decrease OMRD during the mine life. After reclamation, OMRD within BMU 5 would return to preconstruction conditions. Alternative V would not affect OMRD within BMU 6.

Table 4-20. Existing Conditions and Alternative V Effects on OMRD in BMUs 4, 5, and 6.

BMU	OMRD		
	Existing Conditions[2]	Alternative V[1]	
		Construction and Operation	Post-reclamation[3]
4	37	36	36
5	28	27	28
6	29	29	29

[1]Effects in this table incorporate changes in road status associated with Alternative V mitigation, but do not reflect potential improved conditions that could result from required land acquisitions associated with mitigation for each alternative.
[2]Source: KNF moving windows model results for the 2009 bear year monitoring report, as modified with data for BMUs 5 and 6 available as of August 2012. Data for BMUs 5 and 6 were updated for this analysis so that roads temporarily opened for harvest activity, road repair, or other temporary activities were assigned their long-term access status to more accurately reflect baseline conditions.
[3]Approximately 35 years after start of project.

4.13.3.2.3 TMRD

Alternative V effects on TMRD are presented in Table 4-21. As described in Section 3.13, *Threatened and Endangered Species*, existing TMRD meets or is less than 3% of the Access Amendment standards. In Alternative V, TMRD would remain the same as existing conditions during mine construction and operations and following reclamation.

Table 4-21. Existing Conditions and Alternative V Effects on TMRD in BMUs 4, 5, and 6.

BMU	TMRD		
	Existing Conditions[2]	Alternative V[1]	
		Construction and Operation	Post-reclamation[3]
4	29	29	29
5	23	23	23
6	33	33	33

[1]Effects in this table incorporate changes in road status associated with Alternative V mitigation, but do not reflect potential improved conditions that could result from required land acquisitions associated with mitigation for each alternative.
[2]Source: KNF moving windows model results for the 2009 bear year monitoring report, as modified with data for BMUs 5 and 6 available as of August 2012. Data for BMUs 5 and 6 were updated for this analysis so that roads temporarily opened for harvest activity, road repair, or other temporary activities were assigned their long-term access status to more accurately reflect baseline conditions.
[3]Approximately 35 years after start of project.

The mitigation plan for Alternative V would include acquiring or establishing easements on 2,450 acres of replacement habitat to mitigate for grizzly bear displacement and habitat loss. As described in Section 2.3.1.16, *Monitoring and Mitigation Plans*, RCR has acquired 928 acres that are intended to meet the criteria for replacement habitat. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. Potential improved conditions that could result from land acquisitions or easements associated with mitigation were not included in the analysis of effects on percent core habitat, OMRD, and TMRD. Acquired parcels would provide additional core habitat where roads were barriered adjacent to core habitat. Any roads barriered on acquired parcels would also reduce road densities. The mitigation plan also would include managing road and trail access in grizzly bear habitat, managing attractants, funding information and education programs, funding additional law enforcement, funding monitoring and research, implementing measures to reduce habitat fragmentation, and augmenting bear populations. Alternative V proposed mitigation measures are described in greater detail in Section 2.3.1.16, *Monitoring and Mitigation Plans*.

In summary, Alternative V would be consistent with the Access Amendment standards because it would not decrease core area or increase OMRD or TMRD in BMUs 4, 5, and 6. Although baseline conditions in BMUs 4, 5, and 6 do not meet all Access Amendment standards for core habitat, OMRD, and TMRD, the mitigation proposed for the Rock Creek Project is expected to help KNF achieve the Access Amendment standards over time.

The results of the analysis using updated data on existing conditions are consistent with the USFWS 2006 BO and 2007 BO Supplement (USFWS 2006, 2007). In the 2007 BO Supplement, the USFWS determined that the proposed mitigation measures would offset the negative impacts of Alternative V and that Alternative V would not likely jeopardize the continued existence of grizzly bears. The net effect of implementation of Alternative V would be improved conditions for grizzly bears.

4.13.3.3 Lynx

Impacts on lynx under Alternative V were previously addressed on pages 4-189 through 4-192 of the 2001 FEIS and in a previous BA amendment (KNF 2000). As described in Section 3.13, *Threatened and Endangered Species* of this Draft SEIS, the Rock Creek Project study area is not in lynx critical habitat and no lynx have been sighted in the study area. As also described in Section 3.13, the NRLMD was not in place when the 2001 FEIS was issued. The 2001 FEIS analysis was revised and updated in accordance with the NRLMD that was incorporated into the 2015 KFP. The following management direction applies to all NFS lands known to be occupied by lynx. Only the objectives, standards, and guidelines potentially applicable to the Rock Creek Project are discussed below.

Objectives, Standards, and Guidelines Applicable to All Management Projects in Lynx Habitat
Objective ALL O1: Maintain or restore lynx habitat connectivity in and between LAUs and in linkage areas.

Activities that alter vegetative cover over large areas or wide bands of cover, especially in travel corridors (saddles, ridges) or linkage areas, could reduce connectivity within or between LAUs. No activities are proposed in areas that provide connectivity or linkage, thus Alternative V is not expected to affect linkage or connectivity.

Standard ALL S1: New or expanded permanent development and vegetation management projects must maintain habitat connectivity in a LAU and/or linkage areas.

Alternative V was designed in exact accordance with this standard because the proposed facilities would mostly be constructed outside of lynx habitat, and impacts on lynx habitat at the evaluation adit would not be located within a linkage corridor. The segment of NFS road #150 that would be paved in Alternative V is not in lynx habitat. Most mine access roads would not be in lynx habitat and displacement effects from human activity, including low-traffic roads, do not appear to be a major concern for lynx (Ruediger et al. 2000).

There would be minimal potential for increased mortality risk to lynx due to higher traffic levels and increased speeds. The risk would be minimal due to the relative absence of Canada lynx from the study area. Connectivity with other LAUs is good except for to the southwest, where linkage is impaired by the presence of Montana Highway 200, Noxon Reservoir, and Cabinet Gorge Reservoir. Land acquired to mitigate the effects of Alternative V would potentially improve lynx habitat connectivity, if it were managed to provide lynx habitat.

Guideline ALL G1: Methods to avoid or reduce effects on lynx should be used when constructing or reconstructing highways or forest highways across federal land. Methods could include fencing, underpasses, or overpasses.

Forest roads rarely receive motorized use at levels that create barriers or impediments to lynx movements (USFWS 2007b). The primary concern with highways is the risk of lynx mortality due to collisions with high-speed vehicles on paved highways or straight gravel roads on flatter terrain. The best information available suggests that the types of roads in the Rock Creek Project study area that are managed by the Forest Service do not provide surface conditions conducive to fast speeds, and do not adversely affect lynx (USFWS 2007b). Lynx mortality from vehicle strikes has not been documented on NFS lands on the KNF, and although possible, is not likely to occur.

About 4.6 miles of NFS road #2741 to the evaluation adit would be upgraded and a 0.1-mile-long spur road to the adit would be constructed. Improvements to the existing NFS road #2741 would include a minimum road width of 14 feet, improved or added road turnouts about every 1,000 to 1,500 feet, and reconditioning of the road surface for year-round use and maintenance. Minor amounts of clearing may be necessary for turnouts and snowplowing. The short spur road would require a 14-foot-wide surface to accommodate equipment. The spur road and about 4.4 miles of the upgraded NFS road #2741 would be within lynx habitat.

Reconstructed and new roads associated with Alternative V do not incorporate specific design measures to avoid or reduce effects on lynx. Roads improved for Alternative V would allow higher vehicle speeds and increased traffic, and could increase the risk of lynx mortality due to collisions with vehicles. NFS road #2741 is the only access road that would be in lynx habitat and it is unlikely that improvements to this road would facilitate higher vehicle speeds given the steep terrain and sharp curves. However, because the access roads would not be forest highways, guideline ALL G1 does not apply. Specific road design measures that would minimize potential road reconstruction impacts on lynx are not necessary.

Objectives, Standards, and Guidelines Applicable to Vegetation Management Projects in Lynx Habitat
NRMLD objectives, standards, and guidelines applicable to vegetation management activities in lynx habitat within LAUs in occupied habitat do not apply to removal of vegetation for permanent developments such as mineral operations. The objective of all action alternatives is mineral development and the Vegetation Objectives, Standards, and Guidelines (Standard VEG S1, VEG S2, and VEG S6; Objectives VEG O1, O2, O3, and O4: Guidelines VEG G1, G4, G5, and G11) do not apply.

Objectives, Standards, and Guidelines Applicable to Human Use Projects in Lynx Habitat
Objective HU O1: Maintain the lynx's natural competitive advantage over other predators in deep snow by discouraging the expansion of snow-compacting activities in lynx habitat.

The USFWS concluded in their initial Final Rule that snow compaction created by human activities was not found to be a threat to the lynx distinct population segment (USFWS 2000). They also concluded that there was no evidence that any competition existed between lynx and other species that exerted a population-level impact on lynx, and that there was no evidence that packed snow routes facilitated competition to a level that negatively affected lynx or lynx populations (USFWS 2003). The Service does acknowledge that there is evidence that competing predators do use packed trails, suggesting a potential effect on individual lynx. Because there could be possible adverse effects at the site-specific scale, and because of the possibility that unregulated expansion could further impair conservation efforts over time, the NRLMD included provisions to discourage the expansion of snow-compacting activities in lynx habitat above the existing conditions (USFWS 2007b). No particular threshold of allowable increases is provided in the NRLMD.

To access the evaluation adit site during construction, it would be necessary to plow snow on NFS road #2741 for one winter, including a portion of the road within lynx habitat. To access the mill site, NFS road #150 would be plowed for the first 5 miles. This segment of NFS road #150 is not in lynx habitat, nor in any LAU. Alternative V would contribute to progress toward achieving Objective HU O1 because there

would be no increase in groomed or designated over-the-snow routes or snowmobile play areas, and lynx competitive advantage in deep snow would be maintained. Alternative V would be consistent with this objective.

Objective HU O2: Manage recreational activities to maintain lynx habitat and connectivity.

The objective of the action alternatives is mineral development. There are no recreational activities proposed. Most recreational activities in the Rock Creek drainage would continue under Alternative V. Motorized road access would decrease slightly due to road closures and access restrictions during construction and mine operation. As described in the 2001 FEIS on page 4-253, local population growth resulting from the Rock Creek Project likely would result in increased hunting, fishing, and trapping in the study area. Alternative V would contribute to progress toward achieving Objective HU O2 because public access in the mine area would be managed during the Construction and Operations Phases, and would not create new recreational routes affecting lynx habitat or connectivity. Therefore, Alternative V would be consistent with this objective.

Objective HU O3: Concentrate activities in existing developed areas, rather than developing new areas in lynx habitat.

Alternative V would contribute to progress toward achieving Objective HU O3 because the proposed mine facilities would be concentrated outside of lynx habitat, with the exception of the evaluation adit. All buildings and other facilities at the evaluation adit would be removed once the mine is operational. Alternative V would be consistent with this objective.

Objective HU O5: Manage human activities, such as special uses, mineral and oil and gas exploration and development, and placement of utility transmission corridors, to reduce impacts on lynx and lynx habitat.

Alternative V would contribute to progress toward achieving Objective HU O5 because the proposed mine facilities would be concentrated outside of lynx habitat, with the exception of the evaluation adit. The proposed Rock Creek Project facilities within lynx habitat at the evaluation adit would cover the smallest area possible to reduce impacts on lynx habitat. A total of 9.9 acres of lynx habitat (9.7 acres of multistory or late successional forest and 0.2 acre of other lynx habitat) would be impacted under Alternative V, which is less than 0.1% of lynx habitat in the Rock LAU. All buildings and other facilities at the evaluation adit would be removed once the mine is operational. Alternative V would be consistent with this objective.

Objective HU O6: Reduce adverse highway effects on lynx by working cooperatively with other agencies to provide for lynx movement and habitat connectivity, and to reduce the potential of lynx mortality.

The primary concern with highways is the risk of lynx mortality due to collisions with high-speed vehicles on paved highways or straight gravel roads on flatter terrain. Managing habitat beneficial to lynx movement and cover across linkage areas where lynx tend to cross highways could help reduce mortality. Montana Highway 200, on the south side of the Rock Creek Project study area, is the only highway associated with this project. The highway corridor does not include lynx habitat; therefore, this objective does not apply. No mitigation for lynx is proposed in Alternative V, however, mitigation for grizzly bears may benefit lynx by improving connectivity.

Guideline HU G4: For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.

No monitoring for lynx, lynx habitat or snow compaction was proposed in Alternative V. As described above for Objective HU O1, Alternative V would not result in an increase in groomed or designated over-the-snow routes or snowmobile play areas. It would be necessary to plow snow on NFS road #2741 for one winter, including a portion of the road within lynx habitat. Monitoring the effects of plowing one road for one winter would not provide enough monitoring data to provide meaningful information on the effects of snow compaction. Therefore, Alternative V was designed in accordance with this guideline.

Guideline HU G5: For mineral and energy development sites and facilities that are closed, a reclamation plan that restores lynx habitat should be developed.

Lynx habitat would only be disturbed during Phase I and would be limited to the evaluation adit portal pad, the spur road to the portal pad, and improvements to NFS road #2741. All buildings and other facilities at the evaluation adit would be removed once the mine was operational. As described in Section 2.3.1.15, *Reclamation*, a Phase I revegetation plan would be implemented under Alternative V. If reclamation were successful, sites with lynx habitat potential would return to suitable lynx habitat in the long term, equating to about 25- to 30-year life of the mine and reclamation, plus additional time for plant establishment and succession. Therefore, Alternative V was designed in accordance with this guideline.

Guideline HU G6: Methods to avoid or reduce effects on lynx should be used in lynx habitat when upgrading unpaved roads to maintenance levels 4 or 5, if the result would be increased traffic speeds and volumes, or a foreseeable contribution to increases in human activity or development.

The existing access route to the exploration adit (NFS road #2741) crosses lynx habitat. About 4.4 miles of NFS road #2741 would be upgraded with turnouts or widening in select locations and a 0.1-mile-long spur road would be constructed from NFS road #2741 to the adit. This section of road is steep and winding, thus high traffic speeds as a result of the improvements are unlikely. The Rock Creek Project proposes to close NFS road #2741J, which currently extends beyond the adit. This would minimize disturbance around some potential denning habitat, which is important from May to August.

Alternative V proposes paving NFS road #150 and constructing a new paved road to the mill site; however, these road segments are not in lynx habitat. Motorized road access to lynx habitat at higher elevations would decrease slightly due to road closures and access restrictions during construction and mine operation. Therefore, Alternative V was designed in accordance with this guideline.

Guideline HU G7: New permanent roads should not be built on ridge tops and saddles, or in areas identified as important for lynx habitat connectivity. New permanent roads and trails should be situated away from forested stringers.

Alternative V disturbance in lynx habitat would be limited to the evaluation adit portal pad, spur roads to the portal pad, and improvements to NFS road #2741. No new permanent roads would be built in lynx habitat or on ridge tops or saddles. Therefore, Alternative V was designed in accordance with this guideline.

Guideline HU G8: Cutting brush along low-speed, low-traffic-volume roads should be done to the minimum level necessary to provide for public safety.

Low-speed, low-traffic forest roads generally refers to single-lane roads where roadside brush would be likely to intrude into the vehicle-width corridor (about 14 feet wide). The only Rock Creek Project-related road in lynx habitat is the upper part of NFS road #2741, which in Alternative V would only be used during Phase I leading to the evaluation adit. Road maintenance, which could include roadside brushing to the minimum level needed for safety, would occur along this section of road during Phase I of the Rock

Creek Project, which would last 18 to 24 months. A VMP would be developed by RCR and approved by the KNF and DEQ to minimize disturbance during clearing and construction and to maximize revegetation success on all cut-and-fill slopes and reclaimed road segments. Vegetation removal and disposition for Phase I is described in detail in Section 3 of the Rock Creek Evaluation Adit License Application (RCR 2010). Disturbance would be minimized during clearing and construction activities and the edges of the permit boundary would be staked. Therefore, Alternative V was designed in accordance with this guideline.

Guideline HU G9: On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is complete, these roads should be reclaimed or decommissioned, if not needed for other management objectives.

No new roads would be constructed within lynx habitat, with the exception of a 0.1-mile spur road from NFS road #2741 to the evaluation adit, which would be closed to the public. Following Rock Creek Project completion, disturbance at the adit site, including the spur road, would be removed and reclaimed. Therefore, Alternative V was designed in accordance with this guideline.

Guideline HU G12: Winter access for non-recreation special uses and mineral and energy exploration and development should be limited to designated routes or designated over-the-snow routes.

Winter access to the mine site and evaluation adit would be limited to designated routes, including NFS road #150 and NFS road #2741 during construction and operation. The lower section of NFS road #150 is currently plowed in winter, but this road segment is not in lynx habitat. Following mine closure, NFS road #2741 would not be plowed and would not be accessible to wheeled vehicles in winter. It would continue to be accessible to snowmobiles. All motorized winter access for mine related activities would be confined to the existing road network and new roads proposed to access mine facilities, and winter access associated with Alternative V was designed in accordance with this guideline.

Objectives, Standards, and Guidelines Applicable to ALL Projects in Linkage Areas in Occupied Habitat, Subject to Valid Existing Rights.

Objective LINK O1: In areas of intermingled land ownership, work with landowners to pursue conservation easements, HCPs or other solutions to reduce the potential of adverse impacts on lynx and lynx habitat.

Under Alternative V, lands or conservation easements would be acquired as mitigation for grizzly bear habitat physically lost, and all lands would be managed in perpetuity for grizzly bears. If these lands were located in lynx habitat, management for grizzly bears would also benefit lynx by offsetting direct loss of habitat, precluding private parcels within lynx habitat from being developed, improving habitat connectivity for lynx. If road access changes were implemented where land acquired for grizzly bear mitigation provided suitable lynx habitat, reduced motorized access could provide higher levels of security for lynx and potentially reduce risk of displacement and potential poaching. Due to the required habitat compensation for grizzly bear mitigation, impacts on lynx and their habitat could be reduced, and Alternative V would contribute to progress toward achieving Objective LINK 01.

4.13.4 Alternative IV

4.13.4.1 Bull Trout

Potential water quantity and quality effects of Alternative IV on bull trout are similar to those described for Alternative V in this SEIS and are otherwise unchanged from effects described in the 2001 FEIS (page 4-187). Compared with Alternative V, Alternative IV would result in additional disturbance to bull trout

critical habitat in East Fork Rock Creek, where the mill site would impact 18 acres of RHCA in the Rock Creek drainage (including East Fork Rock Creek and West Fork Rock Creek) (Table 4-18 in Section 4.11, *Aquatic Life and Fisheries*).

Alternative IV may also result in additional sediment delivery based on greater new and reconstructed road lengths than Alternative V, fewer road improvements that would reduce sediment delivery from NFS road #150, and ground disturbance from aboveground conveyance pipelines for adit water discharge and slurry and reclaimed water.

Aboveground conveyance pipelines for Alternative IV also would pose a greater threat of leakage from vandalism and other factors. As described in Section 4.7.3.4, *Surface Water Quality*, Alternative V water treatment facilities would discharge higher quality treated water from discharge diffusers. As described in the 2001 FEIS, the potential for adverse environmental impacts on bull trout from a tailings facility failure would be greater under Alternatives II, III, and IV than Alternative V, which includes storage of tailings as paste instead of slurry.

4.13.4.2 Grizzly Bear

Direct physical loss of grizzly bear habitat and mitigation measures under Alternative IV are unchanged from the 2001 FEIS and are described on pages 4-186 and 4-187 of the 2001 FEIS. The amount of habitat physically altered and total space influenced during the Construction and Operations Phases would be greater under Alternative IV than under Alternative V.

Direct and indirect effects on grizzly bears from access management were analyzed on pages 4-179 through 4-181 and pages 4-186 and 4-187 of the 2001 FEIS. Although baseline access management conditions have been updated as described above, effects under Alternative IV are unchanged from the 2001 FEIS. Direct and indirect effects on grizzly bears would be greater under Alternative IV than under Alternative V. Alternative IV would have greater adverse effects on core habitat than Alternative V. Similarly, OMRD and TMRD would be greater under Alternative IV than Alternative V because Alternative V grizzly bear mitigation would involve more road closures. Alternative IV also includes fewer mitigation measures to protect grizzly bears than Alternative V. The adverse effects on grizzly bear and its habitat would not be fully mitigated under Alternative IV.

4.13.4.3 Lynx

Direct impacts on lynx under Alternative IV would be the same as Alternative V, except that direct loss of habitat at the evaluation adit would be about 2.3 acres less than Alternative V. The effects on lynx would be minor.

Compliance with objectives, standards, and guidelines applicable to all management projects in lynx habitat under the NRLMD would be the same as for Alternative V.

4.13.5 Alternative III

4.13.5.1 Bull Trout

Potential water quantity and quality effects of Alternative III on bull trout are similar to those described for Alternative IV in this SEIS and are otherwise unchanged from the effects described the 2001 FEIS (page 4-186). Mine facilities under Alternative III would impact a total of 55 acres of RHCA within the Rock Creek drainage, 25 acres more than Alternative IV (Table 4-18 in Section 4.11, *Aquatic Life and Fisheries*). Alternative III may result in additional sediment delivery, and subsequently more potential sediment-related impacts on bull trout habitat, based on greater road use to a mill site located further up the drainage, fewer road improvements that would reduce sediment delivery, and ground disturbance from

additional powerlines. Longer pipelines for conveying slurry and reclaimed water and excess mine adit water would be necessary based on the mill site location for this alternative.

4.13.5.2 Grizzly Bear

Direct physical loss of grizzly bear habitat and mitigation measures under Alternative III are unchanged from the 2001 FEIS and are described on pages 4-185 and 4-186 of the 2001 FEIS. The amount of habitat physically altered and total space influenced during the Construction and Operations Phases would be greater under Alternative III than under Alternatives IV and V.

Direct and indirect effects on grizzly bears from access management were analyzed on pages 4-179 through 4-181 and pages 4-185 and 4-186 of the 2001 FEIS. Although baseline access management conditions have been updated as described above, effects under Alternative III are unchanged from the 2001 FEIS. Direct and indirect effects on grizzly bears from access management would be greater under Alternative III than under Alternative V. Alternative III would have greater adverse effects on core habitat than Alternative V. Similarly, OMRD and TMRD would be greater under Alternative III than Alternative V because Alternative V would involve more road closures for mitigation. Alternative III also includes fewer mitigation measures to protect grizzly bears than Alternative V. The adverse effects on grizzly bear and its habitat would not be fully mitigated under Alternative III.

4.13.5.3 Lynx

Direct impacts on lynx under Alternative III would be the same as impacts under Alternative IV. Indirect impacts could potentially be greater than under Alternatives IV and V because the mill site would be at a higher elevation and would be just outside mapped lynx habitat. Effects on lynx would be minor and Alternative III would not likely adversely impact lynx or its habitat.

Compliance with objectives, standards, and guidelines applicable to all management projects in lynx habitat under the NRLMD would be the same as for Alternatives IV and V.

4.13.6 Alternative II

4.13.6.1 Bull Trout

Potential water quantity and quality effects from Alternative II on bull trout are similar to those described for Alternative IV in this SEIS and have otherwise not changed from the 2001 FEIS (page 4-176). Mine facilities under Alternative II would impact a total of 66 acres of RHCA within the Rock Creek drainage, 10 acres more than Alternative III (Table 4-18 in Section 4.11, *Aquatic Life and Fisheries*).

4.13.6.2 Grizzly Bear

Direct physical loss of grizzly bear habitat and mitigation measures under Alternative II are unchanged from the 2001 FEIS and are described on pages 4-178 through 4-182 of the 2001 FEIS. The amount of habitat physically altered and total space influenced during the Construction and Operations Phases would be greater under Alternative II than under Alternatives III, IV, and V.

Direct and indirect effects on grizzly bears from access management were analyzed on pages 4-178 through 4-182 of the 2001 FEIS. Although baseline access management conditions have been updated as described above, effects under Alternative II are unchanged from the 2001 FEIS. Direct and indirect effects on grizzly bears from access management would be greater under Alternative II than under the other action alternatives. Alternative II would have greater adverse effects on core habitat than Alternative V. Similarly, OMRD and TMRD would be greater under Alternative II than Alternative V because Alternative V would involve more road closures for mitigation. Alternative II also includes fewer

mitigation measures to protect grizzly bears than Alternative V. The adverse effects on grizzly bear and its habitat would not be fully mitigated under Alternative II.

4.13.6.3 Lynx

As described on pages 4-183 and 4-184 of the 2001 FEIS, Alternative II would have the most impacts on lynx of any of the action alternatives because it has the most activity in the higher elevations preferred by lynx. The main difference in impacts on lynx from Alternative II and the other action alternatives is that Alternative II has a different location for the ventilation adit within the CMW. The ventilation adit in the other action alternatives is on a steep cliff face, in an area that is less likely to provide lynx habitat, whereas in Alternative II, the ventilation adit is in flatter terrain that would be more likely to be used by lynx. Overall, Alternative II effects on lynx would be minor. Compliance with objectives, standards, and guidelines applicable to all management projects in lynx habitat under the NRLMD would be the same as for Alternatives III, IV, and V.

4.13.7 Alternative I

4.13.7.1 Bull Trout

Effects on bull trout under Alternative I are described on page 4-176 of the 2001 FEIS and are unchanged since the 2001 FEIS. Alternative I would have no adverse effect on bull trout or its habitat.

4.13.7.2 Grizzly Bear

Alternative I would not result in direct physical loss of grizzly bear habitat. Core habitat, OMRD, and TMRD would be the same as existing conditions. Alternative I would not likely adversely affect grizzly bears or their habitat; however, under Alternative I, the extensive mitigation measures proposed for the Rock Creek Project Alternative V would not be implemented. The mitigation measures under Alternative V would result in improved conditions for grizzly bears compared with existing conditions and are expected to help achieve the standards outlined in the Access Amendment.

4.13.7.3 Lynx

Effects on lynx under Alternative I are described on page 4-176 of the 2001 FEIS and are unchanged since the 2001 FEIS. Alternative I would have no adverse effect on the lynx or its habitat.

4.13.8 Effectiveness of Agencies' Proposed Mitigation

In Alternative V, RCR would implement mitigation plans for T&E species as described in Section 2.3.1.16, *Monitoring and Mitigation Plans*. Appendix K describes the Alternative V monitoring plan for T&E species.

4.13.8.1 Bull Trout

In the 2007 BO Supplement (Appendix E), the USFWS requires compliance with seven Terms and Conditions for exemption from the take prohibitions of ESA Section 9. These Terms and Conditions are considered appropriate to minimize impacts of incidental take of bull trout. Terms and Conditions 1c, 2, 3, 4, and 5 of the 2007 BO Supplement have already been implemented or would be implemented prior to surface disturbances that are not related to the evaluation adit stage of the Rock Creek Project.

Term and Condition 1c of the 2007 BO Supplement (Appendix E), requires RCR to conduct a watershed assessment to better define bull trout populations and better define habitat conditions. In 1997, Watershed Consulting prepared a report, *1996 Field Data Summary Report for Rock Creek Near Noxon, Montana*, that addressed aquatic habitat issues raised during the environmental review for the proposed Rock Creek

Mine pursuant to the ESA, NEPA, NFMA, and MEPA. The Watershed Consulting (1997) report addressed streamflows, substrate composition, sediment sources, LWD, fish populations and distribution, and potential bull trout spawning habitat. In 2012, Salmon Environmental Services prepared a report, *Rock Creek Fisheries and Aquatic Habitat Assessment Supplement*, that incorporates data collected in the Rock Creek drainage since 1997 and provides information that addresses changes in management and legal direction implemented since 1997. The Watershed Consulting (1997) and Salmon Environmental Services (2012) reports meet the intent of INFS watershed analysis direction. To evaluate pre- and post-project riparian conditions, RCR would, in consultation with the Rock Creek Watershed Council, the Forest Service, and the USFWS, update the watershed assessment with any new data collected prior to the initiation of Phase II Construction and update mitigation and monitoring plans, if appropriate.

The KNF would require RCR to implement following Terms and Conditions of the 2007 BO Supplement (Appendix E), as approved by the USFWS, prior to surface disturbances that are not related to the evaluation adit stage of the Rock Creek Project:

2. Complete and submit an evaluation of locations for the wastewater diffuser in the Clark Fork River. The evaluation would be completed in consultation with the Forest Service, DEQ, and USFWS and focus on recommendations to minimize potential effects on migrating or resident bull trout using the Clark Fork River habitats adjacent to the mouth of Rock Creek and the spring area immediately upstream.
3. Submit a metal monitoring plan for bull trout habitat. The monitoring plan would include monitoring of metals concentrations in water, sediment, and fish tissues. Monitoring would start prior to mine development to establish baseline conditions and continue during operations and post-operations as determined necessary by the Forest Service and USFWS.
4. Submit a groundwater monitoring plan to the Forest Service and USFWS for monitoring of groundwater effects as they relate to bull trout habitat requirements. Monitoring would start prior to mine development to assess the baseline conditions, and continue during operations and post-operations as determined necessary by the Forest Service and USFWS.
5. Submit an assessment of accident risk related to haul routes for mine vehicles. The assessment would identify areas that pose the greatest risk to bull trout and make recommendations for additional measures and responses to minimize risk.

Alternative V also includes measures to mitigate mine impacts on surface water quantity and quality that would indirectly mitigate impacts on bull trout. Table 4-13 and Table 4-14 in Section 4.7.8, *Water Quantity and Quality - Cumulative Impacts* describe mitigation measures to reduce impacts on surface water resources in the CMW, reduce impacts on stream baseflows, minimize sediment delivery to streams, and reduce or minimize detrimental effects on surface water quality. Section 4.6.2, *Geotechnical Engineering - Alternative V* describes the proposed mine paste tailings facility that would greatly reduce the risk of surface water quality impacts from a failure compared with other tailings disposal options. If any additional measures could be incorporated to minimize the risk of catastrophic paste pile or facility failures, the KNF, DEQ, and USFWS would determine the timeline and mechanism for implementation of those identified measures.

4.13.8.2 Grizzly Bear and Canada Lynx

In the 2006 BO (Appendix E), the USFWS requires implementation of the mitigation plan as described in the Terrestrial Threatened and Endangered Species Mitigation Plan (Appendix B of the 2006 BO) and compliance with two Terms and Conditions for exemption from the take prohibitions of ESA Section 9. Collectively, mitigation measures would be expected to prevent the loss of more than one grizzly bear

over the 30-year life of the mine, thus more than offsetting the expected loss of one grizzly bear from the Rock Creek Project (USFWS 2006). The USFWS concluded that the extensive mitigation measures supported a finding that the proposed mine posed "no jeopardy" to the grizzly bear because "collectively, the measures would reduce, remove or more than offset the potential adverse effects of the proposed action" (USFWS 2006). In addition, the USFWS concluded the mitigation plan was so robust that it "would in fact improve conditions over the long term over the existing conditions, ultimately promoting the recovery of the [local] grizzly bear population" (USFWS 2006).

If monitoring described in Appendix B of the 2006 BO and summarized in Appendix K of this SEIS indicated mitigation measures were not effective, as determined by the Oversight Committee, contingency mitigation would be implemented. The Oversight Committee would develop and recommend adaptive management measures KNF could implement to remedy the situation and accommodate the conservation needs of grizzly bears in the study area. The USFWS, in its advisory capacity on the Oversight Committee, would advise KNF on whether additional consultation may be required to assess new information or changes in the mitigation plan resulting from adaptive management.

Although mitigation measures for terrestrial T&E species focus primarily on mitigating impacts on grizzly bears, these mitigation measures also would benefit Canada lynx. Land acquisition and other mitigation measures for grizzly bears would effectively mitigate habitat loss for lynx because although securing private land would not create any additional habitat, habitat acquisition would secure the sites from habitat alteration as a result of regional increases in human development unrelated to the Rock Creek Project. Funding for FWP law enforcement personnel to protect grizzly bears and developing and implementing informational and educational programs for the public about grizzlies would partially mitigate for impacts on this species. Adding personnel and implementing programs would reduce the potential for poaching and harassment of grizzly bear and lynx but would not eliminate all impacts.

4.13.9 Cumulative Impacts

4.13.9.1 General

Section 2.5, *Part IV: Description of Past, Present, and Reasonably Foreseeable Actions* updates past, current, and reasonably foreseeable actions that may contribute to cumulative impacts, including new mining activities, KNF land management activities, activities on private land, and other government agency activities. This section describes cumulative impacts of the Rock Creek alternatives on T&E species where information has been updated since the 2001 FEIS was issued.

4.13.9.2 Bull Trout

The 2007 BO Supplement (Appendix E) updated the analysis of cumulative effects in the 2001 FEIS. The analysis of groundwater and surface water effects on bull trout habitat and clarification of sediment mitigation planning described in this SEIS provides additional information relevant to the status of, and potential cumulative impacts on, bull trout in the study area. Analysis of cumulative impacts relating to habitat conditions (critical habitat), illegal harvest, introduced species, temperature, residential and commercial development, road construction, angling and poaching pressure, timber harvest, and mining activities described in the 2001 FEIS and 2007 BO Supplement remain applicable to the proposed Rock Creek Project.

Since completion of the 2001 FEIS, bull trout recovery efforts that are part of Avista's Clark Fork Settlement Agreement for long-term FERC relicensing have made significant progress documenting the ongoing status of bull trout populations, partially restoring historical migratory connections, restoring stream habitats, and protecting watershed resources.

4.13.9.2.1 Streamflow

Stream intermittency in reaches of mainstem Rock Creek currently impedes movement of fluvial and adfluvial bull trout in the drainage (see Section 3.11.2, *Rock Creek Watershed* and Section 3.11.4, *East Fork Bull River*), although Rock Creek (particularly reaches of East and West Fork Rock Creek) supports a stable population of resident bull trout. Additional reductions in baseflow resulting from both the Rock Creek and Montanore Projects may exacerbate the existing stream intermittency, resulting in reaches that are impassable by migratory bull trout for longer periods. The effects of potentially lengthened periods of stream intermittency in sections of Rock Creek on resident bull trout are less clear. Possible baseflow reductions may restrict patterns of movement within segments of Rock Creek that are important to resident bull trout, although intermittency in lower reaches may be important in excluding nonnative trout from East Fork Rock Creek and West Fork Rock Creek. The ongoing fish transport efforts in Rock Creek by Avista may offset any additional barriers to fish passage potentially resulting from the Rock Creek and Montanore Projects, but it is unclear to what degree the effects may be mitigated. Bull trout passage in the Bull River and East Fork Bull River is not anticipated to be affected by the two mines based on higher baseflows and lack of stream intermittency/migration barriers in the lower and mid-watershed reaches of these drainages.

Possible baseflow reductions resulting from the Rock Creek and Montanore Projects would result in potential loss of bull trout habitat. It is difficult to determine with certainty if the action alternatives would present a risk to bull trout due to the lack of data that would allow prediction of changes to streamflow on a reach level and a better understanding of the relationship between streamflow and habitat in the study area.

Bull trout mitigation actions proposed for the Montanore Project were selected to identify and address factors that are likely limiting bull trout populations within the study area under existing conditions. They include creating genetic reserves through bull trout transplanting, securing genetic reserves through habitat restoration, and eradicating nonnative fish species. Creating and securing genetic reserves would mitigate for potential impacts on bull trout populations by effectively reducing the risk of loss of genetic diversity from project impacts or natural events. A nonnative salmonid repression program has been initiated by Avista in the East Fork Bull River and a shift toward more native species has been documented (Horn and Tholl 2011). Similar beneficial effects would be projected under the Montanore Project mitigation plan from removal of nonnative fish species that currently pose a risk to bull trout populations through hybridization or increased competition. As discussed in Section 4.7, *Water Quantity and Quality*, private timber harvest and development of private lands in the study area that resulted in land clearing could increase peak flows in study area streams, but the potential volume peak flow increases in Rock Creek or other study area streams cannot be quantified.

Reasonably foreseeable future actions that would not affect bull trout habitat in the study area include the following:

- Libby Creek Ventures drilling plan, which would disturb about 1 acre adjacent to the Upper Libby Creek Road
- Wayup Mine and Fourth of July Road Access, which would involve reconstruction of roads in the upper West Fisher Creek drainage
- Miller-West Fisher Vegetation Management Project, which would involve timber harvest and other vegetation treatments in the Miller and West Fisher Creek drainages
- Forestwide herbicide weed control, which would treat noxious weeds in the KNF

4.13.9.2.2 Water Quality

As described in Section 4.7.8.4, *Cumulative Impacts - Surface Water Quality*, there is a possibility that cumulative baseflow reductions resulting from the Rock Creek Project and Montanore Project would result in subtle changes to surface water quality, but quantifying such changes and the effects such changes may have on bull trout is not feasible. Private timber harvest and continued development of private lands in the study area may increase sediment transport to study area streams. Streambank stabilization projects may temporarily increase sediment transport to streams, but when completed, would reduce sediment transport to streams. The potential sediment increases in Rock Creek or other study area streams cannot be quantified and would depend on when timber was harvested and site-specific information that is currently unknown. Implementation of Alternative V sediment mitigation would reduce sediment transport in the Rock Creek drainage and would counteract any increase in the drainage from other activities.

Reasonably foreseeable future actions that would not affect water quality in bull trout habitat in the study area include the following:

- Libby Creek Ventures drilling plan, which would disturb about 1 acre adjacent to the Upper Libby Creek Road, would not affect baseflows in study area streams or sediment transport in the Rock Creek drainage.
- Miller-West Fisher Vegetation Management Project, which would involve timber harvest and other vegetation treatments in the Miller and West Fisher Creek drainages, would not affect baseflows in study area streams or sediment transport in the Rock Creek drainage.
- Wayup Mine and Fourth of July Road Access, which would involve reconstruction of roads in the upper West Fisher Creek drainage, would not affect baseflows in study area streams or sediment transport in the Rock Creek drainage.
- Herbicide application associated with forestwide herbicide weed control projects would "present a low risk, if any, of herbicides threatening the health of aquatic ecosystems, animal species, or the general public" (USFS 2007b). Therefore, effects on study area stream water quality would be negligible.

4.13.9.3 Grizzly Bear

Cumulative effects on grizzly bears are described on pages 4-192 through 4-194 of the 2001 FEIS. Changed access management conditions for the grizzly bear since the 2001 FEIS was issued are described above in Section 3.13.3, *Grizzly Bear*. Past, present, and reasonably foreseeable actions potentially affecting grizzly bears include the Miller West Fisher Vegetation Management Project, the Montanore Project, and other activities as described in Section 2.5, *Part IV: Description of Past, Present, and Reasonably Foreseeable Actions.*

The cumulative effects analysis for grizzly bear was updated for percent core habitat, OMRD, and TMRD under Alternative I (no action) and Alternative V. As described above, direct effects of the Rock Creek Project would occur within BMUs 4, 5, and 6. For the updated cumulative effects analysis, values for core habitat, OMRD, and TMRD were calculated for the following scenarios for BMUs 4, 5, and 6:

1. Montanore construction phase with other past, present, and reasonably foreseeable activities, without the Rock Creek Project (Alternative I).
2. Montanore operations phase with other past, present, and reasonably foreseeable activities, without the Rock Creek Project (Alternative I).
3. Montanore post-reclamation with other past, present, and reasonably foreseeable activities, without the Rock Creek Project (Alternative I).

4. Montanore construction phase with other past, present, and reasonably foreseeable activities, with the Rock Creek Project (Alternative V).
5. Montanore operations phase with other past, present, and reasonably foreseeable activities, with the Rock Creek Project (Alternative V).
6. Montanore post-reclamation, with other past, present, and reasonably foreseeable activities, with the Rock Creek Project (Alternative V).

For the Montanore Project, Alternative 3D-R was used for the cumulative impact scenarios. For BMU 6, cumulative effects of the Miller West Fisher Project Phases 1 and 2 also were considered. Effects also are shown for other reasonably foreseeable actions. The expected timeline for timber harvest projects is approximately 5 years. Because the exact time of occurrence of future projects is not known, future activities were assumed to potentially occur during the construction or operations phase of the Montanore Project. The Miller West Fisher Project, Phases 1 and 2, also were assumed to potentially occur with either the construction or operations phase of the Montanore Project. The updated cumulative effects analysis is presented in Table 4-22 through Table 4-25.

Table 4-22. Cumulative Effects of the No Action Alternative and Alternative V on Percent Core by BMU.

BMU	Existing Conditions[1]	No Action Alternative[1]			Rock Creek Alternative V with All Cumulative Activities[2]		
		With Montanore Alt 3D-R Construction Phase	With Montanore Alt 3D-R Operations Phase	Post-reclama-tion[3]	With Montanore Alt 3D-R Construction Phase	With Montanore Alt 3D-R Operations Phase	Post-reclamation[3]
4	62	62	62	62	62	62	62
5	58	64	64	65	66	66	65
6	54	54/54[4]	54/54[4]	56	54/55[4]	54/55[4]	56

Source: KNF moving windows model results for the 2009 bear year monitoring report, as modified with data for BMUs 5 and 6 available as of August 2012. Data for BMUs 5 and 6 were updated for this analysis so that roads temporarily opened for harvest activity, road repair, or other temporary activities were assigned their long-term access status to more accurately reflect baseline conditions.
[1]Effects shown are for other reasonably foreseeable actions only.
[2]The effects in this table do not reflect potential improved conditions from required land acquisitions associated with mitigation for Alternative V or reasonably foreseeable actions.
[3]Post-reclamation period anticipated to occur approximately 35 years after start of project.
[4]Displays the Miller West Fisher Project Phase 1 / Phase 2 effects in addition to the other cumulative activities being considered within the BMU.

Past, present, and reasonably foreseeable activities would affect percent core habitat in the study area. In BMU 4, core habitat would change less than 1% under each of the cumulative impact scenarios. In BMU 5, core habitat would increase by 6 to 8%, depending on the scenario. In BMU 6, core habitat would increase by 0 to 2%, depending on the scenario. The Rock Creek Project, when combined with other past, present, and reasonably foreseeable actions, would increase core grizzly bear habitat and thus would not result in adverse cumulative impacts. The Rock Creek Project would be in compliance with Access Amendment standards for grizzly bear core habitat in BMUs 4, 5, and 6 because percent core habitat would remain the same or would increase.

Table 4-23. Cumulative Effects of the No Action Alternative and Alternative V on Percent OMRD by BMU.

BMU	Existing Conditions	No Action Alternative[1]			Rock Creek Alternative V with All Cumulative Activities[2]		
		With Montanore Alt 3D-R Construction Phase	With Montanore Alt 3D-R Operations Phase	Post-reclamation[3]	With Montanore Alt 3D-R Construction Phase	With Montanore Alt 3D-R Operations Phase	Post-reclamation[3]
4	37	37	37	37	36	36	36
5	28	28	28	27	27	27	27
6	29	36/36[4]	36/36[4]	27	36/36[4]	36/36[4]	27

Source: KNF moving windows model results for the 2009 bear year monitoring report, as modified with data for BMUs 5 and 6 available as of August 2012. Data for BMUs 5 and 6 were updated for this analysis so that roads temporarily opened for harvest activity, road repair, or other temporary activities were assigned their long-term access status to more accurately reflect baseline conditions.
[1]Effects shown are for other reasonably foreseeable actions only.
[2]The effects in this table do not reflect potential improved conditions from required land acquisitions associated with mitigation for Alternative V or reasonably foreseeable actions.
[3]Post-reclamation period anticipated to occur approximately 35 years after start of project.
[4]Displays the Miller West Fisher Project Phase 1 / Phase 2 effects in addition to the other cumulative activities being considered within the BMU.

Past, present, and reasonably foreseeable activities would affect OMRD in the study area. In BMUs 4 and 5, OMRD would decrease by 1% when the Rock Creek Project is considered in combination with past, present, and reasonably foreseeable actions. In BMU 6, OMRD would increase by up to 7%, during the Montanore and Miller West Fisher Projects, but would be 2% less than existing conditions following reclamation. None of the increase in OMRD in BMU 6 would be attributable to Alternative V. Although other actions would increase OMRD in BMU 6, Alternative V would decrease OMRD in BMUs 4 and 5. Alternative V would be in compliance with Access Amendment standards because it would not increase OMRD in BMUs 4, 5, and 6.

Table 4-24. Cumulative Effects of the No Action Alternative and Alternative V on Percent TMRD by BMU.

BMU	Existing Conditions	No Action Alternative			Rock Creek Alternative V with All Cumulative Activities[1]		
		With Montanore Alt 3D-R Construction Phase	With Montanore Alt 3D-R Operations Phase	Post-reclamation[2]	With Montanore Alt 3D-R Construction Phase	All Actions Considered with Montanore Alt 3D-R Operations Phase	Post-reclamation[2]
4	29	29	29	29	29	29	29
5	23	20	20	18	20	19	18
6	33	35/35[3]	34/35[3]	33	35/35[3]	34/35[3]	32

Source: KNF moving windows model results for the 2009 bear year monitoring report, as modified with data for BMUs 5 and 6 available as of August 2012. Data for BMUs 5 and 6 were updated for this analysis so that roads temporarily opened for harvest activity, road repair, or other temporary activities were assigned their long-term access status to more accurately reflect baseline conditions.
[1]The effects in this table do not reflect potential improved conditions from required land acquisitions associated with mitigation for Alternative V or reasonably foreseeable actions.
[2]Post-reclamation period anticipated to occur approximately 35 years after start of project.
[3]Displays the Miller West Fisher Project Phase 1 / Phase 2 effects in addition to the other cumulative activities being considered within the BMU.

Past, present, and reasonably foreseeable activities would affect TMRD in the study area. In BMU 4, TMRD would be unchanged when the Rock Creek Project is considered in combination with past, present, and reasonably foreseeable actions. In BMU 5, TMRD would decrease by 3 to 5%, depending on the cumulative impact scenario. In BMU 6, changes in TMRD would range from an increase of 1 to 2% to a decrease of 1%, during the Montanore and Miller West Fisher Projects, and would be 1% less than existing conditions following reclamation. None of the increase in TMRD in BMU 6 would be attributable to the Rock Creek Project. Although other actions would increase TMRD in BMU 6, the Rock

Creek Project would decrease in TMRD in BMU 5. The Rock Creek Project would be in compliance with Access Amendment standards because it would not increase TMRD in BMUs 4, 5, and 6.

Cumulative effects under Alternatives II, III, and IV are described in the 2001 FEIS on pages 4-192 through 4-194. The cumulative effects analysis for these alternatives was not updated for changed access management conditions for the grizzly bear since the 2001 FEIS. Direct and indirect impacts on grizzly bear habitat would be greater under Alternatives II, III, and IV than under Alternative V. In addition, Alternatives II, III, and IV would not include as many mitigation measures as Alternative V. For these reasons, Alternatives II, III, and IV would have a greater contribution to cumulative impacts than Alternative V.

BMUs 2, 7, 8, and 22 would not be affected by the Rock Creek Project. Cumulative effects of past, present, and other reasonably foreseeable activities in these BMUs are presented in Table 4-25. The effects in this table do not reflect potential improved conditions that could result from required land acquisitions associated with mitigation for Rock Creek Alternative V. The Kootenai and Lolo NF will meet all Access Amendment standards within the specified compliance time frame for all BMUs.

Table 4-25. Effects of Past, Present, and Reasonably Foreseeable Activities in BMUs 2, 7, 8, and 22.

Habitat Component	Existing Conditions[1]	During Activities[2]	Post Reclamation[2]
BMU 2			
Percent Core	76	77	77
Percent OMRD	20	19	19
Percent TMRD	16	13	13
BMU 7			
Percent Core	62	63	63
Percent OMRD	32	25/26[3]	25
Percent TMRD	23	23	23
BMU 8			
Percent Core	55	55	55
Percent OMRD	33	33	33
Percent TMRD	24	22	22
BMU 22			
Percent Core	51	51	54
Percent OMRD	38	38	38
Percent TMRD	37	34	34

[1]Some BMU habitat components for existing conditions were updated to account for roads temporarily opened for harvest activity (on private or NFS lands) or for road repair etc.; the access status of roads were changed back to their previous access status to better reflect existing conditions. Reasonably foreseeable activities considered, data sources, and assumptions used in the cumulative effects analysis for this SEIS are available in the project files.

[2]Displays the Miller West Fisher Project Phase 1/ Phase 2 effects in BMU 7 in addition to the other cumulative activities being considered in each BMU.

Source: KNF moving windows model results for the 2009 bear year monitoring report, as modified with data for BMUs 5 and 6 available as of August 2012. Data for BMUs 5 and 6 were updated for this analysis so that roads temporarily opened for harvest activity, road repair, or other temporary activities were assigned their long-term access status to more accurately reflect baseline conditions.

4.13.9.4 Lynx

Lynx would benefit from actions that regulate access to their habitat or improve habitat for grizzly bears such as the Access Amendment, Grizzly Bear Management Plan for Western Montana, and DNRC HCP. However, lynx would be adversely affected by past, present, and reasonably foreseeable activities such as development on private lands. Lynx could be adversely affected by increased human activity and vehicle traffic associated with activities such as recreation, mining, and timber harvests. These impacts could result in cumulative impacts when added to the impacts of the action alternatives. Alternative V would

have a relatively small contribution to cumulative effects because impacts under Alternative V would be minimal.

4.13.10 Regulatory Compliance

4.13.10.1 Bull Trout

With implementation of mitigation for bull trout described in Section 2.3.1.16, *Monitoring and Mitigation Plan*, Alternative V would contribute to species recovery and help make progress toward achieving the goal of maintaining or improving the distribution of native aquatic and riparian-dependent species and contribute to the recovery of threatened and endangered aquatic species (GOAL-AQS-01). Alternative V compliance with NFMA, including all other relevant components of the 2015 KFP, the Organic Administration Act, Forest Service Mineral Regulations, and the Wilderness Act, is discussed in Section 4.11.9, Aquatic Life and Fisheries – Regulatory Compliance.

4.13.10.1.1 Endangered Species Act

All action alternatives may affect, and are likely to adversely affect, the bull trout and designated bull trout critical habitat. These effects were summarized in Section 4.13.2.1, *Threatened and Endangered Species - Bull Trout*. The KNF submitted a BA to the USFWS that describes the potential effect on T&E species that may be present in the area (USFS 1999). Implementation of any of the alternatives may affect, and is likely to adversely affect, threatened bull trout; and may affect, and is likely to adversely affect, designated bull trout critical habitat. After review of the BA and consultation, the USFWS issued a BO for the proposed Rock Creek Project in 2003. A new BO was issued in 2006 after the 2003 BO was remanded in a U.S. District Court decision. The 2006 BO was revised in 2007 to consider new information pertaining to the environmental baseline for grizzly bears and to update the 2006 BO with new bull trout information.

In its 2007 BO Supplement, the USFWS indicated that it was the USFWS's BO that the Rock Creek Project as proposed in the KNF's Preferred Mine Alternative is anticipated to negatively impact designated critical habitat in Rock Creek, but will "not jeopardize the continued existence of bull trout at the scale of the Lower Clark Fork Core Area, and by extension is not likely to jeopardize at the Clark Fork River Management Unit and the larger scale of the Columbia River Interim Recovery Unit" (USFWS 2007a).

The 2007 BO stated reinitiation of formal consultation by the KNF was required if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Although the groundwater model may be used to estimate total mine inflows, it is not suitable for assessing changes in streamflow at the scale of individual stream reaches.

The 3D model would be refined and rerun after data from Phase I Evaluation were incorporated into the model (see the Water Resources Monitoring Plan in Appendix K). Following additional data collection and modeling, the predicted impacts on surface water resources in the study area, including simulation of mitigation measures, may change and may have greater clarity. The Water Resources Monitoring Plan in Appendix K also includes an intensive long-term monitoring of stream temperatures and seasonal instream flows in order to detect any mining-induced changes in the groundwater system. The KNF

anticipates the updated model, when coupled with Phase I monitoring, will be sufficient to determine if a causal link between the Rock Creek Project and any effect on the bull trout or bull trout critical habitat is reasonably certain. The KNF continues to coordinate with the USFWS as the SEIS and relevant analyses proceed. The KNF will reinitiate formal consultation with the USFWS if, at any time, new information collected during Phase I Evaluation or Phase II reveals effects of the Rock Creek Project in a manner or to an extent not considered in the 2007 BO Supplement or if the project would cause effects on the bull trout or bull trout critical habitat not previously considered in the 2007 BO Supplement.

4.13.10.2 Grizzly Bear

The 2015 KFP retains the direction from the Access Amendment. Alternative V would comply with the 2015 KFP because it would not decrease core habitat or increase OMRD and TMRD compared with existing conditions. Impacts on core habitat, OMRD, and TMRD would be greater under Alternatives II, III, and IV than under Alternative V. Alternatives II, III, and IV would not fully mitigate for impacts on grizzly bears and would not comply with the 2015 KFP. Alternative V would be consistent with 2015 KFP components pertaining to the grizzly bear. A detailed analysis of the consistency of Alternative V with all 2015 KFP components is available in the project record. None of the new information available since the 2001 FEIS was issued, such as updated baseline information for grizzly bear habitat, incorporation of standards and guidelines in the grizzly bear Access Amendment into the 2015 KFP, and modifications to Alternative V, affects the previous analysis of potential Rock Creek Project effects on grizzly bear.

For grizzly bear, all the action alternatives may affect, and are likely to adversely affect, the bear. In the USFWS 2006 BO and 2007 BO Supplement (USFWS 2006, 2007), the USFWS determined that the Rock Creek Project would result in “no jeopardy” to the grizzly bear.

4.13.10.3 Lynx

Currently, lynx standards are established by the 2015 KFP, which incorporates the NRLMD. All action alternatives would comply with 2015 KFP direction on the lynx. A detailed analysis of the consistency of Alternative V with all 2015 KFP components is available in the project record. None of the new information available since the 2001 FEIS was issued, such as incorporation of standards and guidelines in the NRLMD into the 2015 KFP and modifications to Alternative V, affects the previous analysis of potential Rock Creek Project effects on lynx.

All action alternatives may affect the lynx but are not likely to adversely affect Canada lynx. It was further determined there would be no effect to designated Canada lynx critical habitat as none was designated within the study area. In the 2006 BO transmittal letter (USFWS 2006), the USFWS concurred with the KNF’s determination that the Rock Creek Project would not likely adversely affect the lynx.

4.14 Socioeconomics

This section updates the employment and income effects in the *Environmental Consequences* section for socioeconomics in the 2001 FEIS. This section also includes Section 4.15.2, *Effectiveness of Agencies' Proposed Mitigation* and Section 4.15.4, *Regulatory Compliance*, which were not previously presented in the 2001 FEIS. The remainder of the analysis in the 2001 FEIS (pages 4-194 through 4-240) is unchanged. The data available and methods used are adequate to evaluate and disclose reasonably foreseeable significant adverse effects on socioeconomics in the study area. The Agencies did not identify any incomplete or unavailable information.

4.14.1 All Action Alternatives

4.14.1.1 Employment and Income Effects

The Forest Service produced an analysis of potential employment and labor income effects from the proposed Rock Creek Project during specific years within the three project phases (termed the *Forest Service Effects Analysis* in this section) for use in this SEIS (USFS 2013a). The Forest Service effects analysis estimates employment and labor income of the proposed Rock Creek Project during specific years within the three project phases:

- Evaluation Phase (Phase I) at project Years 1 and 2
- Construction Phase at project Years 3 through 5
- Production Phase at project Years 6 through 28

Rock Creek Project employment and income and the duration of the mine-life phases could vary from projections, depending upon construction progress and the resources applied by Revett toward full-scale operations. Mineral and input market conditions also could cause operations to be curtailed or shut down on short notice at any point during the projected mine life.

Employment and income impacts were estimated in the Forest Service Effects Analysis using input-output analysis. Input-output analysis is a means of examining relationships within an economy between businesses, and between businesses and final consumers. Three types of economic impacts (effects) are identified in the analysis: direct, indirect, and induced. Direct effects are production changes associated with the immediate effects of changes in expenditure tied to evaluation adit construction, mine construction, and production. Indirect effects are production changes resulting from spending in all phases of operations in industries that supply products and services to construction and production. Induced effects are changes in economic activity resulting from households' spending income earned directly or indirectly as a result of all phases of the proposed Rock Creek Project. The sum of indirect and induced effects are referred to as secondary effects, which is the term used in the remainder of this discussion.

Direct employment and labor income effects were estimated using information provided by Revett and the 2001 FEIS. Indirect effects were estimated using nonlabor expenditure information provided by Revett and IMPLAN (MIG 2004). Induced effects were estimated using IMPLAN. Other specific information on the methodological approach and assumptions used in the analysis presented below can be found in the Forest Service Effects Analysis Report (USFS 2013a). Projected employment and labor income effects identified in the Forest Service effects analysis are presented below.

4.14.1.2 Evaluation Adit, Construction, and Production Employment and Income Effects

The estimated total employment during Phase I of the proposed Rock Creek Project would be 131 jobs (Table 4-26). Of these, on average, about 59 of the direct jobs would be mine employees, 4 would be

associated with wildlife mitigation work, and the rest would likely be contractors. The input-output model estimated that there would be about 47 secondary jobs associated with the estimated 84 direct jobs related to the evaluation adit.

The estimated total annual employment during the Construction Phase would be 232 direct jobs per year and 426 total jobs per year (Table 4-26). Employment would be highest during the second year of the Construction Phase (Year 4 of the Rock Creek Project) when the majority of the construction work would likely occur. Direct mine employment during the Construction Phase would be about 73 employees annually, with an additional 4 jobs attributable to wildlife mitigation work. The remaining direct jobs would be associated with contracted construction work. Secondary employment would account for an estimated 194 jobs annually.

For the Production Phase of the Rock Creek Project (Years 6 through 28), estimated annual direct employment would be 340 mine employees and 4 employees associated with wildlife mitigation work. The estimated secondary effects would contribute 299 jobs per year. The estimated total annual employment would be 643 jobs annually. Employment during the Production Phase would likely vary with the production rate over the mine life.

Table 4-26. Average Annual Employment Estimates – Phase I, Phase II Construction, and Phase II Production.

Category	Phase I	Phase II Construction	Phase II Production
Project Year	**1-2**	**3-5**	**6-28**
Direct employment	84	232	344
Indirect and induced employment	47	194	299
Total employment	131	426	643

Source: USFS 2013a.

Table 4-27 shows the direct and secondary total labor income in 2011 dollars associated with Phase I, the Construction Phase, and the Production Phase of the Rock Creek Project. For Phase I, direct labor income would be about $8.6 million annually. Secondary labor income would be $1.2 million annually and total labor income would be $9.8 million annually.

For the Construction Phase, direct labor income would be about $23.2 million per year and total labor income would be about $30.3 million annually. As with employment, contractors would earn the majority of the labor income in the second year of the Construction Phase (Year 4 of the Rock Creek Project). Secondary employment would contribute $7.1 million of the $30.3 million in labor income annually. On a per-job basis, direct labor income for the Construction Phase would be about $100,000 per year. Labor income for indirect and induced employment would be about $37,000 per job.

The Production Phase would contribute about $29.2 million in direct labor income annually. Another $9.6 million in labor income would be associated with the secondary employment effects. In total, mine employment and spending would contribute approximately $38.8 million annually to the local economy. On a per-job basis, direct labor income for the Production Phase would be about $85,000 per year. Annual labor income for indirect and induced employment would be about $32,000 per job.

Table 4-27. Average Annual Labor Income Estimates – Phase I, Construction, and Production.

Category	Phase I	Construction Phase	Production Phase
Project Year	**1-2**	**3-5**	**6-28**
Direct labor income	$8.6	$23.2	$29.2
Indirect and induced labor income	$1.2	$7.1	$9.6
Total labor income	$9.8	$30.3	$38.8

Income shown in 2011 Million $. Actual totals may differ from values shown due to rounding.
Source: USFS 2013a.

4.14.2 Effectiveness of Agencies' Proposed Mitigation

Implementation of the HRMIP (ASARCO 1997) would effectively mitigate for financial impacts on local governments from the proposed Rock Creek Project.

4.14.3 Cumulative Effects

Pages 4-236 through 4-240 of the 2001 FEIS discuss the cumulative effects for socioeconomics. Although commercial production for the Troy Mine recommenced in late 2004, discussion in the 2001 FEIS is mostly unchanged. The Troy Mine was kept on a care and maintenance basis from 1999 until 2004 and was reopened in late 2004.

4.14.4 Regulatory Compliance

Alternative V would be consistent with the Hard Rock Mining Impact Act following implementation of the approved Hard Rock Mining Impact Plan. Alternative V is consistent with 2015 KFP components pertaining to socioeconomics. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record.

4.15 Transportation

This section updates the *Environmental Consequences* section for transportation resources, which consists of a network of roads that would be used during the proposed mine activities, and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously presented in the 2001 FEIS. The remainder of the analysis in the 2001 FEIS (pages 4-241 through 4-252) is unchanged.

4.15.1 Traffic Volume

Traffic during both the Construction and Operations Phases would increase traffic volume on state highways leading to the main mine access road (the reconstructed NFS road #150). The increase in traffic would be greatest on Montana Highway 200. Based on the maximum ADT for the Construction Phase, traffic on Montana Highway 200 would increase 63%. The increase in traffic on Montana Highway 200 would be split between westbound and eastbound traffic. The increase in traffic during operations would amount to a 50% increase in ADT for Montana Highway 200.

4.15.2 Effectiveness of Agencies' Proposed Mitigation

Before mine construction and based on the KNF's and DEQ's approval, RCR would develop and implement a RMP (called a traffic management plan in the 2001 FEIS). The RMP would lay out a set of coordinated transportation management strategies and describes how these strategies would be used to manage the work zone impacts of a road project. Management strategies would include temporary traffic control measures and devices, public information and outreach, and operational strategies such as travel demand management, signal retiming, and traffic incident management. One anticipated provision in the RMP would include busing and carpooling, a strategy that would become a part of the mine permit. This provision in the mine permit would likely ensure effective reduction of the ADT to 400 in Alternative V.

For all provisions proposed to be included in the RMP (Section 2.3.1.10, *Transportation*), effectiveness would ultimately be dependent on rigorous implementation monitoring, as well as the establishment of a systematic process for continually improving practices by learning from the outcomes of previously employed provisions in the RMP.

Monitoring the performance of the work zone and that of the RMP during the Construction Phase would be important to determine if the predicted impacts closely resemble the actual conditions in the field and if the strategies in the RMP are effective in managing the impacts. Examples of possible performance measures for RMP monitoring would include volume, travel time, vehicle line length, delay, number of incidents, incident response and clearance times, contractor incidents, community complaints, user costs, and cumulative impacts from adjacent construction activities. Performance monitoring requirements and performance measures would be based on agency policies, standards, and procedures, and should be effective when included in the permit documents when appropriate.

4.15.3 Cumulative Effects

Past, present, and reasonably foreseeable future actions that were updated or added since the 2001 FEIS that have or may contribute to increased traffic volumes near Rock Creek Project access roads include potential drilling operations, timber harvesting, a private sawmill, a gravel pit, and recreational activities such as hunting and fishing. Although cumulative increases in traffic volumes may be slightly greater as a result of these projects in combination with the Rock Creek Project, cumulative transportation impacts would essentially be the same as described on page 4-251 of the 2001 FEIS.

4.15.4 Regulatory Compliance

Alternative V is consistent with 2015 KFP components pertaining to transportation. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record. Compliance with INFS standards applicable to roads is discussed in Section 4.11, *Aquatic Life and Fisheries*.

4.16 Recreation

This section updates the *Environmental Consequences* section for recreation and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously presented in the 2001 FEIS. As described in Section 3.16, *Recreation*, the affected environment for recreation has not substantially changed since the 2001 FEIS was issued, with the exception of minor changes to ROS classifications.

The limited changes to ROS classifications would include: the northern edge of the proposed paste tailings facility would encroach into an area currently classified as *Semi-Primitive Nonmotorized*. This small area would likely change to *Roaded Natural* because the new development would make this area consistent with the adjacent areas that are also classified as *Roaded Natural*. Likewise, the area immediately surrounding the evaluation adit would likely change from *Semi-Primitive Motorized* to *Roaded Natural* due to the presence of mine development facilities at the adit site. Overall, the proposed Rock Creek Project would result in limited changes to ROS classifications as most of the proposed facilities are consistent with the current *Roaded Natural* classification (KNF 2015f).

The remainder of the analysis in the 2001 FEIS (pages 4-252 through 4-255) is unchanged.

4.16.1 Effectiveness of Agencies' Proposed Mitigation

There is no mitigation associated with recreation. The effectiveness of mitigation for scenic resources and wilderness, IRAs, and unroaded areas are discussed in Section 4.17, *Wilderness, Roadless Areas, and Wild and Scenic Rivers* and Section 4.21, *Scenic Resources*.

4.16.2 Cumulative Effects

Past actions within the study area include the establishment of forest access roads and logging roads and the development of campgrounds. These past actions have resulted in the existing recreation setting described in pages 3-134 through 3-136, *Affected Environment* in the 2001 FEIS. When considering reasonably foreseeable future actions, the development of the Montanore Project likely would have similar effects on recreation access and trails within the CMW as those proposed for the Rock Creek Project. The increased traffic and noise from both mining operations would diminish the quality of some recreational experiences within the CMW, primarily near Elephant Peak, Rock Peak, and their associated ridgeline. Population increases due to these projects would slightly increase demand for recreational opportunities in the region. The quality of hunting and trapping would be affected by timber and mineral activities, as well as the potential increase in the number of hunters and trappers. Timber harvesting might displace big game to other areas within and/or outside of the Rock Creek drainage. Even with this increased demand, an abundance of outdoor recreational opportunities would remain for residents and visitors.

4.16.3 Regulatory Compliance

Alternative V is consistent with 2015 KFP components pertaining to recreation. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record. The analysis in the 2001 FEIS complies with EO 12962, which mandates disclosure of effects on recreational fishing.

4.17 Wilderness, Roadless Areas, and Wild and Scenic Rivers

This section updates the *Environmental Consequences* section for wilderness roadless areas and wild and scenic rivers, and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously presented in the 2001 FEIS. The remainder of the analysis in the 2001 FEIS (pages 4-255 through 4-261) is unchanged.

4.17.1 Summary

Under the No Action Alternative, use of the CMW would be expected to increase as projected in the 2015 KFP. The impacts associated with the Rock Creek Project would not occur.

Under the action alternatives, mine-related activities outside of the CMW would likely be noticeable to visitors from some locations within the CMW. No mine-related sounds are expected to be audible from the wilderness lakes most often visited by wilderness users. Some wilderness visitors may feel that the naturalness of the CMW was adversely affected because of their knowledge that the ventilation adit and underground mine existed within the wilderness boundary. None of the alternatives would directly affect IRAs, but Alternatives IV and V may result in indirect aesthetic impacts. Alternative II may have minor impacts on high-value other unroaded areas. Likewise, none of the alternatives would measurably affect eligible wild and scenic river segments.

4.17.2 Alternative V

4.17.2.1 Wilderness

4.17.2.1.1 Effects on Wilderness Character

Most of the proposed mine-related surface disturbances would occur outside of the CMW boundary and would not physically disturb any land within the CMW or directly affect any wilderness qualities or wilderness character. However, the proposed air-intake ventilation adit would be a new surface disturbance within the CMW. Likewise, mining-related activities outside of the CMW boundaries could indirectly affect the experience of wilderness visitors by indirectly affecting the qualities of wilderness character: untrammeled, undeveloped, natural, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. Recognizing that the wilderness experience is highly personal and individual, and effects may be perceived differently by different visitors, the general indirect effects on wilderness character are described below.

Untrammeled

Indirect effects on the untrammeled qualities of the CMW could result from direct effects on natural systems, such as hydrology, within or adjacent to the wilderness. Reductions in water levels in wilderness lakes (resulting from mining and mine dewatering), including Cliff Lake, St. Paul Lake, Copper Lake, and Moran Basin Lakes, are unlikely to affect visitors' perceptions of an untrammeled wilderness. Cliff Lake and Copper Lake are located in Opportunity Class I areas, which have no trails and visitation is generally low, although Cliff Lake has several defined campsites. Moran Basin Lakes are in an Opportunity Class II area, which is more heavily used by wilderness visitors, with a designated access trail and several campsites.

As described in detail in Section 4.7, *Water Quantity and Quality*, Cliff Lake would not be affected by mine dewatering, while St. Paul Lake may be affected. St. Paul Lake can become completely dry during extended periods of little to no precipitation. St. Paul Lake may be affected by mining, but the effects may be difficult to separate from the large natural lake level variations. If deep groundwater was a component of the inflow to St. Paul Lake, mine dewatering would unavoidably reduce this source of water to the

lake, and the lake level may lower more quickly during dry years when the only source of water to the lake was bedrock groundwater. The average wilderness user likely would not perceive predicted reductions in St. Paul Lake. Copper Lake relies on a shallow local groundwater system and would not be affected by mining. No effects on Moran Basin Lakes are predicted. For all wilderness lakes, a long-term monitoring plan for Alternative V includes monitoring the water balance of Cliff, Copper, St. Paul, and Moran Basin Lakes (see Appendix K). Monitoring of the lakes and streams for early detection of impacts, underground monitoring of mine inflows, avoiding high permeability geologic structures that intersect the ore body, grouting mine inflows, and avoiding outcrops and areas underlying lakes would minimize possible impacts on wilderness lakes.

Undeveloped

The undeveloped quality of the CMW would be adversely affected in the location of the air-intake ventilation adit, which would be a new surface disturbance. In addition, the installation of monitoring equipment such as data loggers and survey monuments could adversely affect the undeveloped qualities of the CMW to some visitors. Most facilities, equipment, and installations would not be noticeable to the average wilderness user, who stays on trails and camps in identified campsites; however, some installations may be visible.

Natural

Contamination of natural systems from the mine or mining activities could potentially affect the natural quality of the wilderness. However, air pollutant concentrations in all areas of the CMW (a Class I air quality area) are expected to remain below federal and state ambient air quality standards. Modeled emissions would not cause an exceedance of the PSD Class I increments (see Section 4.4.3.2, *Air Quality – Modeling*). There is a slight possibility that post-closure groundwater seepage from the underground mine reservoir might exit in outcrop zones in the wilderness. Based on water quality modeling, such effects are unlikely to measurably affect spring water quality, and would not be noticeable to typical wilderness visitors.

Noise from the mill site would not generally be expected to exceed normal ambient wilderness noise levels (35 dBA). Surface noise emissions from the air-intake ventilation adit are predicted to be 46 dBA (equivalent to a quiet room) and would generally be noticeable within a 100-foot radius. Noise impacts would occur on a cliff face below St. Paul Peak with low levels of human use. Section 4.20, *Sound*, of this SEIS and pages 4-284 and 4-286 of the 2001 FEIS provide a more detailed description of Alternative V noise effects in the CMW.

Solitude or a Primitive and Unconfined Type of Recreation

Solitude within the CMW may be affected by increased visibility of mining facilities within and outside of the wilderness, increased use of the CMW by project personnel conducting monitoring, and a potential increase in wilderness visitation from individuals associated with the mine. Proposed mining facilities including the air-intake ventilation adit, evaluation adit, and mill site would be visible from some locations within the wilderness and may affect the sense of solitude for wilderness visitors in those areas. In addition, increased access and familiarity with the area due to mine construction and operations may increase recreational use in the wilderness, which would diminish the sense of solitude in the area.

4.17.2.1.2 Effects of Monitoring

Monitoring activities associated with the evaluation and operation phases, such as water resources monitoring, will require the installation of some types of measuring equipment (e.g., dataloggers) in the CMW. In addition, some surveying would need to occur in the CMW and monuments would be established. Before any monitoring would occur, the Forest Service would use the Minimum Requirement Decision Guide (MRDG) process to ensure that adverse effects on wilderness character are minimized.

The MRDG is a tool to complete a minimum requirement analysis, which is required under the Wilderness Act (see Appendix K, Section 1.13.2 for a description of the MRDG process). The following equipment would likely be used in the CMW:

- Dataloggers
- Water level datum locations (rock bolts)
- Permanent continuous streamflow recorders
- Survey monuments (e.g., elevation monuments for LiDAR)
- Ground-based reflectors (e.g., InSAR)
- Piezometers in critical GDE locations
- High-elevation weather station
- Tensiometers
- Suction lysimeters

The Agencies' conceptual monitoring (see Appendix K) would require the following activities in the CMW:

- Completing a pre-mining baseline topographic survey during the Evaluation Phase over the ore body and GDE inventory/monitoring area (Figure K-4) using aerial methods
- Completing a detailed surficial geologic survey of lands overlying the mine area during the Evaluation Phase
- Monitoring of mountain goats, consisting of three surveys per year for the life of the mine: one 2-week survey of the eastern side of the CMW in the summer, one fall aerial survey, and one winter aerial survey
- Monitoring of neotropical migrant birds
- Monitoring of wilderness water resources in wilderness lakes (Cliff Lake, Copper Lake, St. Paul Lake, and Moran Basin Lakes) and in the Rock Creek and its tributaries, Miller Gulch, Copper Gulch, Chicago Creek, and East Fork Bull River watersheds
- Completing a Level 2 GDE inventory at least 1 year prior to the Evaluation Phase in the area potentially affected by Phase I activities
- Completing a Level 2 GDE inventory at least 1 year prior to Phase II for the area potentially affected by Phase II activities
- Completing GDE monitoring according to an Agency-approved plan (see Appendix K)

As described previously, increased use of the CMW by project personnel conducting monitoring would decrease opportunities for solitude or a primitive and unconfined type of recreation in Opportunity Class II lake areas and in Opportunity Class I areas in the stream drainages. Before any monitoring would occur, the Forest Service would use the MRDG process to ensure that adverse effects on wilderness character are minimized (see Appendix K, Section 1.13. for a description of the MRDG process). The Forest Service would implement solitude monitoring one year prior to the start of mining activity to establish pre-operation baseline information in areas identified with possible '*increased visibility of mine disturbances as well as increased noise from mining facilities*.'

Subsidence

Aerial Topographic Survey

The activities associated with the topographic survey would depend on the technology approved by the Agencies in the final monitoring plan. If LiDAR was the approved technology, RCR would complete the topographic survey using either a helicopter or a small fixed-wing airplane.

Details of the topographic survey requirements would likely be similar to those described in the Final EIS for the Montanore Project (USFS and DEQ 2015). Based on the Montanore Project, the survey would take 2 or 3 days to complete. Satellite data would be used if InSAR was the approved technology. Before any aerial survey work could be done, elevation monuments would need to be established in the CMW over the ore body if LiDAR is the approved technology. For InSAR monitoring, ground-based reflectors would be required to increase the number of months per year that InSAR monitoring may be performed, allow coverage in areas with thick vegetation, and increase the accuracy of all surveys. The number, location, and size of the reflectors would be determined during final design should InSAR be the approved technology.

4.17.2.2 Inventoried Roadless Areas

The proposed mine facilities in Alternative V, including roads, would not directly affect IRAs. The mill site would be about 1,000 feet north and across East Fork Rock Creek from the McKay Creek IRA. The mill location, along with increased use of NFS road #150, may result in indirect effects on the IRA due to increased noise and other aesthetic impacts. Proposed mitigation, such as a RMP, vegetation screening of the mill site, and a 50-foot limitation on building height, would reduce the effects on IRAs.

4.17.2.3 Other Unroaded Areas

The proposed mine facilities in Alternative V, including roads, would not directly affect unroaded land identified in the study area (KNF 2015g). The effects of the mill and road use would be the same as the effect on IRAs.

4.17.2.4 Wild and Scenic Rivers

4.17.2.4.1 Free-Flowing Characteristics

Based on hydrologic modeling, the East Fork Bull River is expected to have reductions in baseflow of 4% or less as a result of mine operations. Models indicated that St. Paul Lake may be affected by mine dewatering, but the effects may be difficult to distinguish from natural lake level variations. No mine facilities would interfere with, obstruct, or otherwise modify the free-flowing characteristics of the East Fork Bull River.

4.17.2.4.2 Water Quality

There is a slight possibility that post-closure groundwater seepage from the underground mine reservoir might exit in outcrop zones in the wilderness. However, based on water quality modeling, such effects are unlikely to measurably affect spring water quality.

4.17.2.4.3 Outstandingly Remarkable Values

Alternative V would not alter the scenic values of the East Fork Bull River or Bull River eligible river segments.

4.17.3 Alternative IV

4.17.3.1 Inventoried Roadless Areas

The effects would be the same as Alternative V.

4.17.3.2 Other Unroaded Areas

The effects would be the same as Alternative V.

4.17.3.3 Wild and Scenic Rivers

The effects would be the same as Alternative V.

4.17.4 Alternative III

4.17.4.1 Inventoried Roadless Areas

Proposed mine facilities in Alternative III, including road construction, would not directly affect the McKay Creek IRA, although significantly increased use of existing roads may result in noise and aesthetic impacts.

4.17.4.2 Other Unroaded Areas

Proposed mine facilities in Alternative III, including road construction, would not affect unroaded land, although significantly increased use of existing roads may result in noise and aesthetic impacts.

4.17.4.3 Wild and Scenic Rivers

The effects would be the same as Alternative V.

4.17.5 Alternative II

4.17.5.1 Inventoried Roadless Areas

Proposed mine facilities in Alternative II, including road construction, would not affect IRAs, although significantly increased use of existing roads may result in noise and aesthetic impacts.

4.17.5.2 Other Unroaded Areas

Proposed new road alignments in Alternative II may adversely impact the unroaded area to the west of Rock Creek, and increased traffic may result in noise and aesthetic impacts. The impact on this unroaded area would be minor.

4.17.5.3 Wild and Scenic Rivers

The effects would be the same as Alternative V.

4.17.6 Alternative I

The use and character of the CMW, IRAs, unroaded areas, and Wild and Scenic Rivers is expected to continue as projected in the 2015 KFP.

4.17.7 Effectiveness of Agencies' Proposed Mitigation

Proposed mitigations in Alternative V related to wilderness, IRAs, and unroaded areas include:

- pursuing all reasonable options to an air-intake ventilation adit in the CMW prior to construction and evaluating variations in topography and rock formations if a wilderness adit is needed
- ensuring the closure plan for the air-intake ventilation adit in the CMW would include provisions to return the site to premining appearance and configuration
- implementing visual mitigations for the mill site, the utility corridor, paste tailings facility; and ventilation and evaluation adits
- implementing measures to reduce noise levels at the mill site and air-intake ventilation adit
- implementing measures to reduce traffic on access roads

If implemented, this mitigation would effectively eliminate or minimize direct long-term effects on wilderness and wilderness characteristics associated with the ventilation adit. Mitigation measures to reduce visual, noise, and traffic-related impacts would minimize effects on IRAs and unroaded areas.

4.17.8 Cumulative Impacts

Cumulatively, mining, timber harvest, and other existing or planned activities outside of the wilderness would alter some natural processes occurring in the wilderness in the short term; these processes would have negligible effects in the long term. These activities have occurred in the past with some evidence that habitat use by goats has been altered. This may have a slight effect on natural integrity. Many human activities that occur outside the wilderness are already seen and/or heard from the wilderness. The Rock Creek Project, in combination with the Montanore Project, would slightly reduce the apparent naturalness of the CMW.

The Rock Creek and Montanore Projects, assuming they occurred concurrently, would cumulatively reduce flow in the East Fork Bull River in the CMW, which could adversely affect the apparent untrammeled quality of those areas of wilderness. No other aspects of the two projects would have cumulative effects on surface water resources in the CMW or an IRA. The maximum effects on the East Fork Bull River would occur after both mines ceased operations (assumed to be operating and closing simultaneously).

The proposed Montanore Project on the east side of the Cabinet Mountains would contribute to cumulative effects on air quality; however, the effects would be minor and compliance with the Class I and Class II increments at the CMW border is predicted.

As with the Rock Creek Project, some types of equipment or markers, such as dataloggers or survey monuments, may be installed in the CMW as part of monitoring efforts for the Montanore Project. The cumulative effects would be minor and not perceivable to the average wilderness user recreating on established trails and camping at identified campsites.

Population increases due to the development of both projects would slightly increase demand for recreational opportunities in the region. Increased recreational use of popular CMW sites, such as Rock Lake, may cumulatively decrease opportunities for solitude or a primitive and unconfined type of recreation.

Increased use of the CMW by personnel from both the Rock Creek and Montanore Projects conducting monitoring (e.g., water resources monitoring) would cumulatively decrease opportunities for solitude or a primitive and unconfined type of recreation. Although lake, stream, and GDE monitoring would focus on different areas of the CMW, there may be an overall perception of loss of solitude. Other monitoring activities common to both projects, such as aerial surveys (e.g., for GDEs, wildlife, and subsidence),

would also cumulatively decrease opportunities for solitude or a primitive and unconfined type of recreation.

The Rock Creek Project, in combination with the Montanore Project near the CMW, would increase the chances for wilderness visitors to see or hear human activities beyond what is currently evident. The apparent naturalness of the area would decrease slightly with increased human use. Evidence of these projects would not be apparent from the wilderness lakes most often visited by wilderness users. Opportunities for solitude or a primitive recreation experience would decrease with human use of the area.

4.17.9 Regulatory Compliance

The experience of wilderness and IRA visitors might be affected by activities outside the wilderness and IRA boundaries. However, the Wilderness Act, the Roadless Area Conservation Rule (36 CFR 294), and the 2015 KFP components for Wilderness, Wild and Scenic Rivers, and Inventoried Roadless Areas do not apply to activities outside these designated areas. Alternative V would conform with the 2015 KFP regarding IRAs. The KNF has, within its authorities, incorporated mitigations into Alternative V to protect the values of the eligible Wild and Scenic River segments. Alternative V would conform with the 2015 KFP regarding Wild and Scenic Rivers.

The location of the air-intake ventilation adit within the CMW is not consistent with guideline MA1a-GDL-AR-01 (management activities should be consistent with the Scenic Integrity Objective of Very High). As described in Section 4.21, *Scenic Resources*, in a mapped SIO of very high, the landscape is intact with changes resulting primarily through natural processes and disturbance regimes. The introduction of the air-intake ventilation adit in an area with a mapped SIO of very high is inconsistent with the definition of the relative SIO. Thus, a project-specific amendment is necessary for Alternative V for it to be consistent with the 2015 KFP. With the project-specific variance for this wilderness component of the 2015 KFP described in Section 4.2, *Kootenai Forest Plan*, Alternative V would be consistent with MA1a-GDL-AR-01, and subsequently the 2015 KFP. A detailed analysis of the consistency of Alternative V with all 2015 KFP components relevant to the CMW, IRAs, and Wild and Scenic Rivers is available in the project record.

4.18 Cultural Resources

Minor modifications were made to this section to clarify the analysis of the effects of Alternative V, and Effectiveness of Mitigation and Regulatory Compliance subsections not previously in the 2001 FEIS were added. The remainder of the analysis in the 2001 FEIS (pages 4-261 through 4-265) is unchanged.

4.18.1 Alternative V

No known NRHP-eligible sites would be affected and, therefore, no mitigation measures would be required. If any human remains or other undiscovered cultural materials were discovered during construction, RCR would cease activity in the area of the discovery and secure the area, notify the county coroner if the discovery was human remains or funerary objects, and notify the KNF Forest Archaeologist if the discovery was on NFS lands (or the SHPO Archaeologist if the discovery was on lands other than NFS lands). A MOU would be developed to address protocol for addressing inadvertent discoveries of human remains and any other cultural materials. Under Alternative V, monitoring of surface-disturbing activities in areas shown in Figure 4-8 would be required (see Appendix K, Cultural Resource Monitoring Plan for more details).

4.18.2 Effectiveness of Agencies' Proposed Mitigation

Mitigation effectiveness is evaluated by assessing whether impacts on unavoidable historic properties would be mitigated appropriately and whether all available data contained within those properties would be fully captured. Because none of the cultural resources or historic sites identified in the study area is eligible for listing on the NRHP, no mitigation is required under any of the alternatives.

4.18.3 Cumulative Impacts

Human disturbance to cultural resources would increase as a result of the Rock Creek Project as well as from reasonably foreseeable activities within the drainage. All cultural resources cumulatively affected have been determined ineligible for listing on the NRHP and no mitigation measures are required.

4.18.4 Regulatory Compliance

Following the identification of cultural resources, mitigation, and consultation, Alternative V would comply with the 2015 KFP and all applicable federal regulations concerning cultural resources. A detailed analysis of the consistency of Alternative V with the 2015 KFP is available in the project record.

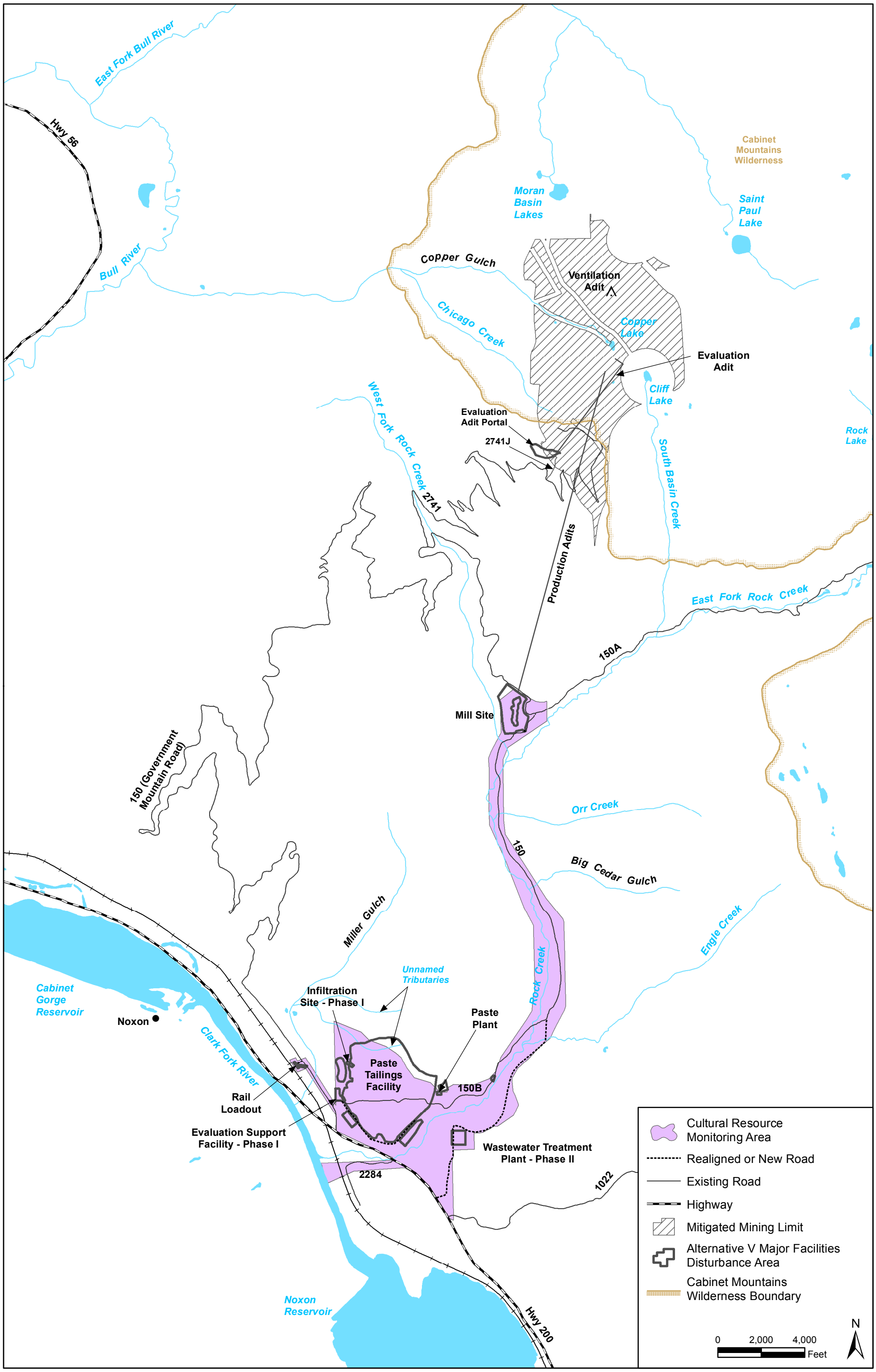


Figure 4-8. Alternative V Cultural Resource Monitoring Area

4.19 American Indian Treaty Rights

This section updates the *Environmental Consequences* section for American Indian treaty rights and includes an updated Cumulative Effects subsection, a description of potential Alternative V effects on TCP, and Effectiveness of Mitigation and Regulatory Compliance subsections not previously presented in the 2001 FEIS. The remainder of the analysis in the 2001 FEIS (pages 4-266 through 4-280) is unchanged.

4.19.1 Traditional Cultural Properties

4.19.2 Alternative V

The CSKT have identified an area as a sacred site and a TCP that may be eligible for the NRHP under the NHPA. The specific location of that area is exempt from public disclosure under Section 304 of the NHPA and the 2008 Food, Conservation, and Energy Act. Formal evaluation of the identified area as a TCP will be completed, and if the evaluation indicates the area is eligible and the KNF concurs, then consultation with the CSKT on avoidance, minimization, and mitigation measures would begin.

Other traditional American Indian uses of resources potentially affected by Alternative V are described on pages 4-277 through 4-280 of the 2001 FEIS.

4.19.3 Effectiveness of Agencies' Proposed Mitigation

Effectiveness of mitigation for impacts on resources potentially affected by Alternative V are discussed in their respective Chapter 4 sections of this SEIS.

Formal documentation of the identified area as a TCP will be completed, and if evaluation indicated the area was eligible and the KNF concurred, then consultation with the CSKT on avoidance, minimization, and mitigation measures would begin. An assessment of the effectiveness of mitigation for impacts on TCPs would be completed following TCP analysis.

4.19.4 Cumulative Impacts

Cumulative impacts on treaty-related resources would be the same as described on page 4-280 of the 2001 FEIS, except that additional timber harvesting activities and increased access to the general Rock Creek Project study area would occur in association with reasonably foreseeable actions that were updated or added since the 2001 FEIS

4.19.5 Regulatory Compliance

The consultation process for this Rock Creek Project is consistent with direction in the 2015 KFP, and all other laws and regulations described in Section 1.6.4, *Laws and Regulations Applicable to the Forest Service* and Section 1.6.5, *Kootenai National Forest Responsibilities to Federally Recognized Tribes*. The KNF has consulted with tribes when management activities may impact treaty rights and/or cultural sites and cultural use.

4.20 Sound

This section updates the *Environmental Consequences* section for sound and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously presented in the 2001 FEIS. The remainder of the analysis in the 2001 FEIS (pages 4-280 through 4-286) is unchanged.

4.20.1 Alternative V

In Alternative V, power would be provided to the evaluation adit through a buried powerline, rather than propane generators, as previously described in the 2001 FEIS. A backup generator would be located at the adit site during Phase I, but would be used only during periods when line power was not available. While sound effects previously described in the 2001 FEIS would remain the same from sources such as truck traffic, construction equipment, facility operations, and ventilation fans, there would be an overall decrease in sound levels during Phase I due to a decreased use of generators at the site.

4.20.2 Effectiveness of Agencies' Proposed Mitigation

Several design features incorporated into Alternative V would result in reduced noise levels, such as locating the rail loadout near the Rock Creek paste tailings facility, which would eliminate noise impacts at the Hereford Loadout and substantially reduce impacts on nearby residents along Montana Highway 200. Although this design element would effectively reduce noise levels, there would still be noise from construction and operation of the rail siding and loadout facilities over the mine life. Under Alternative V, the lower mill site location would provide a 25% greater noise buffering distance from the CMW than Alternatives II and III (1.25 mile versus 1.0 mile in Alternatives II and III). This would provide effective mitigation for noise impacts on sensitive noise receptors such as the CMW, as noise levels would be generally expected not to exceed normal ambient wilderness noise levels (35 dBA).

Mitigation measures such as the retention of forest screening around the mill site and other measures under Alternative V would provide some additional noise attenuation to meet the 55 dBA noise mitigation standard when measured 250 feet uphill from the crushing plant and ball mill. Under Alternative V, proposed mitigation such as busing construction workers to the evaluation adit and the mill site to reduce the frequency (but not the peak levels) of traffic-generated noise in the upper Rock Creek drainage, replacing aboveground vehicle backup beepers with discriminating backup alarms that sense movement behind a vehicle (if allowed by the Occupational Safety and Health Administration), and piping the ore concentrate to the Miller Gulch loadout site to eliminate long-term ore concentrate truck traffic would collectively provide effective reductions in sound impacts. Under Alternative V, air-intake ventilation adit fan noise mitigations, including placing the air-intake ventilation adit higher on the St. Paul Ridge and reducing the intake fan noise levels, would effectively reduce surface noise emissions to about quiet room levels (46 dBA).

Mitigation measures for Alternative V are designed to reduce impacts on natural sounds in the CMW. Alternative V provides the most effective noise mitigation and results in the most significant overall reductions of noise levels. While noise from mining operations would be reduced using these measures, some impacts on sound would still exist throughout the life of the Rock Creek Project.

4.20.3 Cumulative Impacts

Reasonably foreseeable actions that were updated or added since the 2001 FEIS was issued that may create additional noise within the CMW include potential drilling and timber harvest adjacent to the wilderness. Although contributions to sound levels may be slightly greater as a result of these projects in combination with the Rock Creek Project, cumulative noise impacts would essentially be the same as described on page 4-286 of the 2001 FEIS.

4.20.4 Regulatory Compliance

Because no federal, KNF, or county regulations govern noise levels in the study area, regulatory compliance is not applicable for sound effects.

4.21 Scenic Resources

This section updates the *Environmental Consequences* section for scenic resources and includes *Effectiveness of Mitigation* and *Regulatory Compliance* subsections not previously presented in the 2001 FEIS. The remainder of the analysis in the 2001 FEIS (pages 4-286 through 4-312) is unchanged.

4.21.1 Alternative V

Based on field observations, the KNF determined that changes in land uses since the 2001 FEIS are not substantial and would not change the analysis of impacts described in the 2001 FEIS (KNF 2011b). In addition, minor modifications to Alternative V would not substantially change the 2001 FEIS analysis of impacts on visual resources. The terms used in the 2001 FEIS to describe the VQOs are from the VMS, but can be crosswalked to the SMS. References in the 2001 FEIS to 1987 Forest Plan amendment changes in VQOs, by changing MAs, no longer applies.

Under the 2015 KFP, the Rock Creek Project study area SIOs were mapped primarily as moderate with some areas of high and very high. The scenic integrity of Alternative V would be lower than the mapped SIOs of moderate and high in the 2015 KFP. Mine facilities and the overhead power line along NFS road #150 in Alternative V would have low to very low scenic integrity. The project-specific variance would not change the desired SIO under the Scenery Management System (SMS) in the 2015 KFP for the study area even though human-caused changes may alter the scenic integrity level. This would not comply with FW-GDL-AR-01 and would require a project-specific forest plan amendment. Specific impacts of Alternative V would be as follows:

- The paste tailings facility would result in 26 acres of direct impacts on the mapped SIO of high.
- The mill site would result in 42 acres of direct impacts on the mapped SIO of moderate.
- The air-intake ventilation adit would result in 0.02 acre of direct impacts on the mapped SIO of very high within the CMW.
- The realignment of NFS road #150 would result in 8 acres of direct impacts on the mapped SIO of high and 8 acres on the mapped SIO of moderate.
- The overhead power line along NFS road #150 would result in 7 acres of direct impacts on the mapped SIO of high and 22 acres of direct impacts on the mapped SIO of moderate.

4.21.2 Effectiveness of Agencies' Proposed Mitigation

Although painting, staining, or modifying some facility features included in Alternative V would reduce color contrasts with the surrounding area, the tree clearings and earthwork required for some facilities and the shape, size, and lines of the facilities' structures and roads would have a noticeable contrast with surrounding areas. For Alternative V, based on location, the various facilities would be highly visible.

During operations, powerline mitigation measures would also reduce contrasts created by the presence of the utility line, structures, new roads, and tree clearing corridors. These facilities would remain visible throughout operations. Although the use of wood poles, nonspecular conductors, and nonreflective insulators would reduce the contrasts of texture with the surrounding forest and the reflection of light, these facilities would remain visible from some locations. Variations in the width and shape of the tree clearing corridors would create some forest edge characteristics similar to natural clearings. Leaving a variety of species and tree sizes at the clearing edges would also create the appearance of naturally formed clearing edges. Cleared areas would remain highly visible and in contrast with the surrounding forest. Following the mine closure and reclamation, the visible effects of the powerline would be eliminated when revegetation was complete and tree height and density matched the surrounding forest.

The presence of buffer zones, or areas where disturbance would be prohibited would substantially reduce or eliminate the visibility of some proposed mine facilities if the buffer zones are forested or include a hill or mountain. The screening effect within buffer zones located between observation points and proposed mine facilities would be highly effective.

Although reclaimed areas would have visibly different lines, colors, and textures, mitigation measures required in the reclamation process would reduce or eliminate some of these contrasts. Agency-proposed reclamation measures for the paste tailings facility surface would be more successful at establishing sufficient tree cover to blend the surface with the surrounding vegetation and reduce its visibility. In Alternative V, shaping of the paste tailings facility and revegetation during reclamation would significantly reduce visible contrasts. If reclamation were successful, the visible effects of vegetation color contrasts would no longer be apparent once vegetation became established and matured several decades after reclamation. Trees to be preserved in the vicinity of the proposed facilities and along the utility line clearing corridor would not be marked, thereby eliminating permanent paint markings.

During operations, Alternative V mitigation measures for mine facilities' night lighting would reduce the amount of visible artificial light. Although light fixture baffles and directional light sources diminish the amount of ambient light emanating from a fixture, some ambient light would remain, and the light source and some illuminated objects would remain visible from some locations.

4.21.3 Cumulative Impacts

Past actions of timber harvest and road construction have altered the scenic integrity of characteristic landscapes of the study area. Roads have created linear features visible throughout the study area. Timber harvests have altered the line, color, and texture of the undisturbed landscape. Continued development of private lands within the study area is expected. Development is expected to include commercial timber harvest, land clearing, home construction, road construction, septic field installation, water well drilling, exploratory mineral drilling, and livestock grazing. All expected land development activities, in combination with the Rock Creek Project, would noticeably change the visual characteristics of the study area by introducing visible contrasts and obstructions to some existing views.

4.21.4 Regulatory Compliance

The Forest Service's locatable minerals regulations (36 CFR 228.8) require mine operators to minimize or, where practicable, eliminate damage to soil, water, and other surface resource values. Alternative V would result in a scenic integrity of low to very low in portions of the area. Mitigation measures would reduce, to the extent possible, adverse effects on scenery, while allowing for the mining operation. However, management activities would not be consistent with the mapped SIO per forestwide guideline FW-GDL-AR-01. When a project or activity is not designed to comply with the intent or purpose of a guideline, the project or activity must be modified, rejected, or an amendment to the forest plan is required. As described in the *Effectiveness of Agencies' Proposed Mitigation* section, Alternative V would deviate from the desired conditions for scenic resources and, thus, would be inconsistent with the mapped SIOs. It is not possible to modify the project to be consistent with areas with mapped SIOs of high or very high. In a mapped SIO of high, management activities are unnoticed and the landscape character appears unaltered (USFS 2015b). In a mapped SIO of very high, the landscape is intact with changes resulting primarily through natural processes and disturbance regimes. The introductions of the overhead powerline and the paste tailings facility in an area with a mapped SIO of high and the air-intake ventilation adit in an area with a mapped SIO of very high are inconsistent with the definitions of the relative SIOs. Thus, a project-specific amendment is necessary for Alternative V for it to be consistent with the 2015 KFP.

With the project-specific variance for this scenic resources component of the 2015 KFP described in Section 4.2, *Kootenai Forest Plan*, Alternative V would be consistent with forestwide guideline FW-

GDL-AR-01, and subsequently the 2015 KFP. About 38% of the KNF, or 843,258 acres, is mapped with SIOs of moderate to very high (KNF 2015b). Effects of Alternative V on scenic resources would be localized from specific viewpoints in the Rock Creek study area. Even with the project-specific variance, Alternative V would affect a very small proportion (less than .01%) of areas in the KNF with mapped SIOs of moderate to very high. The KNF Scenic resources of the KNF would continue to compliment the recreation settings and experiences across broad areas of the Forest (FW-DC-AR-02). There are no visual regulatory requirements for proposed mine facilities on private land.

4.22 Unavoidable Adverse Effects

The following discussion summarizes the previously identified impacts, which are unavoidable. It does not reiterate the context previously provided in this chapter. Resources that have changed substantially since the 2001 FEIS have been updated in this section. For resources that have not changed substantially since the 2001 FEIS, the reader is referred to the discussion in the 2001 FEIS.

4.22.1 Forest Plan

None of the action alternatives would be consistent with the 2015 KFP unless it was amended. As discussed in Section 4.2.2, *Alternative V Amendments*, Alternative V would include amendments for project-specific variances to suspend the requirements for full consistency with forestwide guideline FW-GDL-WL-09 (related to avoiding native ungulate winter range areas during the critical mid-winter period), forestwide guideline FW-GDL-AR-01 (i.e., consistency of management activities with the mapped SIO), and designated wilderness guideline MA1a-GDL-AR-01 (i.e., consistency of management activities with mapped SIO of very high).

An analysis of the effects of the 2015 KFP amendments is provided in Section 4.2.2, *Alternative V Amendments*. The area of ungulate winter range that would be disturbed by Alternative V construction and operations would be minimal relative to the amount of winter range available forestwide. Given available habitat and current human activity, additional disturbance to wintering elk and deer would likely be minimal when compared with existing disturbance in the area. The effects of Alternative V on scenic resources would be localized from specific viewpoints in the Rock Creek study area. Alternative V would affect a very small proportion of areas in the KNF with mapped SIOs of moderate to very high. The KNF scenic resources would continue to compliment the recreation settings and experiences across broad areas of the Forest (FW-DC-AR-02). Outside of the 0.02 acre, management activities would continue to be consistent with the SIO of very high throughout the CMW (MA1a-GDL-AR-01).

4.22.2 Climate and Greenhouse Gases

The proposed Rock Creek Project would use the control technologies determined to qualify as BACT for each applicable emissions source and pollutant combination. These technologies would effectively minimize GHG emissions from combustion sources. Emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

4.22.3 Air Quality

All action alternatives would temporarily increase air pollutant concentrations in the study area and CMW and the study area. Best available control technologies would minimize emissions.

4.22.4 Geology

Unavoidable adverse effects on geology and mineral resources are discussed on page 4-325 of the 2001 FEIS.

4.22.5 Water Quantity and Quality

4.22.5.1 Water Quantity

The consumptive use of groundwater by the Rock Creek Project during operations would unavoidably reduce the total water yield from the study area in the Cabinet Mountains. The anticipated consumptive use is expected to be small relative to the total water yield of the Cabinet Mountains in the study area. Water yield would remain reduced until the Rock Creek Project no longer consumptively used water, and

then would slowly return to the pre-mining yield as the mine void filled. Assuming the mine would be plugged at the end of mining, water levels overlying the mine are predicted by the model to substantially reach pre-mining water levels within about 300 years after mining ended. The actual time to recover to steady state may be shorter or longer and would be reevaluated using the 3D model after additional data were collected during Phase I. If the mine was not plugged and allowed to drain, groundwater levels would partially recover, but would not return to pre-mining levels, and water would continue to flow from the mine at the rate of about 110 gpm. If deep groundwater was a component of the inflow to St. Paul Lake, mine dewatering would unavoidably reduce this source of water to the lake, and the lake level may lower more quickly during dry years when the only source of water to the lake was bedrock groundwater.

The interception and use of surface runoff at the mine facilities would unavoidably reduce streamflow in study area streams, and the paste tailings facility would unavoidably alter the topography and drainage characteristics of part of the Miller Gulch and Rock Creek watersheds.

4.22.5.2 Water Quality

If less bedrock groundwater were contributed to St. Paul Lake and Rock Creek Project study area streams and springs, water in the lake, springs and streams may become more dilute, with lower dissolved solids concentrations. Downgradient of the paste tailings facility, nitrate, sodium, potassium, chloride, sulfate, ammonia, and aluminum concentrations would increase in groundwater, but would not exceed Montana groundwater quality standards. Treated wastewater would be discharged to either the infiltration ponds or to the permitted outfall in the Clark Fork River and would change the quality of the receiving water; however, treated discharge would be required to meet MPDES permitted effluent limits.

4.22.6 Soils

Unavoidable adverse effects on soils are discussed on page 4-325 of the 2001 FEIS.

4.22.7 Wetlands and Nonwetland Waters of the U.S.

There would be an unavoidable loss of 3.5 to 4.5 acres of wetlands under all action alternatives. RCR’s mitigation plan would mitigate for all unavoidable wetland losses.

4.22.8 Aquatics/Fisheries

Subsurface mining activities could result in baseflow reductions in streams. These potential reductions and associated effects would be similar for all action alternatives. The largest predicted changes in baseflow proportional to pre-mine baseflow would occur in Chicago Creek in the Bull River watershed, South Basin Creek in the Rock Creek watershed, North Basin Creek in the East Fork Bull River watershed, and the East Fork Bull River above St. Paul Lake. There would be minor water quantity-related effects on aquatic habitat in Chicago Creek, South Basin Creek, and North Basin Creek. Habitat in these tributaries is less available and of lower quality relative to their overall respective watersheds. Changes in baseflow may directly affect the quantity of aquatic habitat. Baseflow reductions could magnify or create new seasonal migration barriers in stream reaches in the study area. Groundwater drawdown could also decrease the capacity of groundwater to moderate stream temperatures. Due to uncertainty associated with mine-related ground and surface water effects and because streamflow-habitat relationships have not been defined for study area streams, potential effects on aquatic habitat cannot be quantified.

4.22.9 Biodiversity of Wildlife Habitat/Vegetation and Wildlife Species (Biodiversity)

Seven populations of three plant species of special concern are in the disturbance footprint and would be partially or totally destroyed if they could not be avoided. These species include pointed broom sedge, yerba buena, and wavy moonwort. Impacts on these species vary by alternative. For a discussion of unavoidable adverse effects on biodiversity of wildlife habitat/vegetation and wildlife species, see page 4-325 of the 2001 FEIS. Impacts on plant species of special concern would be the same as described on page 4-325 of the 2001 FEIS, except that impacts on species added to the Forest Service sensitive species list since 2001 were not addressed. Suitable habitat for tapertip onion, Washington monkey flower, and bank money flower is present in the study area. Unavoidable impacts could occur to these species if populations occurred in the disturbance areas and could not be avoided.

4.22.10 Threatened and Endangered Species

4.22.10.1 Bull Trout

Subsurface mining activities could result in baseflow reductions in streams. These potential reductions and associated effects would be similar among action alternatives. The streams potentially affected include reaches designated as bull trout critical habitats including mainstem Rock Creek, East Fork Rock Creek, East Fork Bull River, and Bull River downstream of East Fork Bull River. Baseflow reductions would also occur in West Fork Rock Creek, where bull trout presence has been verified. Changes in baseflow may directly affect the quantity of aquatic habitat available to bull trout at different life stages. Baseflow reductions could magnify or create new seasonal migration barriers in stream reaches in the study area. Baseflow reduction could also indirectly affect bull trout habitat and migration by influencing flows through alluvium and stream substrates, affecting spawning habitats and egg incubation. Groundwater drawdown could also decrease the capacity of groundwater to moderate stream temperatures. Due to uncertainty associated with mine-related ground and surface water effects and because streamflow-habitat relationships have not been defined for study area streams, potential effects on bull trout cannot be quantified at this time.

4.22.10.2 Terrestrial Species

In Alternative V, effects would be mitigated through acquisition or establishment of easements on 2,450 acres of replacement habitat, implementation of road access changes, and implementation of other measures described in Section 2.3.1.16, *Monitoring and Mitigation Plans*. The results of the analysis using updated data on existing conditions are consistent with the USFWS 2006 BO and 2007 BO Supplement (USFWS 2006, 2007). In the 2007 BO Supplement, the USFWS determined that the proposed mitigation measures would offset the negative impacts of Alternative V and that Alternative V would not likely jeopardize the continued existence of grizzly bears. The net effect of implementation of Alternative V would be improved conditions for grizzly bears.

In Alternatives II, II, and IV, construction of mine facilities, construction and improvement of roads, changes in road access, and increased human activity would result in unavoidable adverse effects on grizzly bears, including habitat loss and degradation, reduced core habitat, and increased road densities, would not be fully mitigated. Due to the length of the proposed activity (25 to 30 years) and the loss of available habitat, the habitat carrying capacity for grizzly bear would likely be reduced.

In Alternatives IV and V, unavoidable impacts on lynx would occur due to losses or alteration of about 10 acres of lynx habitat from construction of the evaluation adit. Unavoidable losses of lynx habitat would be slightly greater in Alternatives II, III, and IV, and are described on pages 4-173 through 4-194 of the 2001 FEIS.

4.22.11 Socioeconomics

For a discussion of unavoidable adverse effects on socioeconomics, see page 4-327 of the 2001 FEIS. Total annual employment and labor income described in the 2001 FEIS have been updated. For the Production Phase of the Rock Creek Project, the estimated total annual employment would be about 640 jobs annually. Total labor income would be approximately $38.8 million annually.

4.22.12 Transportation

For a discussion of unavoidable adverse effects on transportation, see page 4-328 of the 2001 FEIS.

4.22.13 Recreation

For a discussion of unavoidable adverse effects on recreation, see page 4-328 of the 2001 FEIS

4.22.14 Wilderness, Roadless Areas, and Wild and Scenic Rivers

The CMW may experience increased use and mine activities would likely be heard, seen, or smelled from some locations within the CMW. Mine facilities may result in indirect impacts on IRAs due to increased noise and aesthetic impacts. Effects on Wild and Scenic Rivers would be negligible.

4.22.15 Cultural Resources

For a discussion of unavoidable adverse effects on cultural resources, see page 4-328 of the 2001 FEIS.

4.22.16 Native American Treaty Rights

For a discussion of unavoidable adverse effects on Native American treaty rights, see page 4-328 of the 2001 FEIS.

4.22.17 Sound

For a discussion of unavoidable adverse noise effects, see page 4-328 of the 2001 FEIS.

4.22.18 Scenic Resources

For a discussion of unavoidable adverse effects on scenic resources, see page 4-329 of the 2001 FEIS Visual impacts under all action alternatives would be direct, long-term, and unavoidable. Existing settings and landscapes in both the Clark Fork Valley and Rock Creek drainage would be dramatically altered during mine operation and for several decades following operation.

4.23 Short-Term Uses and Long-Term Productivity

The analysis of short-term uses and long-term productivity for resources that have changed substantially since the 2001 FEIS have been updated in this section. For resources that have not changed substantially since the 2001 FEIS, the reader is referred to the discussion in the 2001 FEIS.

4.23.1 Forest Plan

The short-term mine construction and operations would devote between 445 and 609 acres, depending on the alternative, of land currently managed for natural resources such as grizzly bear habitat, ungulate winter range, and timber production to mine-related uses.

4.23.2 Climate and Greenhouse Gases

During construction and operation of the mine, nitrogen and sulfur emissions would occur. These emissions would substantially decrease when underground mining ceased and would end after the adits were plugged. Long-term productivity would not be affected.

4.23.3 Air Quality

During construction and operation of the mine, air pollutant concentrations would be higher throughout the study area and in the CMW than current levels, but below applicable air quality standards. Once mining and reclamation are completed, the pollutant concentrations would return to pre-mining levels, assuming adequate revegetation success. Long-term productivity would not be affected.

4.23.4 Geology

See page 4-329 of the 2001 FEIS for a discussion of short-term uses and long-term productivity of geological resources.

4.23.5 Water Quantity and Quality

4.23.5.1 Water Quantity

The short-term use of water resources would consist of using mine inflows and surface runoff for mining/milling and discharging treated water to groundwater via the infiltration ponds or to the Clark Fork River. The short-term reduction in available water from this portion of the Cabinet Mountains would be equal to the consumptive use of the mine. The only changes that may occur that would affect the long-term productivity of water resources in terms of streamflow would be plugging or not plugging the adits after mine closure. Plugging at the top of the adits would result in surface flows that may be slightly less than pre-mine conditions. Without plugging, streamflow would be reduced in the East Fork Bull River and South Basin Creek (Hydrometrics 2014c).

4.23.5.2 Water Quality

Changes may occur that would affect the long-term productivity of water resources in terms of water quality. These water quality changes may occur due to the loss of deep groundwater supply to streams, springs, and lakes. Changes to stream water quality due to discharging treated water to the Clark Fork River would occur over the long-term (potentially in perpetuity). The effect on groundwater quality due to seepage from the paste tailings facility would also be long-term.

4.23.6 Soils

For a discussion of short-term uses and long-term productivity of soils, see page 4-329 of the 2001 FEIS.

4.23.7 Wetlands and Nonwetland Waters of the U.S.

Short-term impacts on wetlands and nonwetland waters of the U.S. would occur during construction activities due to increased sediment contributions but would be mitigated through implementation of BMPs. Other potential short-term impacts would result from time delays between the development and functioning of the created, isolated wetlands and destruction of the existing wetland resources. Because functions and services would be replaced through wetland mitigation, there would be no long-term loss of productivity for wetlands. A long-term impact would result from the 30-year delay in reconstructing the nonwetland waters of the U.S. channel at the proposed mill site for Alternative II.

Short- and long-term impacts on wetlands downstream of the proposed paste tailings facility may occur. The capture of surface water by the paste tailings facility and the capture of both surface and groundwater by the proposed paste tailings facility seepage collection system would reduce the total drainage area contributing to the wetlands and potentially reduce the duration of saturation, inundation, and ponding of water in these wetlands. Decreased surface and groundwater flow, especially during the growing season or dry periods, may allow vegetative species more tolerant of drier sites to replace species requiring moister site conditions. The use of paste tailings disposal for Alternative V should delay impacts on some wetlands for up to 25 years and thus minimize the total cumulative impacts on wetlands for the short term.

4.23.8 Aquatics/Fisheries

Short-term effects of construction and operation of the Rock Creek Project on aquatic life would include increases in sedimentation to streams, which would be mitigated. Effects on aquatic life from potentially reduced base flows would likely occur for the life of the mine and would continue for some time after closure, with an estimated peak at Year 70, eventually returning to pre-project levels. Effects would be similar among all action alternatives.

4.23.9 Biodiversity of Wildlife Habitat/Vegetation and Wildlife Species (Biodiversity)

For a discussion of short-term uses and long-term productivity of biological resources, see page 4-330 of the 2001 FEIS.

4.23.10 Threatened and Endangered Species

4.23.10.1 Bull Trout

Short-term effects of construction and operation of the Rock Creek Project on bull trout would include increases in sedimentation to streams, which would be mitigated. Effects on bull trout from potentially reduced base flows would likely occur for the life of the mine and would continue for some time after closure, with an estimated peak at Year 70, eventually returning to pre-project levels. Effects would be similar among all action alternatives.

4.23.10.2 Terrestrial Species

In Alternative V, impacts on the grizzly bear, including the loss of available habitat and increased human disturbance, would be mitigated through acquisition or establishment of easements on 2,450 acres of replacement habitat, implementation of road access changes, and implementation of other measures described in Section 2.3.1.16, *Monitoring and Mitigation Plans*. Alternative V would not decrease core area or increase OMRD or TMRD in BMUs 4, 5, and 6. Although baseline conditions in BMUs 4, 5, and 6 do not meet all Access Amendment standards for core habitat, OMRD, and TMRD, the mitigation proposed for the Rock Creek Project is expected to help KNF achieve the Access Amendment standards

over time. The results of the analysis using updated data on existing conditions are consistent with the USFWS 2006 BO and 2007 BO Supplement (USFWS 2006, 2007). In the 2007 BO Supplement, the USFWS determined that the proposed mitigation measures would offset the negative impacts of Alternative V and that Alternative V would not likely jeopardize the continued existence of grizzly bears. The net effect of implementation of Alternative V would be improved conditions for grizzly bears.

In Alternatives II, III, and IV, impacts on grizzly bears, including habitat loss and degradation, reduced core habitat, and increased road densities would not be fully mitigated and would last at least until mine reclamation was completed. Due to the length of the proposed activity (25 to 30 years) and the loss of available habitat, the habitat carrying capacity for grizzly bear would likely be reduced in the long term.

Long-term losses of lynx habitat would occur in all action alternatives, including the loss of multistory or late-successional forest snowshoe hare habitat, but would be greater in Alternatives II and II than Alternatives IV and V. Impacts on lynx would be minor in all alternatives, and all alternatives include reclamation of disturbed areas after mine closure. As described in Section 2.3.1.15, *Reclamation*, a Phase I revegetation plan would be implemented under Alternative V. If reclamation were successful, sites with lynx habitat potential would return to suitable lynx habitat in the long term, equating to about 25- to 30-year life of the mine and reclamation, plus additional time for plant establishment and succession.

4.23.11 Socioeconomics

For a discussion of short-term uses and long-term productivity of socioeconomic resources, see page 4-331 of the 2001 FEIS.

4.23.12 Transportation

For a discussion of short-term uses and long-term productivity of biological resources, see page 4-332 of the 2001 FEIS.

4.23.13 Wilderness, Roadless Areas, and Wild and Scenic Rivers

Short-term mine construction and operation may result in aesthetic impacts to visitors from some locations within the CMW and IRAs. Aesthetic impacts would be long-term where disturbed areas, such as the air-intake ventilation adit, mill site, or paste tailings facility, were visible. Monitoring in the CMW would result in long-term effects on wilderness character for some visitors. Long-term effects on Wild and Scenic Rivers would be negligible.

4.23.14 Cultural Resources

For a discussion of short-term uses and long-term productivity of biological resources, see page 4-332 of the 2001 FEIS.

4.24 Irreversible and Irretrievable Commitments of Resources

Irreversible effects are those effects caused by the Rock Creek Project that cannot be reversed. Irretrievable effects are caused by an alternative that changes outputs or commodities of the land's use. These changes in output, however, must be reversible. Resources that have changed substantially since the 2001 FEIS have been updated in this section. For resources that have not changed substantially since the 2001 FEIS, the reader is referred to the discussion in the 2001 FEIS.

4.24.1 Forest Plan

The Rock Creek Project would irretrievably devote NFS lands to mining uses for the 25- to 30-year life of the project. This would reduce local grizzly, timber, and ungulate winter range uses in the Rock Creek drainage. Following completion of mining, about 57 acres of NFS lands at the paste tailings facility would not return to pre-mining uses.

4.24.2 Geology

For a discussion of irreversible and irretrievable commitments of geologic resources, see pages 4-332 and 4-333 of the 2001 FEIS.

4.24.3 Water Quantity and Quality

4.24.3.1 Water Quantity

Most of the total precipitation that falls in the Cabinet Mountains flows from the mountains as surface water and groundwater. The total water yield from the Cabinet Mountains varies from year-to-year as a function of the total precipitation and varying rates of evapotranspiration. During the Operations Phase, some water would be used consumptively by the Rock Creek Project, reducing the total yield of the Cabinet Mountains in the study area by that amount. Relative to the total yield of the affected watersheds, the consumptive use volume would be small. The use of mine and adit inflows and any water needed for mine operations and resulting reduction in yield would be an irretrievable commitment of resources.

In addition to water consumptively used, the estimated increase in groundwater storage due to the mine void would be about 27,000 acre-feet, based on the total estimated ore and waste rock to be mined. This volume of groundwater required to fill the mine void would be an irretrievable commitment of resources.

The paste tailings facility would alter the topography and drainage characteristics in the Miller Gulch and Rock Creek basins, which may slightly affect streamflow in both streams. The flow changes would be an irreversible commitment of surface water resources.

4.24.3.2 Water Quality

Water quality impacts resulting from mine inflows during and after mining would be an irretrievable commitment of surface water resources. Effects on the water quality of the Clark Fork River due to the discharge of treated water and effects on groundwater quality due to seepage from the paste tailings facility would be an irreversible commitment of water resources.

4.24.4 Soils

For a discussion of irreversible and irretrievable commitments of soils, see page 4-333 of the 2001 FEIS.

4.24.5 Wetlands and Nonwetland Waters of the U.S.

There would not be an irreversible loss of existing wetlands and nonwetland waters of the U.S. under all action alternatives because all wetlands and nonwetland waters are renewable resources and the effects would be mitigated. Wetland effects for all alternatives have been reduced compared to those presented in the 2001 FEIS, and updated mitigation plans based on the revised effects would be developed for Alternatives I through IV to mitigate wetland losses. The proposed mitigation plan for Alternative V would create 5.2 acres of wetlands to replace wetland functions and services of 3.5 acres of wetlands.

All alternatives would result in irretrievable losses of wetlands and nonwetland waters for the period that permanent fill is left in place and until vegetation is reestablished. For Alternative V, there would be an irretrievable loss of 3.5 acres of existing isolated wetlands and 0.4 acre of nonwetland waters of the U.S. Successful wetland mitigation would compensate for the loss by reestablishing the diversity and abundance of habitat for aquatic and terrestrial species, reducing sediment transport to Rock Creek and attenuating peak flows.

4.24.6 Aquatics/Fisheries

All of the action alternatives could potentially reduce the quality and quantity of aquatic habitat due to decreases in flow. Due to uncertainty associated with mine-related ground and surface water effects and because streamflow-habitat relationships have not been defined for study area streams, potential effects on aquatic resources cannot be quantified. Any reduction in habitat quality and quantity would be irretrievable. Any mortality or reduction in productivity of aquatic resources would be irretrievable.

4.24.7 Biodiversity of Wildlife Habitat/Vegetation and Wildlife Species (Biodiversity)

For a discussion of irreversible and irretrievable commitments of wildlife habitat/vegetation and wildlife species, see pages 4-334 and 4-335 of the 2001 FEIS.

4.24.8 Threatened and Endangered Species

4.24.8.1 Bull Trout

All of the action alternatives could potentially reduce quality and quantity of bull trout habitat, including designated critical habitat, due to decreases in flow, which would be irretrievable. Potential mortality or reduction in productivity of bull trout would be irretrievable. This potential is difficult to quantify and compare among action alternatives as previously described.

4.24.8.2 Terrestrial Species

In Alternative V, impacts on the grizzly bear, including the loss of available habitat and increased human disturbance, would be mitigated through acquisition or establishment of easements on 2,450 acres of replacement habitat, implementation of road access changes, and implementation of other measures described in Section2.3.1.16, *Monitoring and Mitigation Plans*. Alternative V would not decrease core area or increase OMRD or TMRD in BMUs 4, 5, and 6. Although baseline conditions in BMUs 4, 5, and 6 do not meet all Access Amendment standards for core habitat, OMRD, and TMRD, the mitigation proposed for the Rock Creek Project is expected to help KNF achieve the Access Amendment standards over time. The results of the analysis using updated data on existing conditions are consistent with the USFWS 2006 BO and 2007 BO Supplement (USFWS 2006, 2007). In the 2007 BO, the USFWS determined that the proposed mitigation measures would offset the negative impacts of Alternative V and that Alternative V would not likely jeopardize the continued existence of grizzly bears. The net effect of implementation of Alternative V would be improved conditions for grizzly bears.

In Alternatives II, II, and IV, adverse effects on grizzly bears, including habitat loss and degradation, reduced core habitat, increased road densities, and increased human disturbance, would not be fully mitigated. Due to the length of the proposed activity (25 to 30 years) and the loss of available habitat, the habitat carrying capacity for grizzly bear would likely be reduced. This effect may be irreversible should the loss of habitat keep the population potential below a viable level. If the population stays below the viable level, the effect becomes irretrievable without large-scale augmentation.

No irreversible or irretrievable commitments of resources due to impacts on the Canada lynx or its habitat would occur as a result of any of the action alternatives. Impacts to lynx would be minor in all alternatives, and all alternatives include reclamation of disturbed areas after mine closure. As described in Section 2.3.1.15, *Reclamation*, a Phase I revegetation plan would be implemented under Alternative V. If reclamation were successful, sites with lynx habitat potential would return to suitable lynx habitat in the long term, equating to about 25- to 30-year life of the mine and reclamation, plus additional time for plant establishment and succession.

4.24.9 Socioeconomics

For a discussion of irreversible and irretrievable effects on socioeconomics, see page 4-335 of the 2001 FEIS.

4.24.10 Transportation

For a discussion of irreversible and irretrievable effects on transportation, see pages 4-335 and 4-336 of the 2001 FEIS.

4.24.11 Recreation

For a discussion of irreversible and irretrievable effects on recreation, see page 4-336 of the 2001 FEIS.

4.24.12 Wilderness, Roadless Areas, and Wild and Scenic Rivers

No irreversible or irretrievable effects on wilderness, roadless areas, or wild and scenic rivers would occur. For a discussion of irreversible and irretrievable commitments of wilderness, see page 4-336 of the 2001 FEIS.

4.24.13 Cultural Resources

For a discussion of irreversible and irretrievable commitments of cultural resources, see page 4-336 of the 2001 FEIS.

4.24.14 Native American Treaty Rights

For a discussion of irreversible and irretrievable effects on Native American Treaty Rights, see page 4-336 of the 2001 FEIS.

4.24.15 Sound

For a discussion of irreversible and irretrievable noise effects, see page 4-336 of the 2001 FEIS.

4.24.16 Scenic Resources

For a discussion of irreversible and irretrievable commitments of scenic resources, see page 4-336 of the 2001 FEIS.

4.25 Environmental Justice

EO 12898, Environmental Justice requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations when implementing their respective programs, including American Indian programs. The KNF's analysis of Environmental Justice follows the CEQ's guidance on Environmental Justice (CEQ 1997), the EPA's guidance on Environmental Justice (EPA 1998, 1999), and the U.S. Department of Agriculture's regulation on Environmental Justice (USDA 1997). These documents suggest a step-wise evaluation of Environmental Justice: identification of minority and low-income populations, assessment of effects and determination if the effects would be disproportionately high and adverse, and mitigation. The U.S. Department of Agriculture's regulation indicates an effect on a minority or a low-income population is disproportionately high and adverse if the adverse effect is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the nonminority population and/or non-low-income population.

No minority or low-income populations live in the study area. American Indians are a minority population, and although the proposed mine is not located within or adjacent to any tribal reservations, it is located within the boundaries of land covered by the Hell Gate Treaty (Section 3.19, *American Indian Treaty Rights*). All action alternatives would restrict access to mine facility sites to all members of the public, including tribal members. Proposed mitigations in all action alternatives would reduce the effects of access restrictions. The access restrictions would not be disproportionately high or adverse on any minority or low-income population.

Chapter 5. Consultation and Coordination

5.1 Preparers and Contributors

5.1.1 Forest Service

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Johnsen, Steve	Wildlife Biology/Old Growth	M.S. Wildlife Biology B.S. Wildlife Biology	25
Kedish, Gary	Recreation/Wilderness	M.S. Natural Resources B.S. Natural Resources, Ecology, and Conservation	12
Kindel, Kenny	Forest Hydrology and Watershed Program Manager	B.A. Biology	22
Lacklen, Bobbie	Project Coordinator	B.A. Geology	28
Lampton, Linda	GIS	A.A. Business	27
Mason, Sandi	Lands	Business	15
Neesvig, Craig	Hydrology	B.S. Hydrology	15
Smith, Lawrence	Forester	A.A. Forestry	38
Smith, Megan	Vegetation	B.S. Forestry B.S. Freshwater Fisheries	15
Stantus, Paul	Engineer	B.S. Civil Engineering	33
TeSoro, Ray	Geology	B.S. Geology	34

Name	Responsibilities	Qualifications	Experience (years)
Timmons, Becky	Heritage/American Indian	M.A. Anthropology B.A. Anthropology	32
Werner, Peter	Geotechnical	M.S. Mining Engineering Double B.S. Civil Engineering and Geology	20
Young, Barb	GIS	M.S. Soils B.A. Geology	23

5.1.1.1 Forest Service Contractors

Name	Responsibilities	Qualifications	Experience
Burnside, Michael	Geology	M.S. Economic Geology B.A. Geology	40
McKay, John	Geology	B.A. Geology	29
Wegner, Steve	Hydrology	B.S. Watershed Management	28

5.1.2 SEIS Consultant Team

Name/Firm	Responsibilities	Qualifications	Experience
Baud, Karen ERO Resources Corp.	Project Manager, Wildlife	M.A. Biology B.A. Biology	17
Buscher, Dave Buscher Soil and Environmental	Soils and Reclamation	M.S. Ecological Engineering B.S. Geological Engineering B.S. Wildlife Biology	33
Butler, Steve ERO Resources Corp.	Biodiversity and Terrestrial Threatened and Endangered Species	Master of Environmental Management B.S. Biology	18
Cole, Andy ERO Resources Corp.	Socioeconomics, Transportation and Recreation	Master of Forest Science M.A. German B.A. German/Physics	17
Fleming, Ed Ottertail Environmental	Fisheries and Aquatic Biology	B.S. Aquatic Biology	22
Galloway, Barbara ERO Resources Corp.	Hydrology	M.S. Water Resources Double B.A. Biology and Environmental Studies	30
Galloway, Michael ERO Resources Corp.	Hydrogeology	M.S. Geology B.S. Geology	43
Hesker, David ERO Resources Corp.	Graphics	B.F.A. Graphic Design	24
Hodges, Wendy ERO Resources Corp.	Geographic Information Systems	M.S. Environmental Policy and Management B.S. Natural Science	7
Holdeman, Mark Holdeman Landscape Architecture, Inc.	Visual	B.L.A. Landscape Architecture	30
Larmore, Sean ERO Resources Corp.	Cultural Resources	M.A. Archaeology B.A. Anthropology	15
Mangle, Bill ERO Resources Corp.	Wilderness, and Inventoried Roadless Areas	M.S. Natural Resource Policy and Planning B.S. History/Political Science	16

Name/Firm	Responsibilities	Qualifications	Experience
Martin, Paul AquaResource a division of Matrix Solutions Inc.	Hydrology	M.S. Hydrogeology B.A.S. Civil Engineering	28
Moore, Joel Ottertail Environmental	Fisheries and Aquatic Biology, Bull Trout	M.S. Land Resources and Environmental Sciences B.S. Fisheries and Wildlife	11
Olmsted, Brian ERO Resources Corp.	Geology	M.S. Geochemistry B.S. Geology	12
Rouse, Leigh ERO Resources Corp.	Wetlands	M.S. Botany B.A. Biology	16
Schafer, William Schafer Limited LLC	Geochemistry	Ph.D. Soil Science M.S. Soil Science B.S. Watershed Science	32
Smith, Garth ERO Resources Corp.	Geographic Information Systems	M.A. Geography B.S. Geography	18
Trenholme, Richard ERO Resources Corp.	Quality Control	B.S. Agronomy	37
Vandergrift, Tom Agapito and Associates, Inc.	Mine Engineering	M.S. Mining Engineering B.S. Mining Engineering	25
Wall, Kay ERO Resources Corp.	Technical Editor	B.A. Behavioral Science	32

5.2 Other Federal, Tribal, State, and Local Agencies

The Forest Service consulted the following individuals, federal, tribal, state, and local agencies and agency personnel during the development of this SEIS.

Name/Agency or Tribe	Responsibilities
Allan, Chief J. Coeur d' Alene Tribe	American Indian Rights
Berkeley, James Environmental Protection Agency	Wetlands and 404 Permit
Allen, Dana Environmental Protection Agency	NEPA
Bohan, Susan Environmental Protection Agency	NEPA
Hanley, James Environmental Protection Agency	Mine Engineering
Hill, Chris Montana Department of Environmental Quality	Stormwater Permit
Jepson, Wayne Montana Department of Environmental Quality	Hydrology
McWhorter, Lynne Environmental Protection Agency	NEPA
Moran, E.T. Confederated Salish and Kootenai Tribes	American Indian Rights
Nenema, Glenn Kalispel Tribe	American Indian Rights
O'Mara, Jenny Montana Department of Environmental Quality	Air Quality

Name/Agency or Tribe	Responsibilities
Ott, Toney Environmental Protection Agency	Wetlands and 404 Permit
Pierce, Maggie Environmental Protection Agency	NEPA Project Contact
Porter, Jennifer Kootenai Tribe of Idaho	American Indian Rights
Reid, Tom Montana Department of Environmental Quality, Water Protection Bureau	Water Quality
Rolfes, Herb Montana Department of Environmental Quality	Operating Permit
Russell, Carol Environmental Protection Agency	Mine Waste Team
Schroeder, Christina Army Corps of Engineers	Wetlands and 404 Permit (2013 to present)
Skubinna, Paul Montana Department of Environmental Quality	MPDES Permit
Stevens, Loretta Confederated Salish and Kootenai Tribes	American Indian Rights
Tillinger, Todd Army Corps of Engineers	Wetlands and 404 Permit
Tomten, Dave Environmental Protection Agency	NEPA
Winters, Jim Army Corps of Engineers	Wetlands and 404 Permit (2010 to 2012)
Wireman, Mike Environmental Protection Agency	Hydrogeology

5.3 Agencies, Companies, and Organizations Consulted

This Draft SEIS or its Summary has been distributed to individuals who specifically requested a copy of the document either in hard or electronic copy. In addition, copies have been sent to the federal agencies, tribal governments, state and local governments, and organizations representing a wide range of views regarding the proposed Rock Creek Project. The mailing list was compiled using the names and addresses of the following:

- Parties who participated in public meetings or who submitted written comments on the 1995 DEIS, 1998 Supplemental Draft EIS, or the 2001 FEIS
- Parties who have requested copies of the Draft SEIS
- Agencies, governments, tribes, and companies potentially affected by the proposed operation
- Agencies and groups consulted during the SEIS preparation

A copy of this Draft SEIS can be reviewed at the following locations or via the Internet on the Forest Service web page (http://www.fs.usda.gov/detail/kootenai/landmanagement/projects):

- Supervisor's Office, Kootenai National Forest, Libby, MT
- Cabinet Ranger Station, Trout Creek, MT
- Montana Department of Environmental Quality, Helena, MT
- Montana State Library

- Mansfield Library, University of Montana, Missoula, MT
- Lincoln County Library, Libby, MT
- Thompson Falls Public Library, Thompson Falls, MT
- Laurie Hill Library, Heron, MT

Copies of this document are also available on request from:

Kootenai National Forest
31374 U.S. Highway 2
Libby, MT 59923-3022
(406) 293-6211

The following agencies, organizations, and individuals received a copy of the SEIS or received Notice of Availability:

5.3.1 Federal, State, or Local Agencies

Advisory Council on Historic Preservation
Bonner County Commissioners
City Of Libby
City Of Troy
Coeur D'Alene Tribe
Confederated Salish And Kootenai Tribes
County Commissioner Flathead
County Commissioner Lincoln
Federal Aviation Administration
Idaho Dept Of Environmental Equality
Idaho Dept Of Fish And Game
Idaho Panhandle Ranger District - Priest Lake Ranger District
Kalispell Tribe
Kootenai Tribe Of Idaho
Libby Area Chamber Of Commerce
MT Dept Of Environmental Quality
MT Deputy Director Kirby Campbell-Rierson
MT Fish Wildlife & Parks
MT Govenor Steve Bullock
MT Representative Gerald Bennett
MT Representative Mike Cuffe
MT Representative Nicholas Schwaderer
MT Representative Bob Brown
MT Representative Ryan Zinke
MT Senator Chas Vincent
MT Senator Jennifer Fielder
MT Senator Jim Risch
National Agricultural Library
National Environmental Coordinator, RNCS
Naval Operations Energy & Environmental Readiness Division
Northwest Power Planning Council
Sanders County Commissioner
Troy Public Schools
U.S. Army Corps Of Engineers
U.S. Bureau Of Land Management
U.S. Coat Guard Office of Environmental Management
U.S. Department of Agriculture APHIS PPD/EAD
U.S. Deptartment of Energy NEPA Policy & Compliance
U.S. Environmental Protection Agency
U.S. Environmental Protection Agency Region 10
U.S. Environmental Protection Agency Region 8
U.S. Fish And Wildlife Service
U.S. Senator MT Jon Tester
U.S. Senator MT Steve Daines
University Of Chicago Department Of Geoscience
University of Montana
USDI Office Of Environmental Policy & Compliance

5.3.2 Organizations and Businesses

Organizations

Alliance for the Wild Rockies
American Forest & Paper Association
Associated Students of the University of Montana
Backcountry Hunters And Anglers
Blue Ribbon Coalition
Board of Environmental Review
Bonner County Sportsmen's Association
Boone and Crockett Club
Bowdoin College
Cabinet Back Country Horsemen
Defenders of Wildlife
Great Bear Foundation
Holly Eve Foundation, Inc.
Idaho Mining Association
Kalispell Natural Resources
Kootenai Environmental Alliance
Kootenai River Network
Libby Rod And Gun Club
Lincoln County Sno Kats
Lower Clark Fork Watershed Group
Montanans for Multiple Use
MT Conservation Corps.
MT Snowmobile Association
MT Wood Products Association
National Rifle Association
National Wild Turkey Federation
National Wildlife Federation
North Idaho ATV Association
Noxon Rod & Gun Club
Panhandle Trail Riders Association
Pheasants Forever
Recreational Boating and Fishing Foundation
Rock Creek Alliance
The Cabinet Resource Group
The Lands Council
Tobacco Valley Resource Group
Troy Snowmobile Club
Vanguard Research
Western Land Exchange Project
Western Mining Action Project
Wild Sheep Foundation
Yaak Valley Forest Council

Businesses

A and M Fire and Safety, Inc.
Beartooth Oil and Gas Company
Bennett Homes Realty and Investments
Brake Supply
Calvert Ranch
Canavan Logging
Charles Sage Advertising
Columbia Helicopters
Common Sensing, Inc.
CVA Industries
Dick Irvin, Inc.
Diversified House Log, Inc.
Earthworks
Erickson Air Crane, Inc.
F.H. Stoltze Land & Lumber Company
First State Bank
Galloway Logging
Gold Rush
Golden Sunlight Mines, Inc.
Hecla Mining Company
High Country Outfitters
IDA Inc.
Idaho Forest Group, LLC
Internal Medicine Associated
Kootenai River Development Council, Inc.
Lincoln County Weed and Rodent
Linehan Outfitting Company
Long Machinery
Martlet Venture Management
Montana Bolt Inc.
MSE Technology Applications, Inc.
N.A. Degerstrom Inc.
Plum Creek Timber Company
Rocky Mountain Eye Center
Rusher Air Conditioning
Simplot Company
Stimson Lumber Company
U.S. Antimony Corporation
Yaak Stewardship, LLC
Yaak Valley Gun Repair

5.3.3 Individuals

The names of individuals are available upon request from the KNF.

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Chapter 7. Acronyms

$\mu g/m^3$	micrograms per cubic meter
2001 FEIS	2001 Rock Creek Project Final EIS
2D model	2-dimensional numerical model
3D	3-dimensional
ABA	acid base accounting tests
ABP	acid base potential
ADT	average daily traffic
AIRFA	American Indian Religious Freedom Act of 1978
AMEC	AMEC Earth & Environmental, Inc.
AP	acid-generating potential
APE	area of potential effect
AQRV	air quality related values
ARD	acid rock drainage
ARM	Administrative Rules of Montana
ASARCO	ASARCO, Inc.
Avista	Avista Corporation
BA	biological assessment
BAA	bear analysis area
BACT	best available control technology
BE	biological evaluations
bgs	below ground surface
BMP	best management practices
BMU	bear management unit
BO	biological opinion
CAA	Clean Air Act
CaCO3	carbonates
CE	categorical exclusion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGD	Cabinet Gorge Dam
CHSU	critical habitat subunit
CMIP3	Coupled Model Intercomparison Project Phase 3
CMW	Cabinet Mountains Wilderness
CO	carbon monoxide
CO2e	CO2-equivalent
COC	constituent of concern
Corps	U.S. Army Corps of Engineers
CSKT	Confederated Salish and Kootenai Tribes
cy	cubic yards
CYE	Cabinet-Yaak Ecosystem
dBA	decibels
DBH	diameter at breast height
DCF	discounted cash flow
DEIS	Draft EIS
DEQ	Montana Department of Environmental Quality
DNRC	Montana Department of Natural Resources and Conservation

DPS	distinct population segment
DSL	Montana Department of State Lands
ECA	equivalent clearcut acres
ELG	effluent limit guidelines
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEIS	Final EIS
FEMA	Federal Emergency Management Agency
FeS2	pyrite
FLM	Federal Land Managers
FMEA	Failure Modes and Effects Analysis
FOS	factor of safety
FSM	Forest Service Manual
FWP	Montana Fish, Wildlife and Parks
GDE	groundwater-dependent ecosystem
GHG	greenhouse gas
gpm	gallons per minute
Guidelines	404(b)(1) Guidelines
GVW	gross vehicle weight
GW TAG	Groundwater TAG
HAP	hazardous air pollutant
HCP	habitat conservation plan
HCT	humidity cell test
HD	hunting district
HDPE	high-density polyethylene
HE	habitat effectiveness
HRMIP	Hard Rock Mining Impact Plan
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDHW	Idaho Department of Health and Welfare
INFS	Inland Native Fish Strategy
IRA	inventoried roadless area
JD	jurisdictional determination
KFP	1987 Kootenai Forest Plan
km	kilometers
KNF	Kootenai National Forest
KTOI	Kootenai Tribe of Idaho
LAU	Lynx Analysis Unit
LWD	large woody debris
MA	management area
MAAQS	Montana Ambient Air Quality Standards
MAQP	Montana Air Quality Permit
MCA	Montana Code Annotated
MDT method	Montana Wetland Assessment Method
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
MFISH	Montana Fisheries Information System
mg/m3	milligrams per cubic meter
MIS	management indicator species
ML	metal leaching

MMBtu/hr	millions British thermal units per hour
MMC	Montanore Minerals Corporation
MMI	Mines Management, Inc.
MMRA	Metal Mine Reclamation Act
MNHP	Montana Natural Heritage Program
MOU	Memorandum of Understanding
MPDES	Montana Pollution Discharge Elimination System
MVUM	motor vehicle use map
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NHPA	National Historic Preservation Act
Noranda	Noranda Minerals Corp.
NP	acid-neutralization potential
NPV	net present value
NRD	Noxon Rapids Dam
NRHP	National Register of Historic Places
NRLMD	Northern Rockies Lynx Management Direction
NWP	Nationwide Permit
OHV	off-highway vehicle
OM	optical mineralogy
OMB	Office of Management and Budget
OMRD	open motorized route density
ORD	open road density
PAG	potentially acid generating
PGA	peak ground acceleration
PM	particulate matter
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
PSD-NSR	Prevention of Significant Deterioration – New Source Review
PTTAG	Paste Tailings Technical Advisory Group
QA/QC	quality assurance/quality control
RCR	RC Resources, Inc.
Revett	Revett Mining Company, Inc.
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objective
RMP	Road Management Plan
RO	reverse osmosis
Rock LAU	Lynx Analysis Unit #14702
ROD	record of decision
SAG	semiautogenous grinding
SEIS	Supplemental Environmental Impact Statement
SEM	scanning electron microscopy
SHPO	State Historic Preservation Office
SIL	significant impact level
SPLP	Synthetic Precipitation Leaching Procedure
Sterling	Sterling Mining Company
STIP	Settlement Stipulation and Order
SWPPP	Stormwater Pollution Prevention Plan

T&E	threatened and endangered
TAG	technical advisory group
TCLP	toxicity characteristic leaching procedure
TCP	Traditional Cultural Property
TIN	total inorganic nitrogen
TMRD	total motorized route density
TP	total phosphorus
tph	tons per hour
USDA	U.S. Department of Agriculture
USFS	USDA Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VMP	Vegetation Management Plan
VMS	Visual Management System
VOC	volatile organic compounds
VQO	Visual Quality Objectives
Washington model	Washington Road Surface Erosion Model

Chapter 8. Glossary

acid base potential. A laboratory method to determine the acid-generating potential of sulfide minerals.
activated sludge. Collection of microorganisms and organic material in an aeration basin with the intent of producing a solid that will settle.
adit. A nearly horizontal passage, driven from the surface, by which a mine may be entered, ventilated, and unwatered.
aerie. A bird nest on a cliff or mountainside.
air stripping. A mass of transfer process in which ammonia is removed from water by bringing the water in contact with ammonia-free air. This process reduces the partial pressure of ammonia, which causes the ammonia to leave the water phase and enter the gas phase.
alluvium. Soil and rock that is deposited by flowing water.
altered waste zones. Zones of changed mineralogy that occur around the ore deposit, containing chalcopyrite-calcite, pyrite-calcite, and galena-calcite mineralization.
ambient. Surrounding, existing.
analyte. A chemical to be analyzed in a water quality lab.
appropriators. Persons or corporations that have a legal right to take and use surface or groundwater resources.
aquifer. Rock or sediment that is saturated with water and sufficiently permeable to transmit economic quantities of water to wells.
arete. A glacial feature caused by glacial erosion of both sides of a ridgeline.
argillite. A rock that has formed as a result of the hardening of sediments by pressure and heat. Argillite is harder than mudstone and not as hard as shale. The rock is composed largely of particles of clay size and its made up of thin laminates.
authogenic. Refers to a mineral or sedimentary rock generated where it is found or observed.
background. (air quality) Ambient. (scenic) The viewed landscape from 8 km (5 mi.) to infinity from an observer.
bear analysis area (BAA). A subunit of a BMU used to analyze open road densities. Also used to determine the adequate amount of replacement habitat.
bear management unit (BMU). Land area containing sufficient quantity and quality of all seasonal habitat components to support a female grizzly. Used to analyze percent habitat effectiveness (HE).
Best management practices (BMPs). A practice or set of practices that enables a planned activity to occur while still protecting the resource managed, normally implemented and applied during the activity rather than after the activity.
Best management practices (BMPs) for watershed. A practice or a combination of practices that is determined by the state (or designated areawide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective and practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.
bleed water. Process water with buildup of excess constituents
biodiversity. A term that describes the variety of lifeforms, the ecological role they perform, and the genetic diversity they contain.
biological minimum. In this context, the minimum amount of some component necessary for viability.
borrow materials. Soil or rock dug from one location to provide fill at another location.
breakpoint chlorination. Also known as superchlorination, is accomplished by the addition of chlorine in an amount that will oxidize ammonia-nitrogen to nitrogen gas.
broadcast seeding. A means of planting where seed is distributed on the ground surface mechanically or by hand.

candidate. Those species under consideration for possible listing as “endangered” or “threatened,” in accordance with the 1973 Endangered Species Act.
carbonate. A sedimentary rock composed chiefly of carbonate minerals (e.g. limestone and dolomite).
carrying capacity. The maximum number of animals that can be sustained over the long-term on a specified land area.
catchment. A geographic area that collects rain or snowfall.
character type. Pertains to a large physiographic area of land, such as the Columbia Rockies, which has common visual characteristics of landforms, rock formations, water features, and vegetative patterns.
chlorine contact chamber. A basin designed to allow chlorine and bacteria to come in contact, with the intent of killing or reducing the viability of the bacteria.
clasts. A fragment of pre-existing minerals or rocks.
coarse fragment. Rock that is larger than 2 millimeters (about 1/16 inch) in diameter.
coarse woody debris (CWD). Coarse woody debris consists of dead woody material larger than 3 inches in diameter and derived from tree limbs, boles, and roots.
colluvium. Fragments of rock carried and deposited by gravity.
confluence. The point where two streams meet.
conservation assessment and strategy. A biological analysis of species viability and a plan for managing a species that will allow it to survive over time. Includes biological information, current status, and management and monitoring strategies needed to conserve the species.
contrast. The juxtaposition of dissimilar elements (as form, line, color and texture) in the landscape. The closer the juxtaposition of dissimilar elements and the stronger their differences, the more noticeable they become.
construction zone. The area that includes the physical workings of a mine such as adits, roads, mills, tailings ponds, pipelines, and slurry lines.
containerized seedling. A small, young tree held within a container.
corridor (development). A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries (36 CFR 219.3).
corridor (wildlife). Avenues along which wide-ranging animals can travel, plants can propagate, genetic interchange can occur, populations can move in response to environmental changes and natural disasters, and threatened species can be replenished from other areas.
cutoff. A clay-filled trench beneath a dam to “cut off” water seeping beneath the dam.
cyclone. Centrifugal classifying device.
dBA or decibels A scale. A logarithmic unit for measuring sound intensity, using the decibel A weighted scale, which approximates the sound levels heard by the human ear at moderate sound levels, with a 10 decibel increase being a doubling in sound loudness.
decant water. Water recycled from the tailings pond to the mill for reuse.
deep rip. Breaking up compacted soil, or overburden, to a depth below normal tillage.
degradation. A process by which the quality of water in the natural environment is lowered.
dilution. A process in which the chemical concentration of constituents in a stream decreases as a result of mixing with cleaner water.
dispersal. The movement, usually one way, and on any time scale, of plants or animals from their point of origin to another location where they subsequently produce offspring.
dispersal corridor. A corridor through which young disperse from their area of birth.
dispersed recreation. Recreation that occurs outside of developed sites in the unroaded and roaded environment (e.g., hunting, backpacking, and berry picking).
discontinuity. Any fracture in bedrock, such as faults and bedding fractures; a boundary between seismic layers of the earth.
distance zones. Portions of the viewed landscape that are designated distances from the observer; see foreground, middleground, and background.
downgradient. A direction characterized by lower fluid potential or hydraulic head.
drainage sump. A hole or pit that collects mine waters.

drill seeding. A mechanical method for planting seed in soil.
dynamic flow failure. Landslide movement characterized by fluid-like flow of the landslide material.
earthquake loading. The application of earthquake forces to a structure.
effluent. Wastewater discharge.
endangered. Any species, plant or animal, that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.
Endangered Species Act. An act of Congress, enacted in 1973, to protect and recover threatened or endangered plant or animal species and their habitats. The Secretary of Interior, in accordance with the Act, identifies or lists the species as "threatened" or "endangered."
environmental stochasticity. Random variation in environmental attributes such as temperature, precipitation, and fire frequency.
ephemeral stream. A stream that flows only as a direct response to rainfall or snowmelt events; having no baseflow.
evaporation. The physical separation of a liquid from a dissolved or suspended solid. Energy is applied to the system to volatize the liquid leaving the solids behind.
face. The part of an adit or mine that is actively being excavated; the end of the adit being excavated.
factor-of-safety. Forces causing sliding divided by forces resisting sliding; for example, at a factor-of-safety of 1.0, the forces causing sliding are the same as those resisting sliding.
Failure Modes and Effects Analysis (FMEA). A step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service. "Failure modes" means the ways, or modes, in which something might fail.
fault. A fracture or fracture zone where there has been displacement of the sides relative to one another.
fault gouge zone. A soft clayey or clay-like material filling or partly filling a fault zone.
flotation. A mineral recovery process where individual mineral grains are selectively "floated" and skimmed off the top of an agitated water/chemical bath.
forb. Any herbaceous plant, usually broadleaved, that is not a grass or grass-like plant.
foreground. The viewed landscape from 0 to 0.8 km (0 to 0.5 mi.) from an observer.
fragmentation. A condition in which a continuous area is reduced and divided into smaller sections. Habitat can be fragmented by natural events or development activities.
genus. A group of related species used in the classification of organisms (plural = genera).
glacial moraine. Mounds and ridges of broken rock and soil particles deposited by glacial action.
Grizzly bear core habitat. An area of secure habitat within a BMU that contains no motorized travel routes or high-use nonmotorized trails during the nondenning season and is more than 0.31 mile (500 meters) from a drivable road. Core areas do not include any gated roads but may contain roads that are impassable due to vegetation or constructed barriers. Core areas strive to contain the full range of seasonal habitats that are available in the BMU.
groundwater extraction system. The configuration of wells and associated pumping rates required to contain or remediate groundwater contamination.
guideline (as used in the 2015 KFP). Operational practice and procedure that is applied to project and activity decision making to achieve goals, desired conditions, and objectives.
habituate. Become accustomed to.
hardness. A measure of the amount of calcium, magnesium, and iron dissolved in the water.
heavy metals. Metallic elements with high molecular weights, generally toxic in low concentrations to plants and animals.
home range. An area in which an individual animal spends most of its time doing normal activities.
hydraulic conductivity. A measure of the ease with which water moves through soil or rock; permeability.
hydric soil. A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water-loving) vegetation.

Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.
hydrophytic vegetation. The sum total of plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. When hydrophytic vegetation comprises a community where indicators of hydric soils and wetland hydrology also occur, the area has wetland vegetation.
hydroseeding. Broadcasting seed in a spray of water. Mulch and fertilizer may be added to the spray.
impoundment dike. An earthen dam or tailings dam.
interim reclamation. Reclamation conducted during operations to reduce erosion, sedimentation, noxious weed invasion, and visual impacts. The reclamation may or may not be redisturbed at mine closure,
interior forest bird. Those species whose environmental requirements are best met in stands that are not affected by edge, or those portions of stands that are large enough that edge effects are no longer apparent.
intermittent stream. A stream that does not flow continuously from its source to the mouth, at least for a portion of the year.
introgress. The mixing of genes from two closely related species (hybridization).
ion exchange. A process based on the use of specifically formulated resins. Selective ion exchange for the removal of ammonium is accomplished by passing liquid through a column of zeolite that has a high selectivity for the ammonium ion. After a critical relative concentration of recoverable ion to exchanged ion in the solution is exceeded, the exchange resin, zeolite, is said to be spent. Spent resin is usually recharged by exposing it to a very concentrated solution of the original exchange ion so that a reverse exchange takes place. This results in a regenerated resin and the removal of a concentrated solution of the ammonium ion.
joint. Fracture in rock, generally more or less vertical or transverse.
lacustrine. Fine sediment deposited in a lake.
leachate. A solution obtained by leaching, as in the downward percolation of water through tailings materials, and containing soluble substances.
limit equilibrium analysis. A standard stability analysis.
liquefaction. When an earthquake occurs, energy released by rupturing in the earth's crust causes cyclic waves to travel through the rock and soil mass. Saturated soils can then experience enough pressure between the individual grains that the soil loses its cohesion (shear strength) and behaves as a liquid.
loading. Pertaining to the contribution of material or chemicals to a receiving stream.
loess. Windblown soil deposits.
long term. A period greater than the life of the mine (i.e., post-operational).
macroinvertebrate. Small animals without backbones that are visible without a microscope, for example, insects, small crustaceans, and worms.
macronutrient. Elements necessary in large amounts for plant growth, usually refers to nitrogen, phosphorus, potassium, and sulfur.
mainstem. The primary channel in a stream or river.
makeup water. Additional water required to supplement water lost during the milling process.
management area (as used in the 2015 KFP). A land area identified within a planning area that has the same set of applicable plan components. A management area does not have to be spatially contiguous (36 CFR 219.19).
management indicator species. Each forest plan developed under the 1982 Planning Rule for the National Forest Management Act was required to identify certain vertebrate and/or macroinvertebrate species as Management Indicator Species, or MIS, as one of various components to address the National Forest Management Act requirements related to diversity of plant and animal communities (36 CFR 219.19(a)). The direction for MIS is related to forest plan development, forest project implementation, and forest plan monitoring. MIS for the 2015 KFP are elk, a specific macroinvertebrate assemblage, and a specific landbird assemblage. These MIS were chosen to compare alternatives in the 2015 KFP. Elk are a

commonly hunted species and secure elk habitat is an issue of public concern. Given the restoration emphasis of the 2015 KFP, use of the macroinvertebrate assemblage to evaluate water quality trends across the entire planning area will validate the assumptions of plan implementation or help change management strategies in the event that water quality benefits are not realized. Landbird assemblage (insectivores) are expected to respond to progress made toward desired conditions for vegetation. None of the 2015 KFP MIS were chosen due to viability concerns.

management situations. Areas of grizzly bear or mountain goat habitat, that due to their characteristics, have specific Forest Service management goals and directions.

mean. The average number of a set of values.

median. A numerical value in the midpoint of a range of values with half the value points above and half the points below.

mesic. Intermediate or moderate moisture or temperature; or reference to organisms adapted to moderate climates.

metric. A value calculated from existing data and used for summarization purposes.

microclimate. A small area influenced by its own weather patterns.

middleground. The viewed landscape from 0.8 to 4.8 km (0.5 to 3 mi.) from an observer.

mine dry. Changing room for employees.

mitigation. An action to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

Montanore subdeposit. One of two parts of the Rock Creek-Montanore deposit, which according to Boleneus et al. (2005), is separated from the second part, the Rock deposit, by the Rock Lake Fault.

moraine. A landform resulting from glacial deposition of material such as boulders, till, gravel, sand, and clay.

mycorrhizae. An association that develops when certain fungi and plant roots form a mutually beneficial relationship. One of the beneficial results is that mycorrhizae help plants absorb nutrients for soils.

neotropical migrant birds. Bird species that migrate to tropical areas such as Central or South America for the wintering months. Includes most of Montana's song birds.

nitrification/denitrification. A biological process for the conversion of ammonia compounds to nitrogen gas. The process is carried out in two steps. In the first step, nitrification, the ammonia compound is aerobically converted to nitrate by bacteria. In the second step, denitrification, nitrate is aerobically converted to nitrogen gas.

non-specular. Conductor treated in the factory to remove the sheen normally present on new conductors.

noxious weeds. Any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment. The term typically describes plant species that have been determined to be undesirable or injurious in some capacity. Federal noxious weeds are regulated by the USDA-Animal and Plant Health Inspection Service under the Plant Protection Act of 2000, which superseded the Federal Noxious Weed Act of 1974. State statutes for noxious weeds vary widely, with some states lacking any laws defining or regulating noxious weeds. Depending on the individual state law, some plants listed by a state statute as “noxious” may be native plants that the state has determined to be undesirable. When the species are native, they are not considered invasive species by the federal government. However, in most cases, state noxious weed lists include only exotic (nonnative) species.

old growth. Old growth stands are defined as those that meet the definitions in Green et al. 1992 (errata corrected December 2011). Those definitions include the discussion in that document titled “USE OF OLD GROWTH TYPE DESCRIPTIONS” (see pages 11 and 12). If that document is revised or replaced by the Northern Region, the updated version will be used.

old growth associated species. Those species that depend on habitat components found in old growth, such as large snags or large dead and down woody material, but that can survive in other age or size class forest stands where those habitat components are present.

old growth dependent species. Those species that can only survive in old growth habitats, or that need old growth for some critical portion of their life cycle. The KNF does not have any old growth dependent species (USFS 2013b).
old growth ecosystems. Old growth ecosystems can be defined by elements of structure, function, and composition. Structure includes large live and dead old-growth trees, and fallen dead trees on land and in streams. Function refers to the mechanisms and rates of ecological processes, including high primary productivity (photosynthesis), high respiratory rates relative to younger stands, a shifting-mosaic steady state of living biomass, and large accumulations of dead organic matter. Composition refers to the species of plants and animals present in old growth ecosystems, including old growth dependent or associated species.
overburden. Geologic material of any nature that overlies a deposit of ore or coal.
palliative. A substance that relieves the effects of a problem.
palustrine system wetland. Palustrine system wetlands are traditionally called marshes, swamps, bogs, or fens. They include all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5%.
patio. The level area immediately outside the adit portal, built of fill to provide a work area, and access to the mine area.
peak flow. The greatest attained water flow in a specified period of time.
pelagic. Free swimming or floating organisms that live free from direct dependence on the bottom or shore of a waterbody.
perched water table. An isolated saturated zone above an impermeable layer in an otherwise unsaturated soil or rock.
perennial stream. A stream that flows throughout the year, and from source to mouth.
period of record. The period of time over which data have been collected.
permeable. Allowing the passage of fluids.
phreatic surface. The boundary between saturated and unsaturated soil zone in an aquifer.
pillar. A column of rock retained for structural support in a mine.
piping. Creation of tunnels or cavities from the movement of water in soil.
plankton (ic). Aquatic animal and plant organisms that drift or float, unable to influence their own course, and ranging in size from microorganisms to jellyfish.
plasticity. A soil property indicating the degree to which a soil can be molded before breaking.
poaching. Illegal hunting, including hunting without a license or proper permit or hunting out of season.
population. A collection of individuals that share a common gene pool.
population viability. Probability that a population will persist for a specified period of time across its range despite normal fluctuations in population and environmental conditions.
portal. Surface entrance to a mine, particularly to a tunnel or adit.
pressure filtration. A water treatment system that uses a filter in conjunction with a pump.
probable maximum flood. The flood resulting from Probable Maximum Precipitation; the largest flood event theoretically possible.
quartzite. A rock that has formed as a result of the hardening of sediments by pressure and heat. A granular metamorphic rock consisting essentially of sand-sized particles and quartz.
rain-on-snow event. A meteorological occurrence in the months of December through February during which the heat contained in rainfall melts the existing snow cover producing large amounts of runoff and high streamflows in a short time frame.
raise. Incremental increases in the height of a dam.
raptors. Birds of prey.
reach. An extended portion of river with uniform characteristics.
reclamation. The concept of reclamation of land has been defined as including all desirable and practical methods for: (a) designing and conducting a surface disturbance in a manner that minimizes the effect of the disturbance and enhances the reclamation potential of the disturbed lands; (b) handling surficial

material in a manner that ensures a root zone that is conducive to the support of plant growth where required for future use; and (c) contouring the surface to minimize hazardous conditions to ensure stability and to protect the surface against wind or water erosion (Soil Quality Criteria Working Group 1987).

recruitment potential old growth. Forest stands that do not meet the definition of old growth in Green et al. 1992 (errata corrected December 2011) but are being managed with the goal of meeting that definition in the future.

redd. A fish spawning nest.

regeneration. Regrowth of a tree crop, or other vegetation, whether by natural or artificial means.

return ponds. Storage ponds for water to be recycled to the tailings pond.

reverse osmosis. The normal osmosis process involves the flow of liquid across a semi-permeable membrane from a dilute concentration to a more concentrated solution until equilibrium is reached. Reverse osmosis is accomplished by applying high pressure to the concentrated side causing the process to reverse. This results in an even higher concentration of solute. The nitrogen compounds involved in the reverse osmosis process are mainly in the ammonium or nitrate form.

rhizome. A vegetative species that spreads by shooting out underground stems (Rhyzomatous).

riparian. Areas with distinct resource values and characteristics that are comprised of an aquatic ecosystem, and adjacent upland areas that have direct relationships with the aquatic system. This includes floodplains, wetlands, and lake shores.

run-of-mill. Total material passing through a mill.

salmonid. Member of the fish family Salmonidae; includes salmon and trout.

scarify. To roughen the upper 1 to 2 inches of soil in preparation for seeding.

scenic integrity. The highest scenic integrity ratings are given to those landscapes where the valued landscape attributes appear complete and little or no visible deviations are evident. Scenic Integrity is used to describe both existing (Existing Scenic Integrity) and desired (Scenic Integrity Objective) conditions.

> Very High: Landscape is intact with only minor changes from the valued landscape character associated with significant scenic landscapes. This SIO is typically (but not exclusively) associated with specially designated areas such as wilderness or other designations that imply the landscape is natural appearing.
>
> High: Management activities are unnoticed and the landscape character appears unaltered.
>
> Moderate: Management activities are noticeable but are subordinate to the landscape character. The landscape appears slightly altered.
>
> Low: Management activities are evident and sometimes dominate the landscape character but are designed to blend with surroundings by repeating line, form, color, and texture of valued landscape character attributes. The landscape appears altered.
>
> Very Low: Management activities create a “heavily altered landscape.” Changes may strongly dominate the landscape. Note: This SIO is not a goal or objective.

security habitat. An area with low levels of human disturbance. This general definition covers most uses of the term security habitat, except for elk, which has a specific definition.

security habitat (elk). Generally timbered stands on NFS lands at least 250 acres in size more than 0.5 mile from open motorized routes during the hunting season. Security is calculated for individual planning subunits. Roads not open to the public for motorized uses during the hunting season are not included in this calculation. The effects of nonmotorized use and/or administrative motorized use of closed or temporary roads during the hunting season are not included in this calculation and would instead be analyzed separately at the project level.

sedge. A grass-like plant, often associated with moist or wet environments.

sediment yield. The quantity of sediment delivered to a stream.

seepage collection system. The system of drains, ponds, and pumps to collect and return tailings dam embankment seepage.

segregation. The separation of water from sources of contamination in a mine.

seismic. Of, or produced by, earthquakes.
sensitive species. Those species, plant and animal identified by the Regional Forester for which population viability is a concern, as evidenced by: 1) significant current or predicted downwards trend in population numbers or density or 2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
seral stage. A developmental stage in the succession of plant communities. A seral community (or species) is replaced by another community (or species) as succession progresses.
seven-inch slump. A test to measure the consistency of concrete where a standard 12-inch test column of concrete slumps to 7 inches.
sewage treatment. In the Rock Creek Project SEIS, sewage treatment refers to the process of removing contaminants from domestic sewage from evaluation adit, mill, and office.
short term. A period of time less than 35 years (i.e., operational period).
side slope. The slope of an embankment or waste dump.
significant. See Appendix A.
siltite. A rock that has formed as a result of the hardening of sediments by pressure and heat. Siltite is harder than mudstone, and not as hard as shale. The rock is composed of particles generally larger than clay size and is made up of laminates thicker than argillite.
slump test. A test to measure the consistency of concrete while still wet (see seven-inch slump above).
slurry. A mixture of fine-grained solid material and water used to allow pumping as a way to transport the solid material over long distances.
slimes. A product of wet crushing consisting of wet particles that will pass a 200-mesh screen.
spalling. Rock breaking off in layers parallel to the surface.
stability. The ability of a population to remain at approximately the same population size over time through stable natality and mortality rates.
starter dam. Earthen dams built of borrow material to initiate construction of the tailings impoundment.
standard (as used in the 2015 KFP). Limitation or requirement that is applied to project and activity decision making to help achieve goals and objectives.
standard deviation. A parameter that indicates the way in which a probability function or probability density function is centered around its mean and that is equal to the square root of the moment in which the deviation from the mean is squared.
standpipe piezometer. A small well used to locate the water table.
stochastic. Random, uncertain; involving a random variable.
stope. Step-like underground excavation for removal of ore in successive layers.
stratabound. A mineral deposit confined to a single layer, bed or stratum.
stratum. A section of a formation that consists of primarily the same rock type.
study area. Study areas may refer to those identified in ASARCO's baseline studies or to those used for the environmental analysis. The size of study areas depends on the resource under consideration. For example, the area examined in ASARCO's 1984-1985 wildlife baseline study. The intensive study area, 25 square miles, primarily was comprised of the proposed permit area. The extensive study area, 125 square miles, extended beyond the permit area including adjacent lands. Most survey efforts were concentrated within the intensive study area.
subpopulation. A well-defined set of interacting individuals that comprise a portion of a larger, interbreeding population.
subsidence. The sudden sinking or gradual downward settling of the earth’s surface with little or no horizontal motion.
sustainability. The ability of a population to maintain a relatively stable population size over time.
tackifier. An agent that binds seed, fertilizer, and mulch to a site, often used when seeding slopes.
tailings slurry decant. The liquid portion of the tailings slurry that remains after gravity settling in a tailings impoundment.

threatened. Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, as identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.
toe dam. A small dam located at the base of a larger embankment; usually to collect seepage or runoff.
total suspended solids. Undissolved particles suspended in liquid.
transect. A line, strip, or series of plots from which biological samples, such as vegetation, are taken.
trophic state. Position on food chain relative to other animals.
unconfined aquifer. An aquifer in which there are no confining beds between the water table and the surface.
unconsolidated. Loose or soft.
ungulate. A hoofed mammal, such as deer or elk.
upgradient. A direction characterized by higher fluid potential or hydraulic head.
variety class. A particular level of visual variety or diversity of landscape character.
A (distinctive). Refers to areas where landforms, vegetative patterns, water features, and rock formations are of unusual or outstanding visual quality and are not common in the character type.
B (common). Refers to areas where landscape features contain some variety but tend to be common throughout the character type.
C (minimal). Refers to areas where landscape features have very little variety and high uniformity in form, line, color, and texture.
viability. Ability of a population to maintain sufficient size so that it persists over time in spite of normal fluctuations in numbers; usually expressed as a probability of maintaining a specific population for a specific period.
viewer sensitivity. The degree of viewer interest in the landscape's scenic quality.
Level 1 (high). At least 1/4 of users of primary travel routes, use areas, or water bodies, or at least 3/4 of users of secondary travel routes, use areas, or water bodies have major concern for scenic quality.
Level 2 (moderate). Less than 1/4 of users of primary travel routes or use areas, or between 1/4 and 3/4 of users of secondary travel routes or use areas have major concern for scenic quality.
Level 3 (low). Less than 1/4 of users of secondary travel routes or use areas have major concern for scenic quality.
viewshed. The portion of the surrounding landscape that is visible from a single observation point or set of points.
visual quality objective. A desired level of scenic quality based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape.
wastewater treatment. In the Rock Creek Project SEIS, wastewater treatment refers to the process of removing contaminants from mine water, process water, including tailings seepage, runoff, and tailings reclaim water.
wetlands. Those areas that are inundated by surface water or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, peatlands, and similar areas such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds.
zone of influence. The area outside the physical workings of the mine and related facilities that is affected by noise, pollution, encroachment, or other disturbances caused by mining activities.

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2001 FEIS and SEIS Appendices

2001 FEIS Appendix	SEIS Appendix
Appendix A: Definition of Significance in NEPA/MEPA	Refer to 2001 FEIS
Appendix B: Final Biological Assessment	Refer to 2001 FEIS
Appendix C: Department Decision on Air Quality Permit	Appendix C: RCR's Montana Air Quality Permit #24114-03
Appendix D: Proposed MPDES Permit, Fact Sheet, and Statement of Basis	Outfalls 001 and 002 were remanded. RCR will submit a revised permit application.
Appendix E: USFWS Biological Opinion	Replaced with select portions of 2006 BO and 2007 BO Supplement
Appendix F: Section 404(b)(1) Showing	No longer needed. The Corps determined an individual 404 permit for the Rock Creek Project is not necessary.
Appendix G: Tailings, Subsidence, and Hydrofracturing	Updates to the information in Appendix G of the 2001 FEIS were incorporated into the body of the SEIS. Information in the SEIS replaces Appendix G.
Appendix H: Kootenai National Forest BMP Process	Refer to 2001 FEIS
Appendix I: Description of Reagents	Refer to 2001 FEIS
Appendix J: Revegetation Plans	Included in SEIS. No Changes from 2001 FEIS.
Appendix K: Agencies' Conceptual Monitoring Plans	Updated for SEIS
Appendix L: Wetlands Mitigation Plan for Alternative V	Replaced with RCR's updated Alternative V Wetlands Mitigation Plan. The Corps determined an individual 404 permit for the Project is not necessary. Impacts to isolated wetlands in impoundment footprint are on RCR land.
Appendix M: McKay Creek Alternative Description	Updates to the information in Appendix M of the 2001 FEIS were incorporated into the body of the SIES. Information in the SEIS replaces Appendix M.
Appendix N: Discussion on R1-WATSED Model and Results	Updated for SEIS
Appendix O: New Management Area Descriptions	Refer to 2001 FEIS
Appendix P: Tailings facility Failure Modes Effects Analysis	Refer to 2001 FEIS
Not in 2001 FEIS	Appendix Q (Added for SEIS): Subsidence Failure Modes Effects Analysis

APPENDIX C —

RCR'S MONTANA AIR QUALITY PERMIT #24114-03

Montana Department of
ENVIRONMENTAL QUALITY

Steve Bullock, Governor
Tracy Stone-Manning, Director

P. O. Box 200901 Helena, MT 59620-0901 (406) 444-2544 Website: www.deq.mt.gov

November 3, 2014

Paul Lammers
RC Resources Inc.
7 Rock Creek Road
P.O. Box 1488
Noxon, MT 59853

Dear Mr. Lammers:

Montana Air Quality Permit #2414-03 is deemed final as of November 1, 2014, by the Department of Environmental Quality (Department). This permit is for an underground silver/copper mine and processing facility. All conditions of the Department's Decision remain the same. Enclosed is a copy of your permit with the final date indicated.

For the Department,

Julie A. Merkel
Air Permitting Section Supervisor
Air Resources Management Bureau
(406) 444-3626

Craig Henrikson P.E.
Environmental Engineer
Air Resources Management Bureau
(406) 444-6711

JM:CH
Enclosures

Montana Department of Environmental Quality
Permitting and Compliance Division

Montana Air Quality Permit #2414-03

RC Resources Inc.
7 Rock Creek Road
P.O. Box 1488
Noxon, MT 59853

November 1, 2014

MONTANA AIR QUALITY PERMIT

Issued To:	RC Resources Inc. 7 Rock Creek Road P.O. Box 1488 Noxon, MT 59853	MAQP: #2414-03 Application Complete: June 18, 2014 Preliminary Determination Issued: July 18, 2014 Preliminary Determination Re-Issued: Sept.30, 2014 Department's Decision Issued: October 16, 2014 Permit Final: November 1, 2014 AFS #: 089-0010

A Montana Air Quality Permit (MAQP), with conditions, is hereby granted to RC Resources Inc (RCR), pursuant to Sections 75-2-204 and 211 of the Montana Code Annotated (MCA), as amended, and Administrative Rules of Montana (ARM) 17.8.740, *et seq*., as amended, for the following:

Section I: Permitted Facilities

A. Plant Location

RCR propose construct and operate an underground silver/copper mine and processing facility known as the Rock Creek Mine with activities in Township 27N, Range 32W, Sections 26, 27, 34, and 35: and Township 26N, Range 32W, Sections 3, 10, 15, 22, 23, 27, 28, 29, 32, and 33, Sanders County, Montana.

B. Current Permit Action

The Department of Environmental Quality (Department) received an application from RCR on September 4, 2012; a revised application submittal on September 13, 2013; and a revised application submittal on March 25, 2014, and a final correspondence on June 18, 2014. The March 25, 2014, application submittal received along with the final correspondence represents the complete application reviewed by the Department. The proposed action is for the reissuance of expired permit MAQP #2414-02 for an underground copper/silver mine. The project is scheduled to occur in two different phases. The first phase would be an "evaluation phase" where the ore body would be characterized using an evaluation adit. A second "production phase" would expand operations to include two production adits, a mill site, and a mill tailings process area. The evaluation adit will be adjacent to the southwestern border of the Cabinet Mountains Wilderness Area.

A preliminary determination was posted on July 18, 2014, and was out for public comment through August 18, 2014. Upon a request from RCR, and consultation within the Department, it was determined that the July 18, 2014, version could not rely on the completion of the supplemental environmental impact statement (SEIS) which is being prepared by the Kootenai National Forest Service. Therefore, the Department has prepared its own environmental review to satisfy the Montana Environmental Policy Act (MEPA). Because of the addition of the Department's

MEPA document, the July 18, 2014, version of the permit will not be issued decision, and instead a revised preliminary determination is being issued for a 15 day public comment period. Comments received from the public comment period ending August 18, 2014, have been included in this new preliminary determination as well as any changes the Department is proposing as a result of those comments.

The facility's potential to emit criteria pollutants will be below major source thresholds for the Prevention of Significant Deterioration – New Source Review (PSD-NSR) program. The potential criteria pollutant and hazardous air pollutants will also be below major source thresholds and only a minor source Montana Air Quality Permit application is required.

C. Permitted Equipment

Emitting units are grouped into the following categories:

a. Underground Blasting

b. Underground Ore Processing and Handling

c. Aboveground Ore Processing and Handling Circuit

d. Fine Ore Processing and Handling Process

e. Emergency Power

f. Storage Piles

g. Insignificant Emission Sources
    1. Underground road fugitive emissions
    2. Small number of Building Heaters
    3. Diesel Fuel Storage Tanks
    4. Flotation Separation, Concentrate dewatering, and other "wet" handling operations

Section II: Conditions and Limitations

A. Emission Limitations

1. RCR shall be limited to a maximum of 10,000 tons of ore production per day as measured by the ball mill feed during any 24-hour rolling period (ARM 17.8.749).

2. RCR shall be limited to a maximum of 3.5 million tons of ore production (3,500,000) as measured by the ball mill feed during any rolling 12-month time period (ARM 17.8.749).

3. RCR shall be limited to a maximum of 1,500 tons of emulsion explosive usage during any rolling 12-month time period (ARM 17.8.749)

4. RCR shall not cause or authorize to be discharged into the atmosphere any fugitive emissions from process equipment not covered under 40 CFR 60, Subpart LL that exhibit 20% opacity or greater averaged over 6 consecutive minutes (ARM 17.8.308).

5. RCR shall limit process fugitive emissions for any affected facility as identified in 40 CFR 60, Subpart LL, from the date of the performance test (as required by Section II.C. 1) forward, to a maximum opacity of 10%. Stack emissions from any affected facility are limited to a maximum of 7% opacity unless using a wet scrubber (40 CFR Part 60, Subpart LL, ARM 17.8.308 and ARM 17.8.340).

6. RCR shall not cause or authorize the use of any street, road, or parking lot without taking reasonable precautions to control emissions of airborne particulate matter (ARM 17.8.308).

7. RCR shall treat all unpaved portions of the haul roads, access roads, parking lots, or general plant area with water and/or chemical dust suppressant as necessary to maintain compliance with the reasonable precautions limitation in Section II.A.6 (ARM 17.8.749).

8. The below ground Scrubber #1 shall be operated and maintained per the manufacturer's recommendations (ARM 17.8.749).

9. Emissions from the above ground Scrubber #2 used to control emissions from the above ground ore processing and handling shall be limited to a maximum of 0.05 grams per dry standard cubic meter (g/dscm) (ARM 17.8.340 and 40 CFR Part 60, Subpart LL).

10. RCR shall install, calibrate, maintain, and operate equipment at the above ground Scrubber #2 to monitor the following parameters (ARM 17.8.340 and 40 CFR Part 60, Subpart LL):

    a. Change in pressure of the gas stream through the above ground Scrubber #2. The monitoring device must be certified by the manufacturer to be accurate within ±250 pascals (±1 inch water) gauge pressure and must be calibrated on an annual basis in accordance with manufacturer's instructions.

    b. Scrubbing liquid flow rate to the above ground Scrubber #2. The monitoring device must be certified by the manufacturer to be accurate within ±5 percent of design scrubbing liquid flow rate and must be calibrated on at least an annual basis in accordance with manufacturer's instructions.

11. Emissions from Baghouse #1 used to control emissions from the Fine Ore Processing and Handling Process shall be limited to a maximum of 0.05 g/dscm (ARM 17.8.749 and 40 CFR Part 60, Subpart LL).

12. RCR shall comply with all applicable standards, limitations, and the reporting, record keeping, and notification requirements contained in 40 CFR Part 60, Subpart LL, for all affected facilities (ARM 17.8.340 and 40 CFR Part 60).

13. RCR shall develop a Fugitive Dust Control Plan which identifies practices which will be used to control fugitive dust. This plan shall include the tailings impoundment site to control wind erosion from the tailings impoundment site. Prior to the commencement of operation, RCR shall submit the Fugitive Dust Control Plan to the Department for review and approval. For the tailings impoundment site, the plan must include at a minimum, cell configurations, a general sprinkler arrangement, and a narrative description of the tailings impoundment operation, including tonnage rates, initial area, and plans related to how the impoundment operation might change over the mine life (ARM 17.8.749).

14. Tailings wind erosion control shall be maintained during the interim period after the end of active tailings deposition and prior to final reclamation of the site (ARM 17.8.749 and ARM 17.8.752).

15. RCR shall comply with all applicable standards and limitations, and the reporting, recordkeeping and notification requirements contained in 40 CFR 60 Subpart IIII for the emergency generator (ARM 17.8.340 and 40 CFR 60 Subpart IIII).

16. RCR shall comply with all applicable standards and limitations, and the reporting, recordkeeping and notification requirements contained in 40 CFR 63 Subpart ZZZZ for the emergency generator (ARM 17.8.342 and 40 CFR 63 Subpart ZZZZ).

17. RCR shall comply with all applicable standards and limitations, and the reporting, recordkeeping and notification requirements contained in 40 CFR 60, Subpart A (ARM 17.8.340 and 40 CFR 60, Subpart LL).

B. Emission Control Practice and Requirements

RCR shall utilize the following emission control requirements (ARM 17.8.752):

1. Underground Blasting – Industry Best Operating Practices (BOPs) shall be used for minimizing blasting emissions, including hole size optimization, water spray after each blast, and minimizing time between charge loading and detonation.

2. Underground Primary Crusher – An underground scrubber (Scrubber #1) shall be used to control crushing particulate emissions.

3. Underground Screens/Feeders – Scrubber #1 shall be used to control screens/feeders particulate emissions.

4. Underground Coarse Ore Conveyor Transfers – Scrubber #1 shall be used to control underground conveyor transfers.

5. Aboveground Ore Processing and Handling Circuit –An aboveground scrubber (Scrubber #2) shall be used to control the above ground Coarse Ore Circuit.

6. Fine Ore Processing and Handling – A fabric filter baghouse (Baghouse #1) shall be used to control particulate emissions from the Fine Ore Processing and Handling Circuit

7. Emergency Generator – The diesel-fired generator rated for up to 560 kW shall meet 40 CFR Part 60 Subpart IIII requirements.

8. Evaluation Adit Waste Rock Pile – RCR shall revegetate the Waste Rock Pile the first growing season after its creation or if the conditions do not allow for revegetation, RCR shall address fugitives in the Fugitive Dust Control Plan

9. Production Adit Ore Stockpile – This temporary ore stockpile produced during construction of the production adit shall be processed during the early periods of the mill operation or shall be addressed in the Fugitive Dust Control Plan.

10. Tailings Impoundment – The tailings from the mill shall be slurried through a pipeline to a tailings impoundment site. The impoundment area shall be managed according to the Fugitive Dust Control Plan.

11. Metallic Concentrate Product – The metallic concentrate product shall be slurried through a pipeline to the Highway 200 Paste Plant.

12. U.S. Forest Service Road 150 – U.S. Forest Service Road 150 shall be paved from the highway to the mill site prior to beginning the production phase of the mine.. Sweeping and washing shall also be performed on Forest Service Road 150.

13. Highway 200 Load-Out Facility – A load-out rail facility (or equivalent) shall be constructed and metallic concentrate product shall be loaded for transportation to a melting processing plant.

C. Testing Requirements

1. The affected facilities under 40 CFR 60, Subpart LL shall be tested and demonstrate compliance with the emission limitations contained in Section II.A.9 and Section II.A.11 within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup of the system (ARM 17.8.105, ARM 17.8.340, 40 CFR 60.8 and 40 CFR 60, Subpart LL).

2. The underground Scrubber #1, shall be tested to demonstrate performance against the 98 percent capture used in the emission inventory. This shall be tested within 60 days after achieving the maximum production rate at which the will be operated, but not later than 180 days after initial startup of the system (ARM17.8.105).

3. All compliance source tests shall conform to the requirements of the Montana Source Test Protocol and Procedures Manual (ARM 17.8.106).

4. The Department of Environmental Quality (Department) may require further testing (ARM 17.8.105).

D. Operational Reporting Requirements

1. RCR shall supply the Department with annual production information for all emission points for the same year the emission inventory is being provided, as required by the Department in the annual emission inventory request. The request will include, but is not limited to, all sources of emissions identified in the emission inventory contained in the permit analysis.

   Production information shall be gathered on a calendar-year basis and submitted to the Department by the date required in the emission inventory request. Information shall be in the units required by the Department. This information may be used to calculate operating fees, based on actual emissions from the facility, and/or to verify compliance with permit limitations (ARM 17.8.505). RCR shall submit the following information annually to the Department by March 1 of each year; the information may be submitted along with the annual emission inventory (ARM 17.8.505):

   a. Amount of ore produced.

   b. Amount of diesel fuel used

   c. Amount of propane and natural gas used.

   d. Amount of explosives used

   e. Hours of operation of the emergency diesel-fired generator.

   f. An estimate of company vehicle miles traveled from Highway 200 to the mine and mill access points.

   g. Amount of disturbed acreage (including tailings impoundment area).

2. RCR shall notify the Department of any construction or improvement project conducted, pursuant to ARM 17.8.745, that would include ***the addition of a new emissions unit,*** change in control equipment, stack height, stack diameter, stack flow, stack gas temperature, source location, or fuel specifications, or would result in an increase in source capacity above its permitted operation. The notice must be submitted to the Department, in writing, 10 days prior to startup or use of the proposed de minimis change, or as soon as reasonably practicable in the event of an unanticipated circumstance causing the de minimis change, and must include the information requested in ARM 17.8.745(l)(d) (ARM 17.8.745).

3. All records compiled in accordance with this permit must be maintained by RCR as a permanent business record for at least 5 years following the date of the measurement, must be available at the plant site for inspection by the Department, and must be submitted to the Department upon request (ARM 17.8.749).

4. RCR shall document, by day, the ore production levels as measured by ball mill feed. RCR shall sum the total ore production during the previous 24 hours to verify compliance with the limitations in Section II.A.1. A written report of the compliance verification shall be submitted annually to the Department along with the annual emission inventory (ARM 17.8.749).

5. RCR shall document, by month, the ore production levels as measured by the ball mill feed. By the 25th day of each month, RCR shall total the total tons of ore processed for the previous month. The monthly information will be used to verify compliance with the rolling 12-month limitation in Section II.A.2. The information for each of the previous twelve months shall be submitted along with the annual emission inventory (ARM 17.8.749).

6. RCR shall document, by month, the tons of emulsion explosive used at the facility. By the 25th day of each month, RCR shall total the total tons of emulsion explosive used for the previous month. The monthly information will be used to verify compliance with the rolling 12-month limitation in Section II.A.3. The information for each of the previous twelve months shall be submitted along with the annual emission inventory (ARM 17.8.749).

7. RCR shall record the measurements of both the pressure drop across aboveground Scrubber #2 and the scrubbing liquid flow rate during the initial performance test of Scrubber #2 and at least weekly thereafter. RCR shall submit semiannual reports to the Department of occurrences when the measurements of the scrubber pressure loss (or gain) and liquid flow rate differ by more than ±30 percent from those measurements recorded during the most recent performance test. These reports must be submitted within 30 days following the end of the second and fourth calendar quarters (ARM 17.8.340 and 40 CFR Part 60, Subpart LL).

8. RCR shall document, by month, the diesel fuel consumption of all mine equipment. By the 25th day of each month, RCR shall calculate the total diesel fuel consumption for diesel-fired equipment for the previous month. The information for each of the previous twelve months shall be submitted along with the annual emission inventory (ARM 17.8.749).

9. RCR shall document, by month, the hours of operation of the emergency diesel-fired generator. By the 25th day of each month, RCR shall calculate the hours of operation of the diesel engine/generator for the previous month. The information for each of the previous twelve months shall be submitted along with the annual emission inventory (ARM 17.8.749).

E. Notification

1. RCR shall supply the Department the following notification (ARM 17.8.749 and 40 CFR 60, Subpart A):

   a. Date when Aboveground Ore Processing and Handling Circuit commences construction, postmarked no later than 30 days after such date.

   b. Date when Aboveground Ore Processing and Handling Circuit begins operation, postmarked no later than 15 days after such date.

   c. Date when the Fine Ore Processing and Handling Process commences construction, postmarked no later than 30 days after such day.

   d. Date when the Fine Ore Processing and Handling Process begins operation, postmarked no later than 15 days after such date.

SECTION III: General Conditions

A. Inspection – RCR shall allow the Department's representatives access to the source at all reasonable times for the purpose of making inspections or surveys, collecting samples, obtaining data, auditing any monitoring equipment (CEMS, CERMS) or observing any monitoring or testing, and otherwise conducting all necessary functions related to this permit.

B. Waiver – The permit and the terms, conditions, and matters stated herein shall be deemed accepted if RCR fails to appeal as indicated below.

C. Compliance with Statutes and Regulations – Nothing in this permit shall be construed as relieving RCR of the responsibility for complying with any applicable federal or Montana statute, rule, or standard, except as specifically provided in ARM 17.8.740, *et seq*. (ARM 17.8.756).

D. Enforcement – Violations of limitations, conditions and requirements contained herein may constitute grounds for permit revocation, penalties, or other enforcement action as specified in Section 75-2-401, *et seq*., MCA.

E. Appeals – Any person or persons jointly or severally adversely affected by the Department's decision may request, within 15 days after the Department renders its decision, upon affidavit setting forth the grounds therefor, a hearing before the Board of Environmental Review (Board). A hearing shall be held under the provisions of the Montana Administrative Procedures Act. The filing of a request for a hearing does not stay the Department's decision, unless the Board issues a stay upon receipt of a petition and a finding that a stay is appropriate under Section 75-2-211(11)(b), MCA. The issuance of a stay on a permit by the Board postpones the effective date of the Department's decision until conclusion of the hearing and issuance of a final decision by the Board. If a stay is not issued by the Board, the Department's decision on the application is final 16 days after the Department's decision is made.

F. Permit Inspection – As required by ARM 17.8.755, Inspection of Permit, a copy of the air quality permit shall be made available for inspection by the Department at the location of the source.

G. Permit Fee – Pursuant to Section 75-2-220, MCA, failure to pay the annual operation fee by RCR may be grounds for revocation of this permit, as required by that section and rules adopted thereunder by the Board.

H. Duration of Permit – Construction or installation must begin or contractual obligations entered into that would constitute substantial loss within 3 years of permit issuance and proceed with due diligence until the project is complete or the permit shall expire (ARM 17.8.762).

Montana Air Quality Permit (MAQP) Analysis
Rock Creek Mine
MAQP #2414-03

I. Introduction/Process Description

RC Resources Inc. (RCR) proposed to construct and operate a silver/copper mine referred to as the Rock Creek Mine. The facility is located in Township 27N, Range 32W, Sections 26, 27, 34, and 35: and Township 26N, Range 32W, Sections 3, 10, 15, 22, 23, 27, 28, 29, 32, and 33, Sanders County, Montana.

A. Source Description

RCR proposes to construct a 10,000 ton-ore-per-day (3.5 million tons per year) mine and mill complex to extract copper and silver ore from a mineral deposit underlying a portion of the Cabinet Mountains Wilderness, about 13 miles northeast of Noxon, in Sanders County, Montana. RCR anticipates a 5-year period to fully complete both the evaluation and production phase of the mine. This plan includes a one year period for constructing an evaluation adit and support facilities, a 3-year period for production adit construction, primary crushing installation and tailings impoundment construction, with limited production and rail siding completion in year five. Full production would begin after that and is estimated to last for 30 years. The full production life would depend upon metal prices, engineering, and other factors that determine financial viability. Post-mining reclamation is estimated to last a few years.

Ore would be initially processed in an underground crusher. The above-ground ore-processing complex would further grind the ore to liberate metal-bearing sulfides. Sulfides would then be removed by flotation and the metallic product concentrate transported by slurry pipeline to a paste plant/load facility located about five miles away and ultimately shipped to an off-site smelter.

The mill complex, including surface conveyor, office building, shop, and warehouse, would be located north of USFS Road 150 as it heads west prior to connecting with Highway 200. Tailings would be transported as a slurry to the paste plant location at the tailings disposal area. There it would be dewatered to make a paste approximately 20 percent by weight. Approximately 3.5 million tons per year of tailings would be deposited in the tailings impoundment area.

The proposed evaluation adit would be driven prior to other work on the project in an attempt to better understand the configuration of the ore body. During the mine production phase, this adit would serve as the primary air intake opening and under a secondary contingency plan could serve as a secondary exhaust. Conventional mining methods would be employed for the 1-year adit construction period. All electric power would be provided by electric transmission lines. A backup emergency diesel-fired generator would be used during electrical power outages and for maintenance. Access would largely be by existing roads.

Mine development would include driving two parallel adits directly north-northeast of the mill site. One adit would be used as a conveyor adit for ore being conveyed from below ground and the other as access for personnel and equipment for mine access. A level working area at the portal would be constructed by cutting into the hill to create a vertical face for adit construction. Adit size is dictated by ventilation requirements and dimensions of mining equipment. Each adit would be approximately twenty to twenty five feet in diameter.

Equipment and processes used to prepare the emission inventory is as follows:

a. Underground Blasting

b. Underground Ore Processing and Handling
   1. Ore Bin
   2. Vibrating Grizzly Screen
   3. Primary Crusher
   4. Coarse Ore Bin
   5. Two Vibrating Feeders
   6. Three Belt Conveyors including one transferring ore above ground
   7. One below ground wet scrubber (Scrubber #1)

c. Aboveground Ore Processing and Handling Circuit (Contained in Crushing Building)
   1. Discharge End of Belt Conveyor From Below Ground
   2. Primary Surge Bin
   3. Primary Screen
   4. Secondary Crusher
   5. Secondary Surge Bin
   6. Two Secondary Screens
   7. Two Tertiary Crushers
   8. Three Belt Conveyors Including One Transferring to Milling Building
   9. One Above Ground Wet Scrubber (Scrubber #2)

d. Fine Ore Processing and Handling Process (Contained in Milling Building)
   1. Discharge End of Belt Conveyor from Crushing Building
   2. Tertiary Surge Bin
   3. Two Vibrating Feeders
   4. Belt Conveyor
   5. Wet Milling Processing Equipment
   6. One Baghouse (Baghouse #1)

e. Emergency Generator (Less than or Equal to 560 kW)

f. Storage Piles
   1. Evaluation Adit Waste Rock Pile
   2. Evaluation Adit Ore Stockpile
   3. Production Adit Waste Rock Pile
   4. Production Adit Ore Stockpile
   5. Tailings Impoundment

g. Road Dust
   1. Inclusive of all roads used based on all expected mine related travel

h. Insignificant Emission Sources
   1. Underground road fugitive emissions
   2. Small number of Building Heaters (electric or clean burning fuels, (natural gas or propane) with less than 5 MMBtu/hr ratings)
   3. Diesel Fuel Storage Tanks (Initially 500 gallon during evaluation phase, 20,000 gallon during production phase)
   4. Flotation Separation, Concentrate dewatering, and other "wet" handling operations which have negligible emissions due to moisture content and are located at the Paste Plant/Load-Out Facility

B. Permit History

ASARCO submitted the original air quality permit application **(#2414-00**) for the Rock Creek Project on December 15, 1987. Following the submittal of additional information that application was deemed complete on June 8, 1988. Subsequently, ASARCO requested a temporary suspension of the review process. On August 22, 1995, and December 4, 1995, ASARCO submitted updated modeling analyses in support of the application. The original Preliminary Determination on the application was issued March 5, 1996. ASARCO submitted revisions to the application on March 28, 1997, and May 28, 1997. This revised Preliminary Determination reflected the updated proposal and the revised application was given number 2414-01 for clarification. Based on comments received from the public, the Department of Environmental Quality (Department) requested additional clarification regarding the deposition factor for nitrogen oxides (NO_x) and the emissions from the temporary generators. The additional information was submitted by ASARCO on July 24, 1998. This revised Preliminary Determination reflects the updated proposal and the revised application was given number #**2414-01** for clarification.

The Record of Decision (ROD) for the Rock Creek Project contained the Department's decision on the air quality permit and was signed by the Department on December 26, 2001. However, there were printing and mailing delays associated with the issuance of the ROD and the document itself wasn't mailed until January 8, 2002. Because of these delays, the company and other interested persons were not provided a reasonable opportunity to request a hearing under 75-2-211, MCA on the decision to issue the air quality permit. Therefore, on January 24, 2002, the Department rescinded its decision on the air quality permit and re-issued its decision, resulting in the initiation of a new appeal period on the air quality permit. This re-issued Department decision was not changed in any substantive manner. A section was added to clarify the re-issuance of the Department decision and the dates were updated to reflect the date of issuance.

Upon issuance of the Department's decision on air quality Permit #2414-01, a request for a contested case hearing was filed before the Board of Environmental Review (Board). In settlement of the contested case, the Department agreed to several revisions of the permit. The Department required the company to submit a quarterly summary report to verify compliance with the limitations contained in Section II.A of the permit. The Department clarified the applicable limitations on the exhaust adits (evaluation adit and service adit) proposed at the mine in Section II.D of the permit. The Department also clarified that the

wilderness adit may be used only as an air intake adit and that a compliance demonstration method will be developed and approved by the Department in Section II.F of the permit. Under Attachment I, the monitoring was updated to reflect that the company is required to operate ambient monitors for at least 5 years and a request for discontinuance of monitoring after that time would be reviewed in accordance with the Department's October 9, 1998, "Monitoring Requirements" guidance or a more stringent guidance in effect at that time. The Department also agreed to and stated in Attachment I that one of the three PM_{10} ambient monitoring sites will be located northeast of the evaluation adit (between the evaluation adit and the Cabinet Mountain Wilderness).

Permit **#2414-01**, the original permit for the project, was issued as final on March 28, 2003.

The Department received a letter from Sterling Mining Company on October 23, 2003, requesting a name change for the project to Revett. The permit action made that change and updated the rule citations. Permit **#2414-02** replaced Permit #2414-01.

C. Current Permit Action

The current permit action would re-issue the expired permit based on a revised application for the silver/copper mine that was earlier permitted under MAQP #2414-02 which expired since construction never took place. Potential emissions with the revised application are lower than potential emissions associated with MAQP #2412-02 and the associated 2001 DEQ Record of Decision (ROD). R.C. Resources provided a new MAQP application to allow issuance of a Montana Air Quality Permit. **MAQP #2414-03** replaces MAQP #2414-02.

D. Additional Information

Additional information, such as applicable rules and regulations, Best Available Control Technology (BACT)/Reasonably Available Control Technology (RACT) determinations, air quality impacts, and environmental assessments, is included in the analysis associated with each change to the permit.

E. Response to Public Comments

Person/Group Commenting	**Permit Reference to PD Version**	**Comment**	**Department Response**
RC Resources	Section VIII	Section VIII of the MAQP Analysis erroneously states that the Record of Decision (ROD) was issued by the United States Forest Service (USFS) and Department of Environmental Quality (DEQ) in 2003. The 2003 ROD was issued by the USFS only. The DEQ issued a ROD approving the Rock Creek Project in December 2001 that was not challenged in State court and is currently binding. The 2003 ROD	The language has been modified to better reflect that the 2001 ROD is still considered a valid environmental review by the Department and the details about the Forest Service efforts for an SEIS have been reworded.

		cover letter dated June 27, 2003 states that " ... because DEQ's decision was and is independent of the FWS's BO, their 2001 decision remains in effect.". Permit conditions proposed in MAQP #2414-03 are consistent with those contained in MAQP #2414-02 and approved by DEQ in the 2001 ROD. In addition, the emission inventory outlined in the MAQP #2414-03 Permit Analysis shows a reduction in estimated emissions of all pollutants from MAQP #2414-02 (see Section IV of the Permit Analysis). Additional environmental impact analyses are not necessary to satisfy the requirements of the Montana Environmental Policy Act (MEPA) and Departmental Action should not be predicated upon issuance of the final SEIS.	
RC Resources	Section I.C	Section I.C: "Permitted Equipment" should not include a detailed, descriptive listing of all emitting units addressed in the permit application. The Department's typical practice is to generally describe the facility and its primary emitting units, refer to "associated equipment," and refer to a complete list of permitted equipment matching the emission units outlined in the permit application in the analysis section. Listing specific emission units in the requirements section of the permit could imply conditions that are not intended.	The Department has determined that the units can be better summarized as "process operations" within the permit itself and relocated the individual listing of planned units to the permit analysis.
RC Resources	Section II.A.1	Section II.A.1: This condition requires monitoring at the primary crusher. For consistency with other operations measurement, RCR requests the production measurement point "as measured by ball mill feed". All material feeding the ball mill will have been processed by the primary crusher; therefore, monitoring at the mill will serve the same purpose while ensuring consistency among operational monitoring points.	Change made as requested.

RC Resources	Section II.A.2	Monitoring compliance with this condition should include language similar to that in Section II.A.1 as defining the measurement point	Change was made to Section II.A.2 to include a measurement location and made to match the comment in Section II.A.1.
RC Resources	Section II.A.4	Section II.A.4: This condition should be removed because it relates primarily to emissions from mobile sources, and the permit is intended to ensure compliance with Montana and Federal air quality rules that exclusively regulate non-mobile equipment sources. Almost all of the diesel used by the facility will be combusted in mobile equipment that will operate underground. The permit application presents the facility's expected annual diesel usage rate for the sole purpose of informing the NEPA and MEPA processes as noted on page 23. None of the compliance demonstrations made in the application relied on this value.	Condition has been removed. However, a reporting condition has been left intact in Section II.D.8, to confirm the information supplied is generally consistent with the 2001 EIS.
RC Resources	Section II.A.5	Section II.A.5: This condition's reference to ARM 17.8.340 as an underlying requirement seems inappropriate. That rule requires affected sources to comply with applicable federal New Source Performance Standards (NSPS). But this condition explicitly applies to process equipment that are not subject to the specified NSPS	Reference to ARM 17.8.340 has been removed.
RC Resources	Section II.A.6	Section II.A.6: This condition should be clarified. The first sentence applies to an opacity limit per NSPS Subpart LL that in turn applies to fugitive sources. The text refers to "the performance test" but does not specify or refer to a particular test. We believe the Department intended to refer to the 40 CFR 60.8(a) requirement to perform prescribed initial performance tests within 60 days after achieving the unit's maximum production rate but not later than 180 days after initial startup. This requirement applies as well to the opacity requirement for Subpart LL-affected non-scrubber stack	Underground scrubber does not appear to be covered under 40 CFR 60 LL. Made this a new condition. And therefore did not add Section II.A.6 to II.C.1.

		emissions. The second sentence of the condition addresses this requirement but does not refer to any compliance schedule. For the sake of consistency and clarity, the condition should be constructed similarly to other permit conditions derived from Subpart LL, such as Condition II.A.11 and II.A.13. These conditions simply reiterate the NSPS limit and rely on testing conditions in Section II.C to convey the associated schedule. Note, however, that Section II.C prescribes NSPS-required testing for PM emission limits from Baghouse #1 and Scrubber #2, but it does not address testing for Subpart LL opacity limits. To correct this oversight, Test Requirement II.C.1 should include a reference to Emission Limitation II.A.6	
RC Resources	Section II.A.9	Section II.A.9: This condition is unclear and unnecessary. It requires water availability and use, as necessary, "to maintain compliance with the opacity limitations" (emphasis added). The condition fails to specify what opacity limitations require water to be satisfied. Further, the condition indicates that this is a BACT requirement, but it is not clear what BACT requirement or requirements specify water usage to limit opacity. Finally, other permit conditions inherently or specifically require the use of water to reduce particulate emissions; because water availability is implied by these conditions, a separate condition requiring general water availability is redundant and unnecessary.	The Department has determined this condition is redundant to the Fugitive Dust Control Plan and has been deleted.
RC Resources	Section II.A.10	Section II.A.10: RCR requests that Scrubber #1 operation and maintenance be based on the manufacturer's recommendations rather than "industry best practices." "Best practices" is unclear and open to different interpretations; manufacturer's recommendations will be documented and provided	The applicant used “best operational practices” in the application which would be similar in nature to “industry best practices”. However, the Department has

		with the equipment, and they will be specific for the particular scrubber in use.	clarified the condition to require manufacturer's recommendations, and additionally required those to be available and included in the Fugitive dust Control Plan
RC Resources	Section II.A.11	Section II.A.11: RCR proposes that, because this emission limit derives from an applicable NSPS (Subpart LL), the related state rule citation should be ARM 17.8.340 rather than 17.8.749.Note that the federal rule citation to 40 CFR Part 60, Subpart LL is appropriate. Conditions II.A.12and II.A.14 also appropriately cite 40 CFR Part 60, Subpart LL, but they cite state rule ARM17.8.340.	17.8.749 has been replaced by 17.8.340
RC Resources	Section II.A.15	Section II.A.15 specifies that equipment "detailed descriptions" shall be submitted to the Department "prior to the commencement of construction". RCR requests that this condition be removed as it is not required to ensure compliance with ARM 17.8.749 and other permit requirements specify operating parameters for these devices (see permit conditions II.A.10, 11, and 12). If the Department determines this condition is still necessary, please specify both the specific information required by the Department and that "construction" refers to construction of those pieces of equipment listed. Construction activities associated with the evaluation adit may occur more than one year before the equipment specified in this section is purchased and specific information required by the Department may not be available. (1) When the department issues a Montana air quality permit, the permit must authorize the construction and operation of the facility or emitting unit subject to the conditions in the permit and to	This condition has been determined to be satisfied by performance testing which is required for both scrubbers and the baghouse as identified in other permit conditions.

		the requirements of this subchapter. The permit must contain any conditions necessary to assure compliance with the Federal Clean Air Act, with the Clean Air Act of Montana and rules adopted under those acts.	
RC Resources	Section II.A.16	Section II.A.16: RCR requests that this condition be revised to require only that a fugitive dust control plan be prepared; to remove the requirement that the Department approve a general operation plan {which would include dust control measures in addition to other, unspecified elements); and to remove detailed elements of the dust control plan. The open-ended nature of this condition makes it potentially difficult to comply with and to objectively enforce. RCR has no way of knowing what criteria the Department might apply in accepting or rejecting the operating and dust control plans. Nor is it clear upon what foundation the Department would base its approval or disapproval. Further, it is unclear whether changes to the plans would require Department review and approval and, if required, what process would be followed to secure approval. The fact that this condition refers to ARM 17.8.752, which requires BACT, as an underlying condition could make revisions especially burdensome if detailed elements of the plans were to be considered integral to the BACT determination. A 20% opacity limit for handling and storage of material per ARM 17.8.308{a) applies to the tailings management facility and implies that adequate control measures be used. RCR requests the flexibility to efficiently develop, revise, and implement dust control measures it deems necessary to meet the underlying opacity requirement without potential hindrance from an open ended and unnecessary bureaucratic process.	According to 17.8.749 CONDITIONS FOR ISSUANCE OR DENIAL OF PERMIT, the Department will require a condition be included when the Department determines it is necessary for compliance purposes. Based on the most recent issues with fugitive dust from mine sites, the Department has determined that a Fugitive Dust Control Plan is necessary to protect ambient air quality. The condition has been modified but mostly left intact and changed to a 17.8.749 condition.

RC Resources	Section II.A.18	Section II.A.18 specifies conditions specific to a "conditional additional adit"; however, this feature is not defined in either the permit or application. It is assumed that this feature is the "wilderness air-intake adit" described in the DEQ 2001 ROD which approved the Rock Creek Project. If this is the case, please change the verbiage in the draft permit to match the associated MEPA decision document.	This condition has been removed and no other adits are approvable that are not explicitly mentioned in this permit.
RC Resources	Section II.B.6	Section II.B.6: RCR requests removal of the last sentence: "All of the milling operations shall occur within enclosed buildings." Although RCR plans to conduct dry and wet milling processes inside buildings, BACT for reducing particulate emission from the fine ore handling circuit {which forms a part of the ore milling system) was determined to be fabric filter baghouse control. Projected particulate emissions are independent of whether baghouse-controlled operations occur inside or outside of a building.	The condition has been clarified to indicate all milling operations will be vented to a fabric filter baghouse and the reference to being within a building has been removed.
RC Resources	Section II.B.7	Section II.B. 7: RCR proposed that BACT for the emergency generator diesel engine is compliance with NSPS Subpart IIII requirements, not 40 CFR Part 89 Tier 4 requirements. Part 89 applies to non-road compression ignition engines, the definition of which specifically excludes engines subject to an NSPS. The mine's emergency generator diesel engine will be subject to NSPS Subpart IIII. The permit analysis section discussing BACT for the emergency generator engine {Section Ill) misrepresents RCR's BACT analysis and presents conflicting conclusions. It states that RCR proposed that BACT is compliance with 40 CFR Part 89 Tier 4 requirements. RCR actually proposed that BACT is compliance with 40 CFR Part 60, Subpart IIII requirements and limiting annual operations to no more than 100 hours {see Section 5.5, page 38 of	The BACT analysis has been updated to reflect the reference to 40 CFR 60 Subpart IIII and the associated condition has also been updated.

		the March 2014 application, Revision 3).1 Section III of the permit analysis goes on to state that, "Compliance with applicable federal emission standards with proper operation and maintenance is accepted as BACT ... " 40 CFR Part 89 is not an applicable federal emission standard; NSPS Subpart IIII is.	
RC Resources	Sections II.B.8 and 9	Section II.B.8 and 9: Although RCR does plan to limit particulate emissions from these storage piles as described in the conditions, these control methods were not specifically determined to be BACT for these sources. Please remove these conditions. It should also be noted that the featured referred to in Section II.B.8 as the "Exploration Adit Waste Rock Pile" should be called "Evaluation Ad it Waste Rock Pile" as specified in the permit application	The Exploration Adit Waste Rock Pile has been changed to Evaluation Adit Waste Rock Pile as requested and "evaluation" substituted for "exploration" throughout the document except for a section of the ambient air quality analysis where "exploration" and "evaluation" are used interchangeably. They have been included as 17.8.749 conditions and relocated.
RC Resources	Section II.B.10	Section II.B.10: Conveyor transfers associated with milling operations will be controlled by a wet scrubber or a baghouse as required by Conditions II.B.2 through 6. Both these controls have been determined to qualify as BACT for these sources. Although RCR plans to locate conveyor transfers either underground or inside a building, this is not a BACT requirement. Further, referring to "the mill" within an enforceable condition may cause confusion because that term is not specifically defined. It is generally used within the application to refer to the collection of above-ground beneficiation operations, although primary crushing, which will occur underground, could be considered a milling operation. Please remove this condition as it is not appropriately related to the ARM 17.8.752 BACT requirement,	The Department had originally included this condition as that is what the application indicates. The Department concurs, however, that the condition as written does not significantly reduce emissions and has been deleted.

		it does not reduce emissions beyond reductions achieved by other permit conditions, and it is potentially confusing.	
RC Resources	Section II.B.11	Section II.B.11: This condition and Condition II.A.16 both seek to apply BACT requirements to control fugitive dust emissions from the tailings pond. RCR suggests that having both conditions adds to the complexity of the permit and to RCR's regulatory burden and liability while adding no additional value relative to ensuring compliance with applicable air quality regulations or to protecting the environment. Should the Department decide to keep this condition, we request that the sentences between the first and last sentences (i.e., sentences two, three, and four) be omitted. Though they describe the tailings management facility and its configuration, they do not convey or contribute to a requirement or requirements. RCR is concerned that, if these descriptions remain in the permit, they could inappropriately be construed as requirements and result in confusion and potential enforcement problems.	This condition has been modified to reflect the slurry of the tailings to the impoundment site and now references the Fugitive Dust Control Plan.
RC Resources	Section II.B.12	Section II.B.12: Please remove from this condition the following descriptive portion: " ... where it is further dewatered to approximately 8-10% moisture." Again, RCR is concerned that this description could inappropriately be construed as a requirement and result in confusion and potential permit compliance issues	Modified as requested.
RC Resources	Section II.B.13	Section II.B.13: According to the permit application and to the permit analysis, BACT for controlling fugitive dust emissions from the main access road, Forest Service Road No. 150, is paving with periodic washing and sweeping as needed. Please remove the first sentence of this condition. Though road No. 150 will be the	Deleted the first sentence and removed the reasonable precautions reference and also indicated when paving must commence. The condition remains under a BACT reference according to

		predominant access route from the highway to the mine and mill sites, the requirement as written is not part of the BACT determination and, further, is not practically enforceable. Please also revise the last sentence of this condition to require controlling fugitive dust emissions from the road in accordance with a dust control plan that shall include periodic washing and sweeping. This was part of the BACT determination. The open-ended "reasonable precautions" language also applies in accordance with ARM 17.8.308(2), but is separate and distinct from the BACT requirement of ARM 17.8.752.	the BACT analysis submitted.
RC Resources	Section II.B.13	Section II.B.13 requires that U.S. Forest Service Road 150 will be paved from the highway to the mill site. This work is not planned to occur prior to or during construction of the evaluation adit phase. Please add verbiage to indicate that paving of the above referenced road will occur during production phase construction.	Table 5.4 in the application indicates this is a BACT condition. See comment directly above.
RC Resources	Section II.B.14	Section II.B.14: Please remove this condition. It contains no requirement that is directly or indirectly related to air quality regulation and environmental protection	The Department disagrees, as a rail load out facility implies a proper engineering design is inherent and as such would include a design that would minimize air quality concerns. The condition has been modified to remove the reference to a project schedule. Additionally, page 8 of the application explicitly says air emissions will be negligible due to the materials high moisture content and the enclosures. The application suggests a minimum water

			content is necessary combined with the partial enclosure at the rail load out facility – This is not unrelated to air quality based on the information submitted by the applicant in the application.
RC Resources	Section II.C.1	II.C.1: To improve clarity and completeness, please add reference to demonstrating compliance with the NSPS Subpart LL opacity requirements of Condition II.A.6.	See response to II.A.6
RC Resources	Section II.D.1	II.D.1: In item (a), please change "Amount of ore handled' to "Amount of ore produced." This improves coordination between this condition and Condition II.A.2 which limits annual production, rather than handling, of ore. Please omit from item (b) the parenthetical phrase "underground equipment." While most of the diesel fuel used by the mine will be used in underground mining equipment, not all will, and RCR assumes fees will be assessed based on all diesel fuel combusted, regardless the combustion source. Note that RCR recognizes emissions related to diesel combustion in mobile mine equipment may be subject to annual emissions-related fees even though, because they are not stationary sources, they are not regulated by the permit. Please omit from item (d) the parenthetical phrase "RU Emulsion explosive." RU Emulsion is a specific brand of emulsion explosive. The permit appropriately does not limit RCR to one brand of emulsion explosive, but including it here could cause confusion and potentially be construed as a limiting requirement. Please revise item (f) to specify vehicle miles traveled "by company vehicles." This clarifies that RCR is not responsible for emissions from non-company vehicles traveling the public access road.	Modified as requested.

RC Resources	Section II.D.4	Section II.D.4: Please clarify that the annual compliance report submitted with the annual emissions inventory shall report on compliance with Condition II.A.1 during the year for which annual emissions are reported	Changed the statement in II.D.1 to address all conditions.
RC Resources	Sections II.D.5,6, 8 and 9	Section II.D.5, 6, 8, and 9: Please clarify that the relevant information "for each of the previous months" to be submitted with each year's annual emissions inventory shall be limited to the twelve months preceding the month the inventory is submitted.	Modified as requested
RC Resources	Section II.D.8	II.D.8: Please remove this requirement. As noted above in a comment relating to Condition II.A.4, annual diesel consumption at the mine is relevant only to emissions from mobile sources which are regulated separate from the State and Federal stationary source regulations that the MAQP is required to address. Several details reported in the analysis section lead RCR to believe the Department may have reviewed a superseded version of the air quality application as a basis for their preliminary determination. 2 If true, RCR does not consider this to invalidate the preliminary determination; no fundamental changes exist between the two documents relative to required compliance demonstrations and conclusions. Nevertheless, such an oversight may explain the discrepancies upon which some of the following comments are based.	As the 2001 EIS and application addressed total diesel usage, the reporting condition is left intact but is no longer tied to a maximum diesel usage restriction.
RC Resources	I.A of the Analysis	Section I.A of the Montana Air Quality Permit (MAQP) Analysis indicates that tailings " ... would be dewatered to make a paste approximately 20 percent by weight." This language does not accurately describe the anticipated tailings paste product which will be dewatered to make a paste approximately 20 - 35 percent moisture by weight.	Condition has been modified to eliminate the moisture weight reference.

RC Resources	III of the BACT Analysis	Section III, BACT Underground Ore Processing and Handling and Aboveground Ore Processing and Handling Note that "course" ore throughout this section should be "coarse" ore. Emergency Generator As discussed above relative to Condition II.B.7, the permit analysis section discussing BACT for the emergency generator engine misrepresents RCR's BACT analysis and presents conflicting conclusions. It states that RCR proposed that BACT is compliance with 40 CFR Part 89 Tier 4 requirements. RCR actually proposed that BACT is compliance with 40 CFR Part 60, Subpart IIII requirements and limiting annual operations to no more than 100 hours (see Section 5.5, page 38 of the March 2014 application, Revision 3). Section Ill of the permit analysis goes on to state that, "Compliance with applicable federal emission standards with proper operation and maintenance is accepted as BACT ... " 40 CFR Part 89 is not an applicable federal emission standard; NSPS Subpart IIII is. Fugitive Emissions from Roads. Stockpiles, and Tailings Impoundment. The BACT determination for these sources should refer to a Fugitive Dust Control Plan rather than a Fugitive Control Plan.	Change made to Fugitive Dust Control Plan and correction made to the word course. Reference changed to 40 CFR 60 Subpart IIII.
RC Resources	Section IV, Emission Inventory	The results shown in this section should be revised to correspond with summary projected emission rates reported in the May 2014 application.	The updated tables have been inserted.
RC Resources	Section VI, Ambient Air Impacts	Section VI, Ambient Air Impacts The "NAAQS/MAAQS Impact Modeling Results" summary table purports to be based on modeling results reported in the permit application, but they are different. Please update to correspond to modeling results reported in the May 2014 application. To clarify, the District of Columbia Circuit Court of Appeals, at EPA's request,	Updated information has been added.

		vacated and remanded only two explicit references to $PM_{2.5}$ Sils in the air quality regulations. EPA subsequently revoked the affected rules. $PM_{2.5}$ Sils remain elsewhere in the regulations, along with Sils for other criteria pollutants. Further, updated EPA guidance for $PM_{2.5}$ permit modeling issued May 20, 2014, continues to recognize $PM_{2.5}$ Sils as important and conditionally available tools for demonstrating a proposed project's compliance with the $PM_{2.5}$ NAAQS. At the end of this section, after discussing extensive quantitative modeling analyses and reporting results relative to applicable ambient standards, the Department appears to base its determination of demonstrated compliance on "the minor level of emissions and proposed BACT methods." Please explain why the determination is not based on the submitted and approved modeling analyses.	
RC Resources, October 14, 2014	Application Clarification	In the course of reviewing the Supplemental Environmental Impact Statement development efforts, a discrepancy was discovered that placed a stockpile area designated "Production Adit Stockpile Area" over an area that will actually be protected as a Riparian Conservation Habitat Area. Bison has verified that the stockpile location adjustment does not affect the conclusion of the ambient air quality impacts demonstration model submitted with the permit application. All peak impacts reported in Table 6-6, Cumulative MAAQS/NAAQS Impacts Modeling Results, occurred well away from the subject stockpile and remain unchanged. Revised documents submitted include: Page 47. Figure 6-2 was revised to show the outline of the corrected stockpile area source and the locations of the new receptors placed in the area where the stockpile had been modeled.	The Department reviewed the emission inventory associated with the Production Adit Stockpile Area and due to the minor emissions from this source, distance the stockpile would be located from the previous modeled location, and determined no change would result in the ambient air quality impacts. Additionally, since this stockpile is temporary, once mill facilities are in place, no emissions will occur from this source.

		Page 51 Table 6-1 was revised to show easterly and northerly length parameters for the modified stockpile area source.	

II. Applicable Rules and Regulations

The following are partial explanations of some applicable rules and regulations that apply to the facility. The complete rules are stated in the Administrative Rules of Montana (ARM) and are available, upon request, from the Department of Environmental Quality (Department). Upon request, the Department will provide references for location of complete copies of all applicable rules and regulations or copies where appropriate.

A. ARM 17.8, Subchapter 1 – General Provisions, including but not limited to:

1. ARM 17.8.101 Definitions. This rule includes a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.105 Testing Requirements. Any person or persons responsible for the emission of any air contaminant into the outdoor atmosphere shall, upon written request of the Department, provide the facilities and necessary equipment (including instruments and sensing devices) and shall conduct tests, emission or ambient, for such periods of time as may be necessary using methods approved by the Department.

3. ARM 17.8.106 Source Testing Protocol. The requirements of this rule apply to any emission source testing conducted by the Department, any source or other entity as required by any rule in this chapter, or any permit or order issued pursuant to this chapter, or the provisions of the Clean Air Act of Montana, 75-2-101, *et seq*., Montana Code Annotated (MCA).

   RCR shall comply with the requirements contained in the Montana Source Test Protocol and Procedures Manual, including, but not limited to, using the proper test methods and supplying the required reports. A copy of the Montana Source Test Protocol and Procedures Manual is available from the Department upon request.

4. ARM 17.8.110 Malfunctions. (2) The Department must be notified promptly by telephone whenever a malfunction occurs that can be expected to create emissions in excess of any applicable emission limitation or to continue for a period greater than 4 hours.

5. ARM 17.8.111 Circumvention. (1) No person shall cause or permit the installation or use of any device or any means that, without resulting in reduction of the total amount of air contaminant emitted, conceals or dilutes an emission of air contaminant that would otherwise violate an air pollution control regulation. (2) No equipment that may produce emissions shall be operated or maintained in such a manner as to create a public nuisance.

B. ARM 17.8, Subchapter 2 – Ambient Air Quality, including, but not limited to the following:

1. ARM 17.8.210 Ambient Air Quality Standards for Sulfur Dioxide
2. ARM 17.8.211 Ambient Air Quality Standards for Nitrogen Dioxide
3. ARM 17.8.212 Ambient Air Quality Standards for Carbon Monoxide

4. ARM 17.8.213 Ambient Air Quality Standard for Ozone
5. ARM 17.8.214 Ambient Air Quality Standard for Hydrogen Sulfide
6. ARM 17.8.220 Ambient Air Quality Standard for Settled Particulate Matter
7. ARM 17.8.221 Ambient Air Quality Standard for Visibility
8. ARM 17.8.222 Ambient Air Quality Standard for Lead
9. ARM 17.8.223 Ambient Air Quality Standard for PM_{10}
10. ARM 17.8.230 Fluoride in Forage

RCR must maintain compliance with the applicable ambient air quality standards.

C. ARM 17.8, Subchapter 3 – Emission Standards, including, but not limited to:

1. ARM 17.8.304 Visible Air Contaminants. This rule requires that no person may cause or authorize emissions to be discharged into the outdoor atmosphere from any source installed after November 23, 1968, that exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

2. ARM 17.8.308 Particulate Matter, Airborne. (1) This rule requires an opacity limitation of less than 20% for all fugitive emission sources and that reasonable precautions be taken to control emissions of airborne particulate matter. (2) Under this rule, RCR shall not cause or authorize the use of any street, road, or parking lot without taking reasonable precautions to control emissions of airborne particulate matter.

3. ARM 17.8.309 Particulate Matter, Fuel Burning Equipment. This rule requires that no person shall cause, allow, or permit to be discharged into the atmosphere particulate matter caused by the combustion of fuel in excess of the amount determined by this rule.

4. ARM 17.8.310 Particulate Matter, Industrial Process. This rule requires that no person shall cause, allow, or permit to be discharged into the atmosphere particulate matter in excess of the amount set forth in this rule.

5. ARM 17.8.316 Incinerators. This rule requires that no person may cause or authorize emissions to be discharged into the outdoor atmosphere from any incinerator, particulate matter in excess of 0.10 grains per standard cubic foot of dry flue gas, adjusted to 12% carbon dioxide and calculated as if no auxiliary fuel had been used. Further, no person shall cause or authorize to be discharged into the outdoor atmosphere from any incinerator emissions that exhibit an opacity of 10% or greater averaged over 6 consecutive minutes.

6. ARM 17.8.322 Sulfur Oxide Emissions--Sulfur in Fuel. This rule requires that no person shall burn liquid, solid, or gaseous fuel in excess of the amount set forth in this rule.

7. ARM 17.8.324 Hydrocarbon Emissions--Petroleum Products. (3) No person shall load or permit the loading of gasoline into any stationary tank with a capacity of 250 gallons or more from any tank truck or trailer, except through a permanent submerged fill pipe, unless such tank is equipped with a vapor loss control device as described in (1) of this rule.

8. ARM 17.8.340 Standard of Performance for New Stationary Sources and Emission Guidelines for Existing Sources. This rule incorporates, by reference, 40 CFR Part 60, Standards of Performance for New Stationary Sources (NSPS). RCR is considered an NSPS affected facility under 40 CFR Part 60 and is subject to the requirements of the following subparts.

   a. 40 CFR 60, Subpart A – General Provisions apply to all equipment or facilities subject to an NSPS Subpart as listed below:

   b. 40 CFR 60, Subpart LL – Standard of Performance for Metallic Mineral Processing Plants

   c. 40 CFR 60, Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (CI ICE). Owners and operators of stationary CI ICE that commence construction after July 11, 2005, where the stationary CI ICE are manufactured after April 1, 2006, and are not fire pump engines, and owners and operators of stationary CI ICE that modify or reconstruct their stationary CI ICE after July 11, 2005, are subject to this subpart.

9. ARM 17.8.342 Emission Standards for Hazardous Air Pollutants for Source Categories. The source, as defined and applied in 40 CFR Part 63, shall comply with the requirements of 40 CFR Part 63, as listed below:

   a. 40 CFR 63, Subpart A – General Provisions apply to all equipment or facilities subject to an NESHAP Subpart as listed below:

   b. 40 CFR 63, Subpart ZZZZ - National Emissions Standards for Hazardous Air Pollutants (HAPs) for Stationary Reciprocating Internal Combustion Engines (RICE). An owner or operator of a stationary RICE at a major or area source of HAP emissions is subject to provisions of this subpart, except if the stationary RICE is being tested at a stationary RICE test cell/stand. As an area source, the diesel RICE will be subject to this rule.

D. ARM 17.8, Subchapter 5 – Air Quality Permit Application, Operation, and Open Burning Fees, including, but not limited to:

1. ARM 17.8.504 Air Quality Permit Application Fees. This rule requires that an applicant submit an air quality permit application fee concurrent with the submittal of an air quality permit application. A permit application is incomplete until the proper application fee is paid to the Department. RCR submitted the appropriate permit application fee for the current permit action.

2. ARM 17.8.505 Air Quality Operation Fees. An annual air quality operation fee must, as a condition of continued operation, be submitted to the Department by each source of air contaminants holding an air quality permit (excluding an open burning permit) issued by the Department. The air quality operation fee is based on the actual or estimated actual amount of air pollutants emitted during the previous calendar year.

An air quality operation fee is separate and distinct from an air quality permit application fee. The annual assessment and collection of the air quality operation fee, described above, shall take place on a calendar-year basis. The Department may insert into any final permit issued after the effective date of these rules, such conditions as may be necessary to require the payment of an air quality operation fee on a calendar-year basis, including provisions that prorate the required fee amount.

E. ARM 17.8, Subchapter 7 – Permit, Construction, and Operation of Air Contaminant Sources, including, but not limited to:

1. ARM 17.8.740 Definitions. This rule is a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.743 Montana Air Quality Permits--When Required. This rule requires a person to obtain an air quality permit or permit modification to construct, modify, or use any air contaminant sources that have the potential to emit (PTE) greater than 15 tons per year of any pollutant for asphalt concrete plants, mineral crushers and mineral screens. RCR has a PTE greater than 15 tons per year of CO; therefore, an air quality permit is required.

3. ARM 17.8.744 Montana Air Quality Permits--General Exclusions. This rule identifies the activities that are not subject to the Montana Air Quality Permit program.

4. ARM 17.8.745 Montana Air Quality Permits--Exclusion for De Minimis Changes. This rule identifies the de minimis changes at permitted facilities that do not require a permit under the Montana Air Quality Permit Program.

5. ARM 17.8.748 New or Modified Emitting Units--Permit Application Requirements. (1) This rule requires that a permit application be submitted prior to installation, modification, or use of a source. RCR submitted the required permit application for the current permit action. (7) This rule requires that the applicant notify the public by means of legal publication in a newspaper of general circulation in the area affected by the application for a permit. RCR submitted an affidavit of publication of public notice for the August 31, 2012, issue of the *Western News*, a newspaper of general circulation in the Town of Libby in Lincoln County, as proof of compliance with the public notice requirements.

6. ARM 17.8.749 Conditions for Issuance or Denial of Permit. This rule requires that the permits issued by the Department must authorize the construction and operation of the facility or emitting unit subject to the conditions in the permit and the requirements of this subchapter. This rule also requires that the permit must contain any conditions necessary to assure compliance with the Federal Clean Air Act (FCAA), the Clean Air Act of Montana, and rules adopted under those acts.

7. ARM 17.8.752 Emission Control Requirements. This rule requires a source to install the maximum air pollution control capability that is technically practicable and economically feasible, except that BACT shall be utilized. The required BACT analysis is included in Section III of this permit analysis.

8. ARM 17.8.755 Inspection of Permit. This rule requires that air quality permits shall be made available for inspection by the Department at the location of the source.

9. ARM 17.8.756 Compliance with Other Requirements. This rule states that nothing in the permit shall be construed as relieving RCR of the responsibility for complying with any applicable federal or Montana statute, rule, or standard, except as specifically provided in ARM 17.8.740, *et seq*.

10. ARM 17.8.759 Review of Permit Applications. This rule describes the Department's responsibilities for processing permit applications and making permit decisions on those permit applications that do not require the preparation of an environmental impact statement.

11. ARM 17.8.760 Additional Review of Permit Applications. This rule describes the Department's responsibilities for processing permit applications and making permit decisions on those applications that require an environmental impact statement.

12. ARM 17.8.762 Duration of Permit. An air quality permit shall be valid until revoked or modified, as provided in this subchapter, except that a permit issued prior to construction of a new or modified source may contain a condition providing that the permit will expire unless construction is commenced within the time specified in the permit, which in no event may be less than 1 year after the permit is issued.

13. ARM 17.8.763 Revocation of Permit. An air quality permit may be revoked upon written request of the permittee, or for violations of any requirement of the Clean Air Act of Montana, rules adopted under the Clean Air Act of Montana, the FCAA, rules adopted under the FCAA, or any applicable requirement contained in the Montana State Implementation Plan (SIP).

14. ARM 17.8.764 Administrative Amendment to Permit. An air quality permit may be amended for changes in any applicable rules and standards adopted by the Board of Environmental Review (Board) or changed conditions of operation at a source or stack that do not result in an increase of emissions as a result of those changed conditions. The owner or operator of a facility may not increase the facility's emissions beyond permit limits unless the increase meets the criteria in ARM 17.8.745 for a de minimis change not requiring a permit, or unless the owner or operator applies for and receives another permit in accordance with ARM 17.8.748, ARM 17.8.749, ARM 17.8.752, ARM 17.8.755, and ARM 17.8.756, and with all applicable requirements in ARM Title 17, Chapter 8, Subchapters 8, 9, and 10.

15. ARM 17.8.765 Transfer of Permit. This rule states that an air quality permit may be transferred from one person to another if written notice of intent to transfer, including the names of the transferor and the transferee, is sent to the Department.

F. ARM 17.8, Subchapter 8 – Prevention of Significant Deterioration of Air Quality, including, but not limited to:

1. ARM 17.8.801 Definitions. This rule is a list of applicable definitions used in this subchapter.

2. ARM 17.8.818 Review of Major Stationary Sources and Major Modifications--Source Applicability and Exemptions. The requirements contained in ARM 17.8.819 through ARM 17.8.827 shall apply to any major stationary source and any major modification, with respect to each pollutant subject to regulation under the FCAA that it would emit, except as this subchapter would otherwise allow.

This facility is not a major stationary source because this facility is not a listed source and the facility's PTE is below 250 tons per year of any pollutant (excluding fugitive emissions).

G. ARM 17.8, Subchapter 10 – Preconstruction Permit Requirements for Major Stationary Sources of Modifications Located Within Attainment or Unclassified Areas, including, but not limited to:

ARM 17.8.1004 When Air Quality Preconstruction Permit Required. This current permit action does not constitute a major modification. Therefore, the requirements of this subchapter do not apply.

H. ARM 17.8, Subchapter 12 – Operating Permit Program Applicability, including, but not limited to:

1. ARM 17.8.1201 Definitions. (23) Major Source under Section 7412 of the FCAA is defined as any source having:

   a. PTE > 100 tons/year of any pollutant;

   b. PTE > 10 tons/year of any one hazardous air pollutant (HAP), PTE > 25 tons/year of a combination of all HAPs, or lesser quantity as the Department may establish by rule; or

   c. PTE > 70 tons/year of particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) in a serious PM_{10} nonattainment area.

2. ARM 17.8.1204 Air Quality Operating Permit Program. (1) Title V of the FCAA amendments of 1990 requires that all sources, as defined in ARM 17.8.1204(1), obtain a Title V Operating Permit. In reviewing and issuing MAQP #2414-03 for RCR, the following conclusions were made:

   a. The facility's PTE is less than 100 tons/year for any pollutant.

   b. The facility's PTE is less than 10 tons/year for any one HAP and less than 25 tons/year for all HAPs.

   c. This source is not located in a serious PM_{10} nonattainment area.

   d. This facility is subject to current NSPS as indicated in Section II.C.8.

   e. This facility is subject to current NESHAP standards as indicated in Section II.C.9.

f. This source is not a Title IV affected source, or a solid waste combustion unit.

g. This source is not an EPA designated Title V source.

Based on these facts, the Department determined that RCR will be a minor source of emissions as defined under Title V. However, if minor sources subject to NSPS are required to obtain a Title V Operating Permit, RCR will be required to obtain a Title V Operating Permit.

III. BACT Determination

A BACT determination is required for each new or modified source. RCR shall install on the new or modified source the maximum air pollution control capability which is technically practicable and economically feasible, except that BACT shall be utilized.

A BACT analysis was submitted by RCR in permit application #2414-03, addressing some available methods of controlling emissions from the proposed emitting units. The Department reviewed these methods, as well as previous BACT determinations. The following information has been summarized from the RCR proposed BACT submittal and has been reviewed by the Department in order to make the following BACT determination.

<u>Blasting</u>

Underground mining will be performed using emulsion explosives to liberate and fracture the ore. Blasting will generate both fugitive gaseous and particulate emissions which will largely be confined to underground. However, ventilation required largely for worker safety will also carry some emissions to the surface. The use of common Best Operating Practices (BOPs) is the industry standard method for minimizing the formation of blasting emissions and RCR proposes to use the following BOPs to establish BACT.

- Optimize drill hole sizes. Optimizing drill hole size will result in effective blasting and thus reduce the number of blasts needed to achieve the desired effect. Water added to the ore at this time will continue to reduce particulate emissions throughout downstream handling and processing operations.

- Spray the area with water after each blast. This is standard operating procedure done primarily to reduce airborne dust below thresholds established for worker safety.

- Minimize retention time between loading blasting holes with emulsion and detonation. RCR plans to load blast holes with emulsion and detonate them within 24 hours or less.

The use of BOPs as described above is accepted as BACT for the blasting operations underground.

Underground Ore Processing and Handling and Aboveground Ore Processing and Handling

Since both the underground and above ground handling of coarse ore are similar, for purposes of the BACT analysis they are included in a single category. The combined systems include a total of four crushing operations, four screening operations, four storage bins, and multiple conveyors and feeders.

The following alternatives were reviewed for the coarse ore handling operations:

- No Add-on Control. This is the base case for proposed new sources.
- BOPs. BOPs include a variety of techniques which largely utilize reducing the drop height for material transfers.
- Enclosure. Enclosure technology uses either a full enclosure or partial enclosure to shelter material from wind entrainment.
- Wet Dust Suppression. Water spray with or without surfactant to material reduces particulate emissions by increasing the moisture content.
- Electrostatic Precipitator (ESP). An ESP uses electrical forces to move entrained particles onto a collection surface. Periodic cleaning is needed to dislocate the trapped particulates and provide collection beneath the plates.
- Wet Particulate Scrubber. Wet scrubbers either use a venturi or spray chamber to collect particulate into water droplets.
- Fabric Filter Baghouse. Baghouses collect particulate on tightly woven fabric materials. As the fabric materials are loaded with particulate, the pressure drop increases and periodic cleaning is necessary to maintain collection efficiency and prevent excessive pressure drop.

Both ESPs and fabric filter baghouse technology suffer performance issues with wet particulate air streams and are eliminated as feasible control alternatives for the underground and above ground ore handling processes. Enclosures, BOPs and wet dust suppression are feasible but have relatively low control efficiencies.

The best remaining control technology for coarse ore handling is wet particulate scrubbers and RCR has proposed both a scrubber for the underground process handling activities and a wet scrubber for the above ground coarse ore handling activities. A wet scrubber for the control of coarse ore handling activities is accepted as BACT.

Fine Ore Processing and Handling

Each of the below control technologies were also reviewed for the fine ore processing and handling.

- BOPs
- Enclosure
- Wet Dust Suppression
- Electrostatic Precipitator (ESP)
- Wet Particulate Scrubber
- Fabric Filter Baghouse

The fine ore processing and handling is similar to the coarse ore handling but fine ore moisture content has been reduced to low enough levels that baghouse technology becomes feasible to deal with fine ore materials. ESP technology is still eliminated due to concerns around highly variable product characteristics and concern for long-term performance issues. Therefore, RCR is recommending fabric filter baghouse technology as the recommended control for the fine ore processing and handling operations located within the milling building. Baghouse technology has a minimum removal efficiency typically of 98 percent. Baghouse technology for the control of the fine ore handling activities is accepted as BACT.

Emergency Generator (Less than or Equal to 560 kW)

- RCR proposes that BACT for reducing all criteria pollutant emissions from the proposed emergency generator is compliance with 40 CFR 60 Subpart IIII requirements.

Compliance with applicable federal emission standards with proper operation and maintenance is accepted as BACT as the emission limits associated with the emergency generator represent low emission rates.

Emissions from Roads, Stockpiles and Tailings Impoundment

Primary sources of fugitive dust from the project will be light vehicle traffic and wind erosion of ore and waste stockpiles as well as from the tailings impoundment. RCR has proposed to implement a Fugitive Dust Control Plan for these sources which incorporate BOPs typically recognized as BACT for fugitives from similar sources.

Disturbed/Exposed Soil – Revegetation of disturbed areas will occur in the first appropriate season after disturbance or appropriately addressed in the Fugitive Dust Control Plan.

Roads

- U.S. Forest Service Road 150 will be paved to the mill facilities and be washed and swept to minimize dust emissions.

- All unpaved roads will be water or a dust palliative will be used as needed to reduce fugitive dust.

- Vehicle speeds will be restricted on haul roads to reduce the amount of fugitive dust.

- Heavily used unpaved roads will be chemically stabilized with nontoxic soil cement or dust palliatives mixed into the upper 1 to 2 inches of road surfaces as necessary.

- Metallic Product Concentrate and tailings will be piped in a slurry form from the mill to the paste plant/product load-out area and tailings impoundment.

- Personnel will be transported via multi-passenger vans from Highway 200 to the mill and mine sites.

Conveyors – A covered conveyor system will be used to minimize emissions.

Tailings Impoundment – A sprinkler system will minimize fugitive dust emissions from wind erosion of the tailings impoundment.

The development of a Fugitive Dust Control Plan with the elements incorporated above is accepted as BACT.

The control options and methods selected have controls and control costs comparable to other recently permitted similar sources and are capable of achieving the appropriate emission standards.

IV. Emission Inventory

The point source emission inventory for the proposed RCR operations are indicated below. A full emission inventory with calculations is on file with the Department.

Table 1. Point Source Emission Inventory (Tons Per Year)

Emissions Source	**PM**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**CO**	**VOC**	**SO_2**
Underground Scrubber #1	0.22	0.079	8.7E-3	—	—	—	—
Aboveground Scrubber #2	0.26	0.10	0.012	—	—	—	—
Fine Ore Baghouse	0.091	0.030	2.8E-3	—	—	—	—
Emergency Generator	0.018	0.018	0.018	0.304	0.38	0.043	—
Total	0.6	0.23	0.04	0.304	0.38	0.043	0

The fugitive source totals are listed below. Although the blasting emissions will exit the portal they are shown as fugitive.

Table 2. Fugitive Source Emission Inventory (Tons Per Year)

Emissions Source	PM	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC	SO_2
Blasting	0.33	0.17	0.010	0.38	20.3	—	—
Storage Pile Wind Erosion	2.4	1.2	0.18	—	—	—	—
Road Dust	4.8	0.96	0.24	—	—	—	—
Total	7.53	2.33	0.43	0.38	20.3	0	0

V. Existing Air Quality

RCR production, processing facilities, and tailings area would be located in an area designated as "Unclassifiable/Attainment" for all air quality criteria pollutants (40 CFR 81.327). The Libby, Montana (MT), $PM_{2.5}$ and PM_{10} nonattainment areas (NAA) are located approximately 16.2 and 24.8 miles northeast, respectively, from the proposed Rock Creek Mine tailings pond. The mine tailings pond would be about 30.3 miles north from PM_{10} Thompson Falls NAA, MT, and 45.7 miles east from Sandpoint, Idaho, which has a PM_{10} maintenance area, once designated as nonattainment.

VI. Ambient Air Impact Analysis

The underground Rock Creek Mine would be classified as a minor source under the Title V and PSD regulations. The modeling was conducted for two scenarios according to the mining phase: exploratory or production. The underground emissions from the adits (exploratory and production) were identical but located in different areas. Within this ambient air impact analysis section, "exploratory" and "evaluation" adits are used interchangeably. The modeled emissions of regulated pollutants from the project during peak operations (year 5) are listed in Table 3; these emissions include CO, NO_X, PM_{10}, and particulate matter with a mean aerodynamic diameter equal to or less than 2.5 micrometers ($PM_{2.5}$).

Table 3. Modeled RCR Potential Emissions

Source	CO (tpy)[1]	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_x (tpy)
Underground	20.250	0.250	0.019	0.375
Scrubber #2 (above ground)		0.100	0.012	
Fine Ore Baghouse		0.030	0.003	
Storage Pile		0.230	0.035	
Tailings Impoundment		1.000	0.140	

Source	CO (tpy)[1]	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_x (tpy)
Road Dust		0.963	0.234	
Total	20.250	2.573	0.443	0.375

[1] tpy = tons per year.

The same emission rates were used for both the short and long-term modeled averaging periods, if applicable. The underground emissions included blasting and a scrubber (Scrubber #1) and the road emissions were allocated to 90 volume sources. The application also included the operation of an emergency generator for 100 hours per year. For modeling purposes, the annual tons per year would be multiplied by 0.0114 (100/8760) resulting in very small hourly emissions so this source was not included in the modeling analysis. Furthermore, this source is also considered an intermittent source in regards to the 1-hour NO_2 NAAQS and may be omitted from the associated modeling demonstration (http://www.epa.gov/region7/air/nsr/nsrmemos/appwno2_2.pdf).

As shown in Table 3, the potential rates of the criteria air pollutant emissions, as submitted in the RCR application, were minor and well below de minimis levels that would normally require dispersion modeling; these rates are as follows: CO (100 tons per year, tpy), PM_{10} (15 tpy), $PM_{2.5}$ (10 tpy), and NO_x (40 tpy). However, RCR chose to demonstrate that the proposed increase in air emissions would not cause or contribute to any violation of the state or national ambient air quality standard (MAAQS and NAAQS, respectively) or impact the Cabinet Mountains Wilderness Area, a federally-designated Class I area. Class I areas were created by the Clean Air Act of 1977 and are provided the highest level of air quality protection by U.S. Environmental Protection Agency (USEPA); these areas include wilderness areas and national parks (http://www.epa.gov/visibility/class1.html).

Dispersion Modeling and Associated Programs: The MAAQS/NAAQS compliance demonstrations were conducted using latest versions (at the time of application submittal) of AERMOD and auxiliary support programs; specifically, the following models were applied:

- AERMOD version 13350: primary air dispersion model
- AERMET version 13350: processes the hourly surface and upper air meteorological (met) data for input into AERMOD.
- AERMAP version 11103: processes the terrain data and determines the elevations of the receptors for AERMOD input; receptors are locations where AERMOD calculates the pollutant concentrations.
- BPIPPRM version 04274: characterizes building downwash effects for AERMOD
- AERSURFACE version 13016: extracts land use data to calculate the surface characteristics surrounding the surface met site(s) for AERMET.
- AERMINUTE version 11325: develops hourly wind data for AERMET input; under low hourly wind speeds or highly variable wind directions, AERMOD cannot process the hourly met data which results in zero air pollutant concentration(s) for that hour; uses more recent met data called one-minute ASOS (Automated Surface Observing System) located at National Weather Stations (NWS) which due to continuous data collection generally lacks the undesirable wind characteristics.

The AERMOD air dispersion modeling was conducted using the USEPA default options except for two instances: the mine adits were modeled using the beta option of horizontal emission points and the 1-hour NO_2 non-default modeling methodology was used. The USEPA default options include the following:

- Stack-tip downwash
- Accounts for elevated terrain effects
- Use calms processing routine
- Use missing data processing routine
- No exponential decay

The Ozone Limiting Method (OLM) was applied in determining the short-term (1-hour) NO_2 modeled impacts. A combustion source normally emits a small amount of nitrous oxides (NO_x) as NO_2 with the remaining as nitric oxide (NO); NO can convert in the atmosphere to NO_2 depending on the amount of ozone (O_3) in the atmosphere.

1-Hour NO2 OLM Modeling Methodology: Two important inputs are necessary to use this non-default option: the in-stack NO_2/NO_x ratio and the NO_2/NO_x ratio in the atmosphere. In both cases, the USEPA default options were used, 0.5 and 0.9, respectively (http://www.epa.gov/region7/air/nsr/nsrmemos/appwno2_2.pdf). Background ozone concentrations are also required using this option, either hourly or a single value. RCR used hourly ambient ozone concentrations collected near Lake McDonald in Glacier National Park for the years 2007 – 2011 that corresponded to the most of the met data (http://java.epa.gov/castnet/epa_jsp/prepackageddata.jsp). Corresponding data were not available for the met year 1985 so RCR used 1990 data, the first available year of data. Some substitution of the missing ozone data was required, a normal occurrence.

Urban/Rural Status: This classification accounts for the dispersive nature of the "convective-like" boundary layer that forms during nighttime conditions from urban heat island effects. All of Montana is classified as rural so the rural dispersion coefficients were selected.

Land Use: The surrounding surface characteristic around the surface met sites are required input into AERMET. The most important parameter is the surface roughness length which determines the magnitude of the mechanical turbulence and stability of the boundary layer (where air quality dispersion occurs). A land cover file is required for input into AERSURFACE; the National Land Cover Data 1992 (NLCD92) file was obtained from the U.S. Geological Survey Land Cover Institute website in NAD83 for AERMAP input (http://landcover.usgs.gov/us_map.php). At this time, AERSURFACE only supports NLCD92.

Meteorology (Met): Two met datasets were used:

(1) Surface: On-site 1985 Noxon, MT, surface met which the Department provided; this file has been used in previous modeling demonstrations in the area.

Any missing surface data was substituted with 1985 Kalispell Glacier International Airport (KGPI), MT, National Weather Service (NWS) data (http://www.webmet.com/State_pages/met_mt.htm).
Upper Air: 1985 Spokane International Airport, WA, NWS upper air data (http://www.webmet.com/State_pages/met_wa.htm).

(2) Surface: On-site 2007 – 2011 Troy, MT, purchased from the Western Regional Climate Center (http://www.raws.dri.edu/index.html).

Any missing surface data was substituted with 2007 – 2011 KGPI data purchased from the National Climatic Data Center (http://www.ncdc.noaa.gov/data-access/land-based-station-data).

ASOS 2007 – 2011 KGPI one-minute data (ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin).

Upper Air: 2007 – 2011 Spokane International Airport, WA, NWS upper air data (http://www.esrl.noaa.gov/raobs/).

For the 1-hour NO_2, and 24-hour and annual $PM_{2.5}$, the five years of met data, 2007 – 2011, were combined (concatenated) into one met file (http://www.epa.gov/ttn/scram/models/aermod/aermod_userguide_addendum_v11059_draft.pdf). Table **4** lists for various met station information.

Table 4. Met Station Coordinates and Relevant Statistics

Station	Type	Met Year	Latitude	Longitude	Elevation (m)[1]	Anemometer Height (m)
Noxon, MT	Surface, On-Site	1985	47.979N	-115.74W	710.41	10.00
Kalispell Glacier Park international Airport, MT	Surface, NWS[2]	1985	48.310N	-114.267W	906.00	6.10
Spokane International Airport, WA	Upper Air, NWS	1985	47.370N	-117.310W	NA[3]	NA
Troy, MT	Surface, RAWS[4] On-Site	2007 - 2011	48.481N	-115.905W	612.00	6.10
Kalispell Glacier Park international Airport, MT	Surface, NWS	2007 - 2011	48.310N	-114.267W	906.00	7.92
Spokane International Airport, WA	Upper Air, NWS	2007 - 2011	47.680N	-117.630W	NA	NA

[1] m = meters.
[2] NWS = National Weather Service.
[3] NA = Not Applicable.
[4] RAWS = Remote Automated Weather Station; operated by the U.S. Forest Service.

Source, Structure, and Receptor Elevation/Location Determinations: The RCR provided the Consultant an AutoCAD drawing of the facility boundary including the sources and structures; RCR provided the structure heights information. This drawing was imported into an AERMOD software interface with graphic abilities (GUI) which allows the user to graphically depict the facility and components. The drawing was created in North American Datum 1983 (NAD83), Zone 11, the projected coordinate system of this modeling demonstration.

Using the graphic software interface, receptors were placed at 50 meters (m) spacing intervals on the mine permit boundary for a total of 793 receptors. At this time, the RCR does not plan to erect a physical barrier to restrict public access inside the mine boundary so a Cartesian receptor grid system

of 100 m spacings was developed inside the mine permit boundary. Some of these receptors were removed where the storage pile and tailing pond will be located. The USFS Road 150 runs through the mine permit area which will remain open to the public; additional receptors at 50 m spacings were included to represent this road. Another 100 m spacing grid system was established from the mine permit boundary out to 1 kilometer (km) in distance. From 1 km to 3 km, receptors with 250 m receptor spacings were developed. The total number of receptors was 10,576, including the mine boundary receptors.

National Elevation Dataset (NED) files were obtained from the U.S. Geological Survey website in NAD83 for AERMAP input (http://viewer.nationalmap.gov/viewer/). The NED files had a 1/3 arc-second (about 10 meter) horizontal resolution in Geographic Tagged Image File Format. With the application of AERMAP, the elevations of the sources, structures, and receptors (and hill heights) were determined. The corresponding elevations in the mill area were adjusted according to area grading and leveling information contained in a general plant layout drawing and AutoCAD file developed for the project by the RCR.

RCR Sources and Modeling Parameters: Two adits (nearly horizontal openings into the underground mine) were modeled: exploratory/evaluation and production. The underground blasting and Scrubber #1 emissions will be emitted through these adits and therefore, modeled accordingly. Three different model sources were modeled: point, area, and volume. Area and volume source emissions do not have any associated velocities and are released at ambient temperature. The RCR technical staff developed the following source modeling characteristics, except for the stockpile and tailings pond. The stockpile dimensions were based on the general facility layout drawing and engineering judgment. The tailings pond dimensions were also based on professional engineering judgment; Table 5 lists the modeled RCR sources.

Table 5. Modeled RCR Source Characteristics

Point Source	Stack Height (m)[1]	Stack Temperature (°K)[2]	Stack Velocity (m/s)[3]	Stack Diameter (m)
Exploratory Adit	3.00	289	23.5	6.19
Production Adit	3.80	289	15.3	7.68
Scrubber #2	11.60	289	18.8	1.22
Fine Ore Baghouse	11.60	289	16.9	0.66
Area Source	Release Height (m)	Easterly Length (m)	Northerly Length (m)	Vertical Dimension (m)
Storage Pile	2.29	72.00	350.00	1.06
Tailings Pond	2.29	144.00	144.00	1.06

Point Source	Stack Height (m)[1]	Stack Temperature (°K)[2]	Stack Velocity (m/s)[3]	Stack Diameter (m)
Volume Source	Release Height (m)	Horizontal Dimension (m)	Vertical Dimension (m)	
Road Dust (90)	2.07	5.58	1.93	

[1] m = meters.
[2] °K = degrees Kelvin; to convert °K to Fahrenheit, use the following formula: ($T_{(°F)} = T_{(K)} \times 9/5 - 459.67$).
[3] m/s = meters per second.

The road, USFS Road 150, was represented by 90 volume sources in the permit mine boundary area, spaced at 100 m.

Building Downwash: The USEPA-developed Building Profile Input Program – Plume Rise Model Enhancement (BPIP-PRIME version 04274) was used to determine any building downwash effects and to ensure no stack in the facility had a modeled height that exceeded good engineering practice (GEP). GEP means that the modeled stack height was not used as an air dispersion technique to reduce air pollutant concentrations at ground-level level (ARM 17.8 Subchapter 4: Stack Heights and Dispersion Techniques). A total of eight (8) buildings were included in the analysis and the results indicated no facility stack height exceeded GEP.

Significant Impact Analysis: The first modeling phase was the significant impact analysis which determines whether a cumulative impact modeling is necessary; a cumulative impact analysis includes other off-site emission sources. To reiterate, two scenarios were modeled defined by the mining phase (exploratory or production) with all other RCR sources included in each scenario. The highest (H1H) modeled concentrations were selected for comparison to the relevant Class II significant impact levels (SILs).

The USEPA codified PSD Class I and Class II $PM_{2.5}$ SILs in October 2010 (http://www.gpo.gov/fdsys/pkg/FR-2010-10-20/pdf/2010-25132.pdf). However, in January 2013, the U.S. United States Court of Appeals for the District of Columbia Circuit vacated and remanded these levels at the request of USEPA (http://epa.gov/nsr/documents/20130304qa.pdf). Currently, the USEPA does not preclude the use of the $PM_{2.5}$ SILs but advises exercising caution when applying the values.

Table 6 lists the results of this modeling phase including the met periods that produced the highest concentrations; no background concentrations are included in this type of modeling. Also noted in this table is the source group, exploratory (EXP) or production (PRO), with the other RCR sources included with each group, that caused the highest pollutant concentrations; in some cases, both source groups (EXP + PRO) produced equivalent concentrations.

Table 6. Significant Impact Modeling Results, RCR Sources Only

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)[1]	Class II SIL[2] ($\mu g/m^3$)	Met Period	Significant? (Y/N)
CO	1-Hour	6,805 (PRO)[4]	2,000	2007	Y
	8-Hour	2,045 (PRO)	500	1985	Y
PM_{10}	24-Hour	36 (EXP + PRO)[4]	5	2007	Y
	Annual	7.3 (PRO)	1	2010	Y
$PM_{2.5}$	24-Hour	4.3 (EXP + PRO)	1.2	2007 – 2011	Y
	Annual	0.9 (EXP + PRO)	0.3	2007 - 2011	Y
NO_x	1-Hour	121[5] (PRO)	7.52[6]	1985	Y
	Annual	1.8 (PRO)	1	1985	Y

[1] $\mu g/m^3$ = micrograms per cubic meter.
[2] Class II SIL = Class II significant impact level.
[3] PRO = production adit.
[4] EXP + PRO = both exploratory (EXP) and production adits produced equivalent concentrations.
[5] Ozone Limiting Method was applied.
[6] In 2010, the USEPA proposed an interim 1-hour NO_2 SIL of 4 parts per billion (ppb); converting this value to micrograms per cubic meters results in a 7.52 value (http://www.epa.gov/region7/air/nsr/nsrmemos/appwno2.pdf).

As shown, all of the pollutants and averaging periods were higher than their respective SIL; therefore, a cumulative impact analysis including off-site emission sources was required in all cases. Furthermore, in most cases, the production adit with the other RCR sources included produced the highest concentrations.

Cumulative Impact Analysis: Any source outside the mine that had a Montana air quality permit (MAQP) within 50 kilometers of the mine (the modeling distance limitation of AERMOD) was included in the cumulative impact analysis; two mines, Montanore and Troy, fell within this distance criterion. The Montanore Mine (MAQP #3788-00) is about 12 miles northeast of the mine, over the CMWA mountains whereas the Troy Mine (MAQP #1690-02) is about 24 miles northwest of the mine. Tables 7 and 8 list the modeled off-site emissions and emissions characteristics; these parameters were provided by the Department based on previous modeling demonstrations in the area.

Table 7. Modeled Off-Site Emission Sources

Model ID	CO (tpy)[1]	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NO_x (tpy)
Montanore Mine				
LIBPORT1 (Portal #1)	32.33	7.78	1.80	19.04
LIBPORT2 (Portal #2)	32.33	7.78	1.80	19.04
TAREA1 (Tailings Pond #1)		0.11	0.11	0.00
TAREA2 (Tailings Pond #2)		0.11	0.11	0.00
LIBEQUIP (Surface Equipment: Loader, Road Grader)		0.21	0.21	0.02
MSUREQP (Surface, Mill Mobile Sources)		16.46	3.83	10.97
Troy Mine				
GADITN (Transfer of material to crusher)	15.12	1.29	1.29	217.54
GXFER2SA (Crusher #2)		1.10	1.10	
5BAGHSE (Baghouses)		87.16	87.16	
TAIL1 (Tailings Pond #1)		2.47	2.47	
TAIL2 (Tailings Pond #2)		2.47	2.47	
Grand Total	79.78	126.92	102.35	266.61

[1] tpy = tons per year.

Table 8. Modeled Off-Site Emission Characteristics

Point Source	Location	Stack Height (m)[1]	Stack Temperature (°K)[2]	Stack Velocity (m/s)[3]	Stack Diameter (m)
LIBPORT1	Montanore Mine	15.3	294	2.69	8.84
LIBPORT2	Montanore Mine	3.0	294	0.01	145.00
GADITN	Troy Mine	1.0	283	15.70	6.19

Point Source	Location	Stack Height (m)[1]	Stack Temperature (°K)[2]	Stack Velocity (m/s)[3]	Stack Diameter (m)
GXFER2SA	Troy Mine	34.1	294	12.10	0.61
5BAGHSE	Troy Mine	27.4	286	7.10	0.50
Area Source	Location	Release Height (m)	Easterly Length (m)	Northerly Length (m)	Vertical Dimension (m)
TAREA1	Montanore Mine	3.0	770.9	770.9	3.0
TAREA2	Montanore Mine	3.0	770.9	770.9	3.0
LIBEQUIP	Montanore Mine	3.0	15.0	15.0	3.0
Volume Source	Location	Release Height (m)	Horizontal Dimension (m)	Vertical Dimension (m)	
MSUREQP	Montanore Mine	1.5	34.90	1.40	
TAIL1	Troy Mine	5.0	133.14	4.65	
TAIL2	Troy Mine	5.0	133.14	4.65	

[1] m = meters.
[2] °K = degrees Kelvin.
[3] m/s = meters per second.

Background Concentrations: Background concentrations are added to the modeled concentrations in a full cumulative impact modeling demonstration. These concentrations account for sources not explicitly included in the modeling. The USEPA AirData website provided the CO and NO_2 background concentrations for the relevant averaging periods (http://www.epa.gov/airquality/airdata/ad_rep_mon.html). The CO background concentrations were collected for the year 2012 at the Sieben's Flat, MT (Site ID 30-049-0004), the closest CO monitoring site. The closest NO_2 monitoring site relative to the mine was the Kootenai Water District Building north of Hayden, Idaho (Site ID 16-055-0003), about 50 miles west of the mine. The 98th percentile of the daily maximum 1-hour NO_2 concentration for the years 2008 – 2010 was 19 ppb (about 35.7 $\mu g/m^3$). PM10 data were collected near the Montanore Mine, about 7.5 miles east of the mine. The collection period was between July 1, 1988 and June 30, 1989. The $PM_{2.5}$ background concentrations were obtained from the Cabinet Mountains Wilderness Area IMPROVE (Interagency Monitoring of Protected Visual Environments) monitoring site: http://views.cira.colostate.edu/edmf/Explorer/Default.aspx?btid=FEDBanner1&ssp=~/css/fed1.css. The 2003 data was selected which was the most current year of data at that site; this value has been used in previous modeling demonstrations. The annual concentration was 3.5 $\mu g/m^3$ and the high-second-high 24-hour $PM_{2.5}$ of 10.4 $\mu g/m^3$ was selected for the corresponding background concentration. The Department did review 2004 – 2012 CMWA $PM_{2.5}$ monitoring data; the highest high second high was 19.2 μg/m3 in 2006, but the annual averages over this period were all below the 2003 concentration.

Cumulative NAAQS and MAAQS Impacts: Two scenarios were modeled as defined by the mining phase, exploratory or production, with all the other RCR and off-site sources included in each scenario. The results of the NAAQS and MAAQS compliance demonstrations with the off-site emission sources and background concentrations are listed in Table 9. Also noted in this table is the source group, exploratory (EXP) or production (PRO) adit, with all of the other sources included with each adit, that caused the highest pollutant concentrations; in some cases, both source groups (EXP + PRO) produced equivalent concentrations. For the 24-hour $PM_{2.5}$ modeled concentration, the average of the high-first-high of 24-hour concentrations was selected. It should be noted the USEPA released guidance in 2014 that states that the modeled 98th percentile (high-eighth-high) should be selected with 98th percentile background concentration for comparison to the 24-hour $PM_{2.5}$ NAAQS so result in Table 7 for the 24-hour $PM_{2.5}$ is overly conservative (http://www.epa.gov/scram001/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf).

Table 9. NAAQS and MAAQS Results.

Averaging Period	Modeled Concentration (µg/m^3)[1]	Background Concentration (µg/m^3)	Predicted Ambient Concentration (µg/m^3)	NAAQS[2] (µg/m^3)	Percent of NAAQS (%)	MAAQS[3] (µg/m^3)	Percent of MAAQS (%)	Met Period
CO								
1-hour (H2H)[4]	6466 (PRO)[5]	690	7156	40,000	18	26,450	27	2007
8-hour (H2H)	1981 (PRO)	575	2556	10,000	26	10,000	25	1985
PM_{10}								
24-hour (H6H)[6]	27.2 (PRO)	35	62.2	150	41	150	41	2007 - 2011
Annual (H1H)[7]	7.4 (PRO)	14	21.4	NA[8]	NA	50	43	2010
$PM_{2.5}$								
24-hour (H1H)	4.4 (EXP + PRO)[9]	10.4	14.8	35	42	NA	NA	2007 - 2011
Annual (H8H)[10]	1.01 (PRO)	3.5	4.5	12	38	NA	NA	2007 - 2011
NO_2								
1-hour (H8H)[10]	107[11, 12] (PRO)	35.7	142	188	76	564	25	1985
Annual (H1H)	1.8 (PRO)	6	7.4	100	7	94	8	1985

[1] µg/m^3 = micrograms per cubic meter.
[2] NAAQS = National Ambient Air Quality Standard.
[3] MAAQS = Montana Ambient Air Quality Standard.
[4] H2H = high-second-high.
[5] PRO = production adit.
[6] H6H = high-sixth-high or N-1 number of met years processed.
[7] H1H = high-first-high; highest annual average across the 5 years of met data.
[8] NA = Not Applicable. In this case, the annual PM_{10} NAAQS was revoked in 2006 (http://www.epa.gov/fedrgstr/EPA-AIR/2006/October/Day-17/a8477.htm).
[9] EXP = exploratory adit.
[10] H8H = high-eighth-high, 98th percentile.
[11] Concentration is the one-year average of the 98th percentile of the daily maximum 1-hour averages.
[12] The OLM method was applied.

The RCR CO, PM_{10}, $PM_{2.5}$, and NOx emissions with the nearby off-site corresponding emissions will not cause or contribute to a NAAQS or MAAQS violation pertaining to these ambient air pollutants. In most cases, the production adit emissions with the other sources produced the higher ambient concentrations than the exploratory adit emissions with the other sources. The modeled concentrations for CO and NO_2 appear relatively high compared to the background concentrations but this is due to the low release height of the emissions coming out of the adits. The highest percentage of any associated NAAQS limit was the 1-hour NO_2 at 76%. The next closest to any NAAQS limit was the annual PM_{10} NAAQS, but the results from the $PM_{2.5}$ emissions were very similar.

PSD Class I Increment Impact Analysis: Modeling was conducted to evaluate the Prevention of Significant Deterioration (PSD) Class I increments. This analysis is similar to the NAAQQS/MAAQS modeling analysis except for two major differences: no background concentrations are added and actual rather than potential emissions are used. If a source has not been operating or operating under normal condition, the potential emissions must be used. Similar to the NAAQS/MAAQS analysis, a significant impact analysis is performed first before a full impact analysis is conducted that includes off-site sources.

CMWA Receptors: A shapefile of the CMWA obtained from the following website was imported into the AERMOD graphic software interface: http://www2.nature.nps.gov/air/Maps/receptors/. Any receptor from the NAAQS/MAAQS analysis outside the wilderness area boundary was manually removed. Additional receptors (613) were added in Cartesian grid format so the most of the wilderness area was covered; the wilderness area far to the north was not included since the impacts would occur closer to the RCR emission sources. Complete coverage was not necessary to the large size of the wilderness area, over 94,000 acres (almost 147 square miles). A total of 1,272 receptors represented the CMWA.

PSD Class I Significant Impact Analysis: PSD Class I increments exist only for the following project-related pollutants and averaging periods: PM_{10} (24-hour and annual), and NO_2 (annual); there are no increment for CO and $PM_{2.5}$ (24-hour and annual). The USEPA codified PSD Class I $PM_{2.5}$ SILs in October 2010 (http://www.gpo.gov/fdsys/pkg/FR-2010-10-20/pdf/2010-25132.pdf). However, in January 2013, the U.S. United States Court of Appeals for the District of Columbia Circuit vacated and remanded these levels at the request of USEPA (http://epa.gov/nsr/documents/20130304qa.pdf). Currently, the USEPA does not preclude the use of the $PM_{2.5}$ SILs but advise exercising caution when applying the values; therefore, for completeness purposes the $PM_{2.5}$ values were included in this analysis. The highest modeled concentrations were selected for comparison to the PSD Class I significant impact levels; the modeling results are listed in Table 10 with the met period that caused the highest concentrations. Also noted in this table is the source group, exploratory (EXP) or production (PRO), with the other RCR source included that caused the highest pollutant concentrations.

Table 10. PSD Class I Significant Modeling Results.

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)[1]	Class I SIL[2] ($\mu g/m^3$)	Significant? (Y/N)	Met Period
PM_{10}	24-Hour (H1H)[3]	0.27 (EXP)[3]	0.3	N	1985
	Annual (H1H)	0.02 (EXP)	0.2	N	2010
$PM_{2.5}$	24-Hour (H1H)	0.04 (EXP)	0.07	N	2011
	Annual (H1H)	0.002 (EXP)	0.06	N	2010
NO_x	Annual[3] (H1H)	0.03 (EXP)	0.1	N	2010

[1] $\mu g/m^3$ = micrograms per cubic meter.
[2] Class I SIL = Class I significant impact level.
[3] EXP = exploratory adit.

No receptors were significantly impacted using the six years of met; therefore, the modeling analysis demonstrates continued ambient air protection in the CMWA and no cumulative impact analysis was required.

The Department determined, based on the minor level of emissions, proposed BACT methods, and modeling analysis submitted that the impacts from this permitting action will be minor. The Department believes it will not cause or contribute to a violation of any ambient air quality standard.

VII. Taking or Damaging Implication Analysis

As required by 2-10-105, MCA, the Department conducted the following private property taking and damaging assessment.

YES	NO	
X		1. Does the action pertain to land or water management or environmental regulation affecting private real property or water rights?
	X	2. Does the action result in either a permanent or indefinite physical occupation of private property?
	X	3. Does the action deny a fundamental attribute of ownership? (ex.: right to exclude others, disposal of property)
	X	4. Does the action deprive the owner of all economically viable uses of the property?
	X	5. Does the action require a property owner to dedicate a portion of property or to grant an easement? [If no, go to (6)].
		5a. Is there a reasonable, specific connection between the government requirement and legitimate state interests?
		5b. Is the government requirement roughly proportional to the impact of the proposed use of the property?
	X	6. Does the action have a severe impact on the value of the property? (consider economic impact, investment-backed expectations, character of government action)
	X	7. Does the action damage the property by causing some physical disturbance with respect to the property in excess of that sustained by the public generally?
	X	7a. Is the impact of government action direct, peculiar, and significant?
	X	7b. Has government action resulted in the property becoming practically inaccessible, waterlogged or flooded?
	X	7c. Has government action lowered property values by more than 30% and necessitated the physical taking of adjacent property or property across a public way from the property in question?
	X	Takings or damaging implications? (Taking or damaging implications exist if YES is checked in response to question 1 and also to any one or more of the following questions: 2, 3, 4, 6, 7a, 7b, 7c; or if NO is checked in response to questions 5a or 5b; the shaded areas)

Based on this analysis, the Department determined there are no taking or damaging implications associated with this permit action.

VIII. Environmental Assessment

An environmental assessment, required by the Montana Environmental Policy Act, was completed for this project. A copy is attached.

Analysis Prepared By: Craig Henrikson
Date: September 3, 2014

DEPARTMENT OF ENVIRONMENTAL QUALITY
Permitting and Compliance Division
Air Resources Management Bureau
P.O. Box 200901, Helena, Montana 59620
(406) 444-3490

FINAL ENVIRONMENTAL ASSESSMENT (EA)

Issued To: RC Resources Inc.

Montana Air Quality Permit Number: 2414-03

Preliminary Determination Issued: July 18, 2014
Preliminary Determination Reissued: September 30, 2014
Department Decision Issued: October 16, 2014
Permit Final: November 1, 2014

1. *Legal Description of Site*: RC Resources Inc. (RCR) proposes to construct and operate an underground silver/copper mine and processing facility known as the Rock Creek Mine with activities in Township 27N, Range 32W, Sections 26, 27, 34, and 35: and Township 26N, Range 32W, Sections 3, 10, 15, 22, 23, 27, 28, 29, 32, and 33, Sanders County, Montana.

2. *Description of Project*: The proposed action is for re-issuance of a permit to construct an underground copper/silver mine which is scheduled to occur in two different phases. The first phase would be an evaluation phase where the ore body would be characterized using an evaluation adit. A second production phase would expand operations to include two production adits and would include a mill site, and a mill tailings process area. The evaluation adit will be adjacent to the southwestern border of the Cabinet Mountains Wilderness Area.

3. *Objectives of Project*: Re-issuance of a permit for development of an underground copper/silver mine.

4. *Alternatives Considered*: In addition to the proposed action, the Department also considered the "no-action" alternative. The "no-action" alternative would deny issuance of the air quality preconstruction permit to the proposed facility. However, the Department does not consider the "no-action" alternative to be appropriate because RCR demonstrated compliance with all applicable rules and regulations as required for permit issuance. Therefore, the "no-action" alternative was eliminated from further consideration.

5. *A Listing of Mitigation, Stipulations, and Other Controls*: A list of enforceable conditions, including a BACT analysis, would be included in MAQP #2414-03.

6. *Regulatory Effects on Private Property*: The Department considered alternatives to the conditions imposed in this permit as part of the permit development. The Department determined that the permit conditions are reasonably necessary to ensure compliance with applicable requirements and demonstrate compliance with those requirements and do not unduly restrict private property rights.

7. *The following table summarizes the potential physical and biological effects of the proposed project on the human environment. The "no action alternative" was discussed previously.*

		Major	Moderate	Minor	None	Unknown	Comments Included
A	Terrestrial and Aquatic Life and Habitats			X			Yes
B	Water Quality, Quantity, and Distribution			X			Yes
C	Geology and Soil Quality, Stability and Moisture			X			Yes
D	Vegetation Cover, Quantity, and Quality			X			Yes
E	Aesthetics			X			Yes
F	Air Quality			X			Yes
G	Unique Endangered, Fragile, or Limited Environmental Resources			X			Yes
H	Demands on Environmental Resource of Water, Air and Energy			X			Yes
I	Historical and Archaeological Sites			X			Yes
J	Cumulative and Secondary Impacts			X			Yes

SUMMARY OF COMMENTS ON POTENTIAL PHYSICAL AND BIOLOGICAL EFFECTS: The following comments have been prepared by the Department.

A. Terrestrial and Aquatic Life and Habitats

The proposed operation of the underground mine would have minor impacts upon the terrestrial and aquatic life and habitats in areas where the mine and mine operations would be located. Although air pollutant deposition would occur in the areas where the equipment would be sited, the size and nature of the operation, dispersion characteristics of pollutants, and conditions placed in MAQP #2414-03 would result in minor impacts at the site. Therefore, the operation of the equipment would create minor impacts on terrestrial and aquatic life that is present in the area of proposed operation.

B. Water Quality, Quantity, and Distribution

Although there would be air emissions associated with the mine operation in the area where the equipment would operate, there would only be minor impacts on water quality, quantity, and distribution because of the nature, size, operational requirements, and conditions placed in MAQP #2414-03 for the mine and associated equipment. The revised application has included emission factors would result in lower potential emissions than previously submitted. Further, as described in Section 7.F. of this EA, the Department determined that any impacts from deposition of pollutants would be minor. In addition, any accidental spills or leaks from equipment would be required to be handled according to the appropriate environmental regulations in an effort to

minimize any potential adverse impact on the immediate and surrounding area. Overall, the operation of the equipment would have minor impacts to water quality, quantity, and distribution in the area of operations.

C. Geology and Soil Quality, Stability, and Moisture

As a result of the operation of the underground mine, there would be minor impacts to the geology and soil quality, stability, and moisture near the equipment's operational area because of the increased vehicle traffic and deposition of pollutants from the facility. As explained in Section 7.F. of this EA, the facility's size, operational requirements, and conditions placed in MAQP #2414-03 would minimize the impacts from deposition.

D. Vegetation Cover, Quantity, and Quality

The operation of the underground mine and associated equipment would result in minor impacts to the vegetative cover, quantity, and quality, because the siting would require some ground disturbance. As explained in Section 7.F. of this EA, the Department determined that due to the nature of the operation, conditions placed in MAQP #2414-03, and dispersion characteristics of the emissions, any impacts from deposition would be minor. In addition, because the water usage would be limited to use in particulate control (as described in Section 7.B. of this EA) corresponding vegetative impacts from water and soil disturbance would be minimal.

E. Aesthetics

Equipment associated with the mine would be visible and would create some noise in the areas where it would operate. MAQP #2414-03 would include conditions to control emissions (including visible emissions) from the equipment and the surrounding work area. The proposed project site would utilize many of the existing roads, would utilize vans for employee transport, use pipelines to slurry tailings and metallic product and therefore, aesthetic impact would be minor.

F. Air Quality

Air quality impacts from the operation of the underground mine and milling operations would be minor because emissions from the facility would be relatively small when controls such as scrubbers and a baghouse are applied to the equipment. Dispersion and deposition of pollutants would occur from the operation of the facility; however, the Department determined that any air quality impacts from the pollutants would be minor due to dispersion characteristics (from factors such as wind speed and wind direction) and conditions placed in MAQP #2414-03.

MAQP #2414-03 would include conditions limiting opacity from the facility and would require that reasonable precautions be taken to control emissions from haul roads, access roads, parking lots, storage piles and the general work area. In addition, the permit would also limit total emissions from the underground mine and any additional equipment operated at the same site to 250 tons per year or less. Further, because the underground mine has less than 100 tons per year of potential emissions for any pollutant generated, the Department determined that the underground mine is a minor source of emissions as defined under Title V.

G. Unique Endangered, Fragile, or Limited Environmental Resources

In an effort to identify species of special concern that may be present in the proposed areas of operation, the Department contacted the Montana Natural Heritage Program (MNHP) for a new review of species of special concern. The 2001 EIS was also reviewed relative to endangered and fragile species. The MNHP indicates 18 animal species of concern. These include the Great Blue Heron, Harlequin Duck, Bald Eagle, Peregrine Falcon, Brown Creeper, Pacific Wren, Westslope Cutthroat Trout, Bull Trout, Lake Trout, Townsend's Big-eared Bat, Grizzly Bear, Fisher, Wolverine, Northern Alligator Lizard, Western Skink, Robust Lancetooth, Sheathed Slug, and Millipede. Issuance of this permit would increase actual emissions to the atmosphere near any location proposed for the operation of the underground mine. However, as explained in Section 7.F. of this EA, because of the nature of the underground mine, and conditions placed in MAQP #2414-03, any impacts to unique endangered, fragile, or limited environmental resources from the deposition of pollutants would be minor.

H. Demands on Environmental Resource of Water, Air, and Energy

Water would be used on particulate emissions at equipment transfer points, haul roads, access roads, parking lots, or the general plant property, as necessary, to control dust resulting from use of the underground mine. The diesel-fired equipment would consume energy from diesel fuel, a non-renewable resource. Therefore, any impacts on the demands of the environmental resources of water, air, and energy would be minor.

I. Historical and Archaeological Sites

According to correspondence with the Montana State Historic Preservation Office (SHPO), there have been several previously recorded sites in the sections planned for the mine and paste facility which may have cultural resource value. Most of the sites are related to historic mine and timber development. Many of the sites are ineligible for the National Registry according to SHPO, several are listed as "undetermined" and four sites were listed as "consensus determination (CD). Three of the CD sites are listed as "historic railroads" and the fourth CD site is listed as "historic energy development". However, given the proposed underground mine will primarily use existing roadways, minor or no impact to historical or archaeological sites would likely occur. For new land disturbance which occurs, it will be minimal in acreage, and therefore it is unlikely that the project would affect any historic or archaeological site and resulting impacts would be minor.

J. Cumulative and Secondary Impacts

The operation of the underground mine would cause minor effects to the physical and biological environment because although the mine life is limited, some post-mine closure activities and impacts would be on-going. However, any on-going operations would have to operate these post-closure activities in compliance with these mine closure plans. The permits would address the environmental impacts associated with the operations at the proposed site.

The underground mine operations would be limited by MAQP #2414-03 to total emissions of 250 tons/year or less from non-fugitive underground mine operations and any other additional equipment used at any given site.

8. *The following table summarizes the potential economic and social effects of the proposed project on the human environment. The "no action" alternative was discussed previously.*

		Major	Moderate	Minor	None	Unknown	Comments Included
A	Social Structures and Mores				X		Yes
B	Cultural Uniqueness and Diversity				X		Yes
C	Local and State Tax Base and Tax Revenue			X			Yes
D	Agricultural or Industrial Production			X			Yes
E	Human Health			X			Yes
F	Access to and Quality of Recreational and Wilderness Activities			X			Yes
G	Quantity and Distribution of Employment			X			Yes
H	Distribution of Population			X			Yes
I	Demands for Government Services			X			Yes
J	Industrial and Commercial Activity			X			Yes
K	Locally Adopted Environmental Plans and Goals					X	Yes
L	Cumulative and Secondary Impacts			X			Yes

SUMMARY OF COMMENTS ON POTENTIAL ECONOMIC AND SOCIAL EFFECTS: The following comments have been prepared by the Department.

A. Social Structures and Mores

The operation of the underground mine would not likely alter or disrupt any local lifestyles or communities (social structures and mores) in the area of operation because the mine would have a limited life.

B. Cultural Uniqueness and Diversity

The operation of the underground mine would have no impact on the cultural uniqueness and diversity because the operation because the mine would have a limited life

C. Local and State Tax Base and Tax Revenue

The proposed operation of the underground mine would have minor impacts on local and state tax base and tax revenue as the operation would bring moderately paying jobs to the area.

D. Agricultural or Industrial Production

No impact on agricultural production would occur as the proposed site for the underground mine would be located in an area which is primarily forested. The mine itself could be considered industrial production and it is likely that services supporting the mine would provide contract services which could be included in the industrial production category. Therefore, a minor impact on industrial production and related could occur.

E. Human Health

MAQP #2414-03 would incorporate conditions to ensure that the underground mine would be operated in compliance with all applicable rules and standards. These rules and standards are designed to be protective of human health. As described in Section 7.F. of this EA, the Department determined that any impacts from deposition of pollutants would be minor due to dispersion characteristics and conditions placed in MAQP #2414-03. The air emissions from this facility would be minimized by opacity limitations on the facility and the surrounding area of operation.

F. Access to and Quality of Recreational and Wilderness Activities

The proposed underground mine would limit to some degree access to the area immediately part of the permitted mine area. While the proposed mine would operate in the vicinity of the Cabinet Mountain Wilderness, minor access restrictions could occur directly at the mine site for recreational and wilderness activities.

G. Quantity and Distribution of Employment

Given the expected capacity of the operation, it is expected that the activities from the operation of the underground mine would positively affect the quantity and distribution of employment in any given area. A moderate number of new jobs are expected to be created to support all of the types of employment necessary to support a mine operation.

H. Distribution of Population

Given the expected capacity of the operation, it is likely that the activities from the underground mine would cause a shift from the normal population distribution of any given area or at a minimum result in employees being pulled in from communities further out. Some secondary activities would likely move to the proposed area as a result of the proposed underground mine.

I. Demands of Government Services

Government services could be required for acquiring the appropriate permits and ensuring compliance with the permits that would be issued; however, the government services required would be minor.

J. Industrial and Commercial Activity

The operation of the underground mine would represent only a minor increase in the industrial activity in any given area. Some additional industrial or commercial activities would be likely from the operation of the underground mine and secondary activities would be likely from the limited operation facility. Therefore, some minor industrial and commercial activity resulting from the current permit action would be expected.

K. Locally Adopted Environmental Plans and Goals

The Department is unaware of any locally adopted environmental plans or goals at any given site that the underground mine could be operated at under MAQP #2414-03. The conditions identified in MAQP #2414-03 would apply to operation of the underground mine at the proposed mine site as well as the location of the paste facility.

L. Cumulative and Secondary Impacts

Overall, the cumulative and secondary social and economic impacts from this project would be expected to be minor. Some new businesses would be expected to be drawn to the area as a result of the mine. In addition, any social and economic impacts that could be created would be minor because the mine would have a fixed mine life.

Recommendation: No Environmental Impact Statement (EIS) is required.

If an EIS is not required, explain why the EA is an appropriate level of analysis: Because this underground mine is moderately sized by mining standards, and must use reasonable precautions to control emissions, any impacts created would be minor impacts. A previous EIS and ROD was issued in 2001 by Montana DEQ. This permit is for reissuance of an expired permit which results in lower emissions than the previously issued permit.

Other groups or agencies contacted or which may have overlapping jurisdiction: *Montana Historical Society – State Historic Preservation Office, Natural Resource Information System – Montana Natural Heritage Program*

Individuals or groups contributing to this EA: *Department of Environmental Quality – Air Resources Management Bureau.*

EA Prepared by: Craig Henrikson
Date: September 15, 2014

APPENDIX E —

USFWS BIOLOGICAL OPINION

APPENDIX E – USFWS Biological Opinion

The 2006 Biological Assessment (USFWS 2006) and 2007 Supplement to the Biological Assessment (USFWS 2007a) are available in their entirety upon request. Included in this appendix are the cover letter, cover page, summary, table of contents, terms and conditions and terrestrial mitigation plan associated with the 2006 Biological Opinion. For the 2007 Supplement to the Biological Assessment, this appendix includes the cover letter and summary for the Grizzly Bear assessment and the cover page, table of contents, errata, and terms and conditions for the Bull Trout assessment.

United States Department of the Interior

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October 11, 2006

M 19 Rock Creek Mine

Paul Bradford, Forest Supervisor
Kootenai National Forest
1101 Highway 2 West
Libby, Montana 59923

Dear Mr. Bradford:

This document transmits the Fish and Wildlife Service's (Service) final biological opinions based on the Service's review of the proposed Revett Silver Company's Rock Creek Copper/Silver Mine Project (Rock Creek Mine) and associated mining operations. The proposed Rock Creek Mine is located in the Rock Creek drainage which is a tributary to Cabinet Gorge Reservoir on the lower Clark Fork River in Sanders County, Montana. The opinions describe effects of the proposed action on the threatened grizzly bear *(Ursus arctos horribilis),* bull trout *(Salvelinus confluentus),* and bull trout critical habitat. The opinions have been prepared in accordance with Section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.).

The Service prepared these documents in response to the Kootenai National Forest (Forest) request and the accompanying Biological Assessment (BA) dated July 31, 1998, (USDA 1998) amended May 13, 1999 (USDA 1999) for the bull trout.

The biological opinions are based on information provided in the BA, the environmental impact statement, telephone conversations with Forest personnel, and other sources of information. A complete administrative record of this consultation is on file in the Montana Ecological Services Field Office in Helena. If you have any questions, please contact Mark Wilson at 406-449-5225 extension 205.

Sincerely,

R. Mark Wilson

R. Mark Wilson
Field Supervisor
Montana Field Office

SUMMARY

PART A -GRIZZLY BEARS

In 2005, as a result of a lawsuit, the court set aside and remanded the 2003 biological opinion on the Rock Creek Mine project back to the Service for reconsideration. This biological opinion is based on further consideration in accordance with the 2005 court Order and on new information related to the Cabinet-Yaak Ecosystem (CYE) grizzly bear population that became available from 2003 to the present. Potential adverse effects of the proposed Rock Creek Mine are human-caused grizzly bear mortality, displacement of grizzly bears from key habitat due to disturbances caused by the mine and associated activities, and fragmentation of habitat in the narrow CYE. The new information included additional grizzly bear mortality and scientific models that predicted a high likelihood of extinction for grizzly bears in the CYE, unless a number of recommended actions were taken.

The Service reexamined the proposed action and analyzed its effects given the new information, and engaged in further consultation with the Forest during 2005 and 2006. As a consequence, the Forest incorporated additional conservation measures to the mitigation plan to address the new information regarding the CYE grizzly bear population status, and to address the concerns raised by the court. We re-analyzed the revised mitigation plan and concluded that it includes a suite of measures that adequately address the adverse effects, and would ultimately have a net positive impact on grizzly bears and grizzly bear habitat in the CYE. The revised plan more aggressively addresses the adverse impacts of the incidental take expected as a result of development of the mine, as well as the existing conditions in the CYE that lead to human-caused grizzly bear mortality. An Oversight Committee, with technical input and advice from the Service, would work cooperatively to ensure the implementation of the numerous measures in the Forest's mitigation plan. Through implementation of the conservation measures in the mitigation plan, we expect the effects of the proposed action on the CYE grizzly bear population would include the following:

- a reduction in human-caused grizzly bear mortality rates - accomplished by improved education and outreach to mine employees and CYE communities at large, improved attractant storage and management, and effective prevention and/or resolution of conflicts between grizzly bears and people;
- conservation of grizzly bear habitat that might otherwise be developed in the future;
- continued augmentation of grizzly bears into the Cabinet Mountains; and
- continued and enhanced research related to grizzly bear ecology in the CYE and connectivity between the Yaak and Cabinet portions of the CYE.

This improved condition over baseline is anticipated to offset and fully mitigate the impacts of the incidental take anticipated as a result of mine development.

To accomplish the above, over the course of a 35-year period Revett would be required to fund conservation measures including, but not limited to:

- the purchase of or perpetual conservation easement on 2450 acres of high quality grizzly bear habitat in the CYE that is at risk of being developed;
- two Montana, Fish, Wildlife and Parks grizzly bear management specialists over the life of the mine;
- one law enforcement officer over the life of the mine;
- grizzly bear information, education and outreach programs and projects, in cooperation with Montana Fish, Wildlife and Parks and the Forest Service;
- monitoring and research efforts specifically targeting the CYE grizzly bear population, including augmented grizzly bears;
- the purchase of grizzly bear-resistant garbage containers for all mine employees living in or near grizzly bear habitat, and additional containers for the public at large;
- the conversion of the Sanders County garbage transfer station and others in the CYE over time, to be grizzly bear resistant; and
- bear resistant garbage receptacles at Forest Service campgrounds.

Collectively, the conservation measures are reasonably expected to prevent the loss of more than one grizzly bear over the 30-year life of the mine, thus more than offsetting the loss we anticipate from the project (one grizzly bear). The measures in the mitigation plan required of the Forest and Revett, if implemented, would result in a net reduction in future human-caused grizzly bear mortality rates, even with development and operation of the proposed mine. The conservation measures include actions that are known to prevent conflicts between people and grizzly bears, and/or resolve conflicts that do occur in ways that avoid the removal or mortality of grizzly bears. This reduction in human-caused grizzly bear mortality would occur concurrently with Montana Fish, Wildlife and Parks' augmentation of grizzly bears into the CYE. Research indicated that augmentation of small grizzly bear populations combined with a reduction in human-caused mortality had both short- and long-term positive effects on growth rates (Proctor et al. 2004).

Further, construction of the mine would be deferred until at least six female grizzly bears were augmented into the Cabinet Mountains (two of which have already been augmented) and monitored. The addition of six female grizzly bears to the existing population in the CYE prior to construction of the mine would further assure that the potential loss of a female grizzly bear due to the effects of the proposed mine, if such loss were to occur, would be offset (Kasworm et al. 2006b). Although Montana Fish, Wildlife and Parks' augmentation program is independent of the proposed action, Revett would fund a grizzly bear monitoring and research effort in the southern Cabinet Mountains during the operational life of the mine, which would ensure funds for monitoring all augmented bears. This funding would allow the Service to monitor augmented bears, which is essential to the Montana Fish, Wildlife and Parks' continuance of their program. Funding for CYE grizzly bear monitoring to date has been tenuous and not guaranteed, dependent on available annual government funding. Revett has also agreed to provide funding for actual augmentation, in the event that such funding is needed.

The Service anticipates that some low level of take would occur as a result of disturbance-related displacement of one or two female grizzly bears from key habitat due to noise and human activity in the Rock Creek drainage, once construction of the mine begins. Under the project's mitigation plan, grizzly bear displacement would be offset through the purchase of 2,450 acres of

land (over a five-year period) located in or near the southern portion of the Cabinet Mountains Wilderness. This land would be secured and protected from future development through purchases by Revett followed by either conveyance in fee or perpetual conservation easement to the benefit of the Forest. The effects of displacement on the grizzly bear population would be more than offset by the combination of the land acquisition, the existing and improved access management on the Forest, the net reduction in existing and anticipated future human-caused grizzly bear mortality rates, and augmentation of the CYE grizzly bear population. No other grizzly bear ecosystem has received this level of concerted and coordinated effort to reduce conflicts between grizzly bears and people, to enhance population growth, and to reduce the potential for human-caused mortality of grizzly bears. We expect that over time, the combined measures in the mitigation plan would contribute to stabilization and growth of the CYE grizzly bear population.

After reviewing the current status of the grizzly bear, the environmental baseline for the action area, the effects of the proposed Rock Creek Mine and the cumulative effects, it is the Service's biological opinion that the Rock Creek Mine as proposed, is not likely to jeopardize the continued existence of the listed entity of grizzly bears. No critical habitat has been designated for this species, therefore none would be affected.

PART B- BULL TROUT

The adverse effects of the Rock Creek Mine on bull trout, as proposed, are anticipated to be caused by sedimentation and confined to the Rock Creek watershed and Cabinet Gorge Reservoir. Sedimentation is expected to occur during the 5-year construction period and for 2 years afterward. Sediment delivered to Rock Creek could temporarily degrade spawning and rearing habitat and negatively affect water quality. However, after this period the quality of habitat conditions is expected to improve as sediment delivery subsides and sediment transport conditions return to pre-project watershed conditions. Revett would be required to monitor fine sediment and if fine sediment levels approach or exceed specified thresholds in spawning areas or in total in the watershed, corrective actions would be required to address known or potential sources of delivery.

The Service had concerns that over the 35-year operating period and beyond, mining activities may cause chemical contamination in Rock Creek and possibly Cabinet Gorge Reservoir if MPDES standards are exceeded. There is also a concern that mining activities may intercept sources of groundwater that could result in changes in surface flows and stream temperatures in Rock Creek. Although adverse effects are not anticipated at this time, the effectiveness of the proposed mitigation measures over the life of the project is uncertain. Consequently, Revett will be required to provide long-term monitoring designed to detect changes in water chemistry and changes in stream temperature and stream flows. If monitoring results indicate an elevated risk of adverse impacts to bull trout, the Service would request re-initiation of consultation.

Revett would be required to develop final monitoring and mitigation plans prior to project startup. The regulatory agencies would review and approve the plans as an interagency team. The Service would participate on issues and plan development relative to bull trout, bull trout critical habitat,

water use, water quality, groundwater, sediment, and watershed assessment. The Service would have approval authority of these plans, assessments, and evaluations.

After reviewing the current status of the bull trout and bull trout critical habitat, the environmental baseline, the effects of the proposed Rock Creek Mine and the cumulative effects, it is the Service's biological opinion that the Rock Creek Mine as proposed, is not likely to jeopardize the continued existence of the listed entity of bull trout nor adversely modify critical habitat for this species.

Endangered Species Act
Section 7 Consultation

BIOLOGICAL OPINION

on the

Effects to Grizzly Bears, Bull Trout, and Bull Trout Critical Habitat from the Implementation of Proposed Actions Associated with Plan of Operation for the

Revett RC Resources Incorporated Rock Creek Copper/Silver Mine

as proposed by the

U.S. Forest Service, Kootenai National Forest

U.S. Fish and Wildlife Service
Montana Ecological Services Field Office

October 11, 2006

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However, we anticipate that take would not occur until during either the construction phase of the mine itself or the operational phase, due to the large increase in number of mine employees and associated human population growth in the area. Therefore, the construction phase of the mine would proceed only after at least six female grizzly bears were augmented into the Cabinet Mountains. This number of female bears would minimize the impact of the loss on the population in the event a female grizzly bear was killed (Kasworm et. al. 2006). Also, as described earlier in this opinion, we also expect that the suite of measures in the mitigation plan would work concurrently and pro-actively to reduce rates of human-caused grizzly bear mortality from current levels. The mitigation plan would work to reduce potential human-caused mortality both attributable to the mine and not attributable to the mine, and both within and outside the action area. The mitigation plan would fully offset the impacts of any take that does occur due to the mine by reducing the current rates of human-caused mortality of grizzly bears across the entire CYE, including the mortality of grizzly bears not attributable to the mine. Therefore, we anticipate that full implementation of the proposed action and mitigation plan would result in a net reduction in future potential human-caused grizzly bear mortality rates in the CYE.

Reasonable and Prudent Measures

This biological opinion includes reasonable and prudent measures (RPMs) to minimize incidental take. These measures, which are described below, are nondiscretionary and must be implemented by the Forest in order for the exemption in §7(o)(2) to apply. The Forest has a continuing duty to regulate the activities that are covered by this incidental take statement. If the agency fails to adhere to the terms and conditions of the incidental take statement, the protective coverage of §7(o)(2) may lapse. Should the amount or extent of incidental taking be exceeded, or any of the mitigation and conservation efforts be modified, the Forest must confer with the Service immediately to determine if reinitiation of consultation is required.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of grizzly bears:

1. Reduce the potential for incidental take of grizzly bears resulting from displacement from essential habitat.

2. Reduce the potential for incidental take of grizzly bears resulting from habituation and food conditioning.

3. Monitor and record all conflicts between people and grizzly bears, and people and black bears.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must, in addition to implementing the mitigation plan as proposed, comply with the following terms and conditions which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The following terms and conditions implement RPM 1 :

   a) Forest actions shall not result in a net decrease of core area, nor a net increase open or total motorized route densities within BMUs 4, 5, and 6 during the life of the proposed mine.

   b) The Forest shall ensure that reductions in open and/or total motorized route densities or increases in core areas made possible by acquisition of or obtaining conservation easements on mitigation habitat shall be completed within 3 years of acquisition or easement. Improvements shall constitute the baseline from which term and condition 1.a. above is then measured during the life of the mine. At a minimum, upon acquisition or easement, the Forest and Service shall determine whether, where legally possible, the Forest shall temporarily immediately close access routes to reduce open motorized route densities. Final planning processes would then be conducted.

   c) Within one year of issuing the permit for the evaluation adit the Forest shall berm or barrier Bear Creek road (FR 4784) to increase core area in BMU 5 for the life of the mine.

   d) Currently, a portion of Midas Howard Creek Road (FR 4778) is restricted year-long; the South Fork Miller Creek Road (FR 4724) is partially open year-long and has a spring closure on about 6 miles of the route. These closures shall remain in place for the life of the mine to increase grizzly bear security in spring habitat. Additional closures may occur through separate planning processes and may occur due to information gained through the monitoring and research effort.

   e) The Forest shall ensure that land exchanges related to mitigation properties would not result in a loss of MS-1 grizzly bear habitat in the CYE, unless such loss results in significant habitat benefits for grizzly bears, as agreed to by the Service.

   f) The Forest shall ensure that administrative use levels on restricted roads in BMUs 2, 4, 5, 6, 7 and 8 shall be limited to no more than 57 round trips per year divided by spring, summer and fall seasons.

   g) Access management changes shall be monitored and included in the annual Kootenai National Forest monitoring reports.

2. The following terms and conditions implement RPMs 2 and 3 :

   a) Prior to the construction of the evaluation adit, the Forest shall ensure that Revett shall provide funding for the grizzly bear specialist and the law enforcement officer for a period of no less than 5 years. The mitigation plan requires funding for these positions throughout the life of the mine. This up-front funding would ensure the necessary funding to comply with the mitigation plan in the event of a temporary lapse of activity at the mine between the evaluation adit and

construction phases. The mitigation plan requires the positions remain active in the event of temporary shutdowns. If after the evaluation adit phase, Revett withdraws its plan of operation or rescinds permits with the intention of not moving forward with development of the mine, this term and condition would not be required.

b) Prior to the construction of the mine, the Forest, Montana Fish, Wildlife and Parks bear specialists and Service grizzly bear personnel, shall assess the 16 county garbage transfer stations other than the site near the mine entrance. The group shall work with the counties to prioritize the sites and set a schedule for upgrading the sites to grizzly bear-resistant, at those sites deemed in need of such action.

c) Prior to construction of the mine, the Forest shall ensure that Revett provide funding for five years of salary and expenses for the additional grizzly bear specialist position, to be funded for the life of the mine (as in 2a above).

d) The Forest shall seek approval to give the State law enforcement officer authority to enforce the food storage order on the Forest within 2 years of issuing the permit to proceed with the evaluation adit.

e) Any grizzly bear mortality within the action area shall be investigated by the Service, Forest and Montana Department of Fish, Wildlife and Parks. If deemed attributable to the effects of the mine, additional measures as needed and as approved by the Service shall be taken to prevent additional grizzly bear mortality.

f) The Forest shall monitor grizzly bear and black bear sanitation incidents in BMUs 2, 4, 5 ,6, 7, and 8 and take corrective action through Forest enforcement of the food storage order and/or other adequate remedy, or through activities coordinated or conducted by the grizzly bear management specialist and/or Oversight Committee. Incidences involving black bears will be reviewed by the grizzly bear management specialists and the Service to assess whether the conditions leading to the incident may also be a risk to grizzly bears in the area.

g) The Forest shall work with the grizzly bear specialist on public outreach programs that will advance awareness of grizzly bear conservation issues among the public in and surrounding the Cabinet Mountains.

Reporting Requirements

a) By April of the each year, the Forest shall prepare an annual report of grizzly bear and black bear sanitation incidents and corrective measures taken during the previous year.

b) By April of each year, the Forest shall prepare an annual report that summarizes actions taken to comply with the above terms and conditions implementing RPMs 1, 2, and 3 during the previous year .

The reasonable and prudent measures and implementing terms and conditions are designed to minimize the impact of incidental take that might otherwise result from the proposed Rock Creek Mine. If during the course of the proposed action, the level of take (one grizzly bear during life of the mine) is exceeded, such incidental take would require reinitiation of consultation. If terms and conditions implementing reasonable and prudent measure 1 are not adhered to, this may indicate that the level of exempted take due to displacement has been exceeded. The Service retains the discretion to determine whether this is the case and reinitiation of consultation is required. The federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

REINITIATION NOTICE

This concludes formal consultation on the proposed Revett Silver Company Rock Creek mine as proposed by the Kootenai National Forest. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded ; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. The Service retains the discretion to determine whether the conditions listed in (1) through (4) have been met and reinitiation of formal consultation is required. In instances where the amount or extent of incidental take is exceeded, reinitiation of consultation is required.

R. Mark Wilson — 10-11-06

R. Mark Wilson, Field Supervisor — Date
Montana Ecological Services Field Office

TERRESTRIAL THREATENED and ENDANGERED SPECIES MITIGATION PLAN for the PROPOSED REVETT ROCK CREEK MINE

This mitigation plan displays the specific items identified that are required to reduce, eliminate, or compensate for environmental consequences to species federally listed as threatened or endangered. It covers implementing alternative five as displayed in the final environmental impact statement and Record of Decision (2003) for the Rock Creek Mine project and supports requirements from the U.S. Fish and Wildlife Service (here after FWS) Biological Opinion. This mitigation plan will be implemented by the Revett Mining Company and appropriate state and federal agencies. Timing of completion of this plan is tied to three phases of mine activity (evaluation adit, construction, and operation with each requiring a letter from the Forest Service prior to proceeding).

This plan includes requirements for Revett to provide funding for a number of conservation measures that are needed long-term. Should future projects be proposed, that have adverse effects on grizzly bear in the Cabinet-Yaak ecosystem, funding for some of these measures could be required of the proponents, thus potentially changing the proportional funding required by Revett. Those items are marked with an asterisk **(*)** at the end of the measure description.

A. To reduce mortality risk (avoid incidental take) to Threatened and Endangered species Revett Mining Company will comply with the following, under the direction of the Forest:

1. Develop a transportation plan designed to minimize mine related vehicular traffic, traveling between state highway 200 and the mill site, and minimize parking availability at the plant site. Busing employees to the mill site will be a part of the plan. Forest Service approval required. The plan will be in place prior to starting the evaluation adit.

2. NOT use salt when sanding during winter plowing operations to reduce attracting big game, which can result in vehicles killing them. That in turn could draw bald eagles, wolves and grizzly to the road corridor and increase mortality.

3. Daily remove vehicular killed deer and elk from road rights-of-way within the permit area and along roadways used for access or hauling ore (FDR 150, 150A and new roads built for the project). Road kills would be moved at least 50 feet beyond the right-of-way clearing or as far as necessary to be out of sight from the road. During construction and the first three years of full operation, the Revett Mining Company would monitor the number of big game animals killed on these roads and report findings annually. They would also monitor and report (within 24 hours) all grizzly bear, bald eagle, lynx, wolf and black bear mortalities within the permit area. If a T&E species mortality occurs, and the grizzly bear specialists or law enforcement officer feel it is necessary to avoid grizzly bear or other T&E species mortality, the Revett Mining Company would be required to haul the road kill to a dumping location approved by Montana Fish, Wildlife and Parks (MFWP).

4. Construct power lines following criteria outlined by Olendorff, Miller and Lehman (1981) to reduce potential for electrocution of bald eagles.

5. Fund a local MFWP grizzly bear management specialist (with focus on public information and education) position to aid in grizzly bear conservation for the life of the mine. Funding would be provided prior to starting the evaluation adit to cover the first 5 years. The position would be stationed in the lower Clark Fork valley. The purposes are to reduce mortality risk through (1) education of the public on the law and penalty for violation (illegal killing of T&E species); (2) education of hunters on bear identification to reduce accidental killing of grizzly and (3) educate the public on biological needs of the grizzly so that an understanding exists that reduces "social jeopardy" and 4) educates the public on storage of human and pet (animal) food in bear habitat to prevent and correct sanitation problems. The position description and an initial list of work items will be developed jointly by the agencies (including but not limited to Forest Service, FWS, MFWP) and Revett Mining Company representatives. The Forest Service will request review and advice from the FWS on the position description and list of work items. **(*)**

6. Fund a local MFWP law enforcement position for the life of the mine. Funding would be provided prior to starting the evaluation adit to cover the first 5 years. The position would be stationed in the lower Clark Fork valley. The position description and an initial list of work items will be developed by the agencies (Forest Service and Montana Fish, Wildlife and Parks) and Revett representatives. The Forest Service will request review and advice from the FWS on the position description and list of work items. **(*)**

7. Prior to construction of the evaluation adit Revett will:

   a) In order to proceed with the evaluation adit, agree to defer the construction phase of the mine until at least six female grizzly bears have been augmented into the Cabinet Mountains portion of the Recovery Zone (south of Highway 2). Female grizzly bears placed in the Cabinet Mountains on or after 10/01/2005 count toward this requirement. As of 9/19/2006 two female bears have been placed in the Cabinets.

   b) In coordination the Kootenai Forest and Montana Fish, Wildlife, and Parks (MFWP) fund and/or conduct an enhanced outreach and education program to build support and understanding for the conservation of the Cabinet-Yaak grizzly population. This would involve educational materials, public service announcements, newspaper ads, and billboards supporting grizzly conservation. Examples could be signs at entrance roads to all grizzly habitats on the national forest, education programs for schools and civic clubs, and offering a reward leading to arrest and conviction of people illegally killing grizzly bears in the Cabinet-Yaak ecosystem. **(*)**

   c) Coordinate with bear specialist to provide funding for bear resistant garbage containers for personal use, by all mine employees associated with the evaluation adit phase, who live in or near grizzly bear habitat.

8. Prior to starting the construction phase Revett will:

a) Provide funding for a second bear specialist in Libby for life of mine, similar to position described in #5 above. Initial funding to cover first 5 years of the position provided prior to construction start-up. **(*)**

b) Coordinate with bear specialists and provide funding for bear-resistant garbage containers for personal use by all mine employees associated with the construction and operation phases who live in or near grizzly bear habitat.

c) Provide funding for an additional 100 bear resistant garbage containers plus an additional 20 per year, after the first year of construction phase, for distribution to the community at large by the grizzly bear management specialists.

d) Coordinate with bear specialists, FWS, and the Counties to prioritize and provide funding for fencing and electrification of garbage transfer stations in grizzly habitat in the Cabinet Yaak ecosystem. Revett will provide funding for and work with the FWS and Sanders County to make the Noxon Rock Creek garbage collection site bear resistant prior to start of evaluation adit construction. **(*)**

e) Fund an initial 10 electric fencing kits for use at bear problem sites that can be installed by MFWP bear specialists, and then 2 replacements per year, for use as needed. **(*)**

f) Agree that all mortality reduction measures would be subject to modification based on adaptive management, where new information supports changes. Modifications would be reviewed and approved by the oversight committee.

The Forest shall ensure that the law enforcement and information and education positions (grizzly bear personnel) required in the revised mitigation plan comply with the following :

a. Positions shall be located in the Clark Fork River side of the ecosystem.

b. Grizzly bear personnel shall be new positions with Montana Fish Wildlife and Parks.

c. Funding intended for the grizzly bear personnel positions will not be used to support already existing positions with Montana Fish Wildlife and Parks.

d. Duties for the law enforcement position shall be designed at a State grade determined by MFWP (recommend at least a grade14) and will be primarily directed at wildlife issues in the southern Cabinet Mountains of the CYE.

e. Duties for the bear specialist positions shall be designed as a grizzly bear management specialist at a State grade determined by MFWP (recommend at least a grade 14) and will be specifically tied to bear activities in the southern Cabinet Mountains of the CYE.

f. Grizzly bear personnel shall be fully-funded for the life of the mine through the reclamation period and including shut-down periods to provide for long-term consistency, the establishment of relationships with the resident public, familiarity with issues and potential problems in the area, and to address the large number of people who may remain in the area even in the event of temporary mine shut-downs.

g. Grizzly bear personnel will be operational, with all supportive equipment, vehicles and gear, prior to the letter to proceed on the evaluation adit.

h. Establish and maintain (through coordination with the three grizzly bear personnel: 2 specialists and 1 LEO) a mandatory reporting system to ensure that the Revett Mining Company and U.S. Forest Service employees are required to immediately report any black bear or grizzly bear incidents, observations or mortalities to both grizzly bear personnel to ensure that pre-emptive management, hazing, or removal of food attractants would occur to avoid further risks of habituation, mortality or displacement of grizzly bears. The reporting system would also be coordinated with the MFWP grizzly bear management specialist in Libby and would provide a mechanism to collect reliable information from the public on such incidents, although such reporting could not be required.

7. Use bear-resistant containers to hold attractants at all Rock Creek facilities. Remove contents in a timely manner (weekly unless a problem develops or grizzly bear personnel recommend a more frequent schedule). Containers will be in place at each mine facility site prior to starting any work on each site.

8. Avoid the use of clovers or other plants attractive to black or grizzly bears in the seed mix used on open roadways or any facility associated with the Rock Creek Mine (except as rehabilitation on closed roads or mitigation habitat where attracting bears would be encouraged).

9. Prohibit employees from carrying firearms within the permit area, except for security officers and other designated personnel. Identify consequences for violations in the an employment contract so employees will be aware of consequences prior to beginning their employment.

10. Prohibit employees from feeding wildlife (including dropping food stuffs from lunches etc.) within the permit area to avoid attracting bears or other wildlife into conflicts with people and encouraging habituation. Identify consequences for violations in an employment contract so employees will be aware of consequences prior to beginning their employment.

11. Fund the acquisition of bear resistant garbage containers to be placed in all developed campgrounds within Bear Management Units 1, 2, 3, 4, 5, 6, 7, 8 and 9 (pack in/pack out sites will not require garbage containers). The Forest shall ensure that the Revett Mining Company provide bear resistant garbage receptacles for all U.S. Forest Service camp

grounds and sites where garbage facilities are normally provided within the Cabinet portion of the CYE recovery zone (in BMUs 1-9). This includes those in MS-3 habitat, which often serve as the greatest risk to habituate bears and increase risk of bear removal through defense of life or property incidents or management action.**(*)**

12. Require mine employees (including all management staff) to attend training related to living and working in grizzly bear habitat prior to starting work and on an annual basis thereafter or as scheduled by the grizzly bear management personnel.

B. To maintain habitat effectiveness for Threatened and Endangered species, the Revett Mining Company will, under the direction of the Forest:

1. Secure or protect (through conservation easement, including road closures, or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service) from development (including but not limited to housing, motorized access) and use (timber harvest, grazing, mining) replacement habitat to compensate for acres lost by physical alterations, or acres with reduced habitat availability due to disturbance. Replacement acres for Alternative Five are: 2350. The "in kind" replacement acres must provide 2.61 early (6133.5 total), 1.61 late (3783.5 total) for an overall 2.11 habitat unit value (4958.5 total overall HUs). Replacement habitat will be provided using the following schedule:

Activity Area	Replacement Acres	Timing
Evaluation Adit	53	Prior to Eval. Adit
Tailings & AF	806	Prior to Construction
Mill & AF	248	Prior to Construction
Ventilation Adit	10	Prior to Construction
New Roads	102	Prior to Construction
Existing Roads (Reconstruction)	565	Prior to Construction
Existing Roads (Increased Influence)	566	Prior to Operations
Total Alternative 5	2350	Prior to Operations

AF = Associated Features

This schedule will have all replacement habitat (except ventilation adit) in place prior to starting full operations (end of year 5). Replacement habitat for the ventilation adit will be in place prior to its construction, if the adit becomes necessary.

Either fee title or conservation easements are acceptable. Conservation easements will be in perpetuity and transferred to the Forest Service. If fee lands are retained in private (non-Forest Service ownership) a conservation easement protecting the land in perpetuity must be conveyed to the Forest Service. Fee title lands may be considered for donation or land exchange with the Forest Service. Costs of processing land exchanges, and preparing and accepting conservation easement by the Forest Service for these acres will be funded by the Revett Mining Company. Land exchanges would be for equal valued lands as determined by a federal land appraisal. Any exchange must be beneficial to the Forest Service. First choice

for replacement habitat is within the disturbed BMUs (4,5,6). If adequate replacement acres are not available in those BMUs then acres may be found in other BMUs (1, 2, 7 & 8) within the Cabinet Mountains. See the Replacement Habitat Assessment for acceptable lands to consider **(Not available to public until replacement habitat mitigation completed).**

The FWS will be consulted with and asked advice on the mitigation acres and associated conservation easements as they relate to the requirements included in the Biological Opinion on the Rock Creek Mine, at an early stage in the acquistion negotiations. Forest Service will have final approval of mitigation acres and associated conservation easements prior to closing and recording.

The Forest shall ensure that the 2350 acres of mitigation properties be managed for grizzly bear habitat in perpetuity. Properties acquired in fee by the Revett Mining Company must either be transferred to the U.S. Forest Service or must be protected by perpetual conservation easement transferred to the U.S. Forest Service. Easement properties acquired by the Revett Mining Company must be transferred to the U.S. Forest Service. The 2350 acres of mitigation properties must meet the following requirements:

a) The FWS shall be requested to advise the Forest Service if it believes the proposed mitigation properties meet one or more of the following:

i restores or improves bear security habitat (HE and core) in the Southern Cabinet Mountains, particularly in the constricted north-south grizzly bear movement corridor;

ii improves habitat conditions related to established access standards (open motorized route density, total motorized route density) in BMUs 4,5, and 6,

iii reduces existing threats of development, food attractants or mortality risks in the Southern Cabinets,

iv reduces potential threats of development, food attractants or mortality risks in the Southern Cabinets,

v protect seasonally important habitats, with an primary emphasis on spring, and secondary emphasis on fall habitats

vi would maintain or increase MS-1 habitat (including the potential of acquiring and converting MS-3 properties or lands adjacent to the CYE recovery zone that have high mortality risks to MS-1 if those risks could be eliminated under Federal ownership).

b) Fee-title properties or transfers (trades) of NFS lands must meet standards,

requirements and legal processes for Federal acquisition or trade, including, but not limited to:

i approval by the Office of General Counsel,

ii be a Warranty Deed conveyance

iii comply with Department of Justice standards,

iv be free of hazardous materials, or develop an agreement among MOU signers as to appropriate remedy prior to acquisition

v include all surface and sub-surface rights including rights-of-ways, mineral claims, and/or other easements, unless otherwise advised by the FWS

vi be acquired in priority order. Lower priority acquisitions may be allowed, after approval of the Forest Service and when consistent with advice from the FWS to ensure that such a property would contribute to meeting the requirements of the biological opinion.

vii meet fair market appraised value, according to U.S. Forest Service appraisal processes with the allowance that Revett Mining Company could contribute additional funds to facilitate unequal appraised value trades, as approved by the Management Plan. Advanced approval by the Forest Service, after consultation with the FWS regarding the ability of the proposed lands to meet the requirements of the biological opinion, is required.

viii be acquired and recorded prior to the letter to proceed on the associated phase of the mine, with total acquisitions completed prior to the letter to proceed on the construction phase of the mine.

c) Conservation easements must include language approved in the Management Plan and meet standards, requirements and legal processes for Federal acquisition or trade, including, but not limited to:

i approval by the Office of General Counsel,

ii have the conservation easement be attached to the Warranty Deed

iii comply with Department of Justice standards,

iv be free of hazardous materials, or develop an agreement among MOU signers as to appropriate remedy prior to acquisition

v Include all surface and sub-surface rights including rights-of-ways, mineral claims, and/or other easements, unless otherwise advised by the FWS

vi be acquired in priority order. Lower priority acquisitions may be allowed, when consistent with advice from the FWS to ensure that such a property would contribute to avoiding jeopardy.

vii meet fair market appraised value, according to U.S. Forest Service appraisal processes with the allowance that the Revett Mining Company could contribute additional funds to facilitate unequal appraised value trades, as approved by the Management Plan if the affected parcels are consistent with advice from the FWS as being important to avoid jeopardy

viii be acquired and recorded prior to the letter to proceed on the associated phase of the mine, with all mitigation habitat acquired and recorded prior to the letter to proceed on the construction phase of the mine, excepting the mitigation habitat that may be necessary in the event the ventilation adit is required. Mitigation habitat for the ventilation adit would be acquired prior to the letter to proceed on development of the ventilation adit, should it be necessary.

The Forest shall implement access management improvements on lands acquired in the revised mitigation plan. The FWS requires specific mitigation properties to be acquired to improve habitat security, core area, total motorized route density and open motorized route density and will assess other areas prior to acquisition to ensure these lands will be sufficient to avoid jeopardizing the CYE grizzly bear population. These specific areas will be withheld from public disclosure due to their sensitive nature until acquisitions have been finalized.

The FWS agrees to work with the Forest in determining how road management associated with that property can improve access standards, with the goal of managing BMU 4,5 and 6 above levels in the Access Ammendment FEIS (March 2002). The FWS believes that 35 years of 24 hour disturbances as expected with Rock Creek Mine necessitate access management at a conservative level while the disturbance is ongoing. The acquisition of mitigation habitat may provide opportunities to manage access management at these levels in BMU s 4,5, and/or 6. Should mitigation property be acquired that would enable access management at these levels, the FWS expects that the Forest will provide the bears using BMU's 4,5 and 6 the optimum level of access management to reduce displacement and mortality risks during the life of the mine.

2. Fund habitat enhancement, commensurate with loss of habitat effectiveness. Enhancements include, but are not limited to, prescribed fire to restore whitebark pine, road closures and obliterations. Enhancements are preferred in the affected BMUs, however if opportunities are not available, then work may be done in BMUs in the southern portion of the Cabinet Mountains. Generally enhancements would occur in relation to replacement habitat acres.

Enhancements associated with replacement acres will occur in a timely manner as agreed to by the agencies.

BMU	% H.E. Change	Acres H.E. Mitigation
4	+ 1.0	0
5	- 1.1	348
6	- 0.3	136

C. To reduce mortality risk, maintain habitat effectiveness, reduce incidental take and avoid jeopardy for Threatened and Endangered species the Kootenai National Forest, with Revett Mining Company funds, will:

1. Close the following roads prior to the start of construction phase (see maps):

Road Number	Road Name	Closure Miles	Closure Period	Closure Method
2285	Orr Creek	1.61	Yearlong	Barrier
2741X	unnamed	0.18	Yearlong	Barrier
2741A	unnamed	0.51	Yearlong	Barrier
150	Rock Creek	2.92	Yearlong	Gate *

* 2.5 miles gated (south end), 0.42 miles obliterated (north end) - see map

2. Implement a mandatory food storage order for Bear Management Units 4, 5 and 6 prior to allowing the Revett Mining Company to start the evaluation adit, and implement same order throughout the CYE within 5 years of evaluation adit construction.

3. Monitor use on the Rock Lake and St Paul Lake trails to assure use levels do not exceed "high use" as defined by the IGBC. Monitoring visitor use on these trails would begin within 3 years of ROD. Methods used to monitor will be determined by a technical team led by the Forest Service. A recreational use management plan will be developed to assure high use does not occur. The plan will be implemented when monitoring indicates high use has occurred during one bear season. The plan will be prepared within 3 years of the start of the evaluation adit and must be signed by the involved agencies (Forest Service, FWS).

4. In coordination with the FWS the Forest Service will prioritize lands for conservation easement or acquisition in key linkage areas identified by research and monitoring along Highway 2 between the Cabinets and the Yaak.

5. The Forest Service will coordinate with the FWS and MFWP on release sites for augmentation of grizzly bears on National Forest lands.

6. Prior to the start of the construction phase Revett will: Provide funding for bear monitoring in the area along Highway 2 between the Cabinets and the Yaak. The linkage identification work 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 10 GPS collars, collar rebuilds each year for 3 years, salary for one seasonal worker for 6 month per year for 3 years and salary for one GIS technician for 6 months per year for 3 years. **(*)**

D. To address habitat constriction that reduces the potential to achieve CYE grizzly bear recovery goals (by impacting individuals in the Cabinet Mountains) and to avoid Jeopardy, Revett Mining Company will:

1. Secure or protect (through conservation easement, including road closures) or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service from development (including but not limited to housing, motorized access) and use (timber harvest, grazing, mining) 100 acres of replacement habitat that will enhance the north to south habitat corridor in the Cabinet Mountains. These lands are in addition to those identified under mitigation item B-1. All acres of replacement habitat for the constriction impact will be secured prior to starting the evaluation adit. See the Corridor Replacement Habitat Assessment for acceptable lands to consider **(Not available to public until corridor replacement habitat mitigation completed)** Fee title lands within the corridor would be placed in public ownership either through donation or land exchange. Costs of processing land exchanges, and preparing and accepting conservation easement by the Forest Service for these acres will be funded by the Revett Mining Company. Land exchanges would be for equal valued lands as determined by a federal land appraisal. Any exchange must be beneficial to the Forest Service. All land interest conveyed to the Forest Service must be acceptable and approved by the Office of General Counsel. Fee title land must be conveyed by Warranty Deed in accordance with Department of Justice standards. All property, or interest in property, shall be inspected for hazardous substances in accordance with law, regulation and policy. If hazardous substance are found an agreement needs to be reached on removal and remedial action.

The Forest shall ensure that, the 100 acres of mitigation habitat required to enhance the north-south corridor in the Cabinet Mountains:

a. the fee title or perpetual conservation easement to the 100 acres of mitigation property, be acquired by or transferred to the U.S. Forest Service;

b. include the specific properties identified by the FWS to avoid jeopardy (which will be released to the public when acquisition has been completed and recorded);

c. the U.S. Forest Service will request that the FWS advise the agency as to whether the proposed acres meet the requirements of the biological opinion, and once confirmed, will be acquired and recorded prior to the letter to proceed on the evaluation adit;

d. be managed as grizzly bear security habitat (core) throughout the life of the mine, including the reclamation period and any temporary or extended shutdown periods, and thereafter managed in a manner consistent with grizzly bear conservation requirements;

e. maintain or improve existing baseline core requirements (or other goals affiliated with Alternative E of the FEIS for Access Amendment on the Forest, Lolo and Panhandle National Forests, USDA 2002b); and

f. have any habitat enhancement activities needed to improve the mitigation properties, such as road closures or restoration, be planned and funded prior to the letter to proceed on the associated phase of the mine. Implementation will occur as soon as feasible (e.g. upon completion of any required NEPA process).

E. To assure compliance with the T&E species mitigation plan, and effectiveness of the management plan the Forest Service or Revett Mining Company will:

1. Prior to the Evaluation adit,

a) Revett will establish a trust fund and/or post a bond, to cover the mitigation plan implementation costs. The amount in the fund or posted in a bond will be commensurate with projected work and associated required mitigation items. The oversight committee will determine the amount of trust fund deposits, to be made in five year increments over the life of the mine.

b) Forest Service will lead a stakeholders information annual meeting. Stakeholders may include, but not limited to state and federal agency, county commissioners, mining company, local citizen, and NGO group representatives. The objectives of the meetings are to review a) management objectives, b) implementation of mitigation measures and c) monitoring and research results.

c) Forest Service would agree to adopt management actions in response to new information from monitoring to assure that on going management meets the objectives for grizzly bears in the Cabinet-Yaak ecosystem.

2. Participate in the development of and be a signer on a Memorandum of Understanding (MOU) that

The Forest shall develop an M.O.U. with FWP, the Revett Mining Company and other parties deemed appropriate by the Forest. The MOU must be completed prior to the Forest issuing the Revett Mining Company the letter to proceed with the evaluation adit. The MOU shall establish roles, responsibilities and time lines of an Oversight Committee comprised of members of the Forest, Montana Department of Fish, Wildlife and Parks, and other parties deemed appropriate by the parties named. The FWS shall be an ex-officio, non-voting member of the Oversight Committee, with only advisory responsibilities.

The Oversight Committee shall be responsible for the development of a Comprehensive Grizzly Bear Management Plan and its implementation. The Comprehensive Grizzly Bear Management

Plan shall focus on the Cabinet portion of the CYE and would fully include all provisions of the Forest's mitigation plan for grizzly bears, except where superceded by the FWS's Biological Opinion. It would also include provisions for adaptive management. The plan would be developed in detail by the parties to assure that human access to grizzly bear habitat, grizzly bear habitat quality, grizzly bear mortality, and habitat fragmentation issues shall be addressed to the extent that jeopardy would be avoided. Advice and comments on the plan from the FWS shall be requested and fully considered, including advice on whether the plan would meet the requirements of the biological opinion.

The Oversight Committee, led by the Forest, shall over the 35-year life of the mine:

a) assume responsibility for coordinating various aspects of the Management Plan;

b) assume responsibility for maintaining effective communication among all Committee members, stake holders, and interested public;

c) integrate the principles of adaptive management; collect, disseminate where needed, and review new information on grizzly bears, the results of implementation of the Comprehensive Grizzly Bear Management Plan over time, and other information related to CYE grizzly bears. If information or relevant data indicate appropriate, ensure the needed analysis and development of recommendations for changes or additions to the mitigation plan over the 35 year life of the mine, if such action is needed to ensure the proposed action is not likely to jeopardize the CYE grizzly bear population. The FWS would be asked to review proposed revisions to the Comprehensive Grizzly Bear Management Plan under appropriate section 7 provisions, if required.

The FWS shall be an advisor in the development of the MOU and subsequent Comprehensive Grizzly Bear Management Plan, and the Forest Service will request that the FWS advise, in writing, that the plan would meet the requirements of the biological opinion.

The MOU shall be completed prior to the letter to proceed on the evaluation adit and require the Forest to:

1) Ensure the Management Plan is completed prior to the construction phase of the mine.

2) Establish time frames for mitigation and implementation of other management to occur prior to the letter to proceed on the phase of the mine associated with that mitigation or management activity.

3) Ensure adequate funding, from the Revett Mining Company, to implement the revised mitigation plan according to the time frames.

4) Comply with legal guidelines or processes in as timely manner as possible in order to meet the mitigation plan and/or Comprehensive Grizzly Bear Management Plan implementation schedule.

5) Ensure that the FWS is consulted on the mitigation properties and the Comprehensive Grizzly Bear Management Plan and the FWS is requested to advise the Forest Service if the properties and the Plan meet the requirements in the biological opinion. All mitigation properties not specifically mentioned shall have undergone all necessary procedures for procurement including recordation, prior to the letter to proceed on the associated phase of the mine.

6) Establish language and legal procedures to ensure that mitigation properties acquired through fee title, land transfer or conservation easement:

a. are perpetual;
b. meet federal policies and regulations regarding such realty actions;
c. have the FWS advise whether they would meet the biological opinion requirements;
d. would be implemented and recorded in advance of the phase of the mine with which they are associated;
e. would increase or at least maintain a no net loss of MS-1 CYE habitat;
f. would be adequately funded such that enforcement of easement terms is assured;
g. would be selected on a priority basis with biologically justifiable rationale and the FWS advice that they meet the requirements included in the biological opinion;
h. would ensure management in support of grizzly bear survival and recovery if in public ownership.

The Comprehensive Grizzly Bear Management Plan shall include the measures in the mitigation plan, except where the mitigation plan has been superceded by the FWS's Biological Opinion. In addition, processes shall be established to ensure that access management, prevention of habituation, educational opportunities, reporting and monitoring, enforcement of easements, and management actions are being adequately implemented. Further, the Comprehensive Grizzly Bear Management Plan will establish processes to revise management, access, education or habitat enhancement strategies as new research or policies, such as revised IGBC guidelines.

3. Contribute funding to support monitoring of bear movements and population status in the Southern Cabinet Mountains to confirm the effectiveness of mitigation measures implemented to provide a secure north to south movement corridor. The Forest shall ensure that adequate funding, provided by the Revett Mining Company, is available to monitor bear movements and use of the Southern Cabinet Mountains to confirm the effective implementation of mitigation measures. Information gained would be useful in determining whether the mitigation plan is working as intended. If not, the information would help in developing new management strategies that would be incorporated in the Biological Opinion through appropriate ammendments. Funding would supplement ongoing research and monitoring activities in the CYE, would be conducted or coordinated by the FWS's grizzly bear researcher in Libby or his 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 shall ensure that funding, provided by the Revett Mining Company, is available on an annual basis, two 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 the letter to proceed on the evaluation adit and would continue throughout the life of the mine through the reclamation phase. **(*)**

APPENDIX C (data from Kasworm et al. in litt. 2006a)

Table 1. (**DRAFT** 10/4/06) Known grizzly bear mortality in or near the Cabinet-Yaak recovery zone and the Yahk grizzly bear population unit in British Columbia, 1949-05 (from Kasworm et al. in litt. 2006a).

YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
1949	COPPER CR, MT	1	ADULT FEMALE	HUMAN, HUNTER KILL
1950	SQUAW CR, MT	1	SUBADULT	UNKNOWN
1951	PETE CR, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1951	PAPOOSE CR, MT	2	SUBADULTS	UNKNOWN
1951	GOAT CR, MT	1	SUBADULT MALE	UNKNOWN
1952	FELIX CR, MT	6	2 ADULT FEMALES, 4 YEARLINGS	HUMAN, MANAGEMENT REMOVAL
1953	OBRIEN CR, MT	1	SUBADULT MALE	HUMAN, HUNTER KILL
1953	KENELTY MT, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	20-ODD MT, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	BURNT CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1953	17-MILE CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	N F BULL R, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	S F BULL R, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	CEDAR LK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	CEDAR LK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	TAYLOR PK, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	SILVERBUTTE CR, MT	1	UNKNOWN	HUMAN, HUNTER KILL
1954	SILVERBOW CR, MT	1	ADULT FEMALE	HUMAN, HUNTER KILL
1955	WOLF CR, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1955	MT HEADLEY, MT	1	SUBADULT	HUMAN, MANAGEMENT REMOVAL
1955	BAREE LK, MT	1	ADULT MALE	UNKNOWN
1955	BAREE LK, MT	1	ADULT FEMALE	UNKNOWN
1955	BEAR CR, MT	1	SUBADULT MALE	HUMAN, HUNTER KILL
1958	SQUAW CR, MT	1	ADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
1959	E F ROCK CR, MT	2	ADULT FEMALE, 1 CUB	HUMAN, HUNTER KILL
1959	W F THOMPSON R, MT	4	ADULT FEMALE, 3 CUBS	UNKNOWN
1959	CLIFF CR, MT	1	UNKNOWN	UNKNOWN
1960	PROSPECT CR, MT	2	ADULT FEMALE, 1 CUB	UNKNOWN
1964	GRAVES CR, MT	2	SUBADULTS	UNKNOWN
1964	WANLESS LK, MT	3	SUBADULTS (ADULT WOUNDED)	UNKNOWN
1965	SNOWSHOE CR, MT	2	SUBADULTS	UNKNOWN
1965	PINKHAM CR, MT	1	UNKNOWN	UNKNOWN
1967	SOPHIE LK, MT	1	UNKNOWN	UNKNOWN
1968	BEAR CR, MT	1	ADULT FEMALE	HUMAN, ILLEGAL KILL
1968	GRANITE CR, MT	1	SUBADULT MALE	HUMAN, MANAGEMENT REMOVAL
1969	PRISCILLA PK, MT	1	ADULT FEMALE	UNKNOWN
1970	THOMPSON R, MT	1	UNKNOWN	UNKNOWN
1970	CAMERON CR, MT	1	SUBADULT MALE	UNKNOWN
1970	SQUAW CR, MT	2	ADULT FEMALE, SUBADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
1971	MURR CR, MT	1	ADULT FEMALE	UNKNOWN
1972	ROCK CR, MT	1	SUBADULT	HUMAN, MISTAKEN IDENTITY (Black Bear)
1974	SWAMP CR, MT	1	ADULT MALE	HUMAN, HUNTER KILL
1977	RABBIT CR, MT	1	ADULT MALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1978	MOYIE LAKE, BC	1	SUBADULT MALE	HUMAN, MANAGEMENT
1982	GROUSE, ID	1	ADULT MALE	HUMAN, ILLEGAL KILL
1984	HARVEY CR, ID	1	UNKNOWN	HUMAN, MISTAKEN IDENTITY (Black Bear)
1985	LYONS CR, MT	1	ADULT MALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1986	BURNT CR, MT	1	CUB	UNKNOWN (NATURAL)
1987	FLATTAIL CR, MT	1	FEMALE CUB	HUMAN, MISTAKEN IDENTITY (Elk)
1988	LEWISBY CR, BC	1	ADULT MALE	HUMAN, HUNTER KILL (BC)
1988	N F 17-MILE CR, MT	1	ADULT FEMALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1989	BURNT CR, MT	1	SUBADULT FEMALE	HUMAN, RESEARCH TRAP (Predation)
1990	POVERTY CR, MT	1	SUBADULT MALE	HUMAN, ILLEGAL
1992	TRAIL CR, MT	1	ADULT FEMALE	UNKNOWN
1993	LIBBY CR, MT	2	ADULT FEMALE AND CUB	UNKNOWN (NATURAL)
1994	JIM CR, BC	1	SUBADULT MALE	HUMAN, MANAGEMENT
1994	SOUTHWEST CRANBROOK, BC	3	2 FEMALES AND 1 MALE	HUMAN, MANAGEMENT
1995	RYAN CR, BC	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1996	DODGE CR, MT	1	SUBADULT MALE	HUMAN, UNDER INVESTIGATION

YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
1996	GOLD CR. BC	1	ADULT MALE	HUMAN. UNDER INVESTIGATION
1997?	LIBBY CR. MT	1	ADULT MALE	HUMAN. ILLEGAL
1997	PLUMBOB CR. BC	1	MALE	HUMAN. MANAGEMENT
1997	WARDNER. BC	1	ADULT FEMALE	HUMAN. MANAGEMENT
1997	MAYOOK. CR.BC	1	SUBADULT MALE	HUMAN. ILLEGAL KILL
1999	17 MILE CR. MT	3	ADULT FEMALE. 2 CUBS	NATURAL MORTALITY (Predation)
1999	W FK YAHK R. BC	1	SUBADULT FEMALE	HUMAN. DEFENSE OF LIFE BY HUNTER
1999	E FK YAAK R. MT	1	ADULT MALE	HUMAN. MANAGEMENT REMOVAL
2000	HAWKINS CR. BC	2	2 CUBS	UNKNOWN (NATURAL)
2000	FOWLER CR. MT	1	1 CUB	UNKNOWN (NATURAL)
2000	PETE CR. MT	1	SUBADULT FEMALE	HUMAN. UNDER INVESTIGATION
2001	COLD CR. BC	2	2 CUBS	UNKNOWN (NATURAL)
2001	SPREAD CR. MT	1	SUBADULT FEMALE	HUMAN. MISTAKEN IDENTITY (Black Bear)
2001	ELK CR. MT	1	ADULT FEMALE	HUMAN. TRAIN COLLISION
2002	MARTEN CR. MT	1	SUBADULT FEMALE	NATURAL
2002	PORCUPINE CR. MT	1	SUBADULT FEMALE	HUMAN. UNDER INVESTIGATION (Illegal)
2002	YAAK R. MT	4	ADULT FEMALE. 3 CUBS	HUMAN. ILLEGAL
2002	BLOOM CR. BC	1	UNKNOWN	HUMAN. BLACK BEAR HOUND HUNTERS
2002	KOOTENAY R. BC	1	FEMALE	HUMAN. DEFENSE OF LIFE
2004	WEST FORT STEELE. BC	1	MALE	HUMAN. DEFENSE OF LIFE AT DUMP
2004	JIM CR. BC	1	ADULT MALE	HUMAN. MISTAKEN IDENTITY
2004	NEWGATE.BC	1	ADULT FEMALE	HUMAN. MANAGEMENT REMOVAL
2005	RUSSELL CR. BC	1	ADULT MALE	HUMAN. HUNTER KILL (BC)
2005	GOVERNMENT CR. MT	1	SUBADULT FEMALE	HUMAN. TRAIN COLLISION
2005	PIPE CR. MT	1	SUBADULT FEMALE	HUMAN. ILLEGAL
2005	YAAK R. MT	1	SUBADULT MALE	HUMAN. ILLEGAL

Table 2. (**DRAFT** 10/4/06) Credible grizzly bear sightings, credible female with young sightings, and known human caused mortality by bear management unit (BMU) or area, 2005 (from Kasworm et al. in litt. 2006a).

BMU or Area	2005 Credible Grizzly Bear Sightings	2005 Female with Cub sightings (Unduplicated)	2005 Sightings of Females with Yearlings or 2-year-olds[2]	2005 Human Caused Mortality
3	1	0	0	0
4	1	0	0	1
5	6	1	2	0
6	5	0	4	0
10	4	0	0	0
11	4	0	0	1
12	3	0	0	0
13	1	0	0	0
14	1	0	0	0
15	5	0	0	0
16	1	0	0	1
17	2	0	2	0
20	1	0	0	0
British Columbia[1]	2	0	1	0
Cabinet Face[1]	2	0	0	0
Tobacco[1]	8	0	2	0
West Kootenai[1]	3	0	0	0
2005 TOTAL	50	1	11	3

[1] Areas are outside of Cabinet-Yaak recovery zone.
[2] Sightings may duplicate the same animal in different locations

Table 3. (**DRAFT** 10/4/06) Annual Cabinet-Yaak recovery zone (excluding Canada) grizzly bear minimum unduplicated counts of females with cubs and known human-caused mortality, 1988-2005 (from Kasworm et al. in litt. 2006a).

YEAR	ANNUAL FWC'S	ANNUAL HUMAN CAUSED ADULT FEMALE MORTALITY	ANNUAL HUMAN CAUSED ALL FEMALE MORTALITY	ANNUAL HUMAN CAUSED TOTAL MORTALITY	4% TOTAL HUMAN CAUSED MORTALITY LIMIT[1]	30% ALL FEMALE HUMAN CAUSED MORTALITY LIMIT[1]	TOTAL HUMAN CAUSED MORTALITY 6 YEAR AVERAGE	FEMALE HUMAN CAUSED MORTALITY 6 YEAR AVERAGE
1988	1	1	1	1	0	0		
1989	0	0	1	1	0	0		
1990	1	0	0	1	0	0		
1991	1	0	0	0	0	0		
1992	1	0	0	0	0	0		
1993	2	0	0	0	0.9	0.3	0.5	0.3
1994	1	0	0	0	0.9	0.3	0.3	0.2
1995	1	0	0	0	0.9	0.3	0.2	0
1996	1	0	0	1	0.7	0.2	0.2	0
1997	3	0	0	1	1.2	0.4	0.3	0
1998	0	0	0	0	0.9	0.3	0.3	0
1999	0	0	0	1	0.7	0.2	0.5	0
2000	2	0	1	1	0.5	0.1	0.7	0.2
2001	1	1	2	2	0.5	0.1	1.0	0.5
2002	4	1	4	5	1.2	0.4	1.7	1.2
2003	2	0	0	0	1.2	0.4	1.5	1.2
2004	1	0	0	0	1.4	0.4	1.5	1.2
2005	1	0	2	3	0.9	0.3	1.8	1.5

[1] Presently grizzly bear numbers are so small in this ecosystem that the mortality goal shall be zero known human-caused mortalities.

Table 4. (**DRAFT** 10/4/06) Status of the Cabinet-Yaak recovery zone during 2000-2005 in relation to the demographic recovery targets from the grizzly bear recovery plan (USFWS 1993) (from Kasworm et al. in litt. 2006a).

Recovery Criteria	Target	2000-2005
Females w/cubs (6-yr avg)	6.0	1.8 (11/6)
Human Caused Mortality limit (4% of minimum estimate)	0.9	1.8 (6 yr avg)
Female Human Caused mortality limit (30% of total mortality)	0.3	1.5 (6 yr avg)
Distribution of females w/young	18 of 22	12 of 22

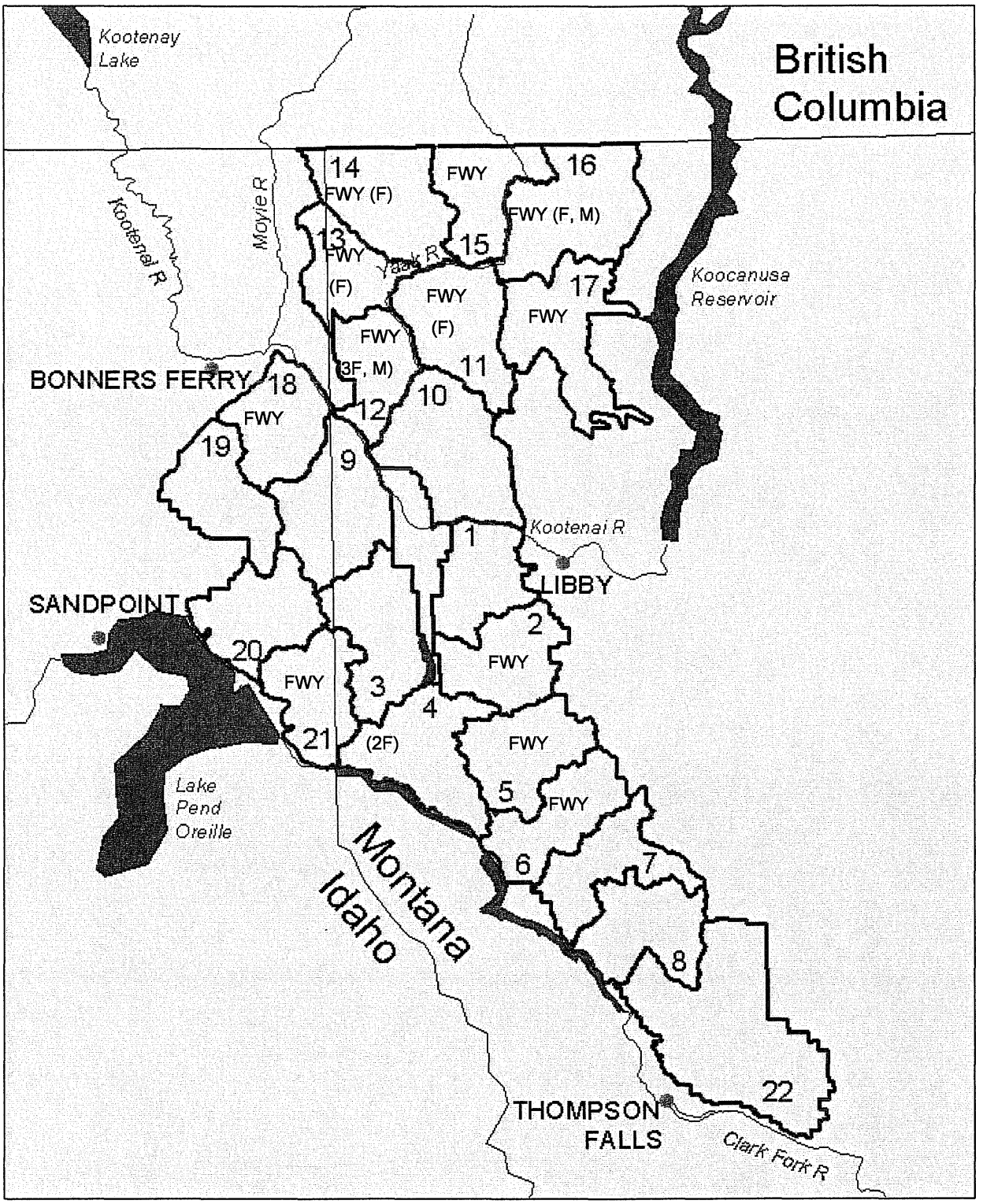

Figure 1. (**DRAFT** 10/4/06) Female with young occupancy and mortality by Bear Management Units (BMUs) within the Cabinet-Yaak recovery zone 2000-2005. (FWY indicates occupancy of a female with young and the sex of any mortality is indicated within parentheses).

Table 5. (**DRAFT** 10/4/06) Credible observations of females with young in or within 10 miles of the Cabinet-Yaak recovery zone, 1988-2005. Observations from Canada shown in parentheses (from Kasworm et al. in litt. 2006a).

Year	Total credible sightings females with young	Unduplicated females with cubs	Unduplicated females with yearlings or 2-year-olds	Minimum probable adult females
1988	3	1	1	2
1989	13	0	3	3
1990	9	1	2	3
1991	4	1	1	2
1992	8	1	5	6
1993	6	2	1	3
1994	5	1	2	3
1995	8	1	2	3
1996	5	1	1	2
1997	14 (1)	3	4	7
1998	6 (1)	0	2 (1)	2 (1)
1999	2	0	2	2
2000	6 (1)	2 (1)	1	3 (1)
2001	5 (2)	1 (1)	3	4 (1)
2002	10 (1)	4 (1)	1	5 (1)
2003	11	2	4	6
2004	11	1	4	5
2005	9 (1)	1	4 (1)	5 (1)

Table 6. (**DRAFT** 10/4/06) Occupancy of bear management units by grizzly bear females with young in the Cabinet-Yaak recovery zone 1988-2005 (from Kasworm et al. in litt. 2006a).

BMU	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1 CEDAR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
2 SNOWSHOE	No	No	Yes	No	No	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No
3 SPAR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
4 BULL	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No
5 ST. PAUL	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No	No	Yes	Yes	Yes
6 WANLESS	No	No	No	No	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes
7 SILVER BUTTE	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No
8 VERMILION	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
9 CALLAHAN	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
10 PULPIT	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
11 RODERICK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
12 NEWTON	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No
13 KENO	No	Yes	No	No	Yes	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	No
14 NORTHWEST PEAK	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	No	No	Yes	No	No	No
15 GARVER	No	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	No	No
16 EAST FORK YAAK	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	Yes	No	No
17 BIG CREEK	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes
18 BOULDER	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No
19 GROUSE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
20 NORTH LIGHTNING	No	No	No	No	Yes	No	Yes	No	No	No	No	No	No	No	No	No	No	No
21 SCOTCHMAN	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No
22 MT HEADLEY	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

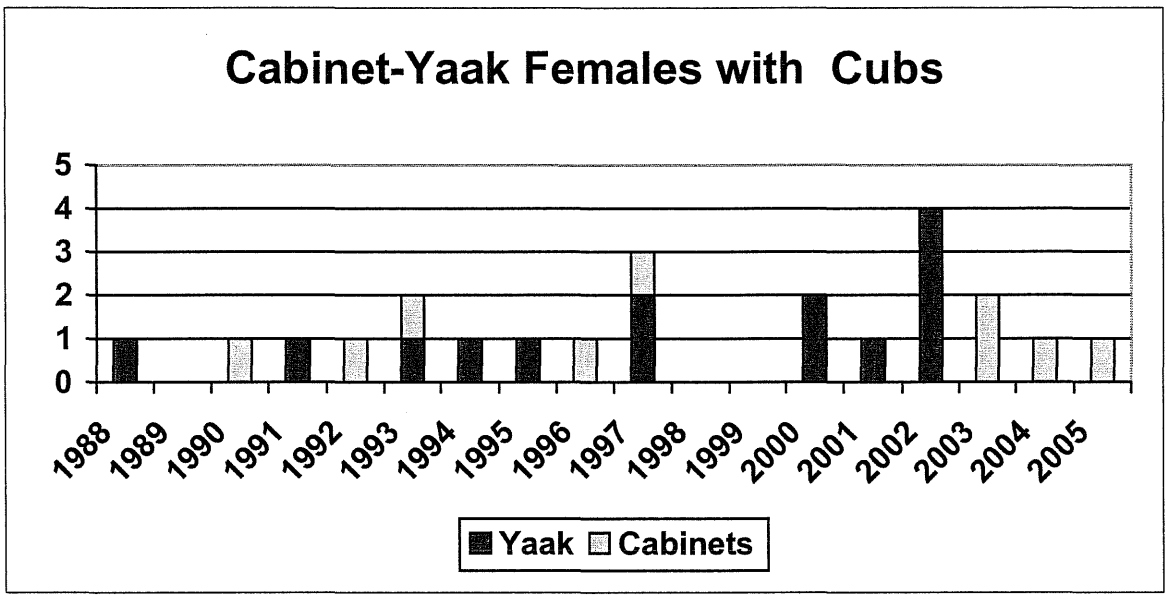

Figure 5. (DRAFT 10/4/06) Credible observations of females with cubs in or within 10 miles of the Cabinet-Yaak recovery zone (excluding Canada), 1988-05 (from Kasworm et al. in litt. 2006a.).

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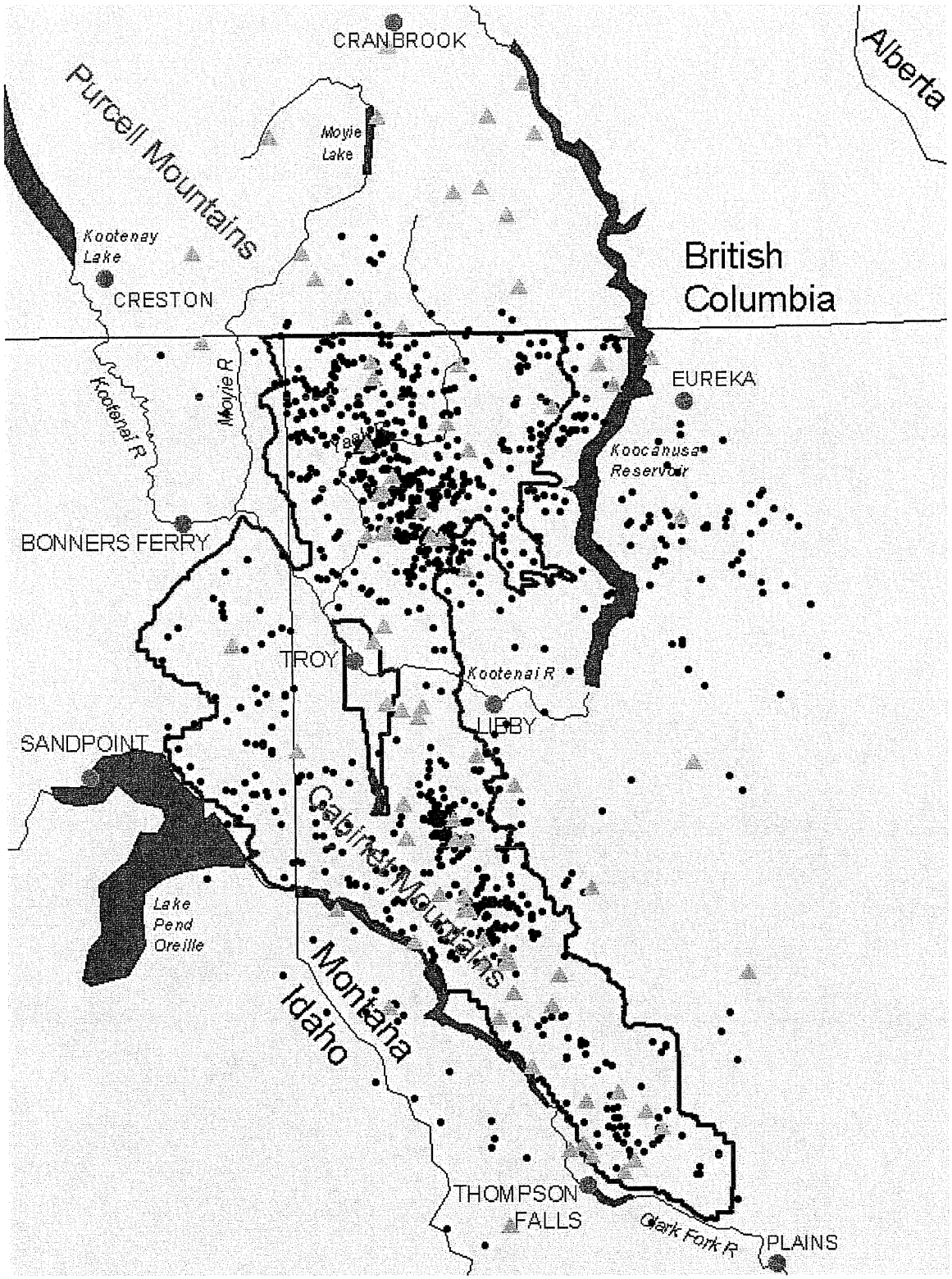

Figure 2. (**DRAFT** 10/4/06) Grizzly bear observations (1959-2005, circles) and mortality (1949-2005, triangles) in the Cabinet-Yaak recovery area. (from Kasworm et al. in litt. 2006).

Endangered Species Act
Section 7 Consultation

BIOLOGICAL OPINION

on the

Part B: Effects to Bull Trout from the Implementation of

PROPOSED ACTIONS ASSOCIATED WITH PLAN OF OPERATION FOR THE

REVETT RC RESOURCES INCORPORATED ROCK CREEK COPPER/SILVER MINE

as proposed by the

U.S. Forest Service, Kootenai National Forest

U.S. Fish and Wildlife Service
Montana Ecological Services Field Office

October 11, 2006

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5. Complete a risk assessment of road failure related to haul routes and mine related vehicle traffic. Incorporate any additional measures identified to minimize the risk of road failures and the associated impacts to bull trout.

6. Incorporate any additional measures identified to minimize the risk of failure of the paste pile or facility and the associated impacts to bull trout.

7. Implement reporting and consultation requirements as outlined in the following terms and conditions.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The following terms and conditions are established to implement reasonable and prudent measure No. 1:

   Upon the of issuance of the letter of approval for the Rock Creek mine, the Forest would require the applicant to initiate baseline studies for use in a complete watershed assessment of Rock Creek. The Forest would require the applicant to complete and submit a comprehensive watershed assessment to the Forest and Service prior to surface disturbance activity *not* related to the evaluation adit stage of the project.

   The comprehensive watershed assessment would include information to characterize the Rock Creek bull trout population, instream and riparian habitat conditions and existing sediment sources in the basin and would address the following issues for bull trout:

   a. A monitoring plan to document the prevalence of Rock Creek bull trout. That monitoring plan would include studies to define bull trout distribution, densities, age class structures, genetics, and status of resident and migratory (adfluvial) bull trout.

   b. An assessment and subsequent monitoring to define the prevalence and distribution of brook and brown trout. In conjunction with Montana Fish, Wildlife and Parks, determine the feasibility of removing brook and brown trout from Rock Creek using accepted methodology. Evaluate the potential reduction of hybridization and competition risk by non native species and benefit to bull trout. If determined feasible and needed, subject to agreement with Montana Fish, Wildlife and Parks, remove brook and brown trout from the Rock Creek drainage using accepted methodology.

c. An assessment of current instream and riparian habitat conditions for bull trout. The assessment would include information on quantity and quality of spawning, rearing and overwintering conditions for resident and adfluvial bull trout. It would include a pre-and post-project assessment of riparian conditions including floodplain and channel migration zone areas, and fish passage barriers (natural and man-made).

d. An assessment of possible sediment mitigation and reduction projects within the Rock Creek watershed as outlined in the proposed action. Recommendations of stream enhancement projects should be included in that assessment.

e. A feasibility assessment (including engineering options, conceptual designs, estimated costs and expected sediment load effects) for sediment abatement measures that would reduce sediment levels in the Rock Creek drainage. This assessment would include any designs for the proposed stream diversion around the proposed paste facility and a complete roads analysis and recommendations associated with mine activities and proposed mitigation projects. This assessment will identify all potential sources of sediment (natural and man-caused) such as mass wasting areas and drainage from road surfaces.

(1) The sediment abatement program shall implement sediment mitigation actions designed to reduce sediment levels in Rock Creek by 38% (the projected increase in sediment levels attributable to development of the mine as described in the BA) <u>prior to</u> surface disturbance activity not related to the evaluation adit stage of the project.

(2) Upon completion of the feasibility assessment (1. d., above), the Forest would require the applicant to complete design and permitting requirements, in consultation with MDEQ, the Forest, and the Service, and begin construction of such sediment abatement measures as agreed to by the Forest and the Service.

f. Upon the issuance of the letter of approval for the Rock Creek Project, the Forest would require the applicant to complete and submit to the Forest and the Service a sediment monitoring plan that would adequately assess the current (i.e., baseline) and long-term status of sediment levels in Rock Creek. The sediment monitoring plan would be developed in consultation with MDEQ, the Forest and the Service and would address the entire Forest permit time period. This also would include a complete assessment of the effectiveness of the sediment abatement program in the Rock Creek drainage. If the assessment concludes, and the Service agrees, that the sediment abatement program failed to substantially reduce sediment levels in Rock Creek, then the applicant would prepare an assessment of other measures that could be implemented in the Rock Creek drainage and would be completed in a time frame agreed to by the Service.

g. Establish and document the natural hydrograph conditions prior to the mine becoming fully operational. Install a system of stream gages, as necessary, in order to record various stream flow conditions throughout the Rock Creek drainage before, during, and after mine operations. Consult a hydrologist to help establish the stream gage locations.

2. The following terms and conditions are established to implement reasonable and prudent measure # 2:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest would require the applicant to complete, and submit to the Forest and the Service, an evaluation of operational options with existing diffuser location and alternative locations for siting the diffuser entering the Clark Fork River below Noxon Dam. The evaluation would be prepared in consultation with the Forest, MDEQ, and the Service and would focus on recommendations that would minimize potential effects on migrating or resident bull trout utilizing the Clark Fork River habitats adjacent to the mouth of Rock Creek and the spring area immediately upstream. The Service would have the authority to ultimately approve the evaluation.

   b. If the evaluation identifies a more appropriate operation or location for the diffuser (2. a., above), the Forest would require the applicant to modify the plan of operations, as agreeable to the Service, to incorporate the alternative most likely to minimize impacts to bull trout.

3. The following terms and conditions are established to implement reasonable and prudent measure #3:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the applicant shall submit a plan to the Forest and the Service for metals monitoring as it relates to bull trout habitat requirements that includes monitoring in water samples, sediment samples, and fish samples. This monitoring would start prior to mine development to establish the baseline, and continue during operations and post operations as determined necessary by the Forest and the Service. The Service would have the authority to ultimately approve the plan.

4. The following terms and conditions are established to implement reasonable and prudent measure #4:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest shall require the applicant to submit a plan to the Forest and the Service for monitoring of groundwater effects as they relate to bull trout habitat requirements. This monitoring would start prior to mine development to assess the baseline, and continue during operations and post operations as determined necessary by the Forest and the Service. The Service would have the authority to ultimately approve the plan.

5. The following terms and conditions are established to implement reasonable and prudent measure #5:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest shall require the applicant to submit a risk assessment of accidents related to haul routes for mine related vehicle traffic to the Forest and the Service for evaluation. The assessment would determine areas most at risk for bull trout and make recommendations for additional measures and responses to minimize risk. If any additional measures can be incorporated to minimize the risk of catastrophic failures, the Forest, MDEQ, and the Service would determine the timeline and mechanism for implementation of those identified measures.

6. The following terms and conditions are established to implement reasonable and prudent measure # 6:

   a. Minimization of paste pile or facility failures includes: employing the Bottom-Up construction sequence, installing blanket and finger drains beneath the paste facility; continually modeling and monitoring the moisture content of the paste pile during operations to better understand saturation levels, generating a detailed design of the paste plant operations and disposal system to ensure quality assurance and quality control during operation and post-closure. If any additional measures can be incorporated to minimize the risk of catastrophic paste pile or facility failures, the Forest, MDEQ, and the Service would determine the timeline and mechanism for implementation of those identified measures.

7. The following terms and conditions are established to implement reasonable and prudent measure # 7:

   a. The Forest would require the applicant to annually prepare and submit to the Service a report of the mining year activities as well as the next year's proposed activities.

   b. Upon locating dead or injured bull trout or upon observing destruction of redds, notification by the Forest or applicant must be made within 24 hours to the Montana Field Office at 406-449-5225. Record information relative to the date, time, and location of dead or injured bull trout when found, and possible cause of injury or death of each fish and provide this information to the Service.

   c. During project development and operation the Forest or applicant shall notify the Service within 24 hours of any emergency or unanticipated situations arising that may be detrimental for bull trout relative to the proposed activity.

   d. Within 90 days of the end of each year, the Forest or applicant would provide a written report or letter to the Service indicating the actual number of bull trout

taken, if any, as well as any relevant biological/habitat data or other pertinent information on bull trout that was collected.

e. The Forest shall assure consistent implementation of measures and standards specified in the Aquatic Conservation strategies as indicated in the 1998 Biological Opinion for the Effects to Bull Trout from the Continued Implementation of Land and Resource Management Plans and Resource Management Plans as Amended by the Interim Strategies for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and portions of Nevada (INFISH), and the Interim Strategy for Managing Anadromous Fish-producing Watershed in Eastern Oregon and Washington, Idaho and portions of California (PACFISH).

f. To better monitor mitigation measures identified, the Forest would provide summaries to the Service of all INFISH compliance, water quality and fish population monitoring conducted in conjunction with these mining operations.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service expects that incidental take of bull trout would result from changes stream channel characteristics associated with increases in sediment, modifications in water quality, and modifications of instream habitat features (e.g. pool depths, channel width, substrate embeddedness) for the life of the mining operations and reclamation activities. Some long term effects of mining operations would likely continue indefinitely after mine closure. If, during the course of the action, the proposed project design and operations are not adhered to, the level of incidental take anticipated in the biological opinion may be exceeded. Such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Service retains the discretion to determine whether non-compliance with terms and conditions results in take exceeding that considered here, and whether consultation should be re-initiated. This may require suspension of mining operations. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. The Service recognizes the impacts of past mining, roading and logging actions on watersheds on the Forest. For the benefit of the watershed and listed bull trout, the Service encourages the Forest to seek appropriate levels of funding to reclaim and restore

United States Department of the Interior

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File: M.19 – Kootenai National Forest
Rock Creek Mine

Paul Bradford, Forest Supervisor
Kootenai National Forest
1101 Hwy 2 West
Libby, Montana 59923

September 27, 2007

Dear Mr. Bradford:

Enclosed is a supplement to our October, 2006, biological opinion on the Rock Creek Mine project, in response to your February 26, 2007 request for reinitiation of formal consultation on the project (U.S. Forest Service, in litt. 2007). Your letter indicated that a December 13, 2006, Missoula District Court order set aside the Final Environmental Impact Statement and the March, 2004, Record of Decision for the Kootenai Forest Plan amendment on access (access amendment), and remanded the decision to the Forest Service.

Accordingly, the access amendment is not currently in place. As your letter indicates, our October, 2006, biological opinion on the Rock Creek Mine project (U.S. Fish and Wildlife Service 2006) was, in part, reflective of an environmental baseline that included the access amendment. You stated that grizzly bear habitat management on the Kootenai National Forest (Forest) would revert back to what was in place prior to the signing of the Record of Decision (ROD), which you described in your letter. We agreed to reinitiate consultation to consider this particular change in the environmental baseline for grizzly bears (U.S. Fish and Wildlife Service, in litt. 2007).

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (a) the amount or extent of incidental take is exceeded; (b) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (c) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the opinion; or (d) a new species is listed or critical habitat designated that may be affected by the action.

Your February 26, 2007 request for reinitiation of formal consultation on the Rock Creek Mine project (U.S. Forest Service, in litt. 2007) was not accompanied by a biological assessment. We examined whether the effects of the proposed Rock Creek mine, when added to the present environmental baseline, would trigger any of the requirements for reinitiation of consultation outlined in 50 CFR 402.16 or would cause us to change our conclusions in the 2006 biological opinion. We concluded that reinitiation of *formal* consultation was in fact not required, as the current environmental baseline condition does not trigger any of the four reinitiation criteria listed above.

Therefore, we prepared a supplement to our 2006 biological opinion, Part A Grizzly Bears. We hereby incorporate by reference the information, analyses and conclusions in the 2006 biological opinion on the Rock Creek Mine project (U.S. Fish and Wildlife Service 2006) to support our rationale.

Further we take this opportunity to provide clarification in several places for our analysis of effects of the Rock Creek mine on bull trout. For ease of reading, we have added clarifications directly to Part B, Bull Trout, of the 2006 biological opinion (U.S. Fish and Wildlife Service 2006) and enclosed the amended document along with this package.

We look forward to continuing to work with the Forest Service on this matter. If you have questions or comments, please contact me at the phone number above at extension 205, or Anne Vandehey of my staff, at extension 212.

Sincerely,

for R. Mark Wilson
Field Supervisor

Enclosures:

Supplement to the Biological Opinion for Revett RC Resources Rock Creek Mine Copper/Silver Mine, Part A: Grizzly Bears

Amended Biological Opinion for Revett RC Resources Rock Creek Mine Copper/Silver Mine, Part A: Bull Trout

Cc: AES, R-6, MS 60120 (Attn: Bridget Fahey)
Montana Department of Fish, Wildlife, and Parks, Helena, MT (Attn: Director)
File: 7759 Biological Opinions - 2007

Endangered Species Act Section 7 Consultation

Supplement to the

BIOLOGICAL OPINION

on the

Part A: Effects to Grizzly Bears from the Implementation of

PROPOSED ACTIONS ASSOCIATED WITH PLAN OF OPERATION FOR THE

REVETT RC RESOURCES INCORPORATED ROCK CREEK COPPER/SILVER MINE

as proposed by the

U.S. Forest Service, Kootenai National Forest

U.S. Fish and Wildlife Service Montana
Ecological Services Field Office

SEPTEMBER 2007

Background

This document supplements our October, 2006, biological opinion on the Rock Creek Mine project, in response to the Kootenai National Forest's (Forest) February 26, 2007 request for reinitiation of formal consultation on the Rock Creek Mine project (U.S. Forest Service, in litt. 2007). The request letter indicated that a December 13, 2006, Missoula District Court order set aside the Final Environmental Impact Statement and the March, 2004, Record of Decision for the Kootenai Forest Plan amendment on access (access amendment), and remanded the decision to the Forest Service.

Accordingly, the access amendment is not currently in place. As the Forest's letter indicated, our October, 2006, biological opinion on the Rock Creek Mine project (U.S. Fish and Wildlife Service 2006) was, in part, reflective of an environmental baseline that included the access amendment. The letter stated that grizzly bear habitat management on the Forest would revert back to what was in place prior to the signing of the Record of Decision (ROD). The Service agreed to reinitiate consultation to consider this particular change in the environmental baseline for grizzly bears (U.S. Fish and Wildlife Service, in litt. 2007).

Because the 2004 access amendment was set aside by the Court, the habitat parameter standards established in that decision were vacated. According to information from the Forest (U.S. Forest Service, in litt. 2006b and 2007g), the standards and analyses in place prior to the access amendment once again become the levels for effects analysis. They will remain in place until a new access amendment Final Environmental Impact Statement (EIS) and ROD are completed (U.S. Forest Service, in litt. 2007c). The Forest expects to reach a decision that will amend the Forest Plan by April, 2008 (U.S. Forest Service in litt. 2007f). The Forest indicated that the requirements in place until that time come from the 1987 Kootenai National Forest Plan (U.S. Forest Service 1987), consultations since 1987, the 1995 amended biological opinion and incidental take statement on the 1987 Forest plan (U.S. Fish and Wildlife Service 1995), the December, 1998 Selkirk/Cabinet-Yaak Grizzly Bear Areas Interim Access Management Rule Set (U.S. Forest Service in litt. 1998), and the March, 2001 Settlement Agreement with the Alliance for the Wild Rockies (U.S. Forest Service, in litt. 2006c, 2007 and 2007g).

This current Forest access management is now part of the environmental baseline for the Rock Creek Mine project until a new access amendment is finalized. The Forest anticipates finalization of a new EIS that will provide equal or better standards than the decision that was set aside (U.S. Forest Service, in litt. 2007).

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (a) the amount or extent of incidental take is exceeded; (b) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (c) the agency

action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the opinion; or (d) a new species is listed or critical habitat designated that may be affected by the action.

The Forest's February 26, 2007 request for reinitiation of formal consultation on the Rock Creek Mine project (U.S. Forest Service, in litt. 2007) was not accompanied by a biological assessment. Therefore, the Service examined whether the effects of the proposed Rock Creek mine, when added to the present environmental baseline, would trigger any of the requirements for reinitiation of consultation outlined in 50 CFR 402.16 or would cause us to change our conclusions in the 2006 biological opinion. We concluded that reinitiation of *formal* consultation was in fact not required, as the current environmental baseline condition does not trigger any of the four reinitiation criteria listed above. Therefore, we prepared this supplement to our 2006 biological opinion (for Part A, grizzly bears). We hereby incorporate by reference, the information, analyses and conclusions in the 2006 biological opinion on the Rock Creek Mine project (U.S. Fish and Wildlife Service 2006) to support this supplement and rationale.

As stated above, we concluded that reinitiation of *formal* consultation was in fact not required. Three of the four triggers for reinitiation are not relevant to this situation: a) the amount and extent of taking specified in the 2006 incidental take statement for the Rock Creek mine would not be exceeded; c) the Rock Creek mine project has not been subsequently modified in a manner that causes an effect to listed species that was not considered in the biological opinion; and finally d) no new species were listed that may be affected by the Rock Creek mine.

We examined the mine project in consideration of the second trigger listed in 50 CFR 402.16 (trigger b) and concluded that there is no new information revealing effects of the Rock Creek Mine that may affect listed species in a manner or to an extent not previously considered. When added to the environmental baseline, the effects of the Rock Creek Mine result in a net improvement in environmental conditions for grizzly bears, as was our conclusion in 2006.

Review and analysis

<u>2004 Forest Plan access amendment</u> - The 2004 access amendment established, among other requirements, specific standards for open motorized route density, total motorized route density and core habitat (core) in each BMU within the CYE and Selkirk Ecosystem (SE). The standards were derived primarily from grizzly bear research conducted within the CYE and SE. The amendment would have resulted in an increase from 14 to 21 (of 22) BMUs on the Forest providing at least 55 percent core or more, increasing core acres by about 11,000 acres (U.S. Fish and Wildlife Service 2004). The amendment would maintained the number of BMUs exceeding the research average for open motorized route density (7) and decreased the number exceeding the research for average total motorized route density from 10 to 6 BMUs. A number of BMUs would provide lower road densities and more core habitat than the research averages for core and road densities. The 2004 biological concluded that overall, the amendment would

have improved grizzly bear habitat conditions by providing 58 percent of the CYE recovery zone in core, distributed throughout the 22 BMUs. The incidental take statement in the Service's 2004 biological opinion on the amendment (U.S. Fish and Wildlife Service 2004) set targets (numbers of BMUs) for partial ecosystem-wide compliance with the standards by the end of 2009 and 2011, and that all stated BMUs were to be in compliance by 2013. The incidental take statement also prescribed no permanent increases in "linear open road densities" or "total linear road densities" in areas where grizzly bears occurred outside the recovery zone. The amendment also limited the amount of administrative use on restricted roads within the recovery zones. See the 2004 biological opinion for a complete description of terms and conditions (U.S. Fish and Wildlife 2004). The ROD for the access amendment contains complete details of the amendment (U.S. Forest Service 2004).

Current Access Management - The following information describes current access management on the Forest, excerpted from information provided to the Service by the Forest (U.S. Forest Service in litt. 2007 and 2007g, Appendices A and B):

> "Six recovery objectives are to be addressed. The first five are from Harms 1990 and the sixth is from the 1995 amended biological opinion and incidental take statement on the 1987 Forest Plan.
>
> *Obj. 1: provide adequate space to meet the spatial requirements of a recovered grizzly bear population.* This analysis determines the percent habitat effectiveness level (standard is ≥70%). This requires at least 0.25 mile buffer (see CEM for buffer distances by activity) of open roads (including seasonally open roads that are open during bear year), active project areas, and MS-3 lands. The remainder equals the effective habitat. You must account for the buffered items outside the BMU if their buffer extends into the BMU. Ownership is not a factor.
>
> It also determines the linear open road density. ORD is displayed at the BMU scale. ORD for the BMU must be ≤ 0.75 miles/square mile. Active BAAs may exceed this ORD if the BMU as a whole meets it. Also, previous consultation may have established higher ORDs for some inactive BAAs which if in place must be explained. The calculation is only done on MS 1 & 2 lands, regardless of ownership.
>
> In addition, include the moving windows analysis here.
>
> - Open motorized route density (OMRD) analysis. The comparison is **"No net increase in OMRD percent".** Use moving windows to report percent of the entire BMU (ownership is not a factor) with open road density greater than 1 mile/square mile.
> - Total motorized route density (TMRD) analysis. The comparison is "**No net increase in TMRD percent".** Use moving windows to report percent of the entire BMU (ownership is not a factor) with total road density greater than 2 mile/square mile.

- Core analysis. **"No net decrease in core area"** is the minimum requirement. Also must work to achieve 55% core if not already there. New core created to compensate for loss of previously existing core by a project WILL 1) be in place prior to conducting the activity; 2) be equal to or better in habitat quality (including seasonal components); 3) be at least equal in block size; and 4) kept in place through the entire period of the interim rule set. NOTE: this replaces the "displacement area" analysis previously used on the KNF.

Obj. 2: Manage for an adequate distribution of bears across the ecosystem.

- Opening size: Unit sizes, in combination with existing units or natural openings, should normally be less than 40 acres. When, for justified reasons, a unit exceeds 40 acres, no point in the opening should be greater than 600 feet from cover.
- Movement corridors: Unharvested corridors > 600 feet in width should be maintained between proposed harvest units and existing harvest units and natural openings.
- Seasonal components: Schedule proposed activities to avoid known spring habitats during spring use period (4/1-6/15) and schedule winter activities to occur when bears are in the den (11/30-3/31). Avoid activity in close proximity of known den sites during the denning period.

Obj. 3: Manage for an acceptable level of mortality risk.

- Achieved by meeting objectives 1, 2, and 6. In addition include a discussion of the possibility the project creating any food attractants (e.g. seeding clovers on open roads).

Obj. 4: Maintain/Improve habitat suitability with respect to bear food production.

- Achieved by meeting objectives 1 and 2. Include discussion of what project does to improve food sources, especially huckleberries, if applicable.

Obj. 5: Meet the management direction outlined in the Interagency Grizzly Bear Guidelines for Management Situation 1, 2, & 3.

- Achieved by meeting objectives 1, 2, 3, and 4.

Obj. 6: Meet the interim management direction specified in the July 27, 1995 Forest Plan Incidental Take Statement to avoid exceeding authorized incidental take levels.

- This is met by meeting the OMRD, TMRD and Core objectives discussed under objective 1, plus:
- Total motorized trail density: No increase in existing density of open motorized trails.

If administrative use levels are part of the proposed project (e.g. special use permit to use closed road to access private land) then the lawsuit settlement (3/25/2001) standard of 57 round trips in total for the bear year apply.

> In conference with the USFWS, and review of the 1995 amended biological opinion and incidental take statement on the Kootenai Forest plan, it was the Agencies' view that the analysis of projects of the recovery zones (in the BORZ areas [areas where grizzly bears occur]) still applies".

Additionally, the February 26, 2007 letter (U.S. Forest Service, in litt. 2007) also included:

- "No ground disturbing activities from Forest Service initiated projects that would occur in grizzly bear habitat that would be likely to adversely affect grizzly bears, including habitat modification. This does not apply to activities initiated by third parties".

The Forest biologist provided further guidance to the Forest regarding access management and analysis for effects on grizzly bears, post the court's December, 2006 order setting aside the access amendment (U.S. Forest Service, in litt. 2007d). Based on the above guidance, the Forest will use the premise that if road densities increase in areas outside the recovery zone where grizzly bears occur, the best science indicates that the effects would be adverse to grizzly bears (W. Johnson, Kootenai National Forest, email pers. comm. 2007). Thus, according the Forest's February 26, 2007 letter (U.S. Forest Service, in litt. 2007), such increases would not occur until or unless an access amendment were finalized.

In summary, Forest access management now is similar to that under the access amendment. However, an important exception is that there is no requirement or schedule for grizzly bear habitat improvements through adding core and reducing motorized route densities to average levels found in female grizzly bear home ranges, as reported in research. While such improvements are allowed under current management, they are not mandatory.

Existing Access Conditions - Table 1 contains a summary of current access management and habitat status in the BMUs within the Rock Creek Mine action area environmental baseline. As described above, current Forest access management direction includes no net increase in open or total motorized route densities in BMUs, and no net loss of core, and a no increase in linear road densities in BMUs as well. It requires projects in priority-one BMUs to improve habitat toward providing 55 percent core. Therefore the access management conditions in action area BMUs, as detailed in Table 1 below, would either remain the same or improve until the completion of a new decision (ROD) on access management.

Table 1. Summary of access management conditions within the Rock Creek Mine action area, per BMU (as of March 2007)(from U.S. Forest Service, in litt. 2007). Numbers in parenthesis are standards contained in the 2004 access amendment.

BMU	% OMRD[a] >1 mi/mi^2	%TMRD[b] >2 mi/mi^2	% Core	Priority	% Habitat Effectiveness	ORD[c] (mi/mi^2)
2	20 (20)*	15 (18)	76 (75)	2	79	.32
4	36 (36)	26 (26)	63 (63)	2	64	.30
5***	27 (30)	23(23)	60 (60)	1	72	.52
6***	35 (34)**	33 (32)	54 (55)	1	66	.63
7	23 (26)	21 (23)	67 (63)	2	77	.41
8	32 (32)	23 (20)	56 (55)	3	77	.68
22	38 (33)	37 (35)	51 (55)	3	67	n/a

[a] open motorized route density
[b] total motorized route density
[c] open road density
* Shaded figures indicate conditions that meet or are better than that required by 2004 for OMRD, TMRD and core.
**Conditions in BMU would meet 2004 access standards through project implementation.
*** Priority-one BMUs

Appendix C of this document includes a table with a summary of current Forest-wide access management status (which would remain at the status quo, or perhaps improve) within the grizzly bear recovery zone for the 2006 non-denning period.

Review of effects - The Forest's 2004 access amendment set specific open and total motorized route density standards for each BMU. The Service's 2004 biological opinion on the access amendment (U.S. Fish and Wildlife Service 2004) required no net loss of core in any BMU, even if a BMU had more core than the research average for core (55 percent). The opinion also set a schedule for achieving the open and total motorized route densities and core area standards for each BMU as set forth in the access amendment. The schedule included dates for partial and total achievement of the open and total motorized route density and core standards set forth in the access amendment.

In comparison, the Forest's current access management would allow, but not require, actions that would meet the standards prescribed in the access amendment. Current access management does not allow degradation of grizzly bear habitat as a result of access management. In other words, it precludes any net increase in open or total road densities. It allows no decrease in core area in any BMU, and requires that projects in the Forest's nine priority-one BMUs work toward establishing at least 55 percent core. There is no requirement for a scheduled amount of improvement in access management within BMUs to meet the amendment standard. The Forest would not initiate any ground disturbing projects that were likely to adversely affect grizzly bears until a new access amendment is finalized. The standard for habitat effectiveness is a minimum of 70 percent per BMU.

Forest-wide, the BMU access improvements are currently ahead of the schedule required by the access amendment. The schedule required that **35 percent** of all BMUs be in compliance with the access standards by **December 31, 2009**. At the end of **2005**, **36 percent** (7 of 17 on the KNF and 1 CYE BMU on the Idaho Panhandle National Forest)

of the BMUs met all three criteria (U.S. Forest Service, in litt. 2007). Therefore the Forest was not required to make improvements in any subunits until after 2009 under the access amendment that was set aside.

The Rock Creek Mine project would result in a slight decrease in motorized route densities (see Appendix D: Table A12 and A13 from 2006 biological opinion;), which would bring the Forest's BMU 6 into compliance with the 2004 open motorized route density standard. Total motorized route density in Forest's BMU 5, which already meets the prior standard, would be lowered (improved) by one percent as well.

Therefore, the differences in current Forest access management requirements (now in the environmental baseline) compared to that analyzed in our 2006 biological opinion (which considered the 2004 access amendment) are negligible, at least through 2009. The existing access management conditions shown in Table 1 (above) would remain the same or could improve through projects, including the Rock Creek Mine project (as described above). Further, Forest Service-initiated projects that may have adverse effects on grizzly bears would not be implemented in the CYE, unless a new Forest access amendment is finalized (U.S. Forest Service, in litt. 2007). The Forest anticipates completing the new access amendment during the spring of 2008. If the mine project were to begin in 2007, it would be in the evaluation adit phase for 18 to 24 months (i.e. through 2008 and at least part of 2009). As detailed in the biological opinion on the Rock Creek Mine (U.S. Fish and Wildlife Service 2006), the mitigation plan requires measures that more than offset the impacts of the evaluation adit.

Therefore, through 2009, the overall anticipated effects of the mine, when added to the existing access management are not different from the effects we previously considered in our 2006 biological opinion, which included an environmental baseline with the 2004 access amendment in place. We arrive at this conclusion because: a) the Forest is ahead of the access management schedule that had been in place with the access amendment, so no improvements in the baseline conditions were required through 2009; b) current management only allows access changes that improve conditions for grizzly bears; it does not allow increases in open or total motorized route densities, or decreases in core in any BMU; c) current access management does not change the proposed Rock Creek mine project requirements that access conditions improve in the two action area BMUs (BMUs 5 and 6); and d) the adverse effects associated with access management for the mine are more than offset by the conservation measures in the mitigation plan, and by terms and conditions in the biological opinion on the project (U.S. Fish and Wildlife Service 2006).

Long-term, the Forest was to achieve all BMU access amendment standards by 2013, according to the 2004 biological opinion on the amendment (see Table 1 and Appendix C for standards and existing conditions). Primarily, this would have resulted in relatively minor improvements within the action area because six of the seven BMUs within the action area (BMUs 2, 4, 5, 6, 7, and 8) already meet or are close to meeting all 2004 access standards (see Table 1). Four of the six BMUs managed by the Forest (BMUs 2, 4, 5, and 7) meet all three access standards per BMU that had been required by the 2004 amendment. By 2013, access conditions would have been improved in three BMUs

within the action area (BMUs 6, 8, and 22 [managed by the Lolo National Forest]) to the amendment standards described in Table 1. However, in two of the three BMUs (BMUs 6 and 8), the improvements needed to meet research averages and/or standards would have been slight, a one to three percentage improvement (see Table 1 and Appendix C). Improvements in BMU 22 would have been more substantial (see Table 1).

The access amendment would have required decreases in motorized access in several more BMUs Forest-wide (detailed in Appendix C), which would have improved grizzly bear habitat conditions throughout the CYE. These improvements are no longer required. Nevertheless, current access management prohibits an increase in open or total motorized route density or a decrease in core in any BMU in the CYE. In the nine priority-one BMUs on the Forest, projects must work toward the establishment of at least 55 percent per BMU. No Forest Service-initiated projects that may have adverse effects on grizzly bears would be allowed in grizzly bear habitat in the CYE until a new Forest access amendment is finalized.

Further, as mentioned earlier, the Rock Creek Mine project (the project) does not degrade access management conditions (Appendix D: Table A12. and A13 from U.S. Fish and Wildlife Service). The project's mitigation plan requires that BMU 6 meet the standard for open motorized route density standard; the BMU would be one percent short of meeting the access amendment standards for total motorized route density and core. BMU 5 would see a one percent decrease in total motorized route density, although it already meets the amendment standard. Further under current management long term, although the project would result in no changes to BMU 8, it currently meets both core and open motorized route standards; the BMU could remain three percent short of meeting the total motorized route density standard. BMU 22 is managed by the Lolo National Forest and does not meet any of the three prior standards (off by two to five percent). This condition could remain indefinitely, although improvements are allowed.

Specifically regarding access management, the Forest's Rock Creek Mine project mitigation plan requires the Forest to a) offset any increases in motorized route densities related to the mine, in order to maintain a no net increase in motorized access in the action area; and b) make slight improvements in access management within the action area (Appendix D; also Tables A12 and A13 *in* U.S. Fish and Wildlife Service 2006). The mitigation plan (and project decision) also requires acquisition of 2450 acres of private lands within grizzly bear habitat for conservation management. The 2006 biological opinion details how this acquisition would result in lowered total or open motorized route density, or increase in core (see biological opinion pages A55 and A114). These requirements and results are not changed or affected by the current access management.

<u>Effects of mitigation plan measures (in addition to access management) when added to environmental baseline</u> - Many other grizzly bear conservation measures are required by the Rock Creek Mine Mitigation Plan (Appendix E). The current Forest access management does not affect the conservation measures in the mitigation plan, the implementation of the measures, or the effects of the measures on grizzly bears.

According to the mitigation plan, a number of grizzly bear and grizzly bear habitat conservation measures and improvements must be in place prior to construction and operation of the evaluation adit and others prior to construction and operation of the mine; see Appendix F for a summary list. The effects of each were described and analyzed in the 2006 biological opinion: see analyses of grizzly bear displacement A48-68; grizzly bear mortality risk A74-84; habitat fragmentation A87-90; grizzly bear conservation needs A90-95; and species response to proposed action A95-98. A number of the mitigation plan requirements, including acquisition of some key habitat parcels, are already in place or in the process of being fulfilled.

As discussed earlier, the access amendment would have resulted in specific, improved conditions in grizzly bear habitat over time as a result of access management; these improvements are not currently required. However, the effectiveness of the conservation measures required in the Rock Creek Mine project mitigation plan is not dependent upon the access amendment. This is in part because of the type (access management), extent (described in the 2004 biological opinion, pages 103 to 107 and elsewhere; summarized in Appendix C of this document) and location (mostly in BMUs outside of the project action area) of these improvements. However, most significant is that the conservation measures required by the mitigation plan, when added to the current environmental baseline, would continue to more than offset the negative impacts of the mine, including any incidental take associated with the mine. The net effect of implementation of the Rock Creek mine project would be improved environmental conditions for grizzly bears above the current conditions in the environmental baseline and in the CYE. Therefore, implementation of the Rock Creek Mine project would affect grizzly bears in the same manner and to the same extent as that analyzed in the 2006 biological on the mine.

Summary of Effects

The primary difference between the 2004 access management and the current access management is an incremental improvement in grizzly bear habitat through access management within BMUs, Forest-wide, that had been required through the amendment. The access amendment required that **35 percent** of the BMUs on the Forest and Idaho Panhandle National Forest meet all three standards by December 31, 2009. At the end of 2005, the Forests in the CYE were ahead of that schedule (U.S. Forest Service, in litt. 2007); **36 percent** (7 of 17 on the Forest and 1 CYE BMU on the Idaho Panhandle National Forest) of the BMUs met all three criteria required in the access amendment.

Therefore, through 2009, there would be no significant differences between access management in the current environmental baseline and access management considered in the environmental baseline (per the 2004 access amendment) in our 2006 biological opinion. Also, through 2009, no access-related improvements in any BMU, including those within the action area, would have been required by the access amendment. Further, current access management now precludes Forest-initiated projects that may adversely affect grizzly bears from occurring until a new Forest access amendment is finalized, no net increase in road densities or loss of core will occur, and projects in

priority-one BMUs must work toward establishing at least 55 percent core. There is no similar direction for priority-two or priority–three BMUs.

After 2009, access management in place now would continue to prohibit degradation of habitat through increased road densities or loss of core, and would not require but would allow access-related improvements (i.e. decreased road densities and increased core area) in BMUs. Further, current access management would continue to preclude Forest-initiated projects that may adversely affect grizzly bears from occurring until a new Forest access amendment is finalized, and projects in priority-one BMUs must work toward establishing at least 55 percent core.

After 2009, the present environmental baseline, under current access management, could result in higher road densities persisting and less core being added within CYE BMUs than what was considered in our 2006 biological opinion. Specific improvements within BMUs are no longer required, but no degradation of the existing conditions could occur. Within the action area, the differences between the amendment and current management are slight in all but one BMU (BMU 22). However, Forest Service-initiated projects that may adversely affect grizzly bears would not occur in the action area unless a new Forest access amendment were finalized, and projects in priority-one BMUs must work towards establishing at least 55 percent core.

The Rock Creek Mine project itself, when implemented, would result in slight decreases in open and total motorized route density, creating slightly improved habitat conditions for grizzly bears in the action area (See Appendix D).

The present environmental baseline may exhibit more adverse effects for grizzly bears due to road densities compared to what would have occurred under the access amendment. However, the baseline, as affected by current Forest access management, changes no part of the Rock Creek Mine project; it does not affect a) the timing and/or implementation of mining actions; b) the required conservation measures in the mitigation plan or their results, that minimize or offset the project's impacts on grizzly bears; or c) the required conservation measures or results that would work, over time to improve the conditions for grizzly bears in the CYE over current conditions. Adverse effects from the mine are fully or more than offset by the mitigation plan (U.S. Fish and Wildlife Service 2006), and over time the project would result in improved conditions for grizzly bears in the CYE. The net effect of implementation of the Rock Creek mine would be improved environmental conditions for grizzly bears above the current conditions in the environmental baseline and in the CYE.

Conclusions

In our 2006 biological opinion (U.S. Fish and Wildlife Service 2006), we concluded that the displacement effects and potential risk of grizzly bear mortality of the Rock Creek mine would be more than offset by the combination of the land acquisition, existing and improved access management on the Forest, the net reduction in existing and anticipated future human-caused grizzly bear mortality rates and augmentation of the CYE grizzly

bear population, resulting in improved conditions for grizzly bears. We believe that the long-term impacts of all conservation measures required through implementation of the project will in fact result in an improvement over current conditions for grizzly bears over time.

The present environmental baseline would likely result in slightly more motorized access in the action area over time compared to access in the baseline we initially considered in our 2006 biological opinion. Access management in place now would not require the level of access-related improvements ecosystem-wide, as anticipated in our 2006 analyses. However, there would be no degradation of current conditions for grizzly bears, improvements through reductions in motorized access are allowed, and the Forest would not initiate any projects that may adversely affect grizzly bears until a new access amendment is finalized.

Further, as explained above, the current access management does not change or affect the Rock Creek Mine project actions, including the mitigation plan or any of the grizzly bear conservation measures required for the mine. Nor does the current access management change the positive effects of the project. Therefore, when added to the present environmental baseline, a) as explained in numerous places in the biological opinion, the project would still more than offset all anticipated incidental take associated with the project, including the mortality of one grizzly bear and take through harm or harassment caused by displacement effects on grizzly bears (U.S. Fish and Wildlife Service 2006, see pages A109-A115 and elsewhere); b) we anticipate no additional adverse effects or incidental take associated with the Rock Creek Mine project as a result of current Forest access management; c) as explained in numerous places in the biological opinion, the net effect of the Rock Creek Mine over the long term would continue to be an improvement in conditions for grizzly bears, compared to current conditions (U.S. Fish and Wildlife Service 2006). In other words, irrespective of whether the access amendment is in place, the Rock Creek Mine project is expected to improve conditions for grizzly bears over current baseline conditions and is consequently not likely to jeopardize the continue existence of grizzly bears.

Therefore, we conclude that, when added to the current environmental baseline, the effects of the Rock Creek mine (including the effects of the collection of Forest-wide conservation measures required by the project's mitigation plan), would affect grizzly bears in the same manner and to the same extent as that analyzed in the 2006 biological on the mine. Therefore reinitiation of formal consultation is not required.

The Service is required to ensure that a proposed agency action is not likely to jeopardize the continued existence of a species, when its effects are added to the environmental baseline. In Cabinet Resource Group et al, vs. U.S. Fish and Wildlife Service and U.S. Forest Service, *CV 04-236-M-DWM*, the Court stated that "The regulations are explicit in requiring the Fish and Wildlife Service to ensure only that the planned action will not make the present situation worse" and that "The standard requires not improvement upon the status quo, but rather no deterioration of the status quo". In Alliance for the Wild

Rockies et al. vs. U.S. Fish and Wildlife Service and U.S. Forest Service, *CV-04-216-M-DWM*, the Court held that "As seen through the lens of ESA section 7(a)(2), the [project] proposed do slightly more for recovery and survival than the status quo."

We believe that because the Rock Creek Mine would not deteriorate the status quo for grizzly bears and will not make the present situation worse, our conclusion that the Rock Creek Mine project will not jeopardize grizzly bears is consistent with the Court's findings in these cases. Furthermore, we believe that the analysis in the biological opinion demonstrates that the Rock Creek Mine project would not just maintain the status quo, but would ultimately result in an improvement over current conditions through a) a reduction of human-caused mortality rates throughout the CYE; b) conservation of grizzly bear habitat that may otherwise have been lost to development; c) improved public outreach and education; d) lowered motorized access route densities; e) continued and enhanced research in the CYE resulting in improved understanding of grizzly bear ecology and habitat linkage issues in the CYE; and f) enhanced assurance that augmentation of the CYE grizzly bear population will continue.

Although not relevant to or considered in our analysis here, it is noteworthy that the Forest anticipates that the Forest Plan access management amendment being prepared and anticipated for finalization in April 2008 would provide equal or better standards than the decision that was set aside by Court action (U.S. Forest Service, in litt. 2007).

Cumulative Effects Update

As of this writing, Montana Fish, Wildlife and Parks is continuing its program to augment the grizzly bear population in the CYE, specifically the Cabinet Mountains, with grizzly bears from elsewhere. Two female bears have been relocated thus far, and at least one female grizzly bear is expected to be augmented to the Cabinet Mountains during 2007.

As mentioned in our 2006 biological opinion, Mines Management, Incorporated (MMI) commenced exploration activities on the Libby Creek adit of the Montanore Mine site on the east face of the Cabinet Mountains. On August 7, 2007 the Forest Service sent a letter to Montanore Minerals Corporation (formerly MMI) (U.S. Forest Service, in litt. 2007e) and on August 15, to the Service as well (U.S. Forest Service, in litt. 2007f). The letters explained that Montanore Minerals Corporation must obtain Forest Service approval of a plan of operations prior to dewatering and continued excavation, drilling, and development work at the Libby Creek adit. Such Forest Service approval is subject to section 7 consultation. According to 50 CFR 402.02, cumulative effects are those effects of future State or private activities, <u>not</u> involving Federal activities (e.g. permits, approvals, or section 7), that are reasonably certain to occur within the action area. Therefore, the activities at the Libby Creek adit will not be further analyzed as cumulative effects for the Rock Creek Mine, but a biological opinion specifically dealing with the Libby Creek adit is forthcoming.

The Service received a biological assessment from the Forest on November 13, 2006 and a supplement to the biological assessment on March 5, 2007 (U.S. Forest Service 2006b and 2007b) on the effects of actions proposed by MMC at that time, including snowplowing and annual road use to access the Libby Creek adit site. The Forest Service requested that the company include these actions as part of the required plan of operations (U.S. Forest Service, in litt. 2007e).

Closing

The Service examined whether the effects of the proposed Rock Creek mine, when added to the present environmental baseline, would trigger any of the requirements for reinitiation of consultation outlined in 50 CFR 402.16 or would cause us to change our conclusions in the 2006 biological opinion. Based on the information in this supplement and its references, and the information and analyses in our 2006 biological opinion, we concluded that reinitiation of *formal* consultation was in fact not required, as the current environmental baseline condition does not trigger any of the four reinitiation criteria.

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Endangered Species Act Section 7 Consultation

BIOLOGICAL OPINION

on the

Part B: Effects to Bull Trout from the Implementation of PROPOSED ACTIONS

ASSOCIATED WITH PLAN OF OPERATION FOR THE REVETT RC RESOURCES

INCORPORATED ROCK CREEK COPPER/SILVER MINE

as proposed by the

U.S. Forest Service, Kootenai National Forest

U.S. Fish and Wildlife Service Montana
Ecological Services Field Office

as amended

SEPTEMBER 2007

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ERRATA SHEET: Part B: Rock Creek Mine Biological Opinion, October 11, 2006

Page B-10, 4th para., 3rd sentence: Added the following language after the word "unquantifiable," ***…., although Gillin (2002) attempted to estimate abundance of bull trout using the Cabinet Gorge fish hatchery ladder located below Cabinet Gorge Dam in the Lower Clark Fork River, but qualified their estimate (N = 162, SE 46.254) stating that the data was too scant for that type of analysis and for making management decisions. Furthermore, the analysis only pertained to fish using the ladder and that the relationship between these fish and other fish in the Clark Fork River was unknown.***

Page B-11, 1st para., 2nd sentence: Added, "***trap and transport program" …***

Page B-14, 2nd para., 11th sentence: Added, … "***and for two years thereafter***."

Page B-41, 1st para., 1st sentence: Added, … "***would greatly reduce***."

Page B-41, 3rd para., beginning 2nd sentence: Revised as follows: In 2003***, two migratory-sized adult bull trout were captured ~~or radio-tagged~~ in the Rock Creek drainage and in 2004 two radio tags from bull trout transported in 2003 were found in lower Rock Creek, although it was unknown initially when these fish entered Rock Creek. However, Lockard et al. (2004) assumed both fish entered Rock Creek in summer 2003 indicating that at least four migratory bull trout were known to be present in Rock Creek in 2003 (Lockard et al. 2004). During 2004 that number increased to ten as evidenced by migratory sized bull trout radio-tracked, trapped, or observed in Rock Creek (Lockard and Hintz 2005). One migratory sized bull trout was weir-trapped (Lockard et al. 2005), six transported bull trout were radio-tracked into Rock Creek (Lockard and Hintz 2005), and three non-radio tagged migratory sized bull trout observed during surveys (Lockard and Hintz 2005)(1 weir capture + 6 transports + 3 observations = 10).***

Page B-42, 2nd bullet: Added: Total 2004 count: ***5*** bull trout redds ***[(originally 6, changed later to 5, Moran 2006b)].***

Page B-44, 2nd para., 1st and 2nd sentence: Deleted, ***"in low numbers and"*** …. Added, ***Katzman and Thou (2003) observed 31.7 brook trout/100m below Engle Creek in 2001. In 2005, one brook trout was caught in the weir below the West Fork in upper Rock Creek (Lockard et al. 2006).***

Page B-45, 2nd para., 7th and 8th sentence: Deleted the word ***"apparent"*** … Added, ***However, the Idaho Fish and Game Department has developed an aggressive program to combat this problem (Columbia Basin Bulletin 1/5/07).***

Page B-46, 3rd para., 6th and 8th sentences: Added citation***: (USDI Fish and Wildlife Service 2005a).***

Page B-48, 4th para.: Added citiations, ***(USDI Fish and Wildlife Service 2005a, USDI Fish and Wildlife Service 2005b)***. Added, ***While redd surveys and electrofishing data in recent years in Noxon and Thompson Falls reservoir tributaries provide some information,*** …

Page B-49, 1st para.: Added citations: ***(USDI Fish and Wildlife Service 2005a, USDI Fish and Wildlife Service 2005b)***.

Page B-54, 2nd para.: Added, ***Cabinet Gorge, and Thompson Falls reservoirs***; deleted the word ***"two";*** added "***and Graves creeks***".

Page B-54, 3rd para., 1st, 2nd, and 3rd sentences: Added, … ***and the Vermillion River***; added ***(Moran 2006b)***; added ***"In the Vermillion River between 2001-2005 there were 15-27 redds located (Moran 2006b)."***

Page B-56, last para.,: Added: ***More recently, extrapolations of the total number of juvenile bull trout present in Rock Creek above the West Fork based on electrofishing population estimates are: 2001 = 860; 2002 = 1,015; 2003 = 1,182; 2004 = 905; 2005 = 644 (Moran 2006a).***

Page B-58, 3rd para., 3rd and 6th sentences: Deleted "***In 2004***" and added "***This***"; added ***2003 (2 captured + 2 radio tags found in 2004 from fish assumed to have entered Rock Creek in 2003)*** and citation ***Lockard et al. 2004.***

Page B-59, 2nd para.: Added, ***Extrapolations of the total number of juvenile bull trout present in Rock Creek above the West Fork based on electrofishing population estimates are: 2001 = 860; 2002 = 1,015; 2003 = 1,182; 2004 = 905; 2005 = 644 (Moran 2006a).***

Page B-63, 3rd para.: Added, ***Northern pike are found to prey on bull trout (Schmetterling 2001)***. Added, ***Superimposition of brown trout redds on bull trout redds was documented in the East Fork Bull River in 2002 (Moran 2003).***

Page B-66, chart: Added decimal points to the following values, ***.45, .66, .42***, and ***.23***.

Page B-70, last para.: Deleted the word "***only***".

Page B-76, 2nd para., 1st sentence: Deleted "***Although***" and "***appropriately***" and added "***at-risk***".

Page B-87, 2nd para.: Deleted the word "***eventually***" and added the word "***likely***".

Page B-96, 2nd para.: Added the following: ***bull trout are assumed to be spawning in this tributary and*** …

actual effect of project activities and proposed mitigation actions on sediment levels in the drainage.

2. Evaluate all possible operations of the existing effluent location or relocating the effluent outfall discharge pipe to a location eliminating any potential impacts to bull trout related to project effects on migrating or holding fish moving into Rock Creek from the Clark Fork River.

3. Implement a metals monitoring program that includes monitoring levels of metal concentrations in groundwater, surface water, sediments, macroinvertebrates, and fish tissues. This could be incorporated in several conceptual monitoring plans including, but not limited to, the Aquatics and Fisheries Monitoring and Mitigation Plan.

4. Identify key spawning areas and implement a monitoring program of changes in groundwater influence for spawning and rearing bull trout. This would be incorporated into the groundwater monitoring program.

5. Complete a risk assessment of road failure related to haul routes and mine related vehicle traffic. Incorporate any additional measures identified to minimize the risk of road failures and the associated impacts to bull trout.

6. Incorporate any additional measures identified to minimize the risk of failure of the paste pile or facility and the associated impacts to bull trout.

7. Implement reporting and consultation requirements as outlined in the following terms and conditions.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The following terms and conditions are established to implement reasonable and prudent measure No. 1:

   Upon the of issuance of the letter of approval for the Rock Creek mine, the Forest would require the applicant to initiate baseline studies for use in a complete watershed assessment of Rock Creek. The Forest would require the applicant to complete and submit a comprehensive watershed assessment to the Forest and Service prior to surface disturbance activity *not* related to the evaluation adit stage of the project.

   The comprehensive watershed assessment would include information to characterize the Rock Creek bull trout population, instream and riparian habitat conditions and existing sediment sources in the basin and would address the following issues for bull trout:

a. A monitoring plan to document the prevalence of Rock Creek bull trout. That monitoring plan would include studies to define bull trout distribution, densities, age class structures, genetics, and status of resident and migratory (adfluvial) bull trout.

b. An assessment and subsequent monitoring to define the prevalence and distribution of brook and brown trout. In conjunction with Montana Fish, Wildlife and Parks, determine the feasibility of removing brook and brown trout from Rock Creek using accepted methodology. Evaluate the potential reduction of hybridization and competition risk by non native species and benefit to bull trout. If determined feasible and needed, subject to agreement with Montana Fish, Wildlife and Parks, remove brook and brown trout from the Rock Creek drainage using accepted methodology.

c. An assessment of current instream and riparian habitat conditions for bull trout. The assessment would include information on quantity and quality of spawning, rearing and overwintering conditions for resident and adfluvial bull trout. It would include a pre-and post-project assessment of riparian conditions including floodplain and channel migration zone areas, and fish passage barriers (natural and man-made).

d. An assessment of possible sediment mitigation and reduction projects within the Rock Creek watershed as outlined in the proposed action. Recommendations of stream enhancement projects should be included in that assessment.

e. A feasibility assessment (including engineering options, conceptual designs, estimated costs and expected sediment load effects) for sediment abatement measures that would reduce sediment levels in the Rock Creek drainage. This assessment would include any designs for the proposed stream diversion around the proposed paste facility and a complete roads analysis and recommendations associated with mine activities and proposed mitigation projects. This assessment will identify all potential sources of sediment (natural and man-caused) such as mass wasting areas and drainage from road surfaces.

(1) The sediment abatement program shall implement sediment mitigation actions designed to reduce sediment levels in Rock Creek by 38% (the projected increase in sediment levels attributable to development of the mine as described in the BA) <u>prior to</u> surface disturbance activity not related to the evaluation adit stage of the project.

(2) Upon completion of the feasibility assessment (1. d., above), the Forest would require the applicant to complete design and permitting requirements, in consultation with MDEQ, the Forest, and the Service, and begin construction of such sediment abatement measures as agreed to by the Forest and the Service.

f. Upon the issuance of the letter of approval for the Rock Creek Project, the Forest would require the applicant to complete and submit to the Forest and the Service a sediment monitoring plan that would adequately assess the current (i.e., baseline) and long-term status of sediment levels in Rock Creek. The sediment monitoring plan would be developed in consultation with MDEQ, the Forest and the Service and would address the entire Forest permit time period. This also would include a complete assessment of the effectiveness of the sediment abatement program in the Rock Creek drainage. If the assessment concludes, and the Service agrees, that the sediment abatement program failed to substantially reduce sediment levels in Rock Creek, then the applicant would prepare an assessment of other measures that could be implemented in the Rock Creek drainage and would be completed in a time frame agreed to by the Service.

g. Establish and document the natural hydrograph conditions prior to the mine becoming fully operational. Install a system of stream gages, as necessary, in order to record various stream flow conditions throughout the Rock Creek drainage before, during, and after mine operations. Consult a hydrologist to help establish the stream gage locations.

2. The following terms and conditions are established to implement reasonable and prudent measure # 2:

a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest would require the applicant to complete, and submit to the Forest and the Service, an evaluation of operational options with existing diffuser location and alternative locations for siting the diffuser entering the Clark Fork River below Noxon Dam. The evaluation would be prepared in consultation with the Forest, MDEQ, and the Service and would focus on recommendations that would minimize potential effects on migrating or resident bull trout utilizing the Clark Fork River habitats adjacent to the mouth of Rock Creek and the spring area immediately upstream. The Service would have the authority to ultimately approve the evaluation.

b. If the evaluation identifies a more appropriate operation or location for the diffuser (2. a., above), the Forest would require the applicant to modify the plan of operations, as agreeable to the Service, to incorporate the alternative most likely to minimize impacts to bull trout.

3. The following terms and conditions are established to implement reasonable and prudent measure #3:

a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the applicant shall submit a plan to the Forest and the Service for metals monitoring as it relates to bull trout habitat requirements that includes monitoring in water samples, sediment samples, and fish samples. This monitoring would

start prior to mine development to establish the baseline, and continue during operations and post operations as determined necessary by the Forest and the Service. The Service would have the authority to ultimately approve the plan.

4. The following terms and conditions are established to implement reasonable and prudent measure #4:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest shall require the applicant to submit a plan to the Forest and the Service for monitoring of groundwater effects as they relate to bull trout habitat requirements. This monitoring would start prior to mine development to assess the baseline, and continue during operations and post operations as determined necessary by the Forest and the Service. The Service would have the authority to ultimately approve the plan.

5. The following terms and conditions are established to implement reasonable and prudent measure #5:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest shall require the applicant to submit a risk assessment of accidents related to haul routes for mine related vehicle traffic to the Forest and the Service for evaluation. The assessment would determine areas most at risk for bull trout and make recommendations for additional measures and responses to minimize risk. If any additional measures can be incorporated to minimize the risk of catastrophic failures, the Forest, MDEQ, and the Service would determine the timeline and mechanism for implementation of those identified measures.

6. The following terms and conditions are established to implement reasonable and prudent measure # 6:

   a. Minimization of paste pile or facility failures includes: employing the Bottom-Up construction sequence, installing blanket and finger drains beneath the paste facility; continually modeling and monitoring the moisture content of the paste pile during operations to better understand saturation levels, generating a detailed design of the paste plant operations and disposal system to ensure quality assurance and quality control during operation and post-closure. If any additional measures can be incorporated to minimize the risk of catastrophic paste pile or facility failures, the Forest, MDEQ, and the Service would determine the timeline and mechanism for implementation of those identified measures.

7. The following terms and conditions are established to implement reasonable and prudent measure # 7:

   a. The Forest would require the applicant to annually prepare and submit to the Service a report of the mining year activities as well as the next year's proposed activities.

b. Upon locating dead or injured bull trout or upon observing destruction of redds, notification by the Forest or applicant must be made within 24 hours to the Montana Field Office at 406-449-5225. Record information relative to the date, time, and location of dead or injured bull trout when found, and possible cause of injury or death of each fish and provide this information to the Service.

c. During project development and operation the Forest or applicant shall notify the Service within 24 hours of any emergency or unanticipated situations arising that may be detrimental for bull trout relative to the proposed activity.

d. Within 90 days of the end of each year, the Forest or applicant would provide a written report or letter to the Service indicating the actual number of bull trout taken, if any, as well as any relevant biological/habitat data or other pertinent information on bull trout that was collected.

e. The Forest shall assure consistent implementation of measures and standards specified in the Aquatic Conservation strategies as indicated in the 1998 Biological Opinion for the Effects to Bull Trout from the Continued Implementation of Land and Resource Management Plans and Resource Management Plans as Amended by the Interim Strategies for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and portions of Nevada (INFISH), and the Interim Strategy for Managing Anadromous Fish-producing Watershed in Eastern Oregon and Washington, Idaho and portions of California (PACFISH).

f. To better monitor mitigation measures identified, the Forest would provide summaries to the Service of all INFISH compliance, water quality and fish population monitoring conducted in conjunction with these mining operations.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service expects that incidental take of bull trout would result from changes stream channel characteristics associated with increases in sediment, modifications in water quality, and modifications of instream habitat features (e.g. pool depths, channel width, substrate embeddedness) for the life of the mining operations and reclamation activities. Some long term effects of mining operations would likely continue indefinitely after mine closure. If, during the course of the action, the proposed project design and operations are not adhered to, the level of incidental take anticipated in the biological opinion may be exceeded. Such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Service retains the discretion to determine whether non-compliance with terms and conditions results in take exceeding that considered here, and whether consultation should be re-initiated. This may require suspension of mining operations. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

APPENDIX J —

REVEGETATION PLANS

APPENDIX J - REVEGETATION PLANS

I. SUMMARY OF RCR'S REVEGETATION PLAN - ALTERNATIVE II

TABLE J-1.
Proposed Final Seeding Mixtures for the Tailings Impoundment Area, Facilities and Mine Areas, and the Transportation Corridor

Common Name	Scientific Name	Drill Seeding rate[1] (pounds/acre)	Seeds per square foot[2]
GRASSES[3]			
Redtop	*Agrostis alba*	0.1	11.0
Meadow foxtail	*Alopecurus pratensis*	1.0	13.0
Mountain brome	*Bromus marginatus*	5.0	10.0
Orchardgrass	*Dactylis glomerata*	1.0	15.0
Sheep fescue	*Festuca ovina duriuscula*	1.0	13.0
Common timothy	*Phleum pratense*	0.5	15.0
Big bluegrass	*Poa ampla*	0.5	10.0
Canada bluegrass	*Poa compressa*	0.2	11.0
	Subtotal Grasses	**9.3**	**98.0**
FORBS[4]			
Common yarrow	*Achillea millefolium*		
Aster	*Aster* spp.		
Bunchberry dogwood	*Cornus canadensis*		
Lupine	*Lupinus* spp.		
Penstemon	*Penstemon* spp.		
Alsike clover[5]	*Trifolium hybridum*		
	Subtotal Forbs	**1-2**	**10-20**
SHRUBS[4,6]			
Western serviceberry	*Amelanchier alnifolia*		
Snowbrush ceanothus	*Ceanothus velutinus*		
Red-osier dogwood	*Cornus stolonifera*		
Oceanspray	*Holodiscus discolor*		
Shrubby cinquefoil	*Potentilla fruticosa*		
Chokecherry	*Prunus virginiana*		
Currant	*Ribes* spp.		
Rose	*Rosa* spp.		
White spirea	*Spiraea betulifolia*		
Common snowberry	*Symphoricarpos albus*		
	Subtotal Shrubs	**3-5**	**5-10**
	TOTAL	**13.3-16.3**	**113-128**

[1]Drill seeding would be done on most slopes at 3:1 (33%) or less. Broadcast seeding methods would be used on steeper slopes or rocky areas in which case the seeding rate would be doubled. Hydroseeding (a broadcast method) would only be used where feasible.

[2]The seeding rate assumes pure live seed (PLS) which is a certified rating for each seed lot adjusted for purity and germination percentage. The target is for 120 PLS/sq.ft.
[3]Grasses would be seeded on the Tailings Impoundment, Facilities and Mine area, Transportation Corridor. Mountain brome would be seeded at a slightly higher rate on the transportation corridor. An annual cereal grain would be included for rapid initial stabilization, as appropriate.
[4]Rates given for forbs and shrubs are a combination of any or all species.
[5]To discourage wildlife use, alsike clover would not be seeded on the transportation corridor; it would be seeded in other areas upon completion of operations.
[6]Shrubs would be seeded on most disturbances but exceptions include: a) the tailings impoundment dam face - shrubs would be planted (not seeded); and b) the transportation corridor - shrubs would not be seeded or planted except as needed on road cut-and-fill slopes.
Source: Culwell, Larsen, and Scow *In* ASARCO, Incorporated 1987 - 1997.

TABLE J-2.
Proposed Final Seeding Mixtures for the Evaluation Adit

Common Name	Scientific Name	Seeding Rate[1] (pounds/acre)	Seeds[2] per square foot
GRASSES[3]:			
Redtop	*Agrostis alba*	0.2	22.0
Meadow foxtail	*Alopecurus pratensis*	1.0	21.0
Mountain brome	*Bromus marginatus*	5.0	10.0
Sheep fescue	*Festuca ovina duriuscula*	2.0	31.0
Big bluegrass	*Poa ampla*	1.0	20.0
Alsike clover	*Trifolium hybridum*	1.0	16.0
TOTAL		**10.2**	**120**

[1]Broadcast seeding methods would be used.
[2]The seeding rate assumes pure live seed (PLS) which is a certified rating for each seed lot adjusted for purity and germination percentage; the target is for 120 PLS/sq.ft.
[3]Beargrass (*Xerophyllum tenax*), a forb, may be seeded, if seed is available; shrubs and trees would not be seeded or planted.
The final revegetation seeding mixtures would be applied throughout the mine life (years 0-35) as areas are prepared for recontouring and topsoiling. Interim revegetation would be applied to areas that require stabilization; these areas would be reseeded with the final seed mixtures and/or plantings after recontouring and topsoiling.

TABLE J-3.
Proposed Final Tree Planting Rates for the Tailings Impoundment Area and Facilities and Mine Areas[1]

Common Name	Scientific Name	Stocking Rate[2] (trees/acre)
Tailings Impoundment Top and Associated Areas		
Western larch	*Larix occidentalis*	133
Western white pine	*Pinus monticola*	133
Ponderosa pine	*Pinus ponderosa*	133
Douglas-fir	*Pseudotsuga menziesii*	266
Tailings Impoundment Dam Face		
Ponderosa Pine	*Pinus ponderosa*	332
Douglas-fir	*Pseudotsuga menziesii*	333
Facilities and Mine Area		
Western larch	*Larix occidentalis*	133
Englemann spruce	*Picea engelmannii*	133
Lodgepole pine	*Pinus contorta*	133
Douglas-fir	*Pseudotsuga menziesii*	266

[1]No trees would be planted on the transportation corridor.
[2]Stocking rates would total 665 trees/acre on all sites.

II. AGENCY MITIGATIONS THAT WOULD BE IMPLEMENTED UNDER ALTERNATIVE III, IV, OR V

RCR would develop a revised revegetation plan to be reviewed and approved by the Agencies. The detailed plan would address all elements currently proposed and those necessary to meet agency mitigations identified in the EIS. The overall goal is to achieve long-term ecosystem stability and potential while incorporating goals and mitigations for other resources. The plan elements would be thoroughly documented to ensure that the rationale for each element is well understood. This is particularly important for plant species selection. In view of the long-term nature of the proposed project, the following practices are identified with the intention of providing flexibility as environmental conditions and agency policies change, and of ensuring that state-of-the-art knowledge is incorporated. The revegetation plan would be coordinated in conjunction with other resource mitigations and monitoring plans for all areas, including wetlands.

Species Selection

The objective would be to develop a revegetation plan that meets as well as balances a variety of short- and long-term needs including soil stabilization, restoration of soil productivity, species selection and plant community successional considerations for wildlife and wildlife habitat needs, and visual resource enhancement.

Grass and forb seed mixes and tree and shrub plantings would be reassessed to address site-specific objectives including:

- environmental conditions of recontoured areas
- visual setting of recontoured areas
- substrate (tailings, waste rock, etc.) and soil chemical and physical conditions
- short-term needs to stabilize soil but not be attractive to wildlife only in transportation and utility corridors
- long-term needs for visuals (rapid screening)
- long-term needs for wildlife
  - browse, forage and cover
  - arrangement of wildlife habitat components in the Rock Creek watershed (travel corridors, snags, winter range, etc.)
- long-term needs for fisheries (shading, food source base, etc.)
- seed collection from the permit area and propagate seeds and plantings to ensure locally adapted and genetically compatible stock
- choice of rapidly establishing grasses that will not hinder native colonization or that would spread off the reclaimed area and would not be persistent
- choice of locally native pioneer species (such as fireweed and pearly everlasting) for rapid stabilization
- hand planting of trees, shrubs, etc. on steep slopes
- consideration of successional changes in plantings and seedings to best achieve overall watershed and habitat conditions.
- innoculating shrub and tree plantings with appropriate mycorrhiza

Revegetation plan elements would be documented to ensure that the rationale for species choices and revegetation actions are well understood. For guidance, the Agencies suggest using Region 1 Native Plant Handbook (USDA Forest Service Northern Region 1995) and other appropriate guidelines in existence at the time of project implementation. The goal for tree stocking is to have a minimum of 150 live trees per acre 30 to 50 years after planting. Assuming 30% mortality, the proposed stocking rate of 240 trees per acre would result in 168 trees per acre.

Suggested seeding and planting mixes include:

TABLE J-4.
Agencies' Suggested Seeding Mixes for the Tailings Deposit (Slopes and top)[1]

Common Name	Scientific Name	Stocking Rate (trees/acre)[2]
TREE PLANTING		
Lodgepole pine[3]	*Pinus contorta*	80
Ponderosa pine [3]	*Pinus ponderosa*	20
Western larch	*Larix occidentalis*	20
Douglas-fir	*Pseudostuga menziesii*	20
Western white	*Pinus monticola*	20
Aspen	*Populus tremuloides*	40
Black	*Populus trichocarpa*	40
	TOTAL TREES	240
SHRUB PLANTING		**(shrubs/acre)[1]**
Alder	*Alnus sinuata*	24
Snowbush	*Ceanothus velutinus*[4]	10
Redstem	*Ceanothus sanquineus*[4]	10
Mockorange	*Philadelphus lewisii*	8
Snowberry	*Symphoricarpos albus*	8
Kinnikinnik	*Arctostaphylos uva-ursi*	8
Buffaloberry	*Shepherdia canadensis*	8
White spirea	*Spirea betulifolia*	8
Ninebark	*Physocarpus malvaceus*	8
Woods rose	*Rosa woodsii*	8
Oceanspray	*Holodiscus discolor*	8
	TOTAL SHRUBS	108
GRASS/FORB SEEDING		**Drill Seeding Rate (pounds per acre)**
Annual rye	*Lolium multiflorum*	2.5
Sterile hydrid		2.5
Idaho fescue	*Festuca idahoensis*	1.5
Bluebunch	*Agropyron spicatum*	1.5
Pinegrass	*Calamagrostis rubescens*	1.0
Elk sedge	*Carex geyerii*	1.0
Fireweed	*Epilobium angustifolium*	1.5
Pearly everlasting	*Anaphalis margaritacea*	1.0
Yarrow	*Achillea millefolium*	1.0
Pussytoes	*Antennaria rosea*	0.5
Strawberry	*Fragria vesca*	0.5
Strawberry	*Fragaria virginiana*	0.5
	TOTAL GRASSES/FORBS	15

[1] Seed and planting mixtures can be modified at any time with agencies approval.
[2] Containerized stock would be preferable; include western red cedar (*Thuja plicata*) at 5 trees/acre on cooler/moister positions.
[3] Innoculated with appropriate mycorrhiza fungi.
[4] Inoculated with appropriate nitrogen-fixing bacteria.

TABLE J-5.
Agencies' Suggested Seeding Mixes for the Mill Site (Alternative III to V)[1]

Common Name	Scientific Name	Stocking Rate (trees/acre)[2]
TREE PLANTING		
Lodgepole pine [3]	*Pinus contorta*	80
Ponderosa pine [3]	*Pinus ponderosa*	5
Western larch	*Larix occidentalis*	20
Douglas-fir	*Pseudostuga menziesii*	20
Western white	*Pinus monticola*	20
Aspen	*Populus tremuloides*	30
Black cottonwood	*Populus trichocarpa*	30
Engelmann spruce	*Picea engelmannii*	35
	TOTAL TREES	240
SHRUB PLANTING		**(shrubs/acre)**[2]
Alder	*Alnus sinuata*	20
Snowberry	*Symphoricarpos albus*	20
Oceanspray	*Holodiscus discolor*	20
Serviceberry	*Amelanchier alnifolia*	20
Snowbush	*Ceanothus velutinus*[4]	10
Redstem	*Ceanothus sanguineus*[4]	10
	TOTAL SHRUBS	100
GRASS/FORB SEEDING		**Drill Seeding Rate (pounds per acre)**
Annual rye	*Lolium multiflorum*	2.5
Sterile hybrid		2.5
Rough fescue	*Festuca scabrella*	1.5
Pinegrass	*Calamagrostis rubescens*	1.0
Elk sedge	*Carex geyerii*	1.0
Beargrass	*Xerophyllum tenax*	2.0
Fireweed	*Epilobium angustifolium*	1.5
Pearly everlasting	*Anaphalis margaritacea*	1.0
Yarrow	*Achillea millefolium*	0.5
Pussytoes	*Antennaria rosea*	0.5
Strawberry	*Fragria vesca*	0.5
Strawberry	*Fragaria virginiana*	0.5
	TOTAL GRASSES/FORBS	15

[1] Seed and planting mixtures can be modified at any time with agencies approval.
[2] Containerized stock would be preferable.
[3] Innoculated with appropriate mycorrhiza fungi
[4] Inoculated with appropriate nitrogen fixing bacteria.

TABLE J-6.
Agencies' Suggested Seeding Mixes for the Evaluation Adit[1]

Common Name	Scientific Name	Stocking Rate (trees/acre)[2]
TREE PLANTING		
Subalpine fir	*Abies lasiocarpa*	60
Engelmann spruce [3]	*Picea engelmannii*	60
Douglas-fir	*Pseudostuga menziesii*	60
Lodgepole pine [3]	*Pinus contorta*	60
	TOTAL TREES	240
SHRUB PLANTING		(shrubs/acre)[1]
Alder	*Alnus sinuata*	16
Snowberry	*Symphoricarpos albus*	16
Oceanspray	*Holodiscus discolor*	16
Serviceberry	*Amelanchier alnifolia*	16
Rocky Mountain maple	*Acer glabrum*	16
	TOTAL SHRUBS	80
GRASS/FORB SEEDING		Drill Seeding Rate (pounds per acre)
Annual rye	*Lolium multiflorum*	2.5
Sterile hybrid grain		2.5
Northwest sedge	*Carex concinoides*	1.5
Pinegrass	*Calamagrostis rubescens*	1.0
Elk sedge	*Carex geyerii*	1.0
Beargrass	*Xerophyluum tenax*	2.0
Fireweed	*Epilobium angustifolium*	1.5
Pearly everlasting	*Anaphalis margaritacea*	1.0
Yarrow	*Achillea millefolium*	0.5
Pussytoes	*Antennaria rosea*	0.5
	TOTAL GRASSES/FORBS	14

[1] Seed and planting mixtures can be modified at any time with agencies approval.
[2] Containerized stock would be preferable.
[3] Innoculated with appropriate mycorrhiza fungi
[4] Inoculated with appropriate nitrogen fixing bacteria.

APPENDIX K —

AGENCIES' CONCEPTUAL MONITORING PLANS

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1.1 Introduction

This appendix contains the agency (Kootenai National Forest (KNF) and Montana Department of Environmental Quality (DEQ))-modified or -generated conceptual monitoring plans for Alternative V. RC Resources (RCR) would submit a final monitoring plan and, if appropriate, update the current plans outlined in the Rock Creek Evaluation Adit License Application (RCR 2010) for approval by the Agencies prior to the Rock Creek Mine Project (project) startup. Where applicable, all plans would identify action levels, which, when reached, would require RCR to implement a contingency action plan. Contingency action plans for the most likely scenarios would be developed by RCR and approved by the KNF and DEQ prior to project startup.

1.2 Monitoring Report Requirements

All monitoring described in the sections below 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 DEQ and made available to the public.

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.

1.2.1.1 Agency Monitoring

Agency staff from the KNF and DEQ would conduct compliance inspections at the Rock Creek Mine under the authority of the Metal Mine Reclamation Act and the Federal Land Management and Policy Act. Comprehensive mine-wide inspections would consist of physical on-site examination of disturbance areas, verification sampling at water quality monitoring points, and geochemical sampling of mine products, construction materials, and reclamation materials. Annual examination of revegetation conditions would be conducted. Inspections more frequent than quarterly may be conducted during periods of intense activity in localized portions of the mine or where compliance problems have been noted and corrective measures are being implemented. Additional compliance inspections pursuant to the Montana Water Quality Act, the Clean Air Act of Montana, and 36 CFR 228 regulations would also be conducted. The results of these inspections would be documented in agency files and would be available to the public upon request.

1.2.1.2 Operator Monitoring Reports

The purpose of monitoring is to demonstrate compliance with the terms and conditions of the approved reclamation plans, detect problems or unanticipated events early, and provide a basis for directing remediation of problems. Monitoring report requirements are described for each monitoring plan. Other required monitoring reports are described below. All monitoring reports would be submitted to the KNF and DEQ and would be available to the public upon request.

1.2.1.2.1 Annual Operating and Reclamation Status Report

The Annual Operating and Reclamation Status Report is required by the Metal Mine Reclamation Act (82-4-339, Montana Code Annotated (MCA), and Administrative Rules of Montana (ARM) 17.24.118) and describes the overall mining and reclamation status. RCR must track the status of all stipulations and conditions required by the KNF and DEQ in this report.

1.2.1.2.1 Hard Rock Impact Board Quarterly Survey Reports

RCR would conduct quarterly monitoring surveys of all employees during the impact period. The impact period is assumed to start 6 months prior to commencement of mine construction and last through the completion of all tax prepayments (through Year 6 of mine operation) and tax crediting (from Year 7 for approximately 5 years (20% per year)). The survey would identify the residence for each worker at the mine, the family size of the worker, how long the worker had been a resident of the area, and where his/her children (if any) were attending school. The results of each survey would be mailed to all identified potentially affected local governmental units identified in the impact plan and the Hard-Rock Mining Impact Board.

1.3 Air Quality Monitoring Plan

DEQ's Final Determination on RCR's Air Quality Permit (Permit # 2414-03; Appendix C of the Supplemental Environmental Impact Statement (SEIS)), does not require ambient air quality monitoring as a condition of the air quality permit for the project. DEQ determined that the emissions would be low due to the use of control technologies.

The following summarizes air quality monitoring reporting requirements described in detail in Appendix C of the SEIS, *RCR's Air Quality Permit # 2414-03*. RCR would submit quarterly data reports and would supply DEQ with annual production information for all emission points required by the department in the annual emissions inventory request. Production information would be gathered on a calendar-year basis and submitted to DEQ by the date required in the emissions inventory request. Information shall be in units as required by the department. In addition, RCR would submit the following information annually to DEQ by March 1 of each year, as required for the annual emission inventory, as well as to verify compliance with permit limitations:

- Amount of ore and waste handled;
- Amount of diesel fuel used (underground equipment);
- Amount of propane and natural gas used;
- Amount of explosives used;
- Hours of operation of the emergency diesel-fired generator;
- An estimate of vehicle miles traveled on on-site access roads;
- Amount of disturbed acreage (including tailings area); and
- Other emission related information DEQ may request (ARM 17.8.710).

1.4 Phase I Data Evaluation Plan

The Phase I Data Evaluation Plan would be developed to provide the Agencies with data that could not be obtained prior to construction of the evaluation adit. Data from the evaluation adit would be used to verify the hydrologic, geochemical, and rock mechanics data used in the analyses described in this SEIS or the 2001 FEIS.

This plan consists of three components. The first is implementation of the evaluation adit portions of the Geochemistry Characterization and Monitoring Plan described below. This plan would provide the geological and geochemical data needed to ensure that nonacid-generating and nonmetals-leaching material was used for facility construction. The second component would require the collection of hydrologic data during evaluation adit construction as described in Section 1.6. These data would be used to better define where groundwater is coming from, how much is being produced, and what the quality is

to ensure the water treatment system operates as predicted and produces a discharge that would comply with any Montana Pollutant Discharge Elimination System (MPDES) permit obtained for the project. A better understanding of the impacts of withdrawal of groundwater on springs, seeps, and streams could be obtained as well as the possible impacts the underground reservoir in the mine might have on those same springs, seeps, and streams. The Rock Mechanics Data Collection and Monitoring Plan in Section 1.7 describes the third component of the Phase I Data Evaluation Plan. The rock mechanics data from the evaluation adit would be used to modify the initial underground mine plan to minimize the risk of subsidence. All evaluation adit data would be supplemented by data collected during mine construction and operation, which would be used to further modify and refine facility designs and operations.

After the evaluation adit is completed, RCR would be required to file a report containing an analysis of data collected through the Geochemical Characterization and Monitoring Plan, the Rock Mechanics Data Collection and Monitoring Plan, and the Water Resources Monitoring Plan as outlined below. The Phase I Data Evaluation Report would include recommendations for any changes to the approved Plan of Operations, reclamation plan, mitigation plans, and monitoring plans. If the evaluation adit data indicated significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts, as described by 40 CFR 1502.9(c)(1)(ii), additional NEPA analysis would need to be conducted and all appropriate facility designs and mine plans would need to be modified and approved by the Agencies. The modifications would be requested and processed as defined in the Metal Mine Reclamation Act (82-4-337(4 and 5) and 82-4-342 MCA) and the Forest Service's 36 CFR 228 regulations. The project could not proceed beyond the evaluation adit construction stage without approval from the Agencies on the facility designs and mine operation plans, as modified based on evaluation adit construction data.

1.5 Geochemical Characterization and Monitoring Plan

1.5.1 Introduction

The purpose of the Geochemical Characterization and Monitoring Plan is to ensure that appropriate kinds and amounts of geochemical data are collected and evaluated during mining at Rock Creek and to ensure that water quality is protected. Geochemical data collected under this plan would supplement other monitoring programs including surface water, groundwater, and mine water quality and process solution monitoring. The following is the proposed plan; RCR would develop a final monitoring plan for agency approval using this plan as a guide.

The kinds of data collection and evaluation efforts described in this plan were guided by an understanding of the nature of the Rock Creek Mine site (Section 1.5.2.1), defining the inherent geochemical risks based on knowledge of environmental pathways and receptors (Section 1.5.2.2), and then developing data quality objectives (Section 1.5.3) to manage those risks. Sample collection, laboratory measurements, and data analysis and decisions are described in Section 1.5.4.

1.5.1.1 Differences from Acid Rock Drainage and Metals Leaching Monitoring Plan

This Geochemical Characterization and Monitoring Plan differs from Appendix D (Acid Rock Drainage and Metals Leaching Monitoring Plan) of the Rock Creek Evaluation Adit License Application (RCR 2010). This plan adds more specific statistical tests than the previous plan. A requirement was added to test Phase I pilot hole composite samples prior to placement of waste material. The pilot hole composite samples would be analyzed by a "Quick Test" (such as acid-base potential, total sulfur, or net acid generation pH) to be proposed by RCR. The approved quick test method would include a monitoring action level. Sampling frequency was also increased in this plan.

Another major difference between this Geochemical Characterization and Monitoring Plan and the RCR's Acid Rock Drainage and Metals Leaching Monitoring Plan is that this plan would supplant the kinetic test requirements with field-scale leach tests, also known as "barrel tests."

1.5.2 Site Background

A Site Conceptual Model, which is a description of site-specific environmental conditions, facilitates better understanding of potential interactions between surface water, groundwater, and mined rock or tailings. Description of a site conceptual model is an integral part of the overall planning process for developing monitoring programs at mines (Russell et al. 2014a). Relevant descriptions of the project, geology, and geochemistry from the Draft SEIS are included below.

1.5.2.1 Site Conceptual Model

A site conceptual model is a description of the features of a project such as Rock Creek that influence environmental behavior. In the case of Rock Creek, elements of the site conceptual model are described and analyzed in detail in the SEIS. Relevant SEIS sections are described in Table K-1.

Table K-1. Elements of the Site Conceptual Model Described in the Rock Creek Project SEIS.

Topic	SEIS Section Number	Description
Project Description	2.3.1	The project involves two phases with Phase I consisting of an exploration decline and Phase II is the fully operational mine with a second production portal, a mill, and a paste tailings facility.
Hydrology	3.7	The surface and groundwater system at Rock Creek is described in this section.
Geology	3.5	Ore at Rock Creek is hosted in pre-Cambrian quartzite within the Lower Revett Formation. Ore zones are spatially associated with other styles of alteration, some of which result in elevated sulfide content in waste rock.
Geochemistry	3.6	Overall, the risk of acid generation and metal leaching is low at Rock Creek. This conclusion is predicated on the core samples collected from the Rock Creek deposit and on the inferred geologic similarities between Rock Creek and the Troy deposit.

1.5.2.2 Sources, Pathways, and Receptors

Based on the site conceptual model, the risk of acid generation and metal leaching at Rock Creek is considered low. The rock units with the highest risk of release of metals or acidity are the Prichard Formation, possibly the Burke Formation, pyritic alteration zones in the Revett Formation, or in unaltered zones in the Revett containing elevated primary pyrite. Metal releases may also occur from the galena alteration zone in the Revett. The Prichard and Burke Formations are lacking from the area of the Phase I Exploration Adit at Rock Creek. An additional contaminant of concern is nitrate and ammonia associated with the explosives blasting.

Phase I: During development of the Exploration Adit in Phase I of the proposed project, two potential sources of contact water are considered: the waste rock and ore placed in the portal pad and exposed rock in underground mine walls (Figure K-1). About 90,000 tons of waste rock are estimated to be excavated from the evaluation adit, of which 47,700 tons are estimated to come from the Upper and Middle Revett, 34,500 tons from the Lower Revett not containing mineralized zones, and 7,800 tons from waste rock in Lower Revett alteration zones (Erickson 2012).

Ore stockpiles (88,000 tons produced) and alteration waste rock (7,800 tons produced) stored in the portal pad may interact with meteoric water, and soluble constituents from the rock could potentially migrate in surface runoff from the site or could infiltrate into groundwater. Stormwater at the facility would be managed with a 600,000-gallon lined pond to minimize off-site migration of water and sediment so the groundwater pathway is the primary concern at the portal pad. Potential receptors would include humans, aquatic organisms, and terrestrial species. To reduce infiltration from precipitation, RCR would minimize snow accumulation by plowing the portal pad and cover stockpiles of alteration waste zone rock and ore with an impermeable material. RCR would also develop and implement an Explosive Handling and Blasting Plan to minimize the potential for elevated nitrate or ammonia concentrations occurring in surface water. To reduce the risk of terrestrial species encountering stored contact water, a fence would be installed around the pond (RCR 2010). Groundwater and surface water would be monitored downgradient of the portal pad. Rock used to create the portal pad would be sampled and analyzed prior to placement to ensure that acid drainage and metal leaching risk is low, as described in Chapter 2 of this Draft SEIS. Also, rock samples would be tested for soluble forms of nitrogen to determine the extent to which blasting agents may contribute to nitrogen loading in contact water.

Mine walls may interact with groundwater inflow to the adit. However, mine water would be collected and treated so potential releases would be controlled using water treatment conducted under a MPDES permit. Studies of potential release from mine walls would be conducted to better quantify potential metals and acidity loading from this source.

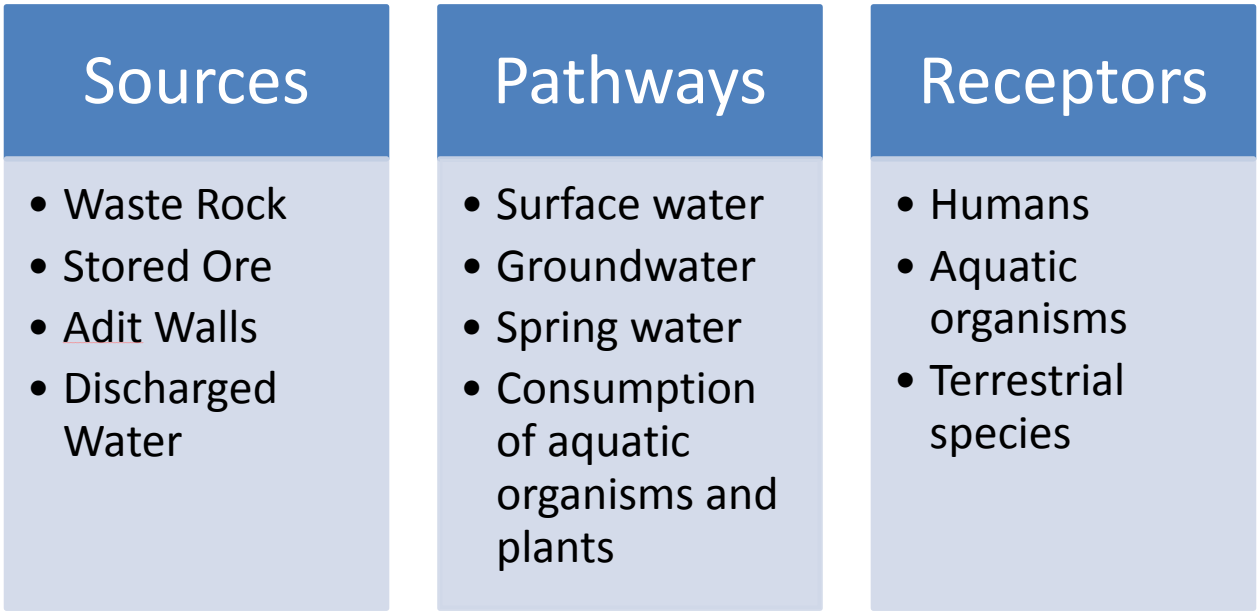

Figure K-1. Sources, Receptors, and Pathways for the Phase I Exploration Adit at Rock Creek.

Phase II: During full operation at Rock Creek, a paste tailings facility would be constructed along with development of a production adit and a mill complex. During Phase II, three potential sources of contact water are considered: waste rock, paste tailings, and exposed rock in underground mine walls (Figure K-2). Geochemical sampling and analysis would continue during the operating stage but details of the plan would be finalized at the end of Phase I, once the operating plan is finalized. However, field data on the geochemical behavior of waste rock, ore, and paste tailings would be collected during the Phase I program. Field data would improve the understanding of the nature of the Phase II facilities.

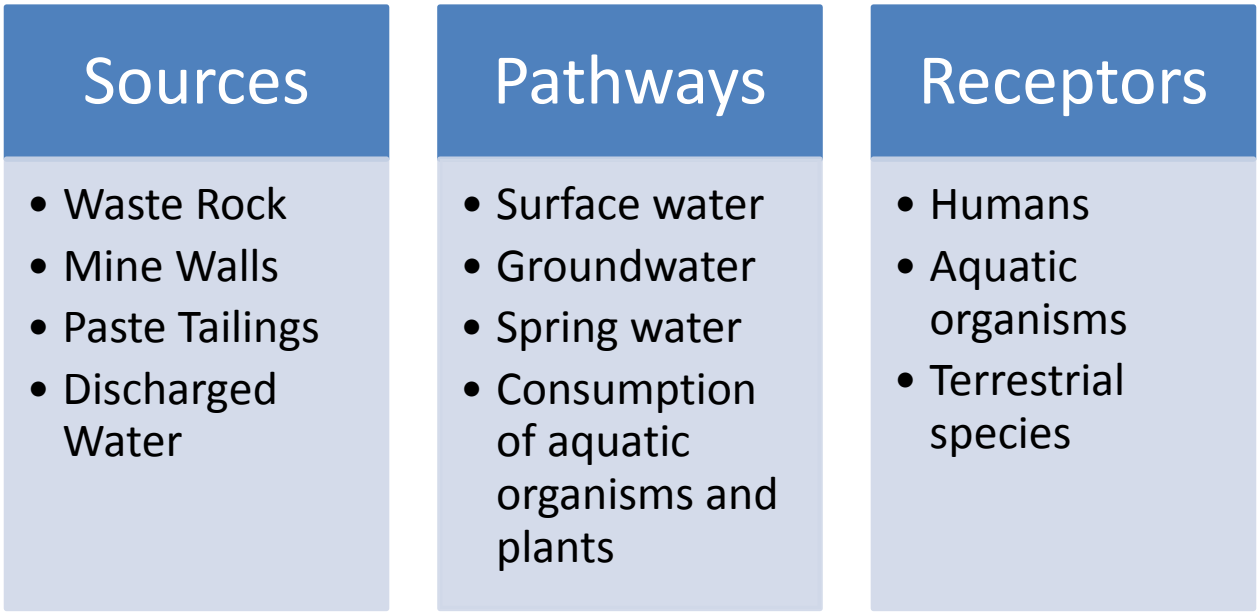

Figure K-2. Sources, Receptors, and Pathways for the Phase II Rock Creek Mine Operation.

1.5.3 Data Quality Objectives

The overall purpose of this monitoring program is to collect the amount, type, and quality of data needed to better define and manage environmental risks associated with water coming into contact with mined rock at the Rock Creek Mine. During environmental review of the project, a geochemical characterization program was developed and background hydrologic conditions at Rock Creek were described in detail. The overall risk of acid generation and metal leaching from waste rock, underground mine workings, ore stockpiles, and tailings were considered low at Rock Creek. This conclusion was based in part on the long-term conditions observed at the Troy Mine, which is considered a close analogue. Conclusions in the SEIS were also predicated on results of the laboratory tests performed on representative core samples.

1.5.3.1 Geochemical Issues and Concerns

Based on the environmental site conceptual model that includes information on the proposed project, the geology and geochemistry of Rock Creek, several questions about the geochemical nature of mined rock need to be confirmed. These include:

- **Topic 1:** Is the geochemical nature of rock material mined from the adits suitable for placement in the portal pad?
- **Topic 2:** Does mined rock (e.g., ore and waste) or exposed rock (e.g., underground mine walls) at Rock Creek have greater geochemical risks, including acid generation and metal leaching risks, than defined in the SEIS using the current dataset?
  a) If geochemical risks at Rock Creek are found to be significantly greater than estimated in the SEIS, it may be appropriate to revise the definition of geochemical risks at Rock Creek accordingly.
  b) A limited number of samples were available from the Rock Creek deposit because of the difficulty of obtaining large numbers of core samples prior to development of an exploration adit.
  c) Additional rock samples would be collected during advancement of the Phase I Exploration Adit to compare with baseline geochemical data collected from core samples.
- **Topic 3:** Is the Troy Mine a representative analogue of Rock Creek?
  a) If geochemical risks at Rock Creek are found to be significantly greater than at Troy, then it may be appropriate to revise the definition of geochemical risks at Rock Creek accordingly.
- **Topic 4:** Will explosives introduce an unacceptable amount of soluble nitrogen into blasted rock that would cause downstream violations of water quality standards for nitrate at a compliance monitoring location?
- **Topic 5:** What are the geochemical risks associated with mine facilities at Rock Creek including exposed waste rock, ore stockpiles, exposed underground mine walls, and paste tailings?
  a) Available baseline geochemical data were somewhat limited because of the scarcity of available core from the deposit.
  b) All lab-scale geochemical tests present challenges when trying to scale water quality predictions from laboratory test results to field-scale behavior.
  c) This plan includes larger scale field tests conducted on larger volume samples that are representative of waste rock, ore stockpiles, underground mine walls, and paste tailings.

1.5.3.2 Data Quality Objectives

Data quality objectives (DQO) are developed as part of the planning process for implementing monitoring strategies. The purpose of DQOs is to identify the amount, type, and quality of data needed to answer critical questions about the environmental performance of a mine (U.S. Environmental Protection Agency (EPA) 2006; Russell et al. 2014b). DQOs for the Geochemical Characterization and Monitoring Plan, include:

- **Topic 1:** Confirm predicted acid drainage risk from the SEIS. Confirmation of acid drainage risk will be based on composite samples from pilot holes drilled in advance of the Phase I adit. Pilot hole composites will be analyzed using suitable test methods. The number and type of samples should be sufficient to ensure that infiltration of meteoric water into the portal pad does not adversely affect downgradient water quality due to leaching of acidity or metals. The Phase 1 Geochemical Monitoring Plan will adopt appropriate monitoring action levels.
- **Topic 2:** Collect additional representative rock samples to facilitate a more refined statistical comparison between the geochemical conditions at Rock Creek with the current baseline geochemical data.

- **Topic 3:** Collect additional representative rock samples to facilitate a statistical comparison between the geochemical conditions at Rock Creek with available data from the Troy Mine.
- **Topic 4:** Collect data on the soluble nitrogen levels in blasted rock samples. If water quality monitoring at downgradient locations shows unacceptable levels of nitrate, the data on soluble nitrogen in blasted rock would be helpful in refining the performance of the blasting program.
- **Topic 5:** Collect additional geochemical characterization data to address metal leaching potential and to evaluate mineralogy of each rock unit mined. Also, collect field-scale data that represent possible water:rock interactions and contact water chemistry in the ore and waste stockpiles, paste tailings facility, and underground mines. Reduce uncertainty regarding scale-up from lab to field-scale, and adjustment from lab to field conditions (including surface area, temperature effects, and other factors) using larger scale field samples tested under field conditions.

1.5.4 Geochemical Testing Plan

A detailed testing plan has been developed for the Phase I Exploration Adit and is based on the DQOs developed in Chapter 3 of the SEIS. A detailed sampling plan would be developed for Phase II Operations once geochemical data have been collected and interpreted from Phase I. The Phase II geochemical monitoring plan would be developed by RCR and would be submitted to the Agencies for review and approval.

1.5.4.1 Proposed Phase I Geochemical Sampling

A summary of the proposed sample collection, analyses, and relevant monitoring action levels is shown in Table K-2. More detailed discussion of sample collection, laboratory methods, and data analysis is provided in the following sections.

Table K-2. Summary of the Proposed Rock Creek Phase I Geochemical Sample Collection, Analyses, and Relevant Monitoring Action Levels.

Sample Type	Number of Samples	Analyses	DQO	Trigger
10–kilogram (kg) Samples	≥ 45 waste ≥44 ore	Quick test	Topic 1	Use results to route waste rock. If material exceeds trigger, do not place in portal pad. Report if >10% of cumulative tests fail trigger.
		Static tests and total metals	Topics 2 and 3	If mean ABP of Phase I waste is less than ABP in baseline Rock Creek samples, reassess ARD risk. If the proportion of Phase I waste samples with ABP<0 is greater than baseline Rock Creek samples, reassess ARD risk. Use similar criteria for comparison with the Troy Mine.
		MWMP extract – soluble nitrogen	Topic 4	If SW or GW monitoring detects nitrogen exceedance of water quality standards, may use soluble nitrogen results from MWMP test to create future trigger as performance standard for blasting program.
		MWMP extract – Nevada Profile 1 by ICP	Topic 5	MWMP metals data used to expand geochemistry dataset. Submit results and annual interpretive report.
		MWMP extract – mineralogy	Topic 5	Mineralogy data used to expand geochemistry dataset. Submit results and annual interpretive report.
Bulk Samples	~10	Barrel tests, analyze leachate for Nevada Profile 1 constituents	Topic 5	Use data to improve understanding of contact water chemistry that may develop in full-scale mine operation. Submit results and annual interpretive report.
	~8	Wall rinse tests	Topic 5	

ABP = acid base potential, ARD = acid rock drainage, MWMP = Meteoric Water Mobility Procedure.

1.5.4.1.1 10-kg Samples

Collect a composite sample from a pilot hole drilled in advance of the Exploration Adit face. One sample should be collected for approximately each 2,000 tons of rock to be mined. Assuming an 18-foot-high and 20-foot-wide drift (and a rock density of 165 pounds per cubic foot or 2.65 grams (g)/centimeter $(cm)^3$), the pilot hole should be sampled across an interval of not more than about 70 feet to represent 2,000 tons of rock.

Samples collected from the pilot hole should consist of either ore or waste and should be limited to a single rock unit. For the purposes of the Geochemistry Characterization and Monitoring Plan, rock unit classification should follow the geologic logging program developed by RCR and should include the formation, member, and mineralization. For each sample, also provide a spatial description consisting of round numbers, geographic coordinates, dates, and collection methods (core, RC, grab, or channel). Where a pilot hole crosses the ore/waste boundary or one or more rock units, the sample should be split as needed. A sample should consist of approximately 10 kg of material that is representative of the rock to be mined. Suitable material may include drill cuttings from the pilot hole, a crushed sample of split core, chips from a channel sample, or a composite sample from a muck pile. A total of not less than 45 waste and 44 ore samples should be derived from this sampling program. If a pilot hole is not drilled well in advance of the adit face, then sampling would need to be performed on shot rock material.

1.5.4.1.2 Bulk Samples

Bulk samples of selected rock types (both ore and waste) and of representative paste tailings would be required for field barrel tests (Section 1.5.4.2.4). Approximately two samples of ore, six samples of waste, and two samples of paste tailings would be required for the field barrel tests, which would consist of about 800 pounds of broken rock (at a density of 110 pounds per cubic foot) or 600 pounds for paste tailings (at a density of 80 pounds per cubic foot).

For ore samples, one sample should approximate the average ore sulfur content while the second sample should approximate the upper 90th percentile sulfur content. For waste, select one representative sample for each of the most prevalent six rock units. The two paste tailings samples may be identically sourced (e.g., from the same metallurgical test), but one test may contain additives to represent addition of cement or flyash or both.

1.5.4.2 Proposed Phase I Geochemical Analyses

1.5.4.2.1 Quick Test to Determine Suitability for Rock Placement

Each 10-kg samples obtained from the pilot hole cuttings would be analyzed by a "quick test" to determine acid drainage risk. A quick test is required to facilitate decisions about rock placement based on test results. A rapid turnaround time is required to avoid production delays. Waste rock that is suitable for placement on the portal pad must have a low risk of acid drainage. At Rock Creek, materials that are consistently low in sulfur (e.g., less than about 0.3%) are also nonmineralized so would also have a low risk of metal leaching. Therefore, testing and classification of rock based on low acid drainage risk should isolate material that is also low in metal leaching risk.

A geochemical test with a rapid turnaround time would need to be used to facilitate analysis of samples from a pilot hole and subsequent placement of the mined rock based on test results. Several methods could potentially provide 24-hour turnaround time to support routing based on geochemical test results. Examples may include, but are not limited to, Acid-base accounting (Sobek et al. 1978), Leco total S only (Sobek et al. 1978), or Net Acid Generation pH (Stewart 2004). The test method selected shall include a suitable site-specific trigger level that indicates potential for acid drainage risk in the sampled interval. Site-specific triggers for the three listed methods could be (ABP >0 ton/1,000 tons as CaCO3; Total S less than 0.3%; or NAG pH > 4.5). The specific test method and trigger would be developed by RCR subject to Agency approval. A contingency plan would be developed and describe how rock that fails the quick test monitoring action level would be managed.

1.5.4.2.2 Static Tests

Each 10-kg sample (minimum of 45 samples of waste and 44 ore) would be analyzed using Acid-Base Accounting with Acid Generating Potential based on nonsulfate S (Sobek et al. 1978), paste pH, and total metals by ALS Chemex method MS61 or equivalent. An additional five samples of paste tailings would also be analyzed by the methods described above. If the quick test method described in the previous section is not the Sobek Acid Base Accounting method, then a method comparison between the quick test and the Sobek ABP would be performed on a minimum of 50 samples. The correlation between ABP and quick test results must be calculated and should ensure that the quick test provides accurate and consistent classification of acid generation risk.

Quality assurance samples should be submitted at a frequency of 1 in 50 samples to verify sample accuracy and precision. At least one each of CANMET KZK-1 or NBM-1 (or equivalent) for ABP or LECO S measurements and NIST 2780 (or equivalent) for total metals or equivalent should be used. Also, blind duplicate samples at a frequency of 1 in 50 for ABP and total metals analyses should be included.

1.5.4.2.3 Selected 10-kg Samples – Mineralogy, Metal Mobility Tests, and Soluble Nitrate Analysis

A selected subset of ten 10-kg samples, based on the same 10 samples used for barrel tests, would be used to characterize potential metal mobility using the MWMP (American Society for Testing and Materials 2013). The MWMP extracts would be analyzed for pH, conductivity, alkalinity/acidity, aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, copper, fluoride, gallium, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, nitrate/nitrite as N, nitrogen total as N, phosphorous, potassium, selenium, silver, sodium, sulfate, thallium, tin, vanadium, and zinc. In addition, the samples would be submitted for mineralogical analysis by x-ray diffraction.

1.5.4.2.4 Barrel Test and Wall Rinse Stations

A field barrel test (Attachment 1) would be conducted on selected samples of ore, waste, and paste tailings to determine the water quality of contact water and rate of release of constituents from bulk samples. Samples, to the extent possible, would approximate the overall size and distribution that is representative of run-of-mine material. The barrel test consists of filling a barrel or other large container with rock or paste tailings. A drain outlet is installed near the base of the container. Barrels would be placed outdoors on a pallet to elevate the base of the container to allow for fluid collection. Natural rain and snowfall would provide the source of water for leaching the rock. If water produced in the test is insufficient because of evaporation, deionized water can be added to accelerate leaching. Samples collected from the barrels would be analyzed for pH, conductivity, alkalinity/acidity, aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, copper, fluoride, gallium, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, nitrate/nitrite as N, nitrogen total as N, phosphorous, potassium, selenium, silver, sodium, sulfate, thallium, tin, vanadium, and zinc.

A wall rock rinsing test (International Network for Acid Prevention 2009) would be used to characterize potential loading from underground mine walls (Attachment 2). In general, at least one wall rinse station would be selected for each major rock unit of waste and ore in the Exploration Adit.

To conduct the wall rock rinse tests, a prescribed area of about 1 m^2 that consists of exposed rock (no shotcrete) and is relatively free of foreign sediment should be designated. A gutter section below the wall should be attached using epoxy, water from backpack sprayer sprayed onto the wall, and runoff collected. Sufficient water should be applied to collect about 5 liters of water from the rinse station. Water quality in the collected water sample should be measured for pH, conductivity, alkalinity/acidity, aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, copper, fluoride, gallium, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, nitrate/nitrite as N, nitrogen total as N, phosphorous, potassium, selenium, silver, sodium, sulfate, thallium, tin, vanadium, and zinc. The test can be repeated at prescribed intervals for semikinetic evaluation.

1.5.4.2.5 Sample Management

A 2-kg portion of each geochemical sample would be archived in case follow-up testing is needed.

1.5.4.3 Phase I Data Analysis and Reporting

1.5.4.3.1 Pilot Hole Samples

Results of the Agency-approved quick test would be used to route waste produced from the Phase I exploration adit. The proposed plan for construction of the portal pad requires that waste rock placed in the portal pad be nonacid-generating. The approved quick test method would include a trigger level that differentiates acid-generating waste from other materials (e.g., nonacid-generating and uncertain

materials). Acid-generating waste would need to be placed underground or otherwise handled according to an Agency-approved plan.

If more than 10% of measured test values from the pilot hole composite samples exceed the approved monitoring action level, then RCR must notify the Agency and reanalyze sample cuttings by intervals corresponding to individual rounds (e.g., one sample per 300 tons of waste). All sample results would be reported immediately when more than 10% of all cumulative tests results exceed trigger. A suitable management plan would be developed and implemented for placing waste to mitigate acid drainage risk. All sample results would be submitted to the Agencies in an annual report.

1.5.4.3.2 Static Test Results

The number of samples proposed for the exploration adit was based on the goal of collecting more samples than are currently available from the Rock Creek deposit and to ensure availability of an adequate dataset to facilitate statistical comparisons between new data, baseline data, and data from the Troy Mine. An estimated 90,000 tons of waste and 88,000 tons of ore would be removed during advance of the decline and through mining in the ore zone. The proposed sampling frequency is 1 sample for each 2,000 tons mined, which would yield about 45 waste and 44 ore samples.

All static test data collected from the Phase I exploration adit would be summarized in an annual report submitted to the Agencies. The SEIS concluded that the risk of acid generation or release of metals was low at Rock Creek based on review of available baseline geochemistry data and based on comparison with the Troy Mine, which was considered a close analogue to Rock Creek. A statistical comparison would be performed to ensure these conclusions about acid drainage risk are warranted. The statistical tests would evaluate the difference, if any, in the population average ABP for waste and ore from three populations: Phase I Rock Creek, Baseline Rock Creek, and Troy. In addition, the population proportion of samples with ABP less than zero would also be determined separately for ore and waste samples from the three populations. The Student's t-test (equation 1) would be used to compare population means and the z-score test (equation 2) to compare population proportions. Results would be compared pair-wise for Phase I Rock Creek waste and ore to baseline geochemistry data and to Troy Mine data. Because of the scarcity of waste samples from Troy, additional waste samples from Troy may be required for this assessment.

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\left(\frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}\right)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}} \qquad [1]$$

$$Z = \frac{(\overline{p}_1 - \overline{p}_2) - 0}{\sqrt{\overline{p}(1 - \overline{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad [2]$$

Where $\overline{X_1}$ and $\overline{X_2}$, $\overline{p_1}$ and $\overline{p_2}$ are ABP means and proportions of ABP<0 for populations 1 and 2,
N_1 and N_2 are the number of samples for populations 1 and
s_1 and s_2 are ABP standard deviations for populations 1 and 2.

The t test and z score test are commonly used statistical methods that are described in standard statistical textbooks (Witte and Witte 2013).

Statistical Analysis of Baseline Data. Statistical analyses (Table K-3) were used to compare ABP in baseline data (Table K-4) for ore at Rock Creek to ore at Troy. Troy waste sample size was too small to perform comparisons (n=2). Two metrics were used for comparison: the mean and the proportion of samples with ABP<0. The Student's t-test was used to determine the significance of measured differences in the mean as shown in [1], which takes into account the means and standard deviations of the populations. A one-tailed distribution of p and t was used. The formula used to compare the difference between population proportions is shown in [2], which considers only the proportions and sample size. The z score that results from equation 2 is compared with a standard table of probabilities for a one-tailed distribution. Based on these statistics, Rock Creek ore has a lower average ABP and a greater proportion of ABP samples less than 0 than Troy ore.

If waste samples from the Phase I Exploration Adit have the same standard deviation measured in baseline samples, and if the mean ABP of Phase I samples was lower by about 3.4 tons (t)/1,000 t as $CaCO_3$, the difference would be significant at 5% probability. The mean would need to decrease by 4.8 t/1,000 t for the difference to be significant at 1%. The z score test for waste samples would likely be even more stringent than the t test.

Table K-3. Statistical Summary for Ore and Waste Samples from Rock Creek and Troy.

Mine	Type	n	Mean ABP (t/1,000 t as $CaCO_3$)[1]	Standard Error of Mean	Standard Deviation	Proportion ABP<0 (%)
Rock Creek	Waste	24	3.0	±1.4	6.8	6
Rock Creek	Ore	34	0.6	±1.1	6.1	50.0
Troy	Waste	2	NA	NA	NA	NA
Troy	Ore	28	7.2	±1.4	7.4	14

[1]mean and proportion calculated from values rounded to the nearest significant integer value.
Average ABP for Rock Creek ore is significantly less than at Troy (probability=0.0002).
Proportion of ABP<0 in Rock Creek ore is greater than for Troy ore (p<0.0001).

Table K-4. Baseline ABP data for Rock Creek and Troy.

n	Rock Creek		Troy
	Ore	Waste	Ore
1	2.9	6.5	17
2	1.6	-0.3	15
3	-6.8	8.8	20
4	-0.6	-0.3	13
5	-2.1	-0.3	11
6	16.8	-0.3	9
7	-8.6	13.3	16
8	-2.8	4.2	4
9	10.0	4.1	15
10	-5.4	-11.5	14
11	1.8	3.2	0
12	5.3	3.9	0
13	-4.6	13.9	-5
14	5.0	4.5	-7
15	-4.6	12.1	-4
16	6.3	3.0	-3
17	-5.4	1.0	1
18	-2.1	4.8	1
19	8.8	1.7	3
20	-5.1	0.7	2
21	-4.2	3.0	4
22	2.5	11.1	8
23	3.4	-16.6	14
24	6.3	-0.3	13
25	8.5		12
26	-12.8		13
27	-1.4		8
28	1.3		7
29	-0.3		
30	-1.3		
31	-3.4		
32	-3.1		
33	8.8		
34	6.1		

If the average ABP of samples collected under the Phase I Monitoring Plan are significantly lower than the average ABP estimated in the Rock Creek baseline geochemistry data (at a probability that the means are equal to 5% or less), then the acid drainage risk should be revised based on the new findings. Similarly, if the proportion of samples with ABP less than zero collected under this program are significantly higher than the proportion estimated in the Rock Creek baseline geochemistry data (at a probability that the proportions are equal to 5% or less), then the acid drainage risk should be revised based on all available data.

1.5.4.3.3 Use of Other Data Collected under This Plan

Other data collected under the Geochemical Monitoring Program is meant to improve and expand the baseline geochemical characterization of the Rock Creek deposit. These data, including MWMP,

mineralogy, barrel test, and wall rinsing tests, would be summarized and interpreted in annual reports submitted to the Agencies.

1.5.4.3.4 Explosive Handling and Blasting Plan

Release of nitrogen compounds is of particular concern in underground mines because of the relatively large amounts of explosives used to break rock. Prior to Phase I, RCR would be required to submit a detailed Explosive Handling and Blasting Plan for agency approval that describes the blasting agents that would be used for various conditions (e.g., when water is present or absent), powder factors used, housekeeping practices, and other relevant information. If soluble nitrogen compounds in downgradient surface or groundwater exceed the action levels described in Section 1.6.10, RCR would notify RCR within 5 working days and follow the process outlined in Section 1.6.10. In the event of action level exceedances, RCR would also be required to submit a revised Explosive Handling and Blasting Plan to the KNF and DEQ for approval. Additionally, nitrate and total nitrogen data from the MWMP test may be used to develop monitoring action levels in blasted rock material for future use to ensure adequate blasting performance.

1.5.4.3.5 Integration with Surface Water and Groundwater Monitoring

As described in Section 1.6, surface and groundwater monitoring would be used to detect potential releases of constituents from the portal pad area (in Phase I) and from all facilities in Phase II. If a chemical release is detected, then the geochemical data collected under this program may be used to better understand the potential contribution of mine contact water to the potential release and to assess ways of preventing, abating, or mitigating releases. It may be necessary to develop and implement new mine waste management procedures, expand monitoring, or set new monitoring action levels if constituent releases are caused by mine contact water.

1.5.4.3.6 Contingencies and Reporting

This Geochemical Characterization and Monitoring Plan contains a number of monitoring action levels, described in previous sections. Preliminary contingency measures associated with each monitoring action level are described in Table K-5. In addition, notification and reporting requirements are also described. An annual report would be submitted to the Agencies that provides sample results, includes the statistical comparisons described above, and integrates the results of solution monitoring (e.g., surface water, groundwater, mine water, and process solution sampling) with the geochemical observations. All analytical data collected from lab samples, as well as field barrel tests and wall rinsing tests, would be compiled in the report. The overall acid drainage and metal leaching risk would be quantified. Issues or concerns would be addressed through appropriate contingencies.

Table K-5. Geochemical Monitoring Plan Elements, Monitoring Action Levels, and Contingencies.

Monitoring Plan Element	Monitoring Action Level (MAL)	Reporting Required	Contingent Action
Topic 1: ARD risk quick test of waste rock	To be developed in coordination with test method[1]	Immediate notice if more than 10% of cumulative samples fail MAL	Place waste rock with ARD risk underground or revise surface placement/handling plan
Topic 2: Compare average ABP and proportion of ABP <0 t/1,000 t to baseline	Average ABP or proportion of ABP results <0 is significantly lower than baseline at 1% probability by t test	Results provided in annual summary report	Revise assessment of inherent acid drainage and metal leaching risk for the project based on new information; revise mining plan as appropriate
Topic 3: Compare average ABP and proportion of ABP <0 t/1,000 t to baseline	Average ABP or proportion of ABP results <0 is significantly lower than baseline at 1% probability by t test	Results provided in annual summary report	Revise assessment of inherent acid drainage and metal leaching risk for the project based on new information; develop new estimate of contact water quality that does not rely on comparison to Troy
Topic 4: Measure total nitrogen levels in waste rock	Exceed nitrate standard in groundwater or surface water monitoring	Refer to groundwater or surface water monitoring plan	Data collected in this program on total nitrogen in waste rock may be used to locate the nitrogen source, refine the Explosive Handling and Blasting Plan, or develop MAL for N in waste rock
Topic 5: Contact water chemistry in waste rock, ore, and paste tailings	None	Results provided in annual summary report	If contact water chemistry measured in field tests differs significantly from assumptions used in the SEIS, the mine plan may require modification

[1]Preliminary monitoring action levels for acid base potential (<0 t/1,000T and nonsulfate S >0.3%), Total sulfur (more than 0.3%), or net acid generation pH (NAG pH <4.5).

1.5.4.4 Phase II Geochemical Sampling

If Phase II of the project proceeds, Phase II testing would be determined based on the Phase I data collected. Information learned during Phase I would inform Phase II testing requirements, sampling frequency, testing methods, and trigger levels. Prior to Phase II, RCR would submit a Phase II Geochemistry Characterization and Monitoring Plan to the KNF and DEQ for review by an agency Technical Advisory Group (TAG) or a third-party reviewer. RCR would not be permitted to implement Phase II of the project (facility construction, mine development, and mine operation) until the KNF and DEQ approve the Phase II Geochemistry Characterization and Monitoring Plan.

1.5.5 Data Management

RCR funded the development of a geochemical database that contains all data relating to ore, waste rock, and tailings of the formations likely encountered by the Montanore Project and the proposed project, such as the Revett, Pritchard, and Burke Formations. Montanore Minerals Corp. is the proposed operator of the Montanore Project, a proposed mine on the east side of the Cabinet Mountains. The database is part of the Montanore Project and Rock Creek Project record. RCR would fund the maintenance and updating of the database. Should Montanore Minerals Corp. continue the development of the Montanore Project, funding for the maintenance and updating of the database would be shared equally by Montanore Minerals Corp. and RCR.

1.6 Water Resources Monitoring Plan

This plan provides the conceptual framework necessary for development of a water resources monitoring program for the project. As described in the introduction to this Appendix K, only a final Agency-approved monitoring plan would be implemented and needs to contain the requirements listed below. Additional monitoring requirements would also be specified in any MPDES permits obtained for the project (see Table 1-2 in Chapter 1 of the SEIS for the status of MPDES permits). The final approved plan would contain specific information on sample location, chemical parameters for analysis, laboratory detection limits, frequency of data collection, and reporting requirements, and details of the monitoring action levels and Contingency Action Plan specified below in Section 1.6.9. As described below in Section 1.6, the USDI Fish and Wildlife Service (USFWS) would have approval authority for the Water Resources Monitoring Plan.

The objectives of the water resource monitoring are to:

- supplement the original data collection and provide long-term monitoring for the project;
- characterize pre-mining hydrologic and water quality conditions;
- collect sufficient data to quantify any measurable environmental impacts accompanying construction, operation, or reclamation of the project; and
- provide information to determine required mitigation measures, if needed, to correct any unanticipated impacts encountered and to ensure compliance with applicable regulatory requirements.

A comprehensive monitoring system network would be established to evaluate potential impacts associated with the underground mine, mill, utility corridor, water treatment facility, and paste tailings facility. Data would be collected and evaluated in detail using standard statistical analyses to determine if differences exist between:

- preconstruction conditions and conditions during mine Development, production/operations and closure/reclamation phases;
- potential impact area sites and benchmark sites (similar to study area sites, but outside the area of potential mine impacts);
- sampling locations;
- seasons; and
- high and low flows, as well as storm events such as rain-on-snow events.

The water resources monitoring program would begin at least 1 year prior to the initiation of evaluation adit construction in the area near the evaluation portal pad and in the area near the infiltration ponds where surface water or groundwater may be affected by Phase I construction and operations (Figure K-3). The program would begin at least 1 year prior to the initiation of Phase II in the Rock Creek, East Fork Bull River, Bull River, Miller Gulch, and Clark Fork River watersheds where surface water or groundwater may be affected by Phase II construction and operations. Monitoring would continue through the life of the project as well as after reclamation for a period to be specified by the Agencies. RCR and its predecessors have collected and reported ambient surface and groundwater quantity and quality data within the study area.

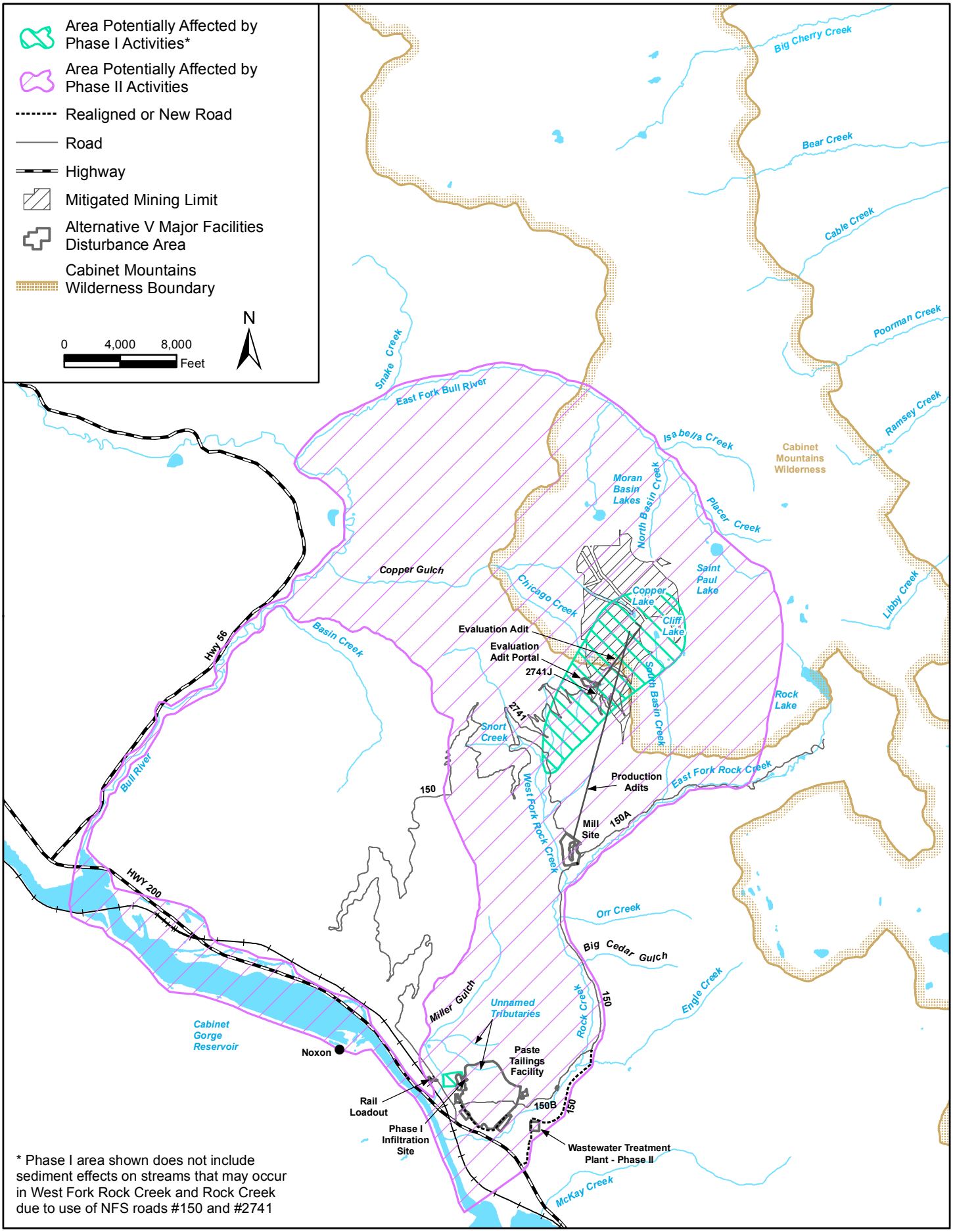

Figure K-3. Areas Potentially Affected by Phase I and Phase II Activities

RCR would work with the KNF and DEQ to develop a Memorandum of Agreement (MOA) that would describe the process of selecting and funding a third-party contractor in amounts equal to RCR's costs for the required water quality monitoring. All of the required water-quality monitoring would be accomplished through implementation of the MOA.

The monitoring plan is divided into several elements:

- sample collection, analytical methods, and data handling;
- water quality parameters;
- baseline monitoring;
- hydrologic investigations during evaluation adit construction;
- surface water monitoring;
- groundwater monitoring;
- sediment monitoring;
- facility water balance and chemistry;
- a quality assurance and quality control (QA/QC) program;
- monitoring action levels;
- contingency action plans; and
- reporting requirements.

These elements are discussed in detail below.

1.6.1 Sample Collection, Analytical Methods, and Data Handling

Field procedures would follow DEQ procedures (DEQ 2012a) and collection, storage, and preservation of water samples would follow EPA procedures (EPA 1982). Grab samples would be collected from streams and springs, and groundwater samples would be obtained with a bailer or submersible pump. Samples would be cooled immediately after collection. Metals in water samples would 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 would follow procedures described in 40 CFR 136, EPA-600/4-79-020 (EPA 1983), or methods shown to be equivalent. All field procedures would follow standard sampling protocols as demonstrated through the QA/QC documentation. Laboratory reporting limits would comply with the required reporting values listed in Table K-6, Table K-7, and Table K-8.

1.6.2 Water Quality Parameters

At a minimum, the parameters evaluated in the SEIS would be analyzed in the water resources monitoring program (Table K-6, Table K-7, and Table K-8). Subsequent to review of data collected during the initial years of the project, continued testing may be changed based on constituents present in the untreated wastewater.

Table K-6. 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)	0.3
Specific conductivity (µS/cm)	1.0
Turbidity (NTU)	1.0
Temperature	-

cfs = cubic feet per second, gpm = gallons per minute, s.u. = standard units, mg/l = milligrams per liter, µS/cm = microsiemens per centimeter, NTU = Nephelometric turbidity unit

Table K-7. 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)
Physical and Biological Parameters			
Flow (cfs or gpm)	Within 10% accuracy	Total alkalinity (as $CaCO_3$)	0.26
pH (s.u.)	0.1	Total hardness (as $CaCO_3$)	1.0
Dissolved oxygen	0.3	Turbidity (NTU)	1.0
Specific conductivity (µS/cm)	1.0	Chemical oxygen demand‡	5.0
Temperature		Oil and grease‡	1.0
Inorganic Parameters			
Total dissolved solids	1.0	Nitrate, as N	0.02
Total suspended solids	1.0	Nitrite, as N	0.01
Sodium	0.03	Nitrate+nitrite, as N	0.02
Calcium	0.08	Ammonia, as N	0.07
Magnesium	0.02	Total inorganic nitrogen	Calculated
Potassium	0.05	Total nitrogen	0.07
Bicarbonate	1.0	Total phosphorus, as P	0.003
Chloride	0.1	Ortho-phosphate	0.003
Sulfate	0.2	Silica	0.4
Metals			
Aluminum, dissolved (0.45 µm filter)	0.03	Lead	0.0003
Antimony	0.0005	Manganese	0.005
Arsenic	0.001	Mercury	0.000005
Cadmium	0.00003	Silver	0.0002
Chromium	0.01	Thallium	0.0002
Copper	0.002	Zinc	0.008
Iron	0.02		

Note: Metals are total recoverable unless otherwise specified.
For parameters without a Circular DEQ-7 required reporting value, the achievable reporting limits shown are from USFS 2012a, Table 3-1.
‡For discharges associated with stormwater runoff.

Table K-8. Proposed Monitoring Parameters and Required Reporting Values for Groundwater Samples.

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	0.3	Antimony	0.0005
Specific conductivity (μS/cm)	1.0	Arsenic	0.001
Total dissolved solids	1.0	Cadmium	0.00003
Sodium	0.03	Chromium	0.01
Calcium	0.08	Copper	0.002
Magnesium	0.02	Iron	0.02
Potassium	0.05	Lead	0.0003
Bicarbonate	1.0	Manganese	0.005
Chloride	0.1	Mercury	0.000005
Sulfate	0.2	Silver	0.0002
Nitrate+Nitrite, as N	0.02	Thallium	0.0002
Ammonia, as N	0.07	Zinc	0.008
Total Phosphorus as P	0.003		
Ortho-phosphate	0.003		
Field temperature	—		
Total alkalinity (as $CaCO_3$)	0.026		
Total hardness (as $CaCO_3$)	1.0		
Acrylamide†	0.01 or lowest possible		

†In groundwater downgradient of the paste tailings facility during operations.
For parameters without a Circular DEQ-7 required reporting value, the achievable reporting limits shown are from USFS 2012a, Table 3-1.

1.6.3 Baseline Monitoring

New surface water baseline data would be collected at least 1 year prior to the initiation of evaluation adit construction in the area where surface water or groundwater may be affected by Phase I construction and operations, and at least 1 year prior to the initiation of Phase II where surface water or groundwater may be affected by Phase II construction and operations (Figure K-3), hereafter referred to as the Phase I and Phase II monitoring areas. Monitoring would include previously monitored sites; sites that might be impacted by construction and mining activities; new surface water sites (streams, springs, and seeps) near the ore body that would need to be added based on the 3D model results and area surveys; and a benchmark stream site. A Groundwater Dependent Ecosystem (GDE) inventory (see Section 1.6.3.2 and Figure K-4), subject to approval by the Agencies, would include parts of the Rock Creek, Miller Gulch, Copper Gulch, Chicago Creek, and East Fork Bull River watersheds that are not on private land. All surface water sites would be monitored for flow and water quality monthly, including storm flows (except when prevented by winter conditions), and continuous flow recorders would be operated at key locations in each stream basin. The measurement of baseline lake levels, and water balance/water budget data at Cliff Lake and Copper Lake would begin at this time. A high-elevation weather station would be installed and maintained for use in the lake water balance studies.

The third-party contractor would also verify the location of all domestic wells, water supplies, and springs with the Department of Natural Resources and Conservation (DNRC) that might be affected by the mine to determine if any new wells or water sources had been filed with DNRC or if any wells had been

misidentified or had information regarding them corrected. Any new domestic wells or water sources or misidentified wells would need to be sampled to provide baseline data prior to mine construction, if they had not already been sampled. Water supply wells and springs would be sampled quarterly 1 year prior to Phase II to provide baseline data and would include water quality parameters, static water levels in wells, and spring flow rates. All surface water quality samples would be analyzed for the parameters listed in Table K-6, Table K-7, and Table K-8. If data collected under this plan were to be used for compliance purposes for any MPDES permit obtained for the project, 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.

1.6.3.1 Benchmark Stream and Spring Sites

It may be difficult to separate the effects of mine dewatering and other activities that could affect streamflow or spring flow from natural variability and the effects of climate change. For this reason, benchmark sites located outside of the Phase I and II monitoring areas would also be monitored during the Phase I and II baseline monitoring periods and continue through the construction, operation/production, and closure/post-closure phases. The third-party contractor would locate and monitor springs and a stream outside of the area potentially affected by mine dewatering or other activities. RCR, with agreement from the Agencies, would choose a benchmark stream in the Cabinet Mountains Wilderness (CMW). This would be a stream with a similar watershed area, aspect, and starting altitude as at least one of the streams predicted to be affected by mining in the CMW (North Basin Creek, South Basin Creek, Chicago Creek, and Copper Gulch). A benchmark stream might be one of the tributaries to the East Fork Bull River within the CMW north of the river that would not be affected by mining. Monitoring at the benchmark stream and springs would be the same and would occur at the same time and frequency as monitoring at the comparable sites within the Phase I and II monitoring areas. Springs would be categorized by location, altitude, and hydrogeologic setting. The benchmark stream and springs would be used to develop trend analyses to determine if flow or water quality changes were due to mine dewatering and other activities or to natural variability and climate change.

1.6.3.2 Groundwater Dependent Ecosystem Inventory

Before beginning a GDE inventory, RCR would conduct aerial photography and Light Detection and Ranging (LIDAR) reconnaissance of the inventory area (Figure K-4), which is based on the maximum drawdown predicted by the 3D model (see Figure 4-5 in the SEIS). Should the reconnaissance identify wetlands or springs in addition to the ones discussed in the SEIS, the third-party contractor would inventory the wetlands or springs during the GDE inventory. The third-party contractor would complete a Level 2 GDE inventory (USFS 2012b) focusing on areas potentially affected by mine or adit inflows. The inventory for the area potentially affected by Phase I activities would be completed between mid-August and mid-September at least 1 year before construction of the evaluation adit started. The inventory for the area potentially affected by Phase II activities would be completed between mid-August and mid-September at least 1 year before Phase II construction activities started. The inventory would include the collection of water samples to determine the general water chemistry and isotopes to assist in establishing the source of the groundwater. Very steep unvegetated areas within the inventory area would not be inventoried; the Agencies would approve any areas not to be surveyed before the inventory was initiated. The inventory area could 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 *Groundwater Dependent Ecosystems: Level II Inventory Field Guide* (USFS 2012b). After RCR submitted the inventory report to the Agencies, the Agencies would determine which GDEs would be monitored during subsequent phases.

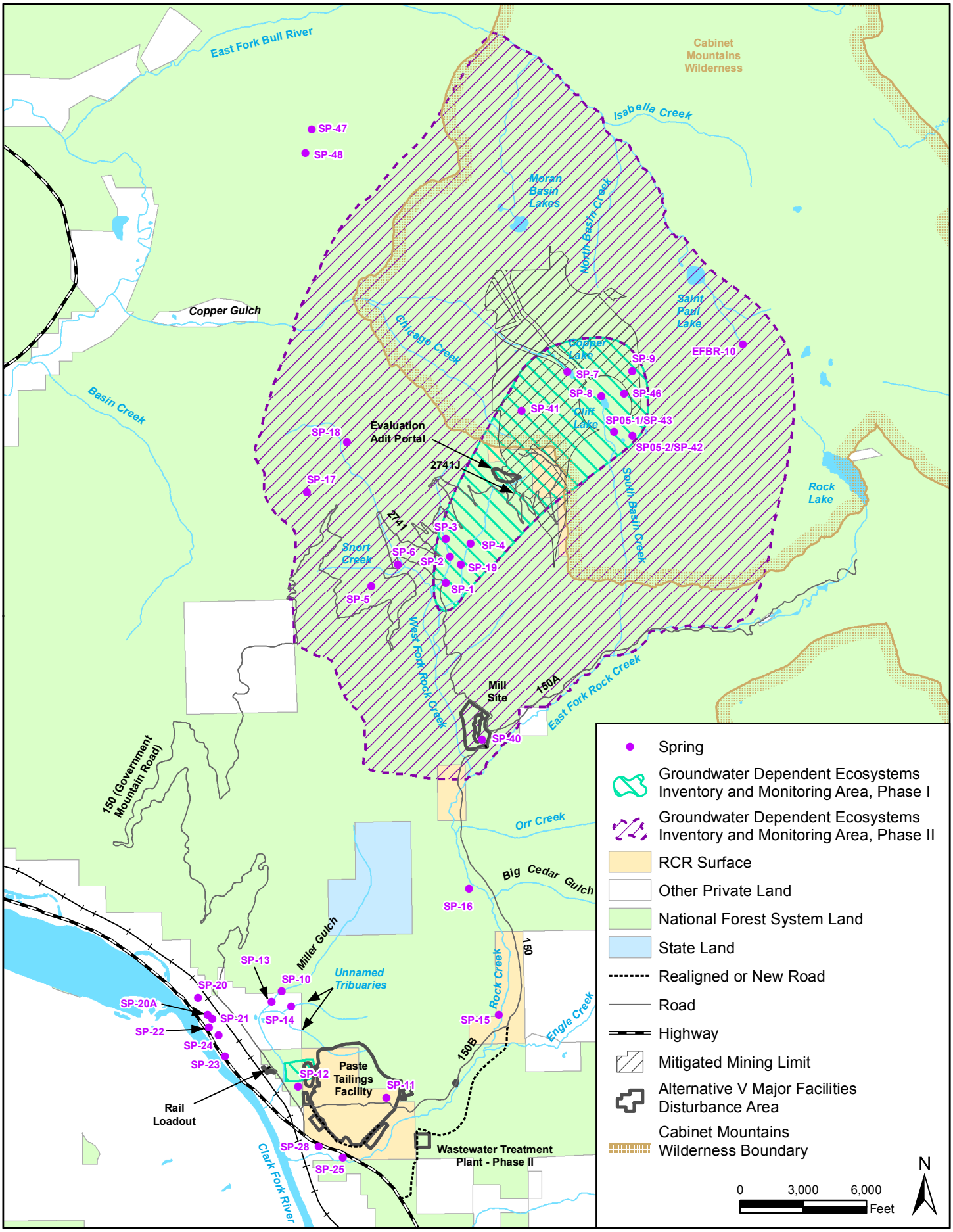

Figure K-4. Groundwater Dependent Ecosystems Inventory and Monitoring Area

RCR 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 GDE Monitoring Plan would specify monitoring locations and frequency based on inventory data, the local hydrogeology, and proximity to the mine or adit voids. The plan's objective would be to effectively detect stress to flora and fauna from effects on surface water or groundwater due to mine dewatering so that mitigation can be implemented to minimize such stress. For each GDE inventory (Phase I and II), 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 Phase I or Phase II construction, as appropriate. The plan would include piezometers in critical locations, 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.

Criteria required to determine 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 groundwater 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), because they provide advance warning of significant stress or degradation on the system, as well as 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 between changed groundwater levels and changes in that parameter (e.g., hydrophytic vegetation community composition).

Table K-9 identifies monitoring options for GDEs in the inventory 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 K-9. Groundwater Dependent Ecosystem Monitoring Options.

Surface Resource Component	Look For:	Using:
Springs and Streams	Flow changes	Flow monitoring
	Wetted perimeter/stage changes	Channel cross-section measurements
	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

1.6.3.2.1 Springs and Seeps

The inventory area shown on Figure K-4 would be surveyed for springs and seeps using the GDE protocol (USFS 2012b). In this initial inventory, the flow of each spring would be measured twice, the first time 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 in the spring or summer (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 including the use of isotopes, and the hydrogeologic setting (associated geology such as the occurrence or absence of colluvium or alluvium). Data collected during previous spring surveys would be incorporated where appropriate.

In addition to identifying springs in the GDE inventory area, the third-party contractor 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 (watershed), 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 for evaluating potential effects on spring flows and water quality due to the project. A spring that was determined, after repeated flow measurements, not to be connected to the regional groundwater system may be eliminated from additional monitoring.

1.6.3.2.2 Wetland and Riparian Vegetation

This section incorporates the *Springs and Seeps Vegetation Monitoring Plan* included in Appendix K attached to the 2003 ROD. The following guidelines would be used to develop a monitoring plan for potential vegetation changes at springs and seeps as a result of changes in water quality or flow changes due to mine development. The GDE inventory would include monitoring of vegetation around seeps and springs and upper tributary streams.

The inventory area shown on Figure K-4 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 (USFS 2012b) would be completed. Initial survey data would include site photos and points, Global Positioning System (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).

Potential monitoring options for wetlands (including fens) and riparian areas are listed in Table K-9. Monitoring would depend on the nature and location of the wetland or riparian area and generally would include vegetation cover (woody, herbaceous, and bryophytes); spring and seep flow measurements; and possible groundwater level measurements.

Information from the initial GDE inventory would be used to develop a prevalence index (U.S. Army Corps of Engineers (Corps) 2008) for monitored wetlands overlying the mine. 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 USFWS compiled a list of plants and their wetland indicator status (USFWS 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 wetland species to a higher percentage of facultative wetland, facultative, and facultative upland species. For example, a reduction in the cover of sphagnum moss, an obligate wetlands species, 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.

1.6.3.2.3 Streamflow

In the initial inventory, the flow of any stream in the GDE inventory area currently not being monitored (Figure K-3 and Figure K-4) would be measured every 2 weeks starting whenever the area was initially accessible in the spring or summer. The most accurate site-specific method for measuring streamflow 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 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). 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.

1.6.4 Hydrologic Investigations During Phase I

Water resources monitoring described in Section 1.6.3 would continue during Phase I and Phase II. If observable trends in flow changes and/or water quality occurred near the adit, the frequency of monitoring may be increased and new monitoring sites may be added based on discussion and approval by the Agencies. RCR would monitor surface water and groundwater for the life of the evaluation adit and for 5 years after the KNF and DEQ determined that the water within the adit met groundwater standards and treatment of the adit water was no longer needed. Monitoring wells in the Rock Creek study area (Figure 3-9) could be used to monitor groundwater levels and water quality. RCR would install additional monitoring wells in the event that additional wells were needed to address possible effects to groundwater. Existing surface water monitoring sites (Figure 3-7) and spring monitoring sites (Figure 3-8) in the Rock Creek study area could be used to monitor spring flow, stream flow, and water quality. RCR would add additional spring and surface water monitoring sites in the event they were needed to address possible effects to springs and surface water.

The primary hydrologic issues of concern are inflow rates to the underground workings, the potential for effects on streams, springs, and nearby water supply sources, and the chemistry of water to be stored in the mine and/or discharged from the mine. These issues would be further investigated during evaluation adit development as described in the Rock Creek Evaluation Adit License Application (RCR 2010) and below.

The evaluation adit would be a decline passing through barren (waste) rock above the ore horizon, then following the ore zone for some distance near the Copper Lake Fault. Water would be constantly pumped away from the working face of the decline during its development to keep the adit dry. The total volume of water pumped from the adit daily would be continually recorded and regularly reported. The total pumped volume per unit time would be used to calculate the average adit inflow rate in gallons per minute. The chemistry of this water would also be routinely tested. The actual adit inflow rates would be incorporated into a revised version of the 3D model. If appropriate, water management and treatment requirements for the mine would be adjusted.

Water would likely enter where the adit crossed zones of fractured bedrock. All discrete zones of inflow to the adit would be mapped and inflow rates would be documented. Field measurements of each inflow (such as pH, temperature, and specific conductance) would also be documented. Additional water chemistry data, as described in the Rock Creek Evaluation Adit License Application (RCR 2010), and including samples for isotope analysis, would be collected from selected seeps, both from segments of the adit penetrating barren rock, as well as the ore body. These data would be compared with predicted mine water chemistry (based upon sampling of the similar Troy Mine) and if significantly different, loading evaluations from mine discharges would be reexamined. Areas of fractured rock not producing inflows to the adit would also be documented. Piezometers would be installed in the Moran Fault, Copper Lake Fault, unfaulted portions of the adit, and under Cliff Lake and Copper Lake and monitored for static head, as described in the Rock Creek Evaluation Adit License Application (RCR 2010).

After completion of sampling and testing within the evaluation adit, dewatering would be discontinued. The rate of rise of water within the adit would be monitored weekly and compared with the known volume of the underground openings to determine the rate in gallons per minute at which the adit was flooding. Deviations from the previously estimated adit inflow rates would be determined. The chemistry of the reservoir forming within the flooding adit would also be monitored monthly.

Prior to initiation of Phase II productions/operations, water in the flooded evaluation adit would be pumped to the treatment plant and the adit would be reopened. Whether the water level in the adit reached steady state prior to draining would depend on several factors, including inflow rates, regional groundwater table elevation, and the duration of time between the exploration and development phases of the project. The adit water level would be monitored monthly. After flooding of the adit, a survey would be completed in the area potentially affected by Phase I activities (Figure K-3) to identify any new springs and seeps that may have developed due to flooding of the adit. If any new springs or seeps were identified, water quality samples would be collected for the parameters listed in Table K-7 and compared with baseline spring and seep water quality. Spring and seep water quality monitoring would continue through this period and the results evaluated to identify any statistically significant increases in indicator parameters (i.e., nitrogen, sulfate, or copper) that would suggest mine water influences. Any statistically significant increases in indicator parameters at any of the spring and seep sites would trigger review of water management and water treatment scenarios under future operational and post-closure conditions.

Groundwater and surface water monitoring specific to the evaluation adit portal pad would be conducted. Prior to storage of any rock types on the surface, the contractor would install a lined ditch and sediment basin at the base of the talus slope. Precipitation that infiltrated the talus from the pad would be collected in the lined ditch and routed to a lined sediment basin designed to contain runoff from a 10-year/24-hour

storm event. The 10-year/24-hour precipitation event is the maximum 24-hour precipitation event with a probable recurrence interval of once in 10 years as established by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, or equivalent regional or rainfall probability information. The collection ditch would be excavated to bedrock. During Phase I construction, water in the sediment basin would infiltrate, evaporate, or discharge through Outfall 006 (see Figure 1-2 of the SEIS). Any discharges from the collection ditch would be regulated under MPDES permit MT0030287 at Outfall 006. During adit development, all of the captured stormwater from the sediment basin would be pumped to the 600,000-gallon portal pad pond and used in adit development or piped from the pond to the water treatment plant. Runoff from the soil stockpile would be collected in a ditch at the base of the pile and routed to a sediment basin designed to contain runoff from a 10-year/24-hour storm event, where it would infiltrate, evaporate, or be discharged at Outfall 007 (see Figure 1-2 of the SEIS). Discharges would not be allowed from Outfalls 006 and 007 unless the measured precipitation exceeded the 10-year/24-hour storm event (2.8 inches), or equivalent amount of snowmelt runoff, so discharges occurring during large precipitation or snowmelt events would result in considerable dilution in the unnamed drainage below the portal pad. Discharges from Outfalls 006 and 007 would be required to meet MPDES permitted effluent limits and could not create concentrations toxic or harmful to human, animal, plant, or aquatic life, or create conditions that produce undesirable aquatic life. Two shallow groundwater monitoring wells would be installed on the downgradient side of the lined ditch to monitor potential impacts on groundwater from underflow and/or leakage from the ditch. The monitoring wells would be screened at the colluvium/bedrock contact. A third-party contractor would monitor groundwater levels in the two wells on a quarterly basis to monitor the effectiveness of the collection ditch and to monitor water quality of any groundwater that bypassed the collection system. The third-party contractor would monitor one surface water monitoring location downgradient of the evaluation adit during periods of flow (EP-1, Figure 3.7). If monitoring indicated that groundwater quality reached any of the action levels listed in Table K-10, or if water quality concentrations exceeded applicable standards or non-numeric effluent limits in surface water at EP-1, a Contingency Action Plan would be developed, as described in Section 1.6.9.

Groundwater and surface water monitoring specific to the evaluation adit infiltration ponds would be conducted. Groundwater would be monitored downgradient of the infiltration ponds, including at MW06-2, MW06-3, and other downgradient wells that DEQ may determine were needed, as well as MW06-1 upgradient of the infiltration ponds (Figure 3-12 of the SEIS) and analyzed for parameters listed in Table K-8. RCR would monitor the wells initially on a weekly basis upgradient and downgradient of the infiltration ponds to document water quality, and weekly during exploration drilling through the ore body, when adit metal concentrations would be expected to be higher. RCR would monitor Miller Gulch initially on a weekly basis upgradient and downgradient of the infiltration ponds to document water quality, and weekly during exploration drilling through the ore body during low-flow periods and analyzed for parameters listed in Table K-7. If the water quality at MG-1 (Figure 3-7) showed increases in metal or nutrient concentrations that did not also occur at the upgradient location, RCR would notify the Agencies within 5 working days. RCR would review the mitigation measures described in the Contingency Action Plan and propose to implement one or more of the measures described therein to ensure that surface water standards and any applicable nondegradation criteria would not be exceeded.

A second water supply well would be installed in the support facility area to supply water to the support and treatment facilities (Figure 2-9). Additional monitoring may be required by DEQ for public water supply monitoring.

Prior to evaluation adit construction, the third-party contractor would inventory domestic wells and water supplies that could potentially be affected by the mine operation and specifically water disposal during Phase I. All water supply wells and springs would be sampled to establish baseline conditions. From the sampled locations, the third-party contractor would establish a list of wells to be sampled on a quarterly

basis. Water samples would be analyzed for the same parameters as required during the baseline period, and as identified in the Rock Creek Evaluation Adit License Application (RCR 2010).

1.6.5 Surface Water Monitoring

USFS field sampling and data analysis protocols would be followed during surface water monitoring (USFS 2012a). Surface water quality samples and flow measurements would be collected and analyzed during Phase I construction and operations, and Phase II construction, production/operations, and closure/post-closure phases at a frequency that would allow the evaluation of high- and low-flow conditions, storm flow events, and seasonal trends. Water samples would also be collected during temporary facility shutdowns and after mine closure. Water quality parameters monitored are listed in Table K-6, Table K-7, and Table K-8. If observable trends in flow changes and/or water quality occur near the adit, the frequency of monitoring may be increased, and new monitoring sites may be added based on discussion and approval by the Agencies.

Surface water sites monitoring would be located on the East Fork and West Fork Rock Creek, tributaries to the East Fork and West Fork, the mainstem of Rock Creek, Miller Gulch, the Clark Fork River, the East Fork Bull River and tributaries, benchmark stream and spring sites, and other locations as determined by the Agencies. GDE monitoring would continue during all mine phases. Any springs in the GDE inventory area would be sampled at the same frequency as the stream sites. The surface water monitoring program would be coordinated with the aquatic monitoring program. The program, including the location of all sites evaluated during the baseline data collection program, would be finalized based on review and approval by the Agencies. The rationale and requirements for monitoring surface water resources at specific stations during the Phase I construction and operations and Phase II construction, operation, and reclamation of the proposed project would be discussed in RCR's final Water Resources Monitoring Plan.

The monitoring of lake levels at Cliff, Copper, and Moran Basin lakes would also be part of the surface water monitoring program during the construction, production/operations and closure/post-closure phases.

1.6.6 Groundwater Monitoring

Groundwater monitoring data would be collected on at least a quarterly basis during the construction, operation, and reclamation phases, as well as during temporary facility shutdowns. Groundwater would be monitored in the underground mine via underground monitoring wells, upgradient and downgradient of the mill, upgradient and downgradient of the proposed paste tailings facility, and from the paste tailings facility perimeter pumpback well system, if implemented. Monitoring wells located below the evaluation adit would be monitored as described in Section 1.6.4. The frequency of underground monitoring of hydraulic conditions in the bedrock would be increased as designated buffer zones were approached. In addition, flow and quality of springs and seeps would be monitored, with particular emphasis on sources of water that provide recharge to Rock Creek and the East Fork Bull River. If elevated metal concentrations were detected through sampling of the post-mining pool of water or the mine water reservoir during mining that could reach surface springs and seeps, then RCR and the Agencies would consider adding limestone or soda ash to the stored water to help remove the metals from the system.

Groundwater monitoring of the paste tailings facility would be initiated prior to placing tailings in the facility. Monitoring well locations and sampling frequency would be reviewed and finalized after consultation with the Agencies. Water samples would be analyzed for physical parameters, nutrients, common ions, metals, volatile organic compounds, and semivolatile organic compounds to establish baseline conditions. All monitoring wells located along the perimeter and downgradient from the paste tailings facility would be installed to serve as potential pumpback wells if water quality monitoring indicates monitoring action levels (Table K-10) had been reached. Water quality and water level data

from monitoring wells would be collected at an approved frequency. Groundwater from all existing domestic water supply wells downgradient of the proposed paste tailings facility would also be collected and analyzed.

A pumpback well system is considered a contingency mitigation, and if the system were required, the pumpback well system would be designed to capture all affected groundwater from beneath the paste tailings facility. Full capture of affected groundwater would be demonstrated by water level data and water quality results. Additional pumping wells may be required to ensure full capture.

Split samples from monitoring and domestic wells would be periodically collected and analyzed by DEQ to verify the monitoring data. Split sample results from domestic wells would be offered to well owners. The Agencies would consider the actual facility water balance data, estimates of seepage, and results of the ongoing groundwater monitoring program in determining how long monitoring of private domestic water supply wells should continue. At a minimum, groundwater quality sampling and analysis would continue at least until bond release.

Water monitoring for any portion of the development adits would be the same as for the evaluation adit. Water monitoring of the mine development area would continue for 20 years after the water was determined to meet groundwater standards.

1.6.7 Sediment Monitoring

Continuous suspended sediment monitoring would begin at least 1 year prior to the beginning of Phase I construction and would continue during Phase I construction and operations and Phase II construction, production/operations, closure, and post-closure. Monitoring would occur in West Fork Rock Creek and East Fork Rock Creek above the confluence of the forks, and in Rock Creek near the confluence with the Clark Fork River. Monitoring would also occur in Miller Gulch near the confluence with the Clark Fork River. Any other suspended sediment monitoring required by the MPDES permit or any other permit or approval would be implemented.

If the Agencies observed increased suspended sediment concentrations that could not be explained by natural events such as snowmelt or large precipitation events, 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 mine-related construction or post-construction mine, RCR would be required, after notification from the Agencies, to implement measures to eliminate the sediment source to the stream within 24 hours.

RCR has applied for a MPDES permit for stormwater discharges associated with construction activities. RCR has prepared a Storm Water Pollution Prevention Plan (SWPPP) that identifies Best Management Practices (BMPs) to be used to minimize or eliminate the potential for pollutants to reach surface water through stormwater runoff. The pollutants would be primarily sediment, but could include wastes or fuels that might be stored at a construction site. BMPs would be developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USFS 2012a). During construction, RCR would inspect the BMPs at least once every 14 calendar days, and within 24 hours after any precipitation event of 0.25 inch or greater, or a snowmelt event that produced visible runoff at the construction site.

RCR 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 0.25 inch or greater or a snowmelt event that produced visible runoff. Inspection and monitoring of stormwater 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% of the predisturbance 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.

1.6.8 Facility Water Balance and Chemistry

A detailed facility water balance and analysis of water and wastewater chemistry would be maintained, and its details specified in the final Water Resources Monitoring Plan. The water balance would be submitted annually by RCR to the Agencies. The purpose of the facility water balance would be to assess the inflow, outflow, and general water or wastewater chemistry associated with the underground mine, water treatment facility, and paste tailings facility. 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, the following aspects of the project water balance would be measured:

- the volume of excess water stored underground
- mine reservoir water quality
- mine adit discharge and water quality
- the amount and water content of tailings deposited as a paste
- the amount and source(s) of fresh makeup water to the mill
- the amount of reclaimed tailings water returned to the mill
- the water quality of tailings decant water, if any
- the amount and quality of water pumped from the seepage collection ponds
- treatment facility influent flow and water quality
- flow rate and quality of water discharged to the percolation ponds or the Clark Fork River
- the amount and source of water used for dust suppression and irrigation
- pan evaporation and precipitation data at the paste tailings facility site

1.6.9 Quality Assurance/Quality Control Program

QA assures the integrity and reliability of monitoring and measurement data. QC is the application of procedures to evaluate data acquisition techniques and analyses according to established criteria. QC procedures define whether sampling and analytical techniques are in or out of control with reference to applied standards and control limits.

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). A specific QA/QC program would be approved by the Agencies. This program would include sample documentation, as well as sample control and data validation.

The third-party contractor 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 data, and the use of chain-of-custody sample tracking and analysis request forms. The third-party contractor would develop a master file of all field forms and laboratory correspondence and would meet the laboratory method-required holding time for each constituent being analyzed. The third-party contractor would ensure representativeness of samples collected by locating sampling stations in representative areas and by providing QC samples and analyses. QC samples would include blind field standards, field cross-contamination blanks, and replicate samples. QC samples would be at a minimum

frequency of 1 in 10. In addition, the third-party contractor would use EPA-approved laboratories. If revised sampling methods or QA/QC protocols change, the third-party contractor would incorporate those changes as directed by the Agencies.

The documentation and sample control portion of the QA/QC plan would be designed to document and track samples from the time of collection through reporting of analytical results. Elements in this portion of the plan include sample identification protocol, the use of standardized field forms to record all field data and activities, and the use of chain-of-custody sample tracking and analysis request forms.

The purpose of data validation would be to ensure that data collected during the monitoring phase would be of known and acceptable quality. QC samples would include field blanks and duplicate samples.

1.6.10 Monitoring Action Levels and Contingency Action Plan

As part of the Water Resources Monitoring Plan, monitoring action levels and a Contingency Action Plan would be developed for the project. This section discusses the Agencies' preliminary monitoring action levels that would require RCR to implement a Contingency Action Plan. Final action levels would be described in RCR's Agency-approved final monitoring plan. Elements of the Contingency Action Plan would include, but not be limited to, the following:

- Defining contingency action criteria and statistically based methods for determining if adverse impacts on surface or groundwater resources occur during the project's construction, operation, and reclamation phases;
- Identifying key players and their respective roles and responsibilities for implementing the Contingency Action Plan;
- Providing details of the decision-making process associated with contingency actions, including schedule;
- Identifying, illustrating, and scheduling the decision-making process associated with contingency actions; and
- Preparing a list of potential action alternatives for various impact scenarios.

If monitoring action levels were reached, RCR would notify the Agencies within 5 working days. RCR would review the mitigation measures described in the Contingency Action Plan and propose to implement one or more of the measures described therein to ensure that the parameter of concern did not exceed action levels. If RCR developed alternative contingency actions not described in the Contingency Action Plan, RCR would revise the Contingency Action Plan with a new or modified measure along with a proposed schedule for implementation and submit it to the Agencies for approval. Within 30 days, the Agencies would: (i) approve, in whole or part, the plan; (ii) approve the plan with conditions; (iii) request clarifying information for the plan or additional review time; or (iv) disapprove, in whole or in part, directing that a revised Contingency Action Plan be submitted. If the Agencies were to disapprove the plan, an explanation would accompany the disapproval. RCR would be required to implement contingency actions as specified in the original, or if applicable, revised and approved Contingency Action Plan.

The effect on surface water quality from an accidental spill or rupture could be large, but a quick response to spills or ruptures would reduce the magnitude and extent of effects. A spill contingency plan would be developed by RCR for each stream in the mine area. If it were determined that the spilled material may reach a stream, mine personnel would immediately construct sumps to collect the spilled material. Accidental spills or ruptures could cause acute effects to aquatic life. RCR would monitor any surface water located in the vicinity of a spill or rupture. If water quality standards or nondegradation criteria

were exceeded, the same location would be resampled, and if again exceeded, would continue to be monitored at an increased frequency during and after cleanup of the spilled material to ensure the areal and temporal extent of any acute effects to aquatic life were minimized.

1.6.10.1.1 Groundwater Quality Monitoring Action Levels

Monitoring action levels for the groundwater monitoring wells at the base of the talus slope below the evaluation adit portal pad and the paste tailings facility are provided in Table K-10. Action levels for selected parameters are included to provide an early detection of adverse groundwater conditions and to trigger notification of the Agencies and preparation of a Contingency Action Plan. 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 action by RCR, but would not be considered a violation of the Hard Rock Operating Permit or Montana groundwater standards.

In addition to assessing the relationship of detected concentrations to action levels, RCR would present a trend analysis of all data for the parameters listed in Table K-10 in an annual report. A statistically significant increasing trend ($p<0.05$) in concentration of any parameter would be discussed. Because arsenic is a carcinogen and changes in ambient concentrations are not allowed under Montana's nondegradation rules, RCR would assess if the arsenic concentration of each well were statistically significantly greater ($p<0.05$) than the well's ambient concentration using an appropriate statistical test.

For new springs and seeps monitored after the evaluation adit filled, any statistically significant increases in indicator parameters at any of the spring and seep sites would trigger review of water management and water treatment scenarios under future operational and post-closure conditions.

Table K-10. Action Levels for Groundwater Compliance Wells.

Parameter	Groundwater Standard (mg/L)	Action Level (mg/L)[§]	Parameter	Groundwater Standard (mg/L)	Action Level (mg/L)[§]
Total Ammonia	—	1	Arsenic	0.01	See text above
Nitrate, as N	10	5	Cadmium	0.005	0.0025
Nitrite, as N	1	0.5	Chromium	0.1	0.05
pH	6.5 – 9.5	≤ 6.7 or ≥ 9.3	Copper	1.3	0.65
Sulfate	—	20	Mercury	0.002	0.001
Potassium	—	10	Selenium	0.05	0.025
Antimony	0.006	0.003	Zinc	2	1

"—" = No applicable concentration.
mg/L = milligrams per liter. All metals are dissolved.
[§]If the ambient concentration in any individual monitoring well were to consistently exceed 50% of an action level, the action level would be increased accordingly.

1.6.10.1.2 Action Levels for Groundwater Flow in the Mine Area

RCR would monitor flows from the mine and adits, as well as from individual fractures within the adits and mine void. If mine and adit inflows greater than 800 gpm occurred over a 2-month period, RCR would notify the Agencies within 5 working days. RCR would then implement excess water contingency plans such as grouting or treatment and discharge at the wastewater treatment plant.

The third-party contractor would monitor flows and water quality in benchmark springs outside of the area potentially affected by mine dewatering. Based on the monitoring, the third-party contractor would establish a relationship between flows and/or water quality in benchmark springs and flows and/or water

quality in any study area monitored spring. Flows and water quality in all monitored springs would be evaluated using simple linear regression or other appropriate statistical analyses. RCR would provide the analysis in the annual report. The trend analysis would follow Forest Service protocols (USFS 2012a), or another method approved by the Agencies. If the relationship in quantity and quality between benchmark and monitored study area springs after adit dewatering began was statistically significantly different ($p<0.05$) than pre-mining or if the concentration of monitored parameters showed an increasing significant trend ($p<0.05$), RCR would flag the flow change or water quality parameter for Agency review. If the Agencies decided that some action was necessary, the procedures regarding a Contingency Action Plan would be implemented.

1.6.10.1.3 Surface Water Monitoring Action Levels

As required by draft renewal MPDES permit MT0030287, the following conditions would require action by RCR:

- An unauthorized release or discharge to surface water at the mine
- If DEQ or RCR became aware that stormwater control measures were not stringent enough for a discharge to meet applicable water quality standards
- If DEQ determined that modifications to stormwater control measures were needed to meet the non-numeric effluent limits at the outfalls, or
- If DEQ found that stormwater control measures are not being property operated and maintained.

RCR would be required to review and revise the selection, design, installation, implementation, and maintenance of the stormwater control measures so that the condition is eliminated and not repeated in the future. Within 14 days of discovery of any of these conditions, RCR would be required to document any corrective actions taken or needed, and any modifications to the stormwater controls would be required to be made as soon as practicable.

Monitoring, analysis, and reporting of streamflows and water quality in benchmark streams outside of the area potentially affected by mine dewatering and in monitored study area streams would be the same for streams as described in the second paragraph in Section 1.6.10.1.2. If the Agencies decided that some action was necessary to prevent adverse effects to surface water quality, the procedures regarding a Contingency Action Plan would be implemented.

1.6.10.1.4 Wetland or Riparian Area Action Levels

If the prevalence index of any monitored wetlands is 50% greater than its baseline index (such as 1.5 to 2.3) or is above 3 for 2 consecutive years, RCR would provide the analysis in the annual report. If the Agencies decided that additional actions were necessary, the Contingency Action Plan described in Section 1.6.10 would be implemented.

If any changes in seep or spring flow, water levels, or water quality were noted that were significantly different than the measurements collected during pre-mining monitoring for an individual site or set of sites, or a trend was observed that was not observed during pre-mining monitoring, then a reevaluation of those potentially affected habitats would be conducted and documented for comparison against baseline 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. If the Agencies decided that additional actions were necessary, the Contingency Action Plan described in Section 1.6.10 would be implemented.

1.6.11 Reporting Requirements

RCR would prepare quarterly and annual reports to summarize information and data obtained during implementation of the water monitoring program. The report would include data tabulations, analysis of trends, statistical computations, maps, cross-sections, and diagrams needed to clearly describe hydrologic conditions. RCR would also submit data and analyses electronically in a format acceptable to the Agencies. All submitted analytical data would comply with DEQ's minimum reporting requirements for analytical data (DEQ 2009).

1.7 Rock Mechanics Data Collection and Subsidence Monitoring Plan

A Rock Mechanics Data Collection and Subsidence Monitoring Plan has two purposes: (1) to acquire data pertinent to the site and use these data in mine planning, and (2) to monitor the surrounding physical environment's response to mining to minimize adverse effects on surface resources. Separate plans would be required for each phase of project development. RCR would develop the plans in conjunction with the Agencies, and the plans' details and implementation would be subject to Agency approval. A detailed plan for data collection and monitoring during the Phase I evaluation adit, as well as a preliminary data collection and monitoring plan for full mine build-out, would be submitted for Agency approval prior to implementation of Phase I. Submitting a preliminary plan would allow the Agencies to begin evaluating the scope of a full mine operation and to modify data collection and monitoring during Phase I, as needed, to better define how best to construct a long-term full build-out monitoring program. A detailed plan for full mine build-out would be submitted for Agency approval prior to implementation of Phase II.

The goals of the data collection and monitoring plans are to:

- collect site specific data on the host environment
- confirm assumptions made by RCR concerning physical parameters of the host rock
- assist in mine planning (e.g., room and pillar size and layout, types and application requirements of artificial support such as rock bolts, location of monitoring devices, and size of buffer zones)
- provide data to RCR and the Agencies that would be used in minimizing adverse impacts on NFS surface resources
- document whether subsidence has or has not occurred

The scope of the data collection and monitoring plans would evolve as the mine development progressed. Initially, the effort would concentrate on data collection during the evaluation adit phase. In time, as mine development evolved, the focus would be to enhance underground safety, assist in mine planning and design, and guard against subsidence. (Note: subsidence monitoring and rock mechanics monitoring are used interchangeably in the text.)

1.7.1 Evaluation Adit Phase (Phase I)

During the development of the evaluation adit (Phase I), data collection to establish baseline conditions and confirm strength parameters for the surrounding rock would be the principal objectives. Stress field measurements, including principal stress magnitudes and directions, would be taken, along with rock samples for laboratory testing. A baseline survey over the ore body would be performed prior to underground development. Considering the terrain, aerial methods such as LIDAR or Interferometric Synthetic Aperture Radar (InSAR) are favored over conventional surveying of surface monuments. This type of technology can measure small deviations over large surface areas, which otherwise would be impossible or impractical to measure using standard geodetic surveying techniques. Surveys would be

repeated periodically prior to production mining to (a) establish the variability of the monitoring method employed (with respect to its technical limitations and outside factors such as snow and vegetation cover, natural rockfalls, and landslides); and (b) establish a pre-mine reference surface for comparison once mining has commenced. The selection of surveying technique and the schedule for surface monitoring and reporting would be established as part of the subsidence monitoring plan developed during the final mine design phase.

1.7.2 Laboratory Testing and In-Situ Rock Characterization

Laboratory testing on representative samples collected during the evaluation adit phase would confirm strength parameters of the local host rock. Tests to determine material properties including, but not limited to, specific gravity, Young's Modulus, Poisson's ratio, cohesion, angle of internal friction, and uniaxial compressive strength would be performed. Observation and documentation of in-situ rock conditions would include faulting, jointing, and other structural features. These data would be used to develop analytical models for the Rock Creek ore body that in turn would assist in mine design and layout. If mining proceeded beyond the evaluation adit phase, RCR would continue to collect and test samples as the mine advances to confirm material properties as new areas are developed. The frequency of sampling may be either determined by changes in lithology or based on a certain number of samples per volume of material extracted.

In situ monitoring devices would also be installed during the evaluation adit development phase. These may include, but are not limited to, stress cells, strain gauges, extensometers, and microseismic monitoring devices. These instruments collect data relating to how the surrounding rock responds to mining and the excavation of cavities underground. As mining progressed, RCR would continue to install and monitor in situ devices as part of their overall environmental monitoring program. The placement of these devices would be determined through consultation with the Agencies. Areas of known or suspected instability, such as near geologic faults, may receive a more concentrated array of devices. The frequency of monitoring would also be resolved with Agency counsel once the adit is underway; however, it is difficult to predict both placement and frequency prior to development.

1.7.3 Underground Mine Construction and Active Operations (Phase II)

During active mining, surface and underground monitoring would be ongoing. Deviations from baseline conditions may be indicative of adverse ground reactions to mining. If such conditions occurred, the Rock Mechanics Data Collection and Subsidence Monitoring Plan would have as part of its program steps and mitigations to minimize adverse effects on surface resources. Possible mitigations may include installation of supplemental supports such as rock bolts, grouting, backfilling the affected area, prohibiting mining in the affected area, or changing the room and pillar sizes to provide more underground support.

Prior to Phase II construction, RCR would submit for KNF and DEQ approval a detailed mine plan that minimizes the risk of subsidence. The mine plan would use the data collected during Phase I. The detailed mine plan would include the physical setting of the ore body (for each ore zone, the elevation of the floor or back, the ore thickness, and depth below surface) and the planned extent of mining, including drive and pillar dimensions. Roof support analysis would be completed during final design to finalize the support plan. RCR would drill long holes beyond the advance of each regular mining round to intersect, grout, and seal water-bearing ground conditions such as faults or extensive jointing that could otherwise tap groundwater from overlying lakes, streams, and wetlands or promote underground instability. Mining would not occur in areas where adverse ground conditions could lead to surface subsidence or effects on the CMW lakes or hydrofracture at outcrop zones (DEQ 2001). The monitoring employed during active mining would provide advance warning of deteriorating ground conditions in response to mining.

During both Phase I and Phase II, RCR would fund an independent technical advisor to assist the KNF and DEQ in review of RCR's mine design, and data collection and monitoring plans. The technical advisor would be selected and directed by the KNF and DEQ through an agreement with RCR. RCR would facilitate underground inspections by the third-party technical advisor. RCR would provide the KNF and DEQ and their representatives access to the underground workings to observe data collection and mine development. RCR would provide mine access, logistical support, and all information required by the technical advisor to complete a review of underground rock mechanics data and RCR's mine plan. Assessments of the underground workings by the technical advisor may occur as frequently as quarterly, with the results of the inspections compiled into an annual assessment report. This annual report from the technical advisor would incorporate data collected as part of the ongoing monitoring program, and would be in addition to the annual report prepared by RCR. The technical advisor would have no financial interest in the Rock Creek Project. After data review, the KNF and DEQ would require RCR to modify the mine plan as necessary to minimize effects on surface resources.

The specific details of the Phase II data collection and monitoring plans would be subject to approval by the Agencies. Should Phase II be approved, information from both the Phase I and II data collection and subsidence monitoring plans would be used to develop a model of rock behavior in response to underground mining. This model would help guide ongoing mine development in an environmentally safe manner. Subsidence monitoring data would be reported to the Agencies in an annual report.

The type of data collected would include logging drillholes and geologic mapping of mine workings and surface features to obtain an initial overview of the geologic profile of the site. More detailed data would include rock quality analysis, which would evaluate fracture and fault frequency, structure orientation, laboratory testing for rock strength parameters, and in-situ geomechanical tests. Gaining a detailed understanding of rock strength, including the potential for shear failure at the pillar/roof or pillar/floor interface, and the overall mine structural setting, including faulting, jointing, bedding, and horizontal stress regime, would improve the Rock Creek mine design.

Microseismic monitoring would be used to assess rock response to underground mining both during operations and post-closure, and would include installation of sensors in operating and abandoned sections of the mine. Stress cells would be located near or on faults, barrier pillars, sill pillars, and other important mine structures. Data would be compiled, assessed, and reported to the Agencies in an annual report.

Numerical modeling would be used to evaluate pillar and sill stability between the two ore zones as the influence and interaction of stacked workings may be critical to overall pillar and sill stability. Numerical modeling would be part of the ongoing mine development during operations and would be applicable to all areas of the mine – not just where the ore horizon is thick or where rooms are stacked on one another.

All RCR designs will reference and incorporate, as appropriate, information from the Troy Mine, which has experienced pillar stability problems resulting in surface subsidence. The data collected and analyzed from the Troy Mine will aid the Agencies in their evaluation of RCR's proposed design and monitoring plan. For example, data from the Troy Mine indicate that adverse pillar orientation with regard to bedding dip may have played a role in some of the pillar instability. Further, the Troy Mine sinkhole events appear to be related to intercepting known faults.

The data collection and monitoring plan would be in a continual process of modification throughout the course of mining as new data were 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.

1.7.4 Rock Mechanics Monitoring Report and Third-Party Review

QA and QC protocols would be reviewed and authorized by the Agencies to maintain strict regulatory compliance and standards of practice. RCR would submit the results of the data collection and monitoring to the Agencies as part of the plan. These reports may be submitted on an annual, semiannual, or quarterly basis depending on what phase of development the mine is undergoing. An initial schedule for frequency of reporting would be developed as part of the Phase I Rock Mechanics Data Collection and Subsidence Monitoring Plan. Data collection and monitoring results for the adit must be submitted at 6-month intervals until the evaluation adit is completed.

Once Phase II commences, assessments of the underground workings by the Agencies' technical advisor may occur as frequently as quarterly, with the results of the inspections compiled into an annual assessment report. This annual report from the technical advisor would incorporate data collected as part of the ongoing monitoring program and would be in addition to the annual report prepared by RCR.

1.8 Wildlife Monitoring Program

Monitoring plans would be developed for several wildlife subjects based on the conceptual plans provided below. Monitoring plans would vary depending upon the species or subject being monitored.

Monitoring of wildlife resources would occur in some cases to supplement baseline data and better estimate potential impacts or changes. Monitoring data would help determine the status of these subjects during or after mining activities but would not be compared with incomplete pre-mine data.

Currently, the Forest Service and Montana Fish, Wildlife and Parks (FWP) are developing or implementing monitoring plans or studies for some species or subjects. Where feasible and appropriate, RCR would contribute funding to current efforts rather than initiating a separate and redundant monitoring activity.

The goal of the wildlife monitoring program would be to determine project-related impacts on existing wildlife populations. If impacts were identified, then appropriate remedial action plans would be developed and implemented. This monitoring program would be started during the first quarter of evaluation adit construction and would consist of monitoring and reporting for the following elements:

- neotropical migrant birds;
- mountain goats;
- sensitive animal species; and
- effectiveness of road closures.

1.8.1 Neotropical Migrant Bird Monitoring

Neotropical migratory bird monitoring would be coordinated with current programs or initiated by state and federal agencies and private organizations. The goal of this monitoring would be to gain additional information about neotropical migrant birds, population trends, species composition changes, and their responses to mine-related impacts.

RCR could assist with funding the KNF's ongoing monitoring of neotropical migrant birds or conduct their own surveys as approved by KNF. Funding would be proportional to the number of transects surveyed across the region for the year in question. At least one transect would be set up within the study area. These transects would be monitored on a schedule determined by the Forest Service's Regional Office, but at least every 2 to 5 years. Reports would be produced annually by the Regional Office.

Information collected, whether through an independent third-party or by KNF, would be incorporated into the regional report.

1.8.2 Mountain Goat Monitoring

Mountain goats would be monitored for their responses to mine-related impacts. Given the current baseline data for mountain goats, comparisons between pre-mine status with status during mine operations or after mine closure would be difficult; however, information gained from monitoring would be useful in determining population trends, habitat use, and to some extent, mine-related impacts. The monitoring plan would integrate aspects of a mountain goat monitoring plan/study that would be developed by FWP. The plan would specify the sampling and analysis methods to be used and, if conducted by a third-party consultant for RCR, would be reviewed and approved by the Agencies.

Mountain goat monitoring for this project would consist of three surveys per year for the life of the mine: one 2-week survey of the eastern side of the CMW in the summer, one fall aerial survey, and one winter aerial survey. Aerial surveys would be conducted using the protocol currently used by FWP. The survey schedule may be modified if the Agencies, in consultation with FWP, determined that fewer surveys would be sufficient.

Currently, FWP conducts one aerial survey every other year. RCR would either fund FWP for the additional surveys or conduct the additional surveys independently and provide the data collected to FWP and the Agencies. Mountain goat monitoring data, including number, age, and gender of animals observed and their precise location in UTM or GPS coordinates would be summarized in an annual report prepared by RCR or by FWP with funding from RCR. Reports would be submitted to FWP and the Forest Service to help evaluate the effectiveness of the additional law enforcement provided by RCR and other mitigation measures in reducing impacts on mountain goats.

1.8.3 Sensitive Animal Species Monitoring

A forestwide monitoring program for sensitive species, including harlequin ducks, is currently being implemented by KNF. RCR would either contribute funding to this existing effort or conduct monitoring through a third-party contractor, as approved by the Agencies. The goal of the sensitive animal species monitoring would be to gain more information about sensitive species behavior, habitat use, and mine-related impacts. RCR would contribute funding to the portion of the KNF's forestwide harlequin duck monitoring program that covers Rock Creek. If impacts on harlequin ducks are found to be greater than those disclosed in the 2001 FEIS, RCR would be required to reduce or minimize those impacts.

Information collected would be reported to the Agencies for review on an annual basis. Monitoring would continue for the life of the mine or until the Agencies, in cooperation with the FWP and USFWS, determined that monitoring intervals can be modified. Monitoring for harlequin ducks for this project involves three parts.

1. Water quality monitoring of Rock Creek. The monitoring required under the Water Quality Monitoring Plan for this project would meet the requirements for assessment of water quality impacts on the harlequin duck.
2. Monitoring of the harlequin ducks on four main tributaries of the lower Clark Fork River in which the ducks are known to have breeding sites are Rock Creek, Marten Creek, Swamp Creek, and Vermillion River. The protocols would follow those as used by Montana Natural Heritage Program (MNHP) harlequin duck monitoring program.
3. A power and sensitivity analysis is required on the data collected through the monitoring. The power analysis is used to determine the effectiveness of the proposed monitoring scheme and to

identify significant population changes from natural stochastic fluctuations. The sensitivity analysis is used to determine population growth rates from data already available and from monitoring.

1.8.4 Road Closure Monitoring

Road closures would be monitored for their effectiveness in excluding motorized access. This would include assessing KNF administrative and unauthorized road use and the ultimate effectiveness of closure devices. The effectiveness of roads closed for grizzly bear mitigation, as well as currently closed roads would be monitored. The monitoring plan would be developed by RCR in coordination with KNF.

1.8.4.1 Reporting

An annual report would be filed with the Agencies stating that the appropriate information has been gathered and/or funded, as defined by the individual monitoring programs, and submitted to the appropriate agencies (FWP, USFWS, and Forest Service). Reports would also incorporate any correspondence from those agencies regarding impact trends, the need to modify mitigation plans and/or monitoring reports, or other pertinent information. The following elements would be covered:

1. Neotropical migrant birds;
2. Mountain goats;
3. Sensitive animal species – harlequin ducks are the only sensitive animal species initially identified to be monitored; and
4. Road and trail closures (may be included with the Threatened and Endangered Species Monitoring Report).

1.9 Aquatics and Fisheries Monitoring Plan

Aquatic biota would be monitored to determine if project activities were adversely affecting aquatic resources. The objectives of the Aquatics and Fisheries Monitoring Plan would be to:

- Establish pre-mining, or baseline, short- and long-term water quality and sediment conditions;
- Detect impacts of mine construction, operations, or closure activities on aquatic communities and fish populations; and
- Determine the effectiveness of BMPs and other mitigation.

There are benefits and drawbacks of monitoring aquatic systems by examining fish, macroinvertebrate, or periphyton assemblages. Aquatic macroinvertebrates are one of the most widely used indicators of water quality because, among other reasons, they are usually present in streams under a wide range of conditions. Monitoring stream fish assemblages is beneficial for detecting changes in aquatic conditions that occur over longer periods, but fish are not found in all drainages, can be transient within a reach, may be excluded from areas by physical barriers (such as waterfalls), and generally have more limited habitat requirements. Benefits of monitoring periphyton communities include the ability to detect short-term changes in water quality in a biotic community that is directly affected by both water quality and physical habitat changes. Programs that combine monitoring of all three communities combine the benefits of each to provide detection of changes to aquatic resources from a wide variety of conditions and periods. As described in the subsections below, RCR would monitor benthic macroinvertebrates, fine sediments, periphyton, fish populations, and metals accumulations in fish tissues. Aquatic and fisheries monitoring would be coordinated with water quality and streamflow monitoring described above in Section 1.6.

Monitoring sites would be selected to facilitate incorporation of available long-term data collected by Avista Corporation under the Clark Fork Settlement Agreement.

This conceptual aquatics and fisheries monitoring plan incorporates the fisheries and aquatics monitoring plan developed by Thomas in 1994. Prior to Phase II construction, RCR would develop and submit for Forest Service, DEQ, and USFWS approval an updated Aquatics and Fisheries Monitoring Plan, including a baseline monitoring program. Monitoring would be implemented, once approved by the Agencies, prior to Phase II construction and continue through post-mining reclamation. In the event of a temporary mine closure, monitoring would continue unless the Agencies agreed to reduce or suspend monitoring requirements.

RCR would compare data collected during the Phase II construction, operations, and closure phases with preconstruction baseline data and data from study area monitoring sites to upstream benchmark monitoring sites. The Aquatics and Fisheries Monitoring Plan may be modified by the Agencies to address any concerns that may be indicated by the data. Baseline monitoring and the monitoring components for all phases of the project are described below.

1.9.1 U.S. Fish and Wildlife Service Role

As described in the Terms and Conditions in the 2007 Supplement to the 2006 Biological Opinion (2007 BO Supplement) (USFWS 2007), the USFWS would participate as an advisor, as needed, on issues related to water resources, aquatics, and fisheries monitoring. The USFWS would have approval authority for the Water Resources and Aquatics and Fisheries Monitoring Plans. Reinitiation of consultation with the USFWS may be necessary if monitoring data indicated changes in risks to bull trout described in the 2007 BO Supplement.

1.9.2 Preconstruction Baseline Monitoring

The goal of baseline data collection is to describe the aquatic community that exists prior to mine development to allow comparisons with data collected during mine construction and operations. Without adequate baseline data, it would be difficult to determine if changes in the aquatic community were due to mine activities or natural events unrelated to mine activities. Baseline data collected as described in the following subsections will supplement data collected within the study area from 1985-2013.

Monitoring sites for preconstruction (baseline) and the Phase II construction, operations, and post-closure phases of the project would be selected in the Rock Creek and East Fork Bull River drainages to detect potential impacts associated with the project. Monitoring components for preconstruction and all other phases are described below.

1.9.3 Benthic Macroinvertebrates

While water samples collected at a specific time may not allow detection of potential pollution events between sampling events, benthic macroinvertebrates are effective indicators of short- and long-term stream water quality and sediment conditions. Certain species of macroinvertebrates can tolerate degraded conditions, such as elevated metal concentrations and fine sediments, while others may be very sensitive to small perturbations in the environment.

RCR would maintain detailed maps and photographs of each sampling site so that the sites can be accurately identified each year. In addition, permanent markers would be installed at each study site.

Quantitative macroinvertebrate data would be collected three times per year at each monitoring site. Monitoring sites would be selected to represent a range of impacted and unimpacted conditions. To

reduce variability, sampling areas would be physically similar as much as possible. It may be necessary to locate a suitable reference station outside the Rock Creek or East Fork Bull River drainage. Samples would be taken in a quantity and manner approved by the Agencies.

Macroinvertebrate collection and assessment methodologies would follow DEQ standard operating procedures (DEQ 2012b). Data analysis techniques would include, but are not limited to, the following:

- Macroinvertebrate Multimetric Index
- observed versus expected taxa
- standing crop
- taxa richness
- percent dominant taxon
- ratio of functional feeding groups
- Shannon-Weaver diversity index
- equitability
- community similarity index
- pollution tolerance indices
- total mayflies, stoneflies, and caddisflies divided by total chironomids
- Mayfly, stonefly, and caddisfly abundance and richness

Data would be compiled by season and comparisons would be made between potential impact sites and reference sites. Data would also be compared with baseline data. In addition, bioassays would be conducted with water samples taken from locations to be specified by the Agencies. Likely sampling locations are the mine adit wastewater, paste tailings facility seepage water, and Rock Creek water downstream of the mill site. Test species would be selected by the Agencies prior to the start of monitoring.

1.9.4 Fine Sediments

Monitoring of fine sediment and the effectiveness of sediment-reduction BMPs is described above in Section 1.6.

Fine sediment loading of spawning gravels in Rock Creek would be estimated during routine monitoring by referencing baseline stream sediment composition following the fine sediment assessment method outlined in *The Montana Department of Environmental Quality Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making* (DEQ 2013). The DEQ (2013) assessment method entails fine sediment measurement by riffle pebble counts and pool grid tosses, and may include additional sediment measurements by McNeil core sampling. Prior substrate sampling attempts in Rock Creek have indicated the difficulty of collecting core samples due to abundant cobbles in many areas of upper Rock Creek and its tributaries. Sampling techniques, times, and locations would be approved by the Agencies prior to the start of monitoring.

1.9.5 Periphyton and Benthic Chlorophyll-a

Similar to benthic macroinvertebrates, algae attached to submerged surfaces such as rocks or logs, known as periphyton, are effective indicators of short- and long-term stream water quality and sediment conditions. In particular, periphyton monitoring can help detect any effects of nutrient loading to a stream from blasting agent nitrate residues or other sources.

RCR would sample periphyton and benthic chlorophyll-a at all aquatic biological monitoring stations concurrent with the proposed benthic macroinvertebrate population sampling during the summer. Qualitative periphyton would be collected following DEQ's standard operation procedure using the appropriate method for the stream type to be sampled (DEQ 2011a). At stream locations with flowing water at the time of sampling, the modified PERI-1 method would be used, which designates a specific longitudinal stream length to be sampled at each site. The sampled stream length would either be 40 times the average wetted width at the mid-point of the stream reach or a minimum of 150 meters, whichever was greater. Eleven transects would be established throughout each site reach and would be located equidistant from one another (shown on Figure 1.0 in DEQ 2011b). Algal material would be collected from each of the 11 transect locations, with all material composited into a single sample per site (DEQ 2011a). Collection methods would include using a toothbrush or knife to collect material from hard substrates and a turkey baster or spoon for soft substrates.

Quantitative benthic chlorophyll-a samples would be collected from each site sampled for periphyton following DEQ's standard operation procedures (DEQ 2011b). Eleven transects would be established throughout the site reach as with the modified PERI-1 method. The samples collected at each transect would be kept separate rather than combining them into one composite sample as recommended for the periphyton samples. The collection method used at each transect would be based on the substrate and conditions at each location. For example, the hoop method would be used for transects dominated by the presence of filamentous algae, regardless of stream substrate. If heavy filamentous algal growth was not observed, the template sampling method would be used at transects dominated by small boulders, cobble, and gravel, while the core method would be used at those transects dominated by silt-clay substrate. The collection tools used for each method differ, but they all result in a quantifiable area of the stream substrate being sampled at each transect (DEQ 2011b). If field personnel visually assessed the site and decided that benthic algal chlorophyll-a was low (<50 mg/m^2) at all transects of a stream site, photographs of the stream substrate at all 11 transects would be taken in accordance with Section 7 of DEQ's standard operation procedures (DEQ 2011b) rather than taking chlorophyll-a samples.

Based on these methods, one composite periphyton sample and 11 chlorophyll-a samples would be collected at each site from the reach that included the Surber sample locations prior to collecting macroinvertebrates As stated in the DEQ's standard operating procedures (DEQ 2011b), the sampling method could be modified to scrub additional delimited areas from the same location for the chlorophyll-a samples if very little material on the filter was observed after filtration or if previous sampling efforts had a high percentage of below detection limit results, provided that appropriate methods and detection limits were used. The number of additional delimited areas scrubbed at each transect would be recorded.

1.9.6 Fish Populations

Fish population monitoring would be conducted to help determine if fish were adversely affected by mine activities. Fish population monitoring would also help track any new establishment of nonnative fish species that may indicate that physical stream conditions such as temperature, habitat, and streamflow have changed from pre-mine conditions.

During baseline monitoring, fish populations in Rock Creek, East Fork Rock Creek, West Fork Rock Creek, and East Fork Bull River would be monitored annually in July or August to establish baseline conditions at sampling sites that have not been monitored annually at the same locations by Avista Corporation. Beginning at Phase II, fish populations would be monitored at 2-year intervals. RCR would coordinate with FWP and Avista Corporation to determine the appropriate sampling locations and avoid potential impacts on fish from duplicative sampling. Fish population surveys would be completed at a variety of stream reaches to represent potential fish population responses to possible water quality and habitat changes. Population densities of each fish species would be estimated, where adequate sample

sizes permit, with snorkeling data, using the Seber-LeCren multiple pass method or comparable method to make population estimates. Monitoring requirements may be satisfied through cooperation with other monitoring efforts in these streams if cooperative efforts satisfy the project monitoring objectives. All fish kills would be monitored and reported within 24 hours to the KNF and DEQ.

1.9.7 Bioaccumulation of Metals in Fish Tissue

Fish would be collected from mainstem Rock Creek and the East Fork and West Fork Rock Creek for metals analysis. Tissue samples from collected fish would be analyzed to determine concentrations of zinc, copper, mercury, cadmium, and lead, which would then be compared with baseline concentrations. Initial baseline concentrations (from 1985) exist for zinc, copper, and mercury, but not for cadmium and lead. To update and statistically improve baseline data for fish tissue metals concentration, RCR would collect data prior to evaluation adit construction not related to the evaluation phase. To reduce sampling variability and enhance detection of changes, fish tissue metals monitoring would be conducted using a single species of fish of a similar age cohort with the highest stream reach fidelity possible. Test procedures and analysis would be the same as those used for initial baseline testing, unless changed by the Agencies. Sampling would be done annually for 5 years and then every 3 years until reclamation was complete, unless otherwise required by the Agencies. If metal concentrations in fish tissue became elevated to a level of concern, an ecological risk assessment would be conducted at the discretion of the Agencies.

1.9.8 Bull Trout in the Clark Fork River

RCR would work with the FWP and USFWS to monitor the effects of the mine discharge from the diffuser on bull trout between Noxon Reservoir and the confluence of Rock Creek and the Clark Fork River. This would be necessary to determine if changes need to be made in diffuser design or requirements within the MPDES permit (e.g., mixing zone and effluent limits) to maintain migration of bull trout across the diffuser and ensure that aquatic life standards were met.

1.9.9 Spills and Accidents

The Pipeline Spill Monitoring, Maintenance, and Repair Plan is described in Section 1.15.2 and, for Phase I, in the Rock Creek Evaluation Adit License Application (RCR 2010). In the event of an accidental discharge of toxic or hazardous materials or sediments, supplemental monitoring may be required by the Agencies if there is a reasonable possibility that the environment could be adversely affected. RCR would be required to immediately report all such accidental discharges to permitting agencies. The type, frequency, and location of monitoring would be contingent on the circumstances of the accident. Mitigations and recommended monitoring for several likely spill or accident scenarios would be developed as part of an Emergency Action Plan prior to mine operation. This would facilitate the process should a spill or accidental discharge of toxic or hazardous material occur.

1.9.10 Quality Assurance/Quality Control

To provide QA/QC for monitoring of aquatic resources, RCR would maintain a permanent taxonomic reference collection that contained all benthic species and representative samples of all dominant and indicator taxa of periphyton collected from study area streams. All nondiatom taxa would be preserved in vials and representative permanent slide mounts made for diatom taxa. Taxa identification in this collection must be documented and confirmed by taxonomic experts who must be selected in concurrence with the Agencies. This reference collection would be maintained by RCR through the period of post-operational monitoring. Following this period, the collection should be transferred to a depository selected by the Agencies for permanent scientific reference.

1.9.11 Reporting

Within 1 week of completing aquatic sampling in April, August, and October, RCR would submit a brief report to the Agencies. This report would include brief statements about stream conditions observed at each monitoring station and alert the review personnel to any marked changes in monitoring data relative to the cumulative monitoring record. Within a reasonable time (5 to 7 weeks, with the exception of analyses conducted by third-party laboratories) after completing sampling, RCR would submit a report to the Agencies containing the results of all data compiled and analyses completed. A brief report would accompany this data submission, highlighting any new or unusual patterns in the data, with a brief discussion of any known or suspected causes for this pattern.

On or before March 1, RCR would submit an annual aquatic monitoring report that contained summaries of all aquatic monitoring data collected during the previous year. Each report must discuss trends in plant and animal population patterns and evaluate changes and trends in terrestrial and aquatic habitat quality, based on all data collected to date for the project. Recommendations in these reports could include modifications to increase monitoring efficiency, improve the quality of the data, or address any potential concerns indicated by the data.

The Agencies, FWP, and other relevant agencies, would meet annually within 1 month after RCR submits the annual report to review the Aquatics and Fisheries Monitoring Plan and monitoring results and to evaluate possible modifications to the plan or to mine operations.

1.10 Reclamation Monitoring Plan

This plan provides the conceptual framework necessary for development of a reclamation monitoring program for the project. RCR had included a revegetation and a soils and erosion-control monitoring plan in its application and in the approved 2010 Evaluation Adit Plan; however, the Agencies believe that those plans needed to be expanded to reduce the risk of sedimentation and revegetation failure (see Chapter 2 and Appendix J of the SEIS).

The final plan would contain specific information on vegetation removal and deposition, soil salvage and handling, sampling methods, frequency of sampling, chemical parameters and analysis methods for any soil testing, and reporting. The reclamation monitoring program would begin as soon as construction activities were initiated and would continue until the Agencies released the reclamation bond.

The overall reclamation goal is to achieve short- and long-term stability and utility of the disturbed lands. The conceptual reclamation monitoring plan contains several elements:

- monitoring soil salvage, handling, segregation, quantity, and quality;
- soil erosion and construction monitoring; and
- revegetation monitoring.

1.10.1 Monitoring of Soil Salvage and Handling

Monitoring would take place throughout mine life during soil salvaging and replacement to ensure that adequate reclamation materials were salvaged, stored, and respread according to a revised and expanded soil salvage and handling plan. Soil depths would be verified using standard U.S. Department of Agriculture methods.

Soil salvage activities would be monitored to verify depth and suitability (primarily rock content) of each lift. Monitoring would also verify that each lift was stored in appropriate locations. Soil replacement activities would be monitored to verify that lifts were replaced in the proper sequence and with sufficient

depths. A 100-foot by 100-foot grid would be established on reshaped landforms at final reclamation of disturbances. After soil replacement, the grid would be resurveyed to verify proper total soil replacement depths. The average of all sample points per reclaimed unit must meet the soil replacement depth identified for each disturbance area. In addition, no sample point on the grid should have less than 50% of the required replacement depth.

Because biological, chemical, and physical changes occur in soils buried within stockpiles for prolonged periods, stored soil would be tested from samples collected deep within soil stockpiles before respreading to identify what, if any, deficiencies or limitations in soil physical and chemical properties existed that may affect plant growth. A reclamation specialist would determine appropriate fertilizer, liming, organic matter, and other amendments.

1.10.2 Soil Erosion and Construction Monitoring

This component of the reclamation monitoring plan has two phases: monitoring of active construction and long-term maintenance monitoring. In general, monitoring would be done to identify areas where slumps, rills, gullies, and sheet wash were occurring. Any erosion problems identified would be immediately corrected.

RCR would conduct annual audits of BMPs implemented during construction of roads and other project facilities. This monitoring would be ongoing throughout road and mine construction and into the operational period for the paste tailings facility storage area. A Forest Service engineer would periodically monitor erosion-control measures to ensure they are implemented according to approved plans and are functioning properly. If deviations from BMPs were found, RCR would immediately correct the practice as well as resource damage that had occurred. In addition, sediment source surveys would be conducted in the Rock Creek and Bull River drainages. RCR would be responsible for mitigating sediment sources on NFS lands in the Rock Creek drainage equivalent to 400 tons of sediment per year.

Routine long-term maintenance monitoring would be conducted during spring and fall and after heavy storm events. This monitoring would focus on reclaimed and disturbed areas. If necessary, immediate erosion-control measures would be applied such as reseeding, mulching, and other appropriate BMPs.

1.10.3 Revegetation Monitoring

Revegetation would be monitored annually during the growing season to identify areas where vegetation was failing and determine the cause. Revegetation monitoring should be conducted in conjunction with the routine soil maintenance monitoring. Systematic visual inspections would be conducted to identify areas that have inadequate cover, poor seedling growth, damage, or poor nutrition.

If problem areas were identified, RCR would need to identify the cause. If the cause appeared to be related to soil infertility or toxicity, then a soil testing program would need to be implemented for the problem area. Soil chemistry tests would be conducted to ascertain macro- and micronutrient status, pH, cation exchange capacity, and potential toxicity and heavy metal problems. Problems could also be caused by inadequate watering or inappropriate species or varieties being planted. Appropriate remedial actions would be taken to correct the problem.

Revegetation success of tree seedlings would be critical to mitigate the visual impacts of project facilities. A sampling design for monitoring tree stocking would be specified in the plan and approved by the Agencies. Other parameters such as ground cover, production or biomass, and plant density could be proposed by RCR to quantitatively evaluate the revegetation success of grasses, shrubs, and forbs. The minimum vegetation cover required after reclamation would be 80% of the total plant cover of a specific

control site after a 3- to 5-year monitoring period. Tree establishment surveys are recommended at Years 1, 3, and 5 after planting.

Post-closure monitoring of trees should be conducted for up to 20 years after mining to determine if visual mitigations and densities have been achieved. Fifteen years after planting, survival rates must number at least 400 trees per acre and 200 shrubs per acre. Frequency and amount of monitoring would be approved by the Agencies.

1.10.4 Reporting

Monitoring of soil loss rate and remediation activities, precipitation infiltration, and revegetation conditions would be conducted concurrent with operations and reclamation. RCR shall submit an annual report to the Agencies that describes any reclamation problems that were identified and remedial measures taken. This report would consist of three main components:

1. Soil salvage activities would be monitored to verify depth, suitability, and proper storage of each lift. Soil replacement depths would be verified and tested to identify any physical or chemical problems that might affect plant growth.
2. RCR would conduct annual monitoring of BMP implementation during road and mine construction and during construction and operation of the paste tailings facility to identify areas where slumps, rills, gullies, and sheet wash is occurring. Any erosion problems identified would be immediately corrected. Routine long-term maintenance monitoring would be conducted during spring and fall and after heavy storm events and would focus on reclaimed and disturbed areas.
3. Revegetation would be monitored annually during the growing season to identify areas where vegetation is failing to become established and to determine the cause. Tree establishment surveys are recommended at Years 1, 3, and 5 after planting and every 5 years thereafter unless otherwise determined by the Agencies. Post-closure monitoring of trees would be conducted for up to 20 years after mining to determine if visual mitigation has been achieved.

1.11 Plant Species of Special Concern Monitoring Plan

1.11.1 Monitoring of Plant Species of Special Concern

Monitoring pertains to all lands within the permit boundary for threatened and endangered plants but only to NFS lands within the permit boundary for sensitive plants. Additional on-site verification studies would be performed during development of final facility designs to precisely locate any additional KNF sensitive plant populations as well as populations of MNHP plant species of special concern for avoidance. Whenever the KNF sensitive species list was updated, the KNF botanist would alert RCR with the updated list. RCR would be responsible for ensuring that various plant surveys are revisited and conform to KNF standards within the study area to determine whether newly listed species, as well as any new MNHP plant species of special concern, had been identified. Reporting timeframes for the resurveys would be determined at the time KNF informs RCR of the updates.

1.11.2 Plant Species of Special Concern Monitoring Report

Reports would include data collected during on-site verification studies performed during final design development to precisely locate KNF sensitive plant populations and populations of MNHP plant species of special concern identified in the 2001 FEIS or the SEIS, as well as when any new sensitive plant species lists are updated. The monitoring report should also identify any changes that may be needed to avoid disturbance of these plants. Reports should be submitted prior to facility design review by the Agencies and again prior to surface disturbance for those facilities to re-verify population locations.

1.12 Terrestrial Threatened, Endangered, and Proposed Species Monitoring Plan

The monitoring plan outlines the basic monitoring elements to be designed in detail by the participating Agencies and RCR. The monitoring elements are connected to required mitigation items from the Threatened and Endangered Mitigation Plan in the USFWS 2006 BO. Monitoring would be conducted by RCR and the Agencies as indicated below. Monitoring elements below are cross-referenced with the relevant mitigation item from the Wildlife Monitoring and Mitigation Plan in the Rock Creek Evaluation Adit License Application (RCR 2010) or the USFWS 2006 BO.

1.12.1 Reporting Interval

The results of all monitoring efforts would be reported annually, unless specified otherwise. RCR would prepare an annual monitoring report and submit it to the KNF by February 15 of each year.

1.12.2 Monitoring Elements (RCR Responsibility)

Following are elements of the Threatened and Endangered Mitigation Plan that RCR would be required to implement:

- RCR would fund, for the life of the mine, monitoring and research efforts aimed at the Cabinet Mountains grizzly bear population, including the monitoring of grizzly bears augmented into the region over time (mitigation item A-7).
- RCR would contribute funding to continue the existing bear research and monitoring effort to identify bear movement patterns across Highway 2 between the Cabinet Mountains and the Yaak area (required by the USFWS 2006 BO).
- Following RCR development and Agency approval of the Road Management Plan (RMP; called a transportation plan in the mitigation plan attached to the 2006 BO), RCR would monitor the effectiveness of reducing mine-related traffic by busing employees to the mill site. RCR would provide traffic counts (summarized by month) and traffic type (to the extent possible - commercial, employee personal, bus, company vehicle, agency, nonmine-related traffic). The KNF and DEQ would review the plan to determine if mine-related traffic levels are above projected levels. Adjustments to traffic levels may be determined following completion of the construction phase, but prior to full operation (mitigation item A-1).
- RCR would provide an annual summary of the number and species of all dead animals found along roads. RCR would report the death of a listed or proposed species immediately. The KNF and DEQ would use random trips to assure this reporting is occurring (mitigation item A-3). As stipulated in the Terms and Conditions of the 2006 BO, any grizzly bear mortality within the action area, as defined in the 2006 BO, would be investigated by the USFWS, KNF, and FWP. If deemed attributable to the effects of the mine, additional measures as needed and as approved by the USFWS would be taken to prevent additional grizzly bear mortality.
- Timely service of bear-proof containers at all mine facility sites (mitigation item A-7) would be monitored. Problems in timely service would be corrected immediately.
- Results of seed application would be monitored to assure compliance with mitigation item A-8. RCR would immediately remove preferred bear foods found in the seed mix and resulting plants.
- Monitoring of mitigation item A-9 (no firearms) would be done by RCR and the results reported to the Agencies.

- Random checks to assure feeding of wildlife (mitigation item A-10) is not occurring would be done by the RCR and the annual report to the Agencies would document the number of violations.
- RCR would provide assurance to the Agencies that all employees complete training on living in bear country on an annual basis (mitigation item A-12). Assurance can be a current (dated) list of employees along with an attendance sheet with employees' original signatures.
- All road closures implemented as part of the mitigation plan (mitigation item C-1) would be monitored by RCR to assure that closures are effective. The question to be answered by the monitoring is: Are roads actually closed or not, based on use levels during various seasons? Seasons are: spring (April 1 – June 15), summer (June 16 – September 15), fall (September 16 – November 30), and winter (December 1 – March 31). Annual reports would show the total traffic count passing by each road closure being monitored and provide an interpretation on the number of round trips those counts represent by season.
- RCR would monitor recreation use levels on the Rock Lake and St. Paul trails (mitigation item C-3). Trail counters and other methods would be used to determine if use levels reach the "high" category as defined by the Interagency Grizzly Bear Committee.

1.12.3 Monitoring Elements (Agency Responsibility)

Following are elements of the Threatened and Endangered Mitigation Plan that the Forest Service and DEQ would be required to implement:

- The traction mixture used during winter operations would be monitored by the Forest Service to assure salt is not used (mitigation item A-2).
- The Forest Service would monitor compliance with the food storage order (mitigation item C-2).
- The Forest Service would monitor RCR's efforts to remove animals killed by vehicles traveling along routes used for the evaluation, construction, and operation of the mine (mitigation item A-3). This would be done with random trips along those routes. When animals are found that were not removed in the time frames specified in the mitigation plan, Forest Service would immediately notify RCR.
- Construction of powerlines according to criteria specified in the mitigation plan (mitigation item A-4) would be monitored by the Agencies to assure compliance. Compliance would be recorded in the annual monitoring report until powerline construction completed.
- The Forest Service would monitor and record all conflicts between people and grizzly bears, and people and black bears (mitigation item A-3).
- The KNF would monitor grizzly bear and black bear sanitation incidents in Bear Management Units 2, 4, 5, 6, 7, and 8 and take corrective action if necessary (required by the USFWS 2006 BO).
- The USFWS would also monitor grizzly bear movement across fracture zones (NFS road #154, NFS road #220, and E.F. Rock Creek Trail) using radio-telemetry methods. Results from this monitoring would be included in the annual "Cabinet/Yaak Grizzly Bear Recovery Area Research and Monitoring Progress Report" (mitigation item E-3).

1.12.4 Threatened and Endangered Species Monitoring Report

The results of all monitoring efforts would be reported annually and submitted to the USFWS by April of each year. The following elements are required:

1. Prepare an annual report of grizzly bear and black bear sanitation incidents and corrective measures taken during the previous year by April of each year;
2. Prepare a Transportation Monitoring Report or summary of that report;
3. Report the number of vehicular-killed deer, elk, and other species on project-related roads. After 5 years of full operation, the KNF, in consultation with the USFWS, would reevaluate the mortality risk to these animals to determine the need to continue, remove, and monitor the number of road-killed animals;
4. RCR would also monitor and report within 24 hours all grizzly bear, bald eagle, wolf, or lynx mortalities within the permit areas;
5. Timely service bear-proof containers at all mine facility sites;
6. Prepare a report on the results of seed application to locate and remove preferred bear foods (such as clovers) and document any necessary plant removals;
7. Provide the number of wildlife feeding violations;
8. Document required annual employee training on living in bear country;
9. Determine the effectiveness of road closures required by the USFWS 2006 BO;
10. Provide the results of monitoring recreation use levels on Rock Lake and St. Paul trails; and
11. Provide a summary and statement of compliance with all requirements of the Threatened and Endangered Species Mitigation Plan (Appendix E of the SEIS) and requirements in the USFWS 2006 BO.

1.12.5 Transportation Monitoring Report.

RCR would report the total vehicle count per road (summarized by month) and traffic type (to the extent possible) for NFS road #150 above and below the mill site, NFS road #150B, and NFS road #2741 above and below the evaluation adit access road to determine average daily traffic. The report should also define any necessary changes to the Traffic Management Plan. This report may be included with the annual Threatened and Endangered Species Monitoring Report.

1.13 Wilderness Monitoring Plan

1.13.1 Objective

The objective of monitoring for wilderness is to determine if activities approved within the CMW boundary, such as the required monitoring described in this appendix, are in conformance with mitigation and special provisions, and if management is minimizing impacts on wilderness values.

1.13.2 Locations, Parameters, and Frequency

1.13.2.1 Approval of Final Monitoring Plans

A Minimum Requirements Analysis (MRA) is required when prohibited use(s) are being considered in an administrative action (Wilderness Act, Section 4.c). Prohibited uses in the CMW include motorized equipment and motorized or mechanized transportation. Motorized equipment is defined as any machine activated by a nonliving power source except small battery-powered hand-carried devices such as flashlights, GPS units, cameras, or cell phones (36 CFR 261.2). Small battery-powered equipment left on-site for a period of time would be considered motorized equipment.

The Minimum Requirements Decision Guide (MRDG; Arthur Carhart National Wilderness Training Center 2014) is a tool to complete a minimum requirement analysis. The MRDG has two parts: 1) determine if administrative action is necessary and, if necessary, 2) determine the minimum activity necessary. Prior to Phase I, the KNF would conduct a MRDG on the conceptual monitoring plan through

Step 1. Step 2, which is the determination of the minimum activity necessary, would be used to evaluate final plans as they are submitted.

RCR would clearly identify any activities (e.g., monitoring, equipment, and transport) that would occur within the CMW boundary in submitted plans (e.g., maps, tables, and monitoring locations). The KNF would complete Step 2, determination of the minimum activity necessary, of the MRDG. The MRDG would be completed for final plans and updated as the project progresses.

1.13.2.2 National Wilderness Stewardship Performance

The Forest Service issued the National Wilderness Stewardship Performance Guidebook in 2015 (USFS 2015). Two elements that apply to the Rock Creek Project are described below:

- **Other Special Provisions -** includes a management plan and monitoring of the special provisions for the protection of wilderness values for the project. Special Provisions of the Wilderness Act Sec. 4(d)(3) allow for "*Mineral leases, permits, and licenses covering lands within national forest wilderness areas designated by this Act shall contain such reasonable stipulations as may be prescribed by the Secretary of Agriculture for the protection of the wilderness character of the land consistent with the use of the land for the purposes for which they are leased, permitted, or licensed*."

  The KNF would develop a Special Provision Monitoring Plan, covering both management and monitoring within the CMW boundary. The Rock Creek Final Monitoring Plan would be used as a basis for the Forest Service Special Provision Monitoring Plan. The Special Provision Monitoring Plan would be interactive and collaborative with RCR in determining priority management issues. If monitoring of the special provisions indicates resources are not in conformance with the plan, corrective actions would be taken.

- **Wilderness Character Baseline -** establishes a baseline and provides foundation for evaluating trends in wilderness character. These trends indicate the outcome of stewardship actions and success at "preserving wilderness character," as directed by the Wilderness Act. National protocol for monitoring wilderness character is currently under development. The KNF would develop a wilderness character narrative, select measures for each indicator, and gather data to establish a baseline. Once a baseline is established, wilderness character monitoring would be conducted on a 5-year cycle.

The Forest Service has developed a National Minimum Protocol for Monitoring Outstanding Opportunities for Solitude (USFS 2014). The KNF would implement solitude monitoring one year prior to the start of mining activity to establish pre-operation baseline information in areas identified with possible "*increased visibility of mine disturbances as well as increased noise from mining facilities*."

1.13.3 Reporting

RCR would submit the Final Monitoring Plan with activities (e.g., monitoring, equipment, and transport) within the CMW boundary clearly identified. The Forest Service would complete Step 2 of the MRDG and determination of minimum activity.

RCR would submit all activities (e.g., monitoring, equipment, and transport) occurring within the CMW annually on the Administrative and Special Provisions Authorization to the Forest Service by October 1 of every year. This form tracks motorized equipment/mechanical transport use authorizations to facilitate

post-season data entry into Infra-WILD, which is part of the Natural Resource Manager, a system of database tools used by the Forest Service for managing agency data.

The KNF would complete a Special Provisions Monitoring Plan annually (starting the year the Final Monitoring Plan was approved) by October 1 of every year.

1.14 Cultural Resource Monitoring Plan

1.14.1 Cultural Resources Monitoring

Monitoring would be required during any land-disturbing activity that has potential to adversely impact unidentified sites. The areas to be monitored for Alternative V are identified in Figure 4-8 in the SEIS. Monitoring must be completed by a qualified archaeologist meeting the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 Federal Register 44716) and all four tribes would be afforded an opportunity to monitor the activity. If a site is discovered during project implementation, activity would stop until the site is formally recorded and evaluated for eligibility to the National Register of Historic Places (NRHP).

Should a historic site (nonaboriginal) be discovered on private lands during project implementation, that activity would stop and the on-site archaeologist would notify the Montana State Historic Preservation Officer (SHPO). Should a prehistoric site (aboriginally affiliated) be discovered on private lands during project implementation, activities would immediately stop and the on-site archaeologist would notify the KNF, the Montana SHPO and the four tribes.

If a historic or prehistoric site were discovered on federal lands during project implementation, activities would immediately stop and the on-site archaeologist would notify the KNF, the Montana SHPO, and the four tribes (if the site were a prehistoric site). In addition, if the site were prehistoric, the four tribes would also be notified. All sites would be formerly recorded and evaluated for eligibility to the NRHP.

Evaluations should consider traditional tribal history. Should a site be determined to be eligible (in consultation with the tribes and formal review of the Montana SHPO, consideration of effects of continuing with the project activities should be characterized (36 CFR 800.5). A determination of adverse effect should result in the design of mitigation measures. Mitigation measures would be described in a plan for site protection or data recovery. Mitigation plans require consultation with the tribes and formal review by the Montana SHPO and the Advisory Council on Historic Preservation, resulting in a Memorandum of Understanding (MOU). Failure to stop work and notify the proper authorities may result in criminal and civil penalties as prescribed by state and federal law. A determination of adverse effect would result in the design of mitigation measures. If a site is found, RCR would not be permitted to conduct surface-disturbance activities until the site is formally recorded, eligibility resolved, a determination of effect completed, a mitigation plan approved by the Agencies, and the mitigation measures implemented.

A MOU would be drafted to outline a protocol to follow when aboriginally affiliated cultural materials are encountered during monitoring. The MOU would include a specific process for site evaluation, data collection, and curation of artifacts. This protocol must be in place prior to surface-disturbing activities as identified for monitoring areas in Figure 4-9 of the SEIS.

In Montana, when human remains are found on nonfederal lands, the Montana State Burial Law comes into effect. First, the local coroner is called and then the Montana State Burial Board. The Montana State Burial Board is made up of tribal representatives, representatives of the Montana SHPO, the State Coroners Association, physical anthropologists, and archaeologists.

In the event that human remains are discovered on federal lands during monitoring, the Native American Graves Protection and Repatriation Act (NAGPRA) and its implementing regulations take effect. All land-disturbing activities must stop until the steps described below are taken. The federal process for meeting the intent of NAGPRA (Public Law 101-601 November 16, 1990) and its implementing regulations (43 CFR 10) for inadvertent discoveries of human remains, funerary objects, sacred objects, and/or objects of cultural patrimony on federal land includes the following:

1. The KNF archaeologist or a designated representative would send a certified receipt notification of the inadvertent discovery to all four tribal officials, including the type of remains found, the status of law enforcement involvement, and the location of the discovery. This would take place no later than 3 working days after discovery [43 CFR 10.4(d)(i)]. The KNF archaeologist or a designated representative would also telephone each tribal official immediately, but no later than 3 working days after discovery [43 CFR 10.4(d)(iii)].
2. The KNF archaeologist or a designated representative would follow up with a letter of consultation [43 CFR 10.5(b)(iv)(3)] to each designated tribal NAGPRA specialist detailing:
    a. A time and place for further consultation [43 CFR 10.5(b)(iv)(2)].
    b. A list of tribes that have been notified [43 CFR 10.5(c)(1)].
    c. Intent to forward any additional documentation [10.5(c)(2)].
3. The tribal NAGPRA specialist would coordinate the identification of all lineal descendants and would keep of list of who has been contacted [43 CFR 10.5(d)(2)].
4. The tribal NAGPRA specialist would document the specific information used to determine custody (geographical, kinship, biological, archaeological, linguistic, folklore, oral tradition, and historical) [43 CFR 10.5(e)(2)]. The first priority for custody would be given to the lineal descendant [43 CFR 10.6(a)(1)] and then to the tribe with the closest cultural affiliation [43 CFR 10.6(a)(2)(ii)].
5. The KNF archaeologist would prepare reports [43 CFR 10.5(d)(8)] to include:
    a. location of discovery
    b. description of discovery
    c. dates, times, and nature of consultation with the tribes
    d. analysis reports
    e. archaeological records
    f. treatment and storage of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered
    g. the custody and disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony
6. The KNF would publish a notice of the proposed disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony at least two times at least 1 week apart in the Federal Register and tribal papers [43 CFR 10.6(c)]. The notice would provide information as to the nature and affiliation of the human remains, funerary objects, sacred objects, or objects of cultural patrimony, and would solicit further claims to custody.

Consultation with each tribe would determine procedures on a case-by-case basis [43 CFR 10.5(d)(3-9)].

1. Planned treatment, care, and handling of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered.
2. Planned archaeological recording of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered.
3. Planned analysis of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered.

4. The kind of traditional treatment to be afforded by the tribes for human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered.

1.14.2 Cultural Resources Monitoring Report

An annual report that describes monitoring activities for the year would be submitted to the Agencies. If a site is found, the site form, determination of effect, and mitigation plan would be submitted to the appropriate state and/or federal agencies within 30 days of completion of the site recordation fieldwork.

1.15 Mine Facility Construction and Operations Monitoring

1.15.1 Paste Tailings Facility and Paste Plant Monitoring

The intent of the construction and operations monitoring plans for the paste tailings facility, the paste production plant, and associated tailings pipelines, would be to assure the facilities are constructed and operated in a manner consistent with the design specifications and to ensure the facilities meet all performance objectives. RCR plans to construct an exploration adit to further assess the Rock Creek ore deposit. This limited underground exploration project is referenced as Phase I. Phase II of the project refers to full mine build-out. All final design and monitoring plans would be submitted to the Agencies for approval before Phase II could begin.

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 facility. The plan would identify monitoring requirements for pre-construction, construction, operations, and closure. The plan would be submitted for Agency approval prior to the Agencies authorizing Phase II.

The objectives of the geotechnical monitoring program as it pertains to the tailings facility and appurtenances 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
- Monitor paste performance during construction and operations
- Assist in assessing material used in dam construction
- Estimate tailings quantities and physical characteristics
- Establish requirements and a schedule for annual reporting.

A geotechnical monitoring plan adopted for Alternative V would incorporate many, if not all, of the monitoring elements listed in Table K-11. The exact type of monitoring technique used for data collection, location of monitoring devices, and frequency of data collection would be finalized during the final tailings facility design process and incorporated into a monitoring plan presented to the Agencies prior to Phase II. The monitoring plan would require RCR to submit an annual tailings facility construction and performance report.

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 Rock Creek, piezometers would be installed in

the foundation to measure pore pressures during construction, with particular attention given to areas where there may be glaciolacustrine clay present. 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 also be installed in the compacted paste shell as it is constructed to monitor pore pressure build-up.

The piezometer cables would be buried and lead to a common readout station at the toe of the paste embankment where continuous data reading equipment would be installed.

Inclinometers would be used to monitor potential deformation of the paste embankment, which could be an indication of foundation or embankment failure. Inclinometers would be replaced as needed.

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, cracks or slumps in the embankment, evidence of slope failure, erosion features along the embankment face, and changing trends in seepage quantities, piping, and wet spots, are representative of the kinds of observational features that could be indicative of potential problems with the paste facility and the kinds of features that would be noted and documented during a visual inspection.

During construction and operation of the impoundment, QA/QC of embankment and paste placement construction activities would be carried out by a qualified third-party engineering consultant. Prior to the commencement of construction, the responsibilities of the third-party consultant would be detailed in an Agency-approved field manual and would include standard field and laboratory QC tests.

Table K-11. Example Monitoring Program.

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
Paste Facility Embankment	Piezometers	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 paste; visual inspections by professional engineer
	Inclinometers	Deformation (inches)	Monthly	Measure embankment deflection and movement
	Material quantities: Paste, borrow, or mine waste used for construction	Tons, and cubic yards per year	Annually	Annual reconciliation of paste and any fill material; visual inspections by professional engineer
	Material Properties	Paste density and moisture content	Weekly	A QA/QC program would be implemented to measure and monitor in-situ paste density and moisture content; visual inspections by professional engineer
Paste Facility Interior	Material Properties	Paste density and moisture content	Weekly	A QA/QC program would be implemented to measure and monitor in-situ paste density and moisture content; visual inspections by professional engineer

During the Operations Phase of the facility construction, 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 embankment and foundation as the embankment is constructed. In-situ paste consolidation within the interior of the facility would also be monitored to assist with closure planning. The monitoring program would continue into the Closure Phase, although the frequency of monitoring would likely be reduced as steady-state conditions within the facility and embankment were approached. The following type of monitoring could be incorporated into a closure monitoring program:

- Installation of piezometers within the facility interior to monitor phreatic surface build-up.
- Installation of settlement plates and in-situ pressure transducers within the paste to monitor the consolidation and settlement of the tailings to help confirm the predicted consolidation behavior of the paste at closure.
- Visual inspections.

The monitoring plans for the Alternative V paste tailings facilities can generally be divided into four segments:

- Final Design Phase
- Preproduction Construction Phase
- Operations Phase

- Interim Facility Shutdown/Closure

Following is a general outline of the scope of monitoring:

Final Design Phase. The Agencies would require review and approval of final designs for the paste tailings facility, the paste plant, tailings pipelines, and associated tailings facilities before construction of Phase II could begin. In addition to design details, supporting data, and assumptions associated with the final designs, RCR would be required to submit detailed construction and operations monitoring plans for all paste-related facilities.

The final design of the paste tailings facility would be reviewed by the Paste Tailings TAG (PTTAG), whose role would be to serve as an independent third-party reviewer of the paste tailings facility design. This advisory group, comprised of Agency personnel and third-party technical advisors, would provide an assessment of the final design, provide independent interpretation and analysis of existing and new laboratory test results and assumptions used in the design, provide objective QA/QC oversight on the final design and its components, and make recommendations for changes to the final design as appropriate. Areas of particular interest would include the soft clay areas of the paste tailings foundation, paste (physical) properties as it leaves the paste production facility, and how the paste properties change over time once placed in the paste tailings facility. The PTTAG would also review and make recommendations for construction monitoring, and operations monitoring and maintenance. Members of the PTTAG would include Agency representatives along with third-party contractors selected by the Agencies, who have expertise in paste production, paste delivery systems, construction and management of paste facilities, and geotechnical engineering. Possible PTTAG members include the KNF, DEQ, EPA, Corps, Idaho Department of Water Resources, Idaho Department of Lands, the Confederated Salish and Kootenai Tribes, and Sanders County, Montana.

Preproduction Construction Phase. The Construction Monitoring Plan would establish standard-of-care construction implementation, testing, and reporting guidelines. The plan would outline construction QA/QC protocols to ensure that any constructed facility was being constructed to the design and performance standards set forth in RCR's Plan of Operations and the design documents.

Standard inspection and QA/QC procedures would be outlined with specific requirements for monitoring, testing, and reporting. Specific construction items that would be monitored include the identification and removal of areas of glaciolacustrine clay, pore pressure monitoring of foundation clays if left in place, construction of foundation shear keyways, and installation of foundation underdrains. A schedule for material testing would be a required, and a final as-built construction report would be submitted and approved by the Agencies prior to operations start-up. This report would include at a minimum a summary of work completed, descriptions of field changes to the design with all approvals clearly annotated, QC test summaries, appendices with documentation of changes, all test data, and as-built drawings.

Operations Phase. Monitoring would continue throughout project life and would include ongoing monitoring, data collection, and review through the life of the project as well as routine inspections and reports of facility geometry, material specifications, embankment drainage, foundation pore pressure, and observational performance. Operational data collected would concentrate on the paste tailings facility and include routine measurements using standard geotechnical instruments (e.g., piezometers, inclinometers, and pore pressure transducers) installed in the paste tailings disposal facility, daily production data from the paste plant to monitor paste characteristics such as moisture content, and in-place paste parameters such as moisture content, saturation, consolidation, and density. This kind of data collection will enable ongoing modeling of saturation levels in the paste tailings facility, which is an important component of a stability assessment. Data would also be collected on the paste production facility to monitor and track

paste parameters during production. These types of data collection and reporting requirements are consistent with the risk management plan recommendations contained in the Failure Modes Effects Analysis, summarized in Appendix P of the 2001 FEIS.

Quarterly summaries and annual reports would be prepared to document construction completed, data collected, and inspections conducted. The annual report would be reviewed by the PTTAG for conformance with design and operational performance and stability and to provide a means for recommendations or modifications to facilities operation.

Protocols would be established to alert operations managers of changed conditions that would impact the performance or stability of the paste tailings disposal facility, which could require immediate attention for resolution. RCR would be required to prepare a maintenance plan addressing items such as diversion ditches, repair of areas to minimize erosion or areas where the paste may require reinforcement, and control of surface water to minimize water from infiltrating into the paste. The tailings line would also require a monitoring and maintenance plan to ensure proper functioning. An emergency response plan for all paste-related facilities addressing emergency response protocols and contingency plans for system upsets would also be prepared.

Interim Facility Shutdown/Closure. A plan would be developed addressing temporary facility shutdown due to unforeseen circumstances. The intent of the plan would be to ensure all facilities were maintained in a manner that would not jeopardize or compromise the facilities' near and long-term performance and stability. An interim facility shutdown monitoring program could also form the basis for the final closure monitoring program.

Reporting and Third-Party Review. During the final design process, and during Operations and Closure, RCR would fund an independent technical advisor to assist the Agencies in ongoing oversight and review of the paste facility impoundment and associated appurtenances. The duties of the third-party technical advisor would be similar to those of consultants retained by the Technical Advisory Group as part of the review of the final tailings design. The technical advisor would be selected by, directed by, and report to the Agencies through an agreement with RCR. RCR would provide site access, logistical support, and all information required by the technical advisor to complete ongoing reviews of the paste facility.

RCR would submit an annual paste facility construction and performance report to the Agencies. It would detail facility construction, monitoring, and performance.

1.15.2 Pipeline Spill Monitoring, Maintenance, and Repair

RCR prepared a Pipeline Monitoring, Maintenance, and Emergency Response Plan for the Evaluation Adit (RCR 2010). This plan would be resubmitted to the Agencies to include the information described below. The pipeline emergency response plan would address emergency response protocols and contingency plans for system upsets.

Spill monitoring of the pipelines would consist of weekly scheduled inspections of the pipeline route. This would consist of inspection of aboveground steel/synthetic discharge pipeline for physical signs of corrosion and vandalism, air valves for signs of leaks, and the pipeline for visual signs of a pipeline leak as evidenced by the appearance of wet spots or springs along the buried portion of the pipeline alignment, and surface erosion and/or springs on sloped portions of the alignment. If visual indications of a pipeline leak were observed, mine personnel would partially excavate a small shallow portion of the trench to confirm whether a leak or spill is actually originating from the trench.

If a leak or spill originating from the trench is confirmed, mine personnel would notify appropriate government agencies (Noxon Volunteer Fire Department, Sanders County Sheriff, Sanders County

Emergency Management Coordinator, MDHES Water Quality Bureau, FWP, Forest Service, and National Response Center, as appropriate); the pump would be shut off; the pipeline would be allowed to drain; the trench would be opened up so the pipe can be thoroughly inspected; and the ground surface around the leak would be inspected to determine if pipeline contents are reaching a stream. Once the location of the leak is determined, that portion of the pipeline would be repaired and the trench would be backfilled using the same construction specifications used during pipeline construction.

If it is determined that the spilled material may be reaching a stream, mine personnel would immediately construct sumps to collect the material. Material from the sumps would be pumped into tanks and transported for proper disposal or to the water treatment plant. If it is determined that material reached a stream, water quality samples would be taken in the stream downgradient from the spill location using approved sampling and analytical protocols. A material recovery plan would be developed for each individual stream. RCR would store on-site the materials and supplies required to conduct the appropriate level of first response such as silt fence, oil booms, contamination supplies, and excavation equipment.

Due to the materials used for pipeline construction and the length of time the pipelines are anticipated to be in service, RCR does not expect the need to replace the pipelines due to age. However, it is possible that certain segments of the pipelines may need to be replaced due to some unforeseen material defect or failure. In that instance, flow through the pipeline would be shut down until the pipeline has been repaired.

1.15.3 Water Treatment Plant Construction and Operation Monitoring Plans

The intent of the Water Treatment Plant Construction and Operation Monitoring Plan is to establish QA/QC practices and operational standards for the water treatment plant and associated activities. The operating plan would include operating protocols, water quality treatment standards, and contingency plans for system upset or malfunction. These plans would be submitted to the Agencies for approval prior to plant construction.

1.15.4 Mine, Mill, and Associated Facilities Construction and Operation Monitoring Plans

All mine and mill facilities would have construction and operation monitoring plans. These plans would outline standard of care construction practices for these facilities and would include information on testing, monitoring, and reporting. The site location of certain facilities may encroach on sensitive habitat and construction practices would be clearly defined with regard to building in these areas so as to minimize impacts.

The intent of the operation monitoring plans is to establish protocols for the operation of all facilities to ensure standardized performance. The operating plans would address daily operations, contingency plans, system upsets, and performance criteria. The plans would be submitted to the Agencies for approval prior to construction.

1.15.5 Engineering Construction and Operational Quality Assurance Reports

RCR would submit to the KNF and DEQ Engineering Construction and Operational Quality Assurance Reports for the paste tailings facility and paste plant, mill site, wastewater treatment plant, rail loadout, and pipelines. Interim construction reports would be submitted monthly during construction of the key buttresses of the paste tailings facility. A final construction report would be submitted prior to operation and would contain as-built drawings. During mine operation, monitoring would include routine inspections and biannual reports of facility geometry, material specification, tailings seepage, foundation pore pressure, and observational performance. As-built reports would be submitted for all other facilities

prior to operation of the facilities. Operational monitoring of all other facilities would be appropriate for the facility involved.

1.16 Underground Mining Boundary Monitoring

To ensure RCR only mined ore within its valid existing rights and that the underground mine development adhered to required buffer zone boundaries, the Plan of Operations and DEQ Operating Permit would include requirements for underground monitoring. RCR would fund and facilitate biannual surveys of the underground workings that would be completed by an independent qualified mine surveyor. The surveyor would be selected and directed by the Agencies through an agreement with RCR. The surveyor would have no financial interest in the project. The Agencies may also require more frequent surveys and/or as-built drawings if discrepancies arose. RCR would provide mine access, logistical support, and all information required by the surveyor to complete independent inspections and resulting documentation for the identified tasks. This would include all company-conducted mine surveys of the underground workings. After completing the monitoring survey, the independent surveyor would submit maps of the workings to the Agencies and would report any ground disturbances that were outside of RCR's valid existing rights, entered into designated buffer zones, or deviated from Agency-approved mine design.

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Attachment 1: Field Barrel Test

Introduction

The purpose of a barrel test is to collect information about contact water quality using larger scale samples that is generally possible in a laboratory setting. Barrel tests are an example of a pilot scale field test on mine waste. Pilot tests may vary from a few hundred kg of material as in barrel tests to hundreds or thousands of tons of material as in test piles (INAP 2009).

Equipment

1. Select suitable size of field reaction vessel. Candidate containers for field experiments may include barrels (42 gallons or larger), large diameter columns (30 cm or larger with 2 m height), custom-fabricated cribs, or test piles.
2. Reaction vessels should be located outdoors in an area away from traffic patterns and in a location that receives normal precipitation, snowfall, wind and exposure to sunlight. Areas subject to snow drifting or snow storage areas should be avoided.
3. The vessel should be open at the top and if a column or barrel is used, the container should be filled to within 10 cm of the top.
4. The vessel should allow for gravity collection of effluent from the reaction vessel. If a tap or drain is installed at the base of the barrel or column, it should be located on the bottom of the container or on the side as close as possible to the base of the vessel.

Loading Barrels

1. A representative sample of rock or tailings shall be selected for loading into the container. Clasts larger than about 25 % of the reaction vessel diameter should be excluded from the sample. The approximate weight percentage of the sample's oversize material should be reported.
2. If the outlet for the vessel is installed in the sidewall, the container should initially be filled with coarse quartz sand up to the level of the drain to minimize ponding of water within the sample interval. Similarly, sample composed of less than 30 % gravel, or samples containing high clay contents (e.g. more than about 20 % clay in < 2mm fraction) should have a sand bedding layer installed to minimize ponding.
3. Carefully split a representative subsample from the vessel charge using a suitable sampling technique (that should be described in the report). The solid subsample will be analyzed for gradation, moisture content, and geochemical characteristics as described below.

Field Operation and Sampling

1. Place a rain gauge near the field reaction vessels and measure accumulated rainfall at least weekly or whenever a sample is collected.
2. Perform weekly inspection of reaction vessels and note any changes in the appearance of the sample including staining, slaking, piping, moss or algae growth, or vegetation establishment. Document changes with photographs.

3. At a net infiltration rate of 12 inches per year, a barrel should produce about 80 L of solution, or a little more than 1 L per week. Fluid samples should be collected weekly for the first three months of testing or less frequently if the cumulative solution volume is less than 1 L. At a minimum, a sample should be selected when 1 L of solution accumulates for sample intervals greater than one week. After three months, sample interval can be reduced to monthly. Sampling interval can be further reduced to quarterly upon Agency approval. Report sample volume and sample collection date for all samples.

Analysis and Reporting

1. Solid sample should be analyzed as follows:
    a. Perform gradation test including use of suitable screen sizes ranging from coarse gravel (>4") to silt (50 μ). Perform hydrometers analysis to determine silt and clay size fractions. Estimate surface area (m^2/kg) based on gradation.
    b. Measure bulk density and particle density.
    c. Also measure initial moisture content.
    d. Geochemical tests should include MWMP extraction (ASTM) followed by analysis for pH, conductivity, Alkalinity /Acidity, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chloride, Chromium, Cobalt, Copper, Fluoride, Gallium, Iron, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Nitrate/Nitrite as N, Nitrogen Total as N, Phosphorous, Potassium, Selenium, Silver, Sodium, Sulfate, Thallium, Tin, Vanadium and Zinc. Also perform Sobek ABP determination and NAG pH if this method is used as a quick test. This sample will also be analyzed for mineralogy by X-ray diffraction.
2. Fluid samples should be analyzed for pH, conductivity, Alkalinity /Acidity, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chloride, Chromium, Cobalt, Copper, Fluoride, Gallium, Iron, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Nitrate/Nitrite as N, Nitrogen Total as N, Phosphorous, Potassium, Selenium, Silver, Sodium, Sulfate, Thallium, Tin, Vanadium and Zinc. Metals should be in the dissolved form.
    a. The operator may petition to remove certain constituents from analysis that are consistently below detection is samples. Changes in the analyte list are subject to Agency approval.

Attachment 2: Wall Rinsing Test

Method for wall rinsing from:

Morin, Kevin A. and Nora M. Hutt . 2004. The Minewall Approach for Estimating the Geochemical Effects of Mine Walls on Pit Lakes. In Pit Lakes 2004; United States Environmental Protection Agency; Reno, Nevada; November 16-18, 2004

This method is developed for repeated sampling and can be used to derive kinetic rates of constituent release. A single rinse method can provide data for initial release from mine walls suitable for use in water quality predictions during mine flooding.

The following is taken from Appendix D of Morin and Hutt (1997), based on information in MEND (1995).

Equipment (for each station):

❶ 3 m of 90°-bent, flexible plastic bathtub edging
❷ 2 tubes of pure silicon bathroom sealant (must be pure silicon)
❸ 1 sheet of clear plastic 1 m by 1 m
❹ 8 black metal clasps often used for holding unbound reports
❺ 1 L of distilled water in a squeeze bottle which allows the direction and pressure of water to be controlled

Installation Procedure (see Figure A-1):

❶ Select a relatively flat surface of rock, preferably with no surface fractures, measuring no more than 1 m by 1 m.
❷ Mark the intended perimeter of the station on the surface with a pencil, with three, four, or five limbs of plastic edging.
❸ The lowest, or bottom, limb must slope downwards from horizontal so that all water caught on it will drain in one direction for collection and later analysis.
❹ Cut the plastic edging to the length required for each limb.
❺ Install each limb by using pure silicon sealant as glue.
❻ Ensure silicon sealant fills all open spaces between the edging and the rock surface so that no water can pass underneath.
❼ Ensure each limb overlaps so that no large gaps exist at any junction; seal any smaller gaps with silicon.
❽ Ensure the upper limb(s) will divert wall runoff around the sides of the station so that the water will not flow over the isolated area.
❾ With 1 L of distilled water, wash the entire isolated surface within the edging, rinsing out any loose rock/dust and ensuring all water is caught by the edging and directed to the bottom limb where the water can then be caught in a bottle.
❿ Cut the clear plastic sheet to extend 2 cm over each limb, then loosely attach the plastic sheet with the metal clasps, ensuring the plastic sheet does not touch the rock surface but prevents all precipitation or runoff from reaching the isolated rock surface.

Regular Sampling:

❶ Carefully remove the plastic sheet and place it somewhere clean and dry.
❷ Inspect the station for loose edging and broken seals against the rock; repair any problems after sampling (below), but avoid losing rinse water through any broken seals.
❸ Record a note if there is any condensation and if any water may have condensed and trickled out of the station between sampling events.
❹ Place a calibrated collection bottle at the downstream (outflow) end of the lower limb (trough) to catch all subsequent rinse water.

❺ With a calibrated squeeze bottle, spray at least 200 mL onto the isolated rock surface to rinse the entire area thoroughly; use as little water as possible; it is important to catch all rinse water in the collection bottle; record the volume of water sprayed on the rock.

❻ Record the amount of water recovered in the collection bottle.

❼ Analyze the water in the collection bottle like any other water sample, including pH, acidity, alkalinity, sulfate, dissolved metals, and total metals as desired.

❽ As a quality-assurance procedure for one round of sampling, also filter a similar volume of the distilled water through a 0.45 µm filter, then analyze like all other water samples

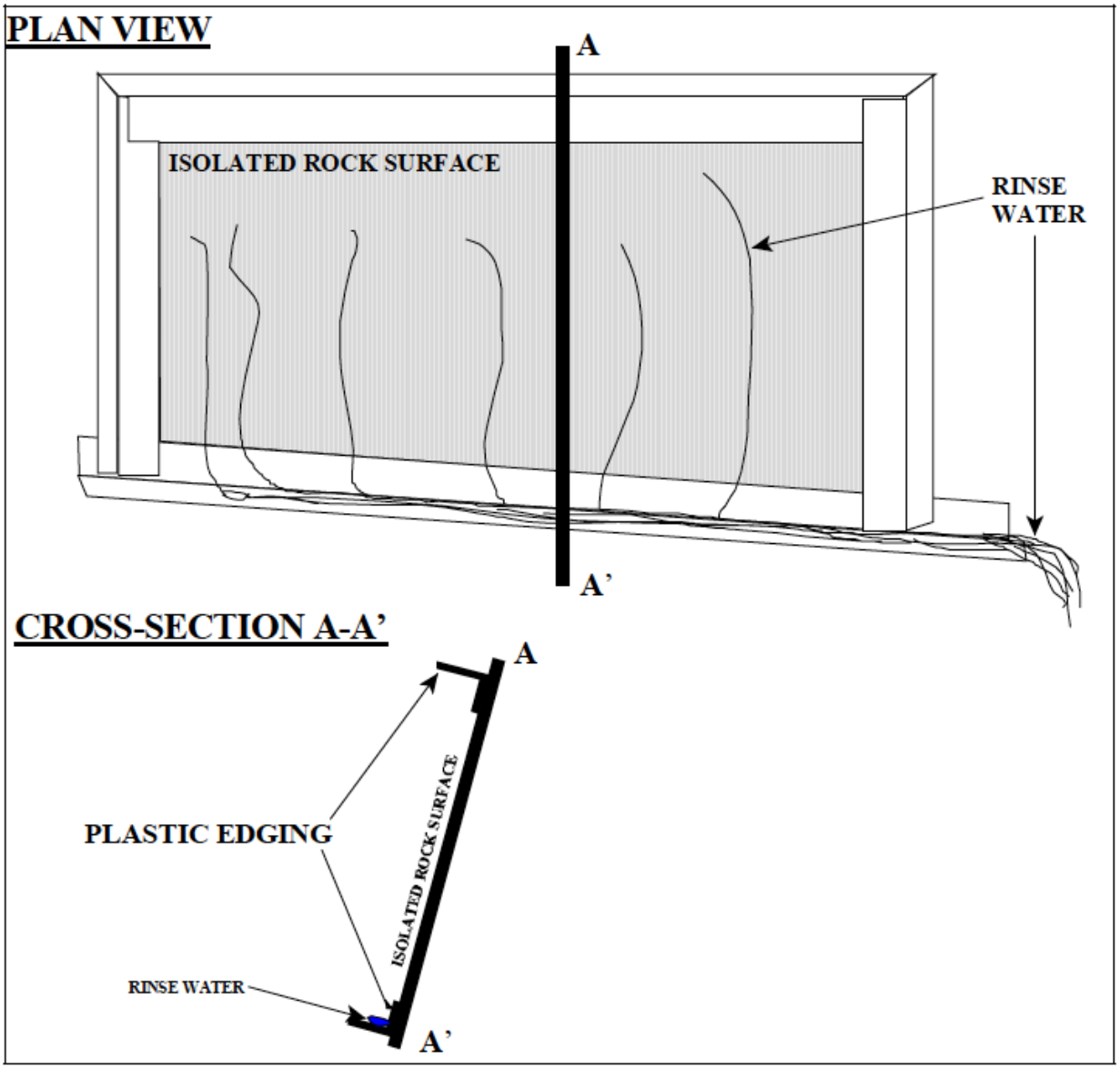

FIGURE A-1. Example of a MINEWALL Station (Plan View and Cross-Section).

APPENDIX L —

WETLANDS MITIGATION PLAN FOR ALTERNATIVE V

ROCK CREEK PROJECT

WETLAND MITIGATION PLAN

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Appendix

APPENDIX A. U.S. Army Corps of Engineers Jurisdictional Determination Letter for Rock Creek Project

GLOSSARY

Acronym	Entity
FA	Functional Assessment
FEIS	Final Environmental Impact Statement
KNF	Kootenai National Forest
MDEQ	Montana Department of Environmental Quality
MDT	Montana Department of Transportation
MTNHP	Montana Natural Heritage Program
Project	Rock Creek Project
RCR	RC Resources, Inc.
ROD	Record of Decision
RPW	Relatively Permanent Waterway
T&E	Threatened and Endangered
TNW	Traditional Navigable Waterway
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFS	USDA Forest Service
USFWS	U.S. Fish and Wildlife Service
WESTECH	WESTECH Environmental Services, Inc.
WUS	Waters of the U.S.

1.0 INTRODUCTION

RC Resources, Inc.'s (RCR) Rock Creek Project (Project) is a proposed underground hard rock silver and copper mine and associated facilities within the Rock Creek and Miller Gulch drainages northeast of Noxon in Sanders County, Montana. A 2001 Final Environmental Impact Statement (FEIS) issued for the Project by Montana Department of Environmental Quality and USDA Forest Service (MDEQ and USFS 2001) identified Alternative V as the preferred alternative; a 2003 Record of Decision (ROD) re-issued by Kootenai National Forest (KNF) confirmed selection of Alternative V (KNF 2003). Alternative V consists of an evaluation adit, tailings management facility, mill site, access road and utility corridors, and other ancillary facilities.

Wetlands and streams within the Project were inventoried by WESTECH Environmental Services, Inc. (WESTECH) in 1991-92, 2004, and 2011 (WESTECH 2012b).

On March 7, 2013, the U.S. Army Corps of Engineers (USACE) Montana Regulatory Office completed a jurisdictional determination of wetlands and streams based on the 2011 delineations, USACE field evaluations, and consultation with other USACE offices and the U.S. Environmental Protection Agency (Appendix A). The USACE concluded that no jurisdictional wetlands will be impacted within the Project tailings management facility or mill site. The USACE also concluded that all Project related stream crossing activities are to be regulated pursuant to the Nationwide Permit program.

The KNF (with USACE as a cooperating agency) is currently preparing a supplemental EIS (SEIS) for the Project. As part of the SEIS, new information and changed conditions are being evaluated. The KNF and USACE identified changes to the regulatory program and the need to update the 2005 wetlands delineation as issues to be addressed in the SEIS.

Wetland/stream delineations have been used to determine where wetlands and stream channels would be impacted by Alternative V activities. As currently designed, Alternative V would not disturb stream channels since stream crossings will be avoided by means such as overhead placement of utilities, installation of pipelines in directional drilled borings and use of existing bridges for road corridors.

RCR commits to implementing the proposed voluntary Mitigation Plan contained in this report, which addresses mitigation of non-jurisdictional wetlands at the tailings management facility that will be impacted by Alternative V activities. All of these non-jurisdictional wetlands occur on RCR property. The Alternative V tailing facility footprint has been modified to avoid wetland impacts on public land.

A Wetland Mitigation Plan was originally submitted by the applicant (Rock Creek Project) in September 1995 as part of the mitigation under action Alternative IV with modifications (ASARCO, Inc. 1995). The Plan was revised by the applicant in 1997 and 1998. The regulatory agencies further revised the Plan in 2001 to account for changes proposed under action Alternative V and to include six optional wetland mitigation areas proposed by the applicant in 1998. The agencies also modified the proposed wetland revegetation mixture to include both native plant species (preferred) and non-natives (where other options are not feasible), as specified in the KNF Plan. A 2005 revision was submitted by the applicant at

the request of USACE to reflect the new corporation established for the Project, to incorporate revised acreages from the 2004 wetland redelineation, to modify compensatory mitigation resulting from reduced wetland impacts, and to address conditions related to wetlands of the June 2003 ROD by the KNF (Conditions 61a, 61b, 71 and 72).

This 2013 version addresses regulatory changes since 2005, results of the 2011 wetlands redelineation, the 2013 jurisdictional determination by USACE, and discussions with USACE and KNF. This proposed voluntary Mitigation Plan, although not required under USACE 404 regulations, is generally organized to follow USEPA's Model Mitigation Plan Checklist for compensatory mitigation plans (USEPA 2003).

2.0 MITIGATION GOALS AND OBJECTIVES

Proposed activities may affect up to 3.5 acres of non-jurisdictional wetlands, all on private property owned by RCR within the tailings management facility area (Table 1). The goal of this proposed voluntary Mitigation Plan is to provide "no net loss" of wetlands regardless of jurisdictional status. This Mitigation Plan provides appropriate mitigation and compensation of the unavoidable loss and potential diminishment of wetland values associated with development of the Project. RCR's primary objective in developing the final design of the tailings management facility will be to attempt to avoid impacts to any wetlands if possible. If wetlands are in fact affected during build-out of the tailings management facility, RCR commits to create new wetlands at a ratio of 1.5 acres for every 1 acre of wetlands that are affected. RCR commits to create new wetlands concurrent with any project impacts to existing wetlands. About 18 acres have been identified as available and suitable for creating wetlands. If 3.5 acres of non-jurisdictional wetlands are affected during build-out of the tailings management facility, RCR proposes to concurrently create at least 5.25 acres of wetlands to compensate for the loss of 3.5 acres of affected non-jurisdictional wetlands.

Acreages in Table 1 reflect reductions in impacts since past applications due to the 2011 wetland re-delineation and project revisions to minimize impacts by avoidance. This reduction in impact results in a corresponding reduction in compensatory mitigation. Whereas the 2001 application had 6.6 acres of wetland impact and 9.9 acres of mitigation, and the 2005 plan had 4.86 acres of wetland impact and 7.29 acres of mitigation, the revised impact area of 3.5 acres results in 5.25 acres of mitigation at a ratio of 1.5:1.

2.1 IMPACT SITES

The potentially impacted wetlands are in the tailings management facility area (Figure 1). Wetlands within the tailings management facility will be avoided if possible during development of the final design for the facility. Wetlands on adjacent USFS land have been avoided by modifying the tailing facility footprint. Other potential wetland (jurisdictional and non-jurisdictional) impacts from Phase II have also been avoided by moving the road alignment at the junction with Highway 200, moving the road alignment at the Engle Creek bridge crossing and modifying the mill site footprint to avoid isolated wetlands.

2.1.1 Aquatic Resource Types and Functions and Aquatic Resource Concerns in the Watershed

Table 1 shows aquatic resources to be impacted by the Project. All wetlands to be impacted are in the tailings management facility area. These wetlands, a mix of forested, scrub-shrub, emergent, and open-water types, are scattered along small ephemeral drainages and include some small, isolated, depressional wetlands. Most scored fairly low on functional assessments and all were rated either Category III or IV, the two lowest-ranked categories (WESTECH 2012a). Low functional assessment scores for these wetlands were generally due to some combination of small size, isolation, higher anthropogenic disturbance levels, low uniqueness, lack of fisheries, and moderate to low wildlife usage and habitat quality.

Table 1.
CLASSIFICATION AND DESCRIPTION OF IMPACTED WETLANDS - ROCK CREEK PROJECT, SANDERS COUNTY, MONTANA

Wetland ID[1]	Cowardin Classification[2]	HGM Code[3]	Functional Assessment[4]		Impact Acreage[5]	Comments
			Rating	Category		
TAILINGS MANAGEMENT FACILITY AREA						
TI-01	PEMAh	DEMAh	39	III	0.009	Depression in drainage bottom created by Rock Creek Road; culvert under road; poorly defined flowline to receiving drainage
TI-02	PEMCh	DEMCh	39	III	0.057	Depression in drainage bottom created by Rock Creek Road; culvert under road, flowline to tributary TI-04/TI-09
TI-03	PSSA	DSSA	44	III	0.034	Low area in drainage near confluence with TI-04; updrainage no longer hydrophytic
TI-04	PSSA/PFOA	DSSA/DFOA	44	III	0.537	Drainage with intermittent wetland; weak flowline to Miller Gulch
TI-05	PSSA	DSSA	44	III	0.007	Small wetland in minor drainage; flowline connected to TI-04/TI-09 drainage
TI-06	PSSAh	DSSAh	39	III	0.051	Depression in drainage bottom created by Rock Creek Road; culvert under road
TI-07A	PEMA	DEMA	29	IV	0.006	Small low area in swale near head of drainage; nexus not significant
TI-07B	PEMA	DEMA	29	IV	0.016	Small low area in swale near head of drainage; nexus not significant
TI-07C	PEMA	DEMA	29	IV	0.004	Small low area in swale near head of drainage; nexus not significant
TI-07D	PEMA	DEMA	29	IV	0.004	Small low area in swale near head of drainage; nexus not significant
TI-08	PSSAh	DSSAh	39	III	0.043	Depression in drainage bottom created by Rock Creek Road; culvert under road
TI-09	PSSA/PFOA/PEMA	DSSA/DFOA/DEMA	44	III	0.258	Discontinuous along minor drainage bottom; weak flowline to Miller Gulch
TI-11	PEMA/PSSA	DEMA/DSSA	44	III	0.155	Minor drainage tributary to TI-04/TI-09 drainage
TI-12	PEMA/PSSA	DEMA/DSSA	44	III	0.041	Minor drainage tributary to TI-04/TI-09 drainage
TI-13A	PEMA	DEMA	36	III	0.062	Narrow drainage bottom above pond (TI-13B)
TI-13B	POWCh/PEMCh	DOWCh/DEMCh	36	III	0.051	Dammed pond in small drainage
TI-13C	PFOA/PSSA	DFOA/DSSA	36	III	0.114	Flooded/saturated area in drainage below pond
TI-13D	PEMA	DSSA	36	III	0.004	Drainage bottom below road down drainage from TI-13C
TI-14	PEMAh	DEMAh	39	III	0.007	Small depression in minor drainage created by Rock Creek Road; culvert in road; upstream from TI-11 drainage
TI-16	PEMA	DEMA	31	IV	0.277	Small swale/drainage connected to Miller Gulch and Clark Fork River; marginally meets wetland criteria
TI-19A	PEMA	DEMA	28	IV	0.003	Depressional microsite created by logging; not connected to Miller Gulch
TI-19B	PEMA	DEMA	28	IV	0.026	Mostly barren swale bottom tributary to Miller Gulch
TI-20	PFOB/PEMB/PSSB/ PEMA	SFOB/SEMB/SSSB/ DEMA	61	III	1.496	Miller Gulch from seep to below pond – tributary to TNW but flowline weak below TI-24
TI-21	PSSA/PEMA	DSSA/DEMA	61	III	0.066	Swale tributary to Miller Gulch
TI-22	PEMA	DEMA	28	IV	0.002	Depression formed by logging road; nexus to Miller Gulch not significant
TI-23	POWHh	DOWHh	61	III	0.010	Constructed pond on Miller Gulch

Table 1.

CLASSIFICATION AND DESCRIPTION OF IMPACTED WETLANDS - ROCK CREEK PROJECT, SANDERS COUNTY, MONTANA

Wetland ID[1]	Cowardin Classification[2]	HGM Code[3]	Functional Assessment[4]		Impact Acreage[5]	Comments
			Rating	Category		
TI-25	PEMA/PFOA	DEMA/DFOA	33	III	0.013	Narrow drainage below TI-04/TI-09 drainage; weakly connected to Miller Gulch
TI-26	POWAh/PEMA	DOWAh/DEMA	26	IV	0.019	Small pond with wetland fringe; no significant nexus to Miller Gulch or Clark Fork River
TI-26A	PEMA	DEMA	26	IV	0.007	Narrow rill with depressional wetland below TI-26; no significant nexus to Miller Gulch or Clark Fork River
TI-27	PEMA	DEMA	35	III	0.119	Narrow drainage; indistinct flowline to Rock Creek along logging road
TI-28	PFOC	DFOC	35	III	0.001	Narrow drainage; indistinct flowline to Rock Creek along logging road
TOTAL IMPACTED ACRES - TAILINGS - MANAGEMENT SITE					**3.499**	

[1]See Rock Creek Project 2011 Wetland Redelineation Report (WESTECH 2012b) for description of wetland ID's.

[2]Cowardin classifications of wetlands (Cowardin *et al.* 1979).

[3]Hydrogeomorphic (HGM) classification of wetlands (Brinson 1993).

[4]See Rock Creek Project Functional Assessment Report (WESTECH 2012a). Rating is percent of total possible score for all functions/values.

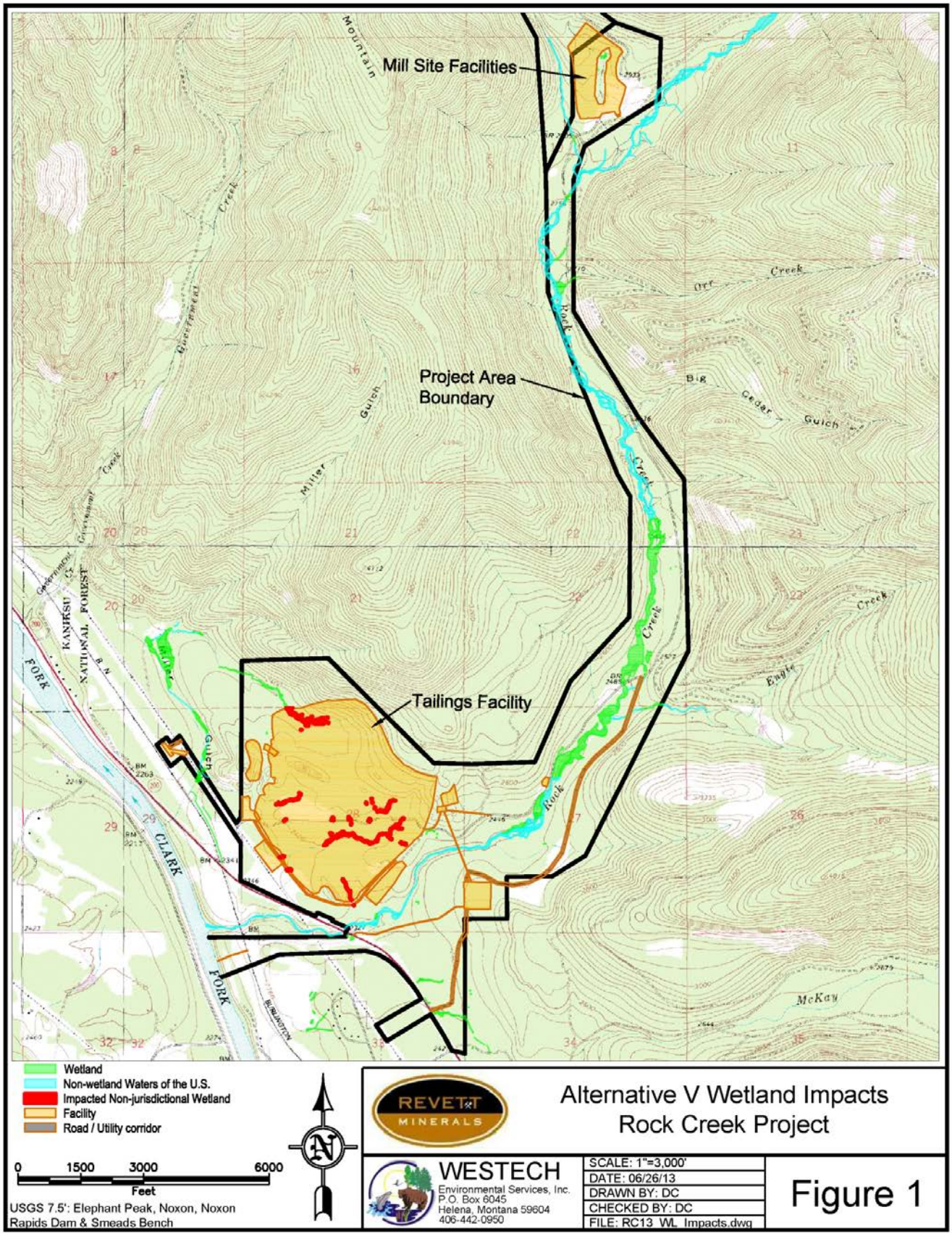
Category I: exceptionally high quality wetlands, generally rare to uncommon in the state or important from a regulatory standpoint; includes any AA that is documented primary habitat for a federally listed T&E species

Category II: more common wetlands than Category I; provide habitat for rare species and/or provide high-quality fish or wildlife habitat, and/or have high values for other wetland functions

Category III: more common and generally less diverse wetlands than Categories I and II

Category IV: generally small, isolated wetlands that lack vegetative diversity, provide little wildlife habitat, and are often anthropogenically disturbed.

[5]Acreage to be impacted by Alternative V activities.


Mill Site Facilities
Project Area Boundary
Tailings Facility
Wetland
Non-wetland Waters of the U.S.
Impacted Non-jurisdictional Wetland
Facility
Road / Utility corridor
0 1500 3000 6000
Feet
USGS 7.5': Elephant Peak, Noxon, Noxon Rapids Dam & Smeads Bench
REVETT MINERALS
Alternative V Wetland Impacts
Rock Creek Project
WESTECH
Environmental Services, Inc.
P.O. Box 6045
Helena, Montana 59604
406-442-0950
SCALE: 1"=3,000'
DATE: 06/26/13
DRAWN BY: DC
CHECKED BY: DC
FILE: RC13_WL_Impacts.dwg
Figure 1

Watershed objectives for the KNF, including the Rock Creek drainage, are generally described in the Draft Land Management Plan (USFS 2011). The Miller Gulch watershed is not specifically addressed. Functional assessments within the tailings management facility area indicate that most of the wetlands are too small and/or isolated to contribute substantially to watershed functions such as surface water management, flood attenuation, etc. (WESTECH 2012a), and are not known to support fisheries (Littlejohn 2012). The wetlands primarily provide moderate-quality wildlife habitat and recreation potential; wetlands in the main Miller Gulch drainage also provide some potential hydrologic benefits such as flood attenuation and sediment/nutrient/toxicant removal.

2.2 MITIGATION SITES

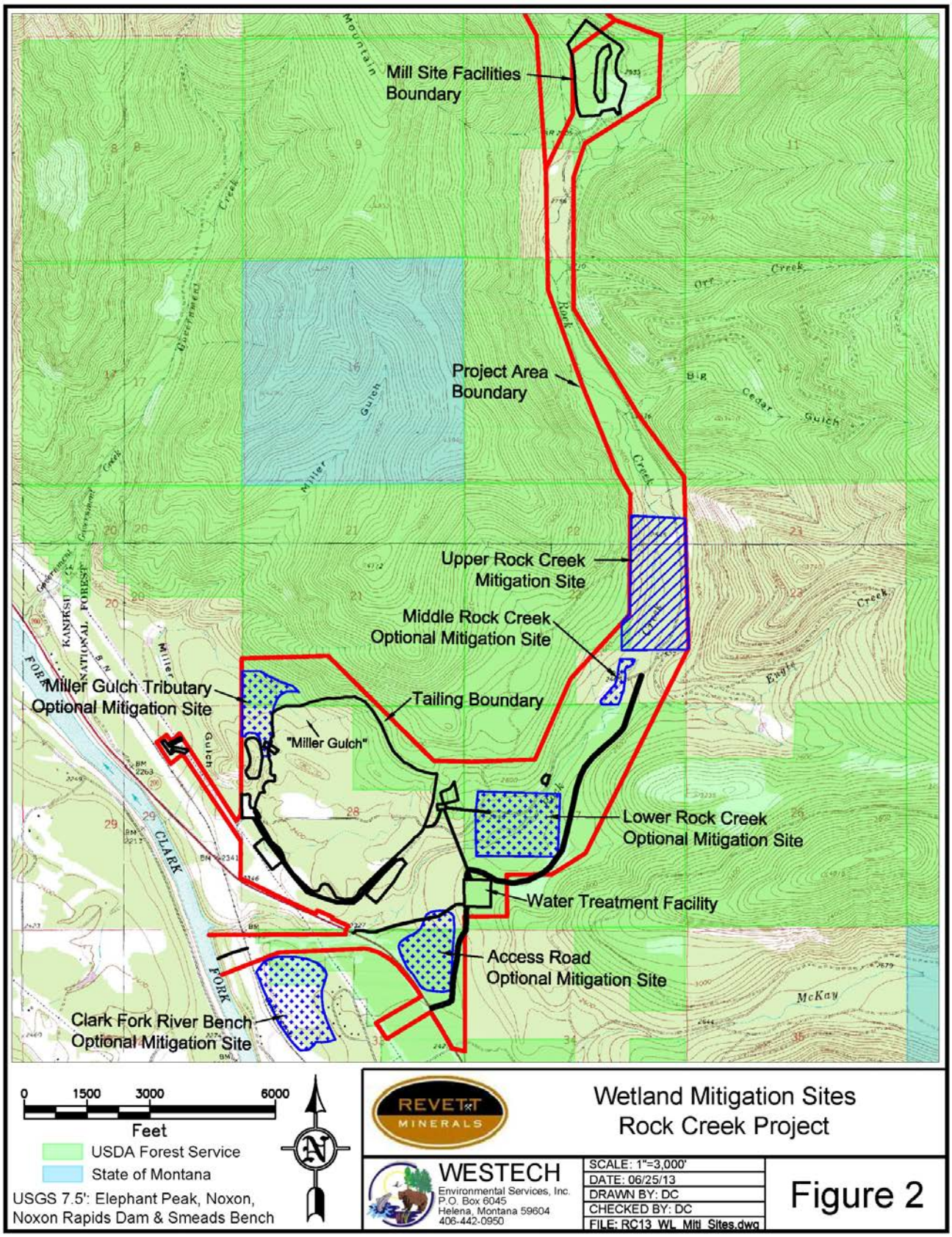
Mitigation by avoidance and minimization of impacts to WUS is discussed in Chapter 2 of the FEIS (MDEQ and USFS 2001) As part of the current SEIS, facility siting alternatives have been re-examined; and although major project facility locations in the agency preferred alternative have not changed, minor modifications to Alternative V have occurred to avoid wetland impacts. Of all of the proposed alternatives, the agency preferred alternative impacts the least amount of jurisdictional wetlands although impacts to some non-jurisdictional wetlands will be unavoidable under the preferred alternative. Wetland creation is proposed to mitigate unavoidable wetland losses. Wetland creation is proposed at one main site and, if necessary, at five (5) optional sites (Figure 2). The proposed mitigation site is designated the Upper Rock Creek Mitigation Site and is located in the E ½ of Section 22, T 26 N, R 32 W (Figure 2). It consists of a broad, gently sloping bench between Rock Creek and FR 150 (Rock Creek Road), north of the proposed tailing management site and south of the proposed mill site. The site is owned by the applicant. Mitigation will create linear wetlands adjacent to Rock Creek. This site includes what was previously designated as the Upper Rock Creek Mitigation Site Extension in the 2005 Mitigation Plan.

The five optional mitigation sites are:

1. Miller Gulch Tributary Wetland Mitigation Site: Wetland hydrology at this site would rely on surface water provided by runoff into the tributary and a diversion on the northwest side of the tailings management facility.

2. Lower Rock Creek Wetland Mitigation Site: This site is east of the proposed tailing management facility and north of Rock Creek in the vicinity of the previously proposed Borrow Area 3 (USFS ownership). Borrow Area 3 was deleted as a result of design changes in the tailing management facility. This site includes the previously designated Lower Rock Creek Wetland Mitigation Site Extension.

3. Access Road Wetland Mitigation Site: This site (previously designated Optional Mitigation Site 2) lies along the lower portion of the proposed access road and contains soils with low percolation rates suitable for surface water retention with minimal surface manipulation.


Mill Site Facilities Boundary
Project Area Boundary
Upper Rock Creek Mitigation Site
Middle Rock Creek Optional Mitigation Site
Miller Gulch Tributary Optional Mitigation Site
Tailing Boundary
"Miller Gulch"
Lower Rock Creek Optional Mitigation Site
Water Treatment Facility
Access Road Optional Mitigation Site
Clark Fork River Bench Optional Mitigation Site
0 1500 3000 6000
Feet
USDA Forest Service
State of Montana
USGS 7.5': Elephant Peak, Noxon, Noxon Rapids Dam & Smeads Bench
REVETT MINERALS
Wetland Mitigation Sites
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SCALE: 1"=3,000'
DATE: 06/25/13
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Figure 2

4. Middle Rock Creek Wetland Mitigation Site: Previously designated Optional Mitigation Site 1, this area is between the Upper and Lower Rock Creek sites on a terrace above Rock Creek.

5. Clark Fork River Bench Wetland Mitigation Site: Previously designated Optional Mitigation Site 3, this site occurs east of the Clark Fork River and south of Rock Creek in an area of fine-textured soils previously disturbed by construction of the Noxon Rapids Dam.

Because wetland demonstration cells constructed in the Upper Rock Creek Wetland Mitigation Site have documented the feasibility of creating wetlands in this area (see Sections 5.5 and 5.6) and the evaluation adit facilities have been removed from this area in Alternative V, the applicant proposes to conduct all mitigation in the Upper Rock Creek site.

2.2.1 Aquatic Resource Types and Functions and Watershed Value-Added Benefits

The mitigation project is intended to provide for "no net loss" of wetlands by creating wetlands to compensate for unavoidable impacts to existing wetlands within the Project area. The objective of the design of the Upper Rock Creek Mitigation Site is to create new wetlands that will provide additional long-term beneficial wildlife diversity/abundance functions to the adjacent (as well as upstream/downstream) Rock Creek riparian/wetland areas. The design of a series of linear wetland areas excavated to varying depths will provide for saturation/ inundation by shallow groundwater, and will recreate wetland conditions characterizing the adjacent riparian/wetland areas. This will allow for the successful establishment of wetland vegetation and wildlife diversity/abundance functions currently being provided by the existing riparian/wetland areas along Rock Creek. The functionality of the created wetlands to provide additional beneficial wildlife diversity/abundance values will not be fully established until successful wetland revegetation has occurred, including maturation of seeded species and the natural re-invasion of additional adjacent hydrophytic species. It is anticipated, however, that this process will likely be relatively rapid, as demonstration cells constructed at the site in the fall of 1996 and monitored in 2001 had substantial reestablishment of native hydrophytic species. Subsequent observations through 2013 have indicated the continued self sustaining success of this re-establishment methodology.

The proposed Upper Rock Creek Mitigation Site will rely on the demonstrated availability of shallow groundwater to successfully achieve and maintain long-term wildlife functions. Once the wetland wildlife functions have been established through successful revegetation, the functional life of the wetlands is anticipated to extend well beyond the life of the mining project, and to be similar to the functional life of the adjacent riparian/wetland areas.

3.0 BASELINE INFORMATION

3.1 IMPACT SITES

In the following subsections, the primary impact site of the Miller Gulch tailings management facility is discussed first, followed by discussion of the Engle Creek potential impact site.

3.1.1 Location

Impacted non-jurisdictional wetlands are in the tailings management facility area (Figure 1). These wetlands are designated TI-01 through TI-28 in the 2011 wetland delineations (WESTECH 2012 b) and are located north of Rock Creek and Highway 200 in Section 28 and the S ½ of Section 21, T26 N, R32 W.

3.1.2 Ownership

Most of the tailings management facility site in the Miller Gulch area is owned by RCR; portions of the site in Section 21 and the NE ¼ of Section 28 are KNF-administered land.

3.1.3 Assessment Methods

Wetlands within the Project area were delineated in 2011 using protocols and guidance of the 1987 USACE wetlands delineation manual (Environmental Laboratory 1987) and the USACE regional supplement for western mountains, valleys, and coast region (USACE 2010). Methods and results are fully described in WESTECH 2012b. The intersections of delineated wetlands and proposed disturbance areas within the Project boundaries were mapped in GIS to determine locations and acreages of wetlands that may be impacted (Figure 1). Functional assessments (FAs) of Rock Creek Project area wetlands were conducted using the Montana Department of Transportation (MDT) Montana Wetland Assessment Method (Berglund and McEldowney 2008; WESTECH 2012a).

3.1.4 Classification

Cowardin (1979), hydrogeomorphic (HGM; Brinson 1993), and functional assessment categories of impacted wetlands are shown in Table 1 (Section 2.0), along with a general description of the wetlands.

3.1.5 Aquatic Resources Quantification

Impacted wetland acreages will total 3.5 acres (Table 1). Acreages were determined in GIS using the Alternative V footprints and the 2011 wetlands delineation results (WESTECH 2012b).

3.1.6 Hydrology

Surface and groundwater hydrology within the Project area are fully described in Hydrometrics, Inc. (1987). A detailed water balance model for the optional Miller Gulch Tributary Mitigation Site is provided in ASARCO, Inc. (1995), Appendix 3-2.

Miller Gulch is a small, ephemeral to intermittent drainage that flows northwest from its headwaters near the center of the proposed tailings management area. The entire Miller Gulch watershed encompasses 2.8 square miles (1792 acres). Seeps and a constructed pond occur along the upper portion of the drainage (WESTECH 2012b). Channels and flowlines are indistinct or discontinuous along much of the upper drainage and lack stream bed-and-bank morphology. Surface flow disappears outside the western boundary of the project area. The lower portion of Miller Gulch beyond project boundaries includes a large wetland complex and ultimately flows into the Clark Fork, but an approximately ¼-mile gap between lower and upper Miller Gulch has no evident surface connection. No other surface flowpath to the Clark Fork was observed.

Wetlands in upper Miller Gulch that will be impacted by the tailings management facility include the main drainage within project boundaries, consisting of a wider, flatter upper segment (TI-20) and a narrower, steeper lower segment that is mostly or all beyond the impact area boundary; wetlands in small tributary swales (TI-19B and RC-TI-21); a constructed pond in the drainage bottom (TI-23); and several small depressional wetlands not contiguous with the main drainage (TI-19A and TI-22).

A tributary to Miller Gulch near and roughly parallel to Rock Creek Road flows generally westward through the southern portion of the proposed tailings management facility area. Wetlands are scattered along this tributary and on small, south-flowing tributaries of this tributary. Some small wetlands occur where the south-flowing tributaries are dammed by Rock Creek Road. Like Miller Gulch, this southern tributary exhibits an apparent gap in surface connection between the upper segment and a lower segment that flows into Miller Gulch near Highway 200.

Wetlands along this southern tributary that will be impacted by the tailings management facility include those along or near the main tributary south of Rock Creek Road (TI-03, 04, 05, 09, 11, 12, and 25); TI-13 on a small secondary tributary north of Rock Creek Road; small depressional wetlands on the north side of Rock Creek Road (TI-01, 02, 06, 07, 08, and 14); and TI-16 along another secondary tributary farther north near the current RCR support buildings.

3.1.7 Vegetation

Vegetation mapping for the Project is in Scow *et al.* (1987, Map 1). The Miller Gulch tailings management facility area is predominantly western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) forest, with some Douglas-fir (*Pseudotsuga menziesii*) forest on southwest-facing slopes along the northeastern edge of the area and on small ridgetops within the area. Baseline vegetation mapping using Pfister *et al.*'s (1977) forest habitat types classified the area as mostly western hemlock/queencup beadlily (*Clintonia uniflora*) forest, with some patches of western red cedar/queencup beadlily forest and Douglas-fir/mallow ninebark (*Physocarpus malvaceus*) forest. Portions of the tailings management facility area in Section 28 were selectively logged in the 1990s; the logged forest remains compositionally similar but with less tree cover and greater shrub/sapling and herbaceous cover than pre-logging.

Wetlands in the impact area are dominated by herbaceous vegetation, with trace to 35 percent tree cover, 0-4 percent shrub cover, and 79-102 percent herbaceous cover in wetland plots (WESTECH 2012b). The main drainage (RC-TI-20 and 24) has moderate to dense forest cover, primarily western red cedar and Engelmann spruce (*Picea engelmannii*) ; the other sites are more open, with tree cover limited to a few black cottonwood (*Populus trichocarpa*) or conifers around wetland margins. Shrub layers, where present, consist of minimal cover of Sitka alder (*Alnus sinuata)*, common snowberry (*Symphoricarpos albus)*, Pacific blackberry (*Rubus ursinus)*, and thinleaf huckleberry (*Vaccinium membranaceum*). Herbaceous strata are dominated by graminoids such as panicled bulrush (S*cirpus microcarpus)*, redtop (*Agrostis stolonifera)*, and several sedges (*Carex* species); few forbs are present.

Most wetlands along the main tributary south of Rock Creek Road (TI-03, 04, 05, 09, 11, 12, and 25) are shrubby or forested but also have a substantial herbaceous layer. Because of logging in recent decades, this area has a patchy canopy of western red cedar, western hemlock, lodgepole pine (*Pinus contorta)*, Douglas-fir, and black cottonwood. Typical dominant shrubs are red osier dogwood (*Cornus stolonifera*), Sitka alder, buckthorn (*Rhamnus alnifolia*), and common snowberry. The herbaceous layer is typically dominated by wetland grasses (e.g. redtop, tall mannagrass (*Glyceria elata)*, reed canarygrass (*Phalaris arundinacea)*, horsetail (*Equisetum* species*)*, sedges, rushes (*Juncus* species), panicled bulrush, and a few wetland forbs such as glandular willow-herb (*Epilobium glandulosum)* and common forget-me-not (*Myostis scorpioides)*.

The small depressional wetlands on the north side of Rock Creek Road (TI-01, 02, 06, 07, 08, and 14) and the small drainage north of the road (TI-16) are predominantly herbaceous; some have patchy shrub cover and a few have minor western hemlock or black cottonwood cover. Douglas' spiraea (*Spiraea douglasii)*, red osier dogwood, common snowberry, and/or black hawthorn (*Crataegus douglasii)* are the shrub species at these sites. Hydrophytic vegetation at these wetlands is similar to that of the wetlands south of Rock Creek Road, but has slightly lower species diversity.

3.1.8 Soils

Baseline soils mapping of the Project area (Noel 1986) indicates that soils in the Miller Gulch tailings management facility area are predominantly silt loams to silty clay loams on 0-8 percent slopes (Map Unit L), with some areas of very gravelly loam on 25-50 percent slopes (Map Unit TC). Steep (over 50 percent) slopes along the northeastern edge of the area and on small ridges within the area support a complex of very gravelly loams and rock outcrops (Map Unit TD RO). Soil samples SS-26 through 29 are within the tailings management facility area; soil profiles and laboratory analytical results for these samples are in Noel (1986), Tables 2 and 3. Wetland soils within the tailings management facility area are predominantly silt loams, silty clay loams, and clay loams displaying hydric indicators such as redox features and depleted horizons; histosols were observed in the upper portion of the main Miller Gulch drainage (WESTECH 2012b).

3.1.9 Wildlife

Wildlife usage within the Project area is detailed in environmental baseline reports (ASARCO, Inc. 1987-1997, Vol. 2), Rock Creek Project FEIS (MDEQ and USFS 2001 – Vol. 1, Chapter 3), and U.S. Fish and Wildlife Service's Biological Opinion for the Project (USFWS 2006). Discussion of wildlife and fisheries specific to wetlands within the Project area is in WESTECH 2012a.

Two federally listed threatened species, grizzly bear (*Ursus arctos horribilis)* and lynx (*Lynx canadensis*), and one candidate for federal listing, wolverine (*Gulo gulo luscus*), are known to occur in the Cabinet Mountains. Evidence of grizzlies and wolverines has been documented within the Project area (MDEQ and USFS 2001; USFWS 2006). No specific evidence of any of the three species has been documented in any of the delineated wetlands within the Project area, although the wetland areas are considered subject to suspected incidental use by these species (WESTECH 2012a). Other federally listed threatened and endangered (T&E) species discussed in the 2001 FEIS have been de-listed in subsequent years.

No fisheries have been documented in the ephemeral drainages of Miller Gulch within the Project area (Littlejohn 2012). Other Montana Natural Heritage Program (MTNHP) species of concern that are potentially present within the Project area are discussed in WESTECH 2012a. Mainstem Rock Creek is designated critical habitat for bull trout (*Salvelinus confluentus*), a federally listed threatened species (USFWS 2006; Federal Register 75FR63898).

3.1.10 Land Use

The Rock Creek and Miller Gulch watersheds are predominantly forested land of the KNF and are managed for multiple uses including forest resources, wildlife habitat, and recreation (USFS 2011). Private lands within the watersheds include timber holdings and small residential and commercial developments. Development is minimal, and is concentrated near Highway 200.

Logging and recreation have been the primary land uses in much of the Rock Creek drainage, including the impact areas (MDEQ and USFS 2001, USFWS 2006). Recreational uses include fishing, hunting, trapping, hiking, camping, etc. Public recreational use is limited in much of the Miller Gulch area by private land ownership.

3.1.11 Watershed Context

MDEQ has listed the entire length of Rock Creek as impaired due to alteration in streamside or littoral vegetative cover (a non-pollutant type of impairment) (MDEQ 2010, Table 1-1). No other impairment is listed for the Rock Creek drainage. Miller Gulch is an ephemeral drainage and was not discussed in MDEQ's stream impairment assessment.

Land use within the 33-square mile (21,120 acres) Rock Creek watershed and the 2.8-square mile (1792 acres) entire Miller Gulch watershed is discussed above. Because development is minimal, the watersheds have a high degree of landscape connectivity, with fragmentation primarily due to Highway

200, Government Mountain Road, a powerline corridor, and residential development near the lower ends of the watersheds close to the Clark Fork River; Forest Road 150 along much of the length of Rock Creek; and other forest and logging roads. Road density in the watershed is low (1.2 mi/mi^2) (Littlejohn 2012).

Natural buffers for wetlands and waters in the Rock Creek drainage include streamside riparian zones and adjacent uplands. Riparian strips ranging from a few feet to several tens of feet wide are present along much of Rock Creek and its tributaries. Adjacent uplands are typically heavily vegetated, mostly with forest cover. Natural buffers in the Miller Gulch watershed are primarily the adjacent, mostly forested uplands; riparian fringes are generally minimal or lacking on the ephemeral drainages of Miller Gulch within the Project area.

Delineated wetlands within Project boundaries in the Miller Gulch watershed total 5.3 acres, which is 0.3 percent of total watershed acreage. Impacted acres in the Miller Gulch watershed total 3.5 acres, which is 0.2 percent of total watershed acreage.

Within the Rock Creek Project area, 36.6 acres of wetlands have been delineated in the Rock Creek drainage. This represents 0.2 percent of the total acreage of the entire Rock Creek watershed.

3.2 MITIGATION SITE

In previous versions of this Plan, two (or more) mitigation sites were proposed. Most recently, RCR had proposed mitigation at two sites: Upper Rock Creek and Miller Gulch Tributary. With measures implemented to avoid or minimize impacts to wetlands and reductions in wetland acreage impacted, sufficient compensatory mitigation acreage can be created at just the Upper Rock Creek Mitigation Site.

3.2.1 Location

The Upper Rock Creek Mitigation Site is between Rock Creek and the proposed road/utility corridor, in the E ½ of the E ½ of Section 22, T26 N, R32 W (Figure 2).

3.2.2 Ownership

The Upper Rock Creek Mitigation Site is on land owned by RCR.

3.2.3 Assessment Methods

Wetlands within the Project area were delineated in 2011 using protocols and guidance of the 1987 USACE wetlands delineation manual (Environmental Laboratory 1987) and the USACE regional supplement for western mountains, valleys, and coast region (USACE 2010). Methods and results are fully described in WESTECH 2012b. The intersections of delineated wetlands and proposed disturbance areas within the Project boundaries were mapped in GIS to determine locations and acreages of wetlands that may be impacted (Figure 1). Functional assessments (FAs) of Project area wetlands were

conducted using the MDT Montana Wetland Assessment Method (Berglund and McEldowney 2008; WESTECH 2012a).

3.2.4 Classification

The proposed mitigation at the Upper Rock Creek Mitigation Site would create linear wetlands on a broad, gently sloping bench on the east side of Rock Creek. Existing nearby wetlands along Rock Creek are classified R3UB/PFOC (upper perennial stream reaches with mud bottoms and associated palustrine, seasonally flooded forested wetlands) (WESTECH 2012a). Rock Creek's stream channel in this vicinity is classed as a Rosgen Type C (MDEQ 2010, Figure A-5).

3.2.5 Aquatic Resources Quantification

Impacted non-jurisdictional wetland acreages totaled 3.5 acres (Table 1). Acreages were determined in GIS using the Alternative V footprints and the 2011 wetlands delineation results (WESTECH 2012b).

The applicant proposes to concurrently create at least 5.25 acres of wetlands (1.5:1 ratio) to compensate for the loss of 3.5 acres of affected non-jurisdictional wetlands. Sufficient additional acreage suitable for creating wetlands is available, if needed.

3.2.6 Hydrology

Surface and groundwater hydrology within the Project area are fully described in Hydrometrics, Inc. (1987). In general, there are two broad classes of wetlands based on hydrology: 1) wetlands which derive water from perennially shallow or seasonally shallow water tables and 2) wetlands which derive water from surface water run-on and/or precipitation. The Upper Rock Creek Mitigation Site is intended to support groundwater supplied wetlands. The site is on a gently sloping bench above Rock Creek and does not currently support wetlands. Groundwater level observations in a test well and demonstration excavations that were monitored at 2 and 5 years post-construction demonstrated that sufficient groundwater is available for establishment of wetland hydrology, as detailed in Section 5.5. These tests found that groundwater is generally six feet or less below ground level at the site and that wetland hydrology was established and maintained in the test excavations more than 5 years post-construction.

3.2.7 Vegetation

Vegetation mapping for the Project is included in Scow *et al.* (1987, Map 1). Vegetation in the Upper Rock Creek Mitigation Site is predominantly western hemlock and western red cedar forest, with wetland and riparian vegetation along the Rock Creek floodplain. Baseline vegetation mapping using Pfister *et al.*'s (1977) forest habitat types classified the mitigation site area as mostly western hemlock/queencup beadlily forest, with some western red cedar/devil's club (*Oplopanax horridum*) and western red cedar/oak fern forest in narrow strips near the center of the floodplain, and two relatively small areas of western hemlock/wild ginger (*Asarum caudatum*) on the west side of Rock Creek (Scow *et al.* 1987). Western hemlock/ queencup beadlily forest tends to occur on the driest sites capable of

supporting western hemlock (Cooper *et al.* 1991); western red cedar/devil's club and western red cedar/oak fern forests tend to occur on moist sites. During baseline vegetation mapping, two vegetation transects were sampled on the east side of Rock Creek in the northeast and southeast portions of the mitigation site (Scow *et al.* 1987). Both transects were on higher ground about 500-700 feet east of Rock Creek and were in dense western hemlock/queencup beadlily forest. Transect 32 in the northeast part of the mitigation site had a tree layer (116 percent cover) dominated by western hemlock and western red cedar; a minimal (less than 1 percent cover) shrub layer predominantly of dwarf bilberry (*Vaccinium myrtillus*); and an herbaceous layer (4 percent cover) dominated by beargrass (*Xerophyllum tenax*). Transect 31 in the southeast part of the mitigation site had a tree layer (111 percent cover) dominated by western hemlock and western red cedar; a minimal (2 percent cover) shrub layer dominated by western twinflower (*Linnaea borealis*) and dwarf bilberry; and a minimal (2 percent cover) herbaceous layer dominated by western goldthread. In the 2011 wetland delineation, the floodplain on the mitigation site was described as a mosaic of wetlands and non-wetland riparian areas with numerous rocky overflow channels in the riparian forest (WESTECH 2012b). Higher ground between channels is western red cedar forest with an understory dominated by queencup beadlily, devil's club, or ladyfern (*Athryium filix-femina*). Channels and fringe wetlands are dominated by shrub and herbaceous species including Sitka alder, Rocky Mountain maple, ladyfern, and thimbleberry (*Rubus parviflorus*).

Western red cedar/wild ginger forest is a MTNHP-listed ecological community of concern (MTNHP 2002). Within the Upper Rock Creek Mitigation Site this community is limited to two relatively small areas on the west side of Rock Creek. These areas would be unaffected by the proposed mitigation, which would occur on a bench east of Rock Creek.

Noxious weeds, particularly spotted knapweed (*Centaurea maculosa*), are abundant in the general vicinity of the mitigation site, but are predominantly species that do not tolerate saturated conditions and should not pose a significant threat to constructed wetlands. The 1987 baseline survey and the 2011 wetland delineations generally found minimal non-native plant cover in and near wetlands.

3.2.8 Soils

Baseline soils mapping of the Project area (Noel 1986) indicates that soils on the Upper Rock Creek Mitigation Site are predominantly sandy loams on 0-8 percent slopes (Map Unit C) on the eastern half of the Rock Creek floodplain where most of the mitigation work will occur. The center of the floodplain is occupied by very gravelly, loamy sands on 0-15 percent slopes (Map Unit CB) and gravelly silty loams on 0-8 percent slopes (Map Unit B). The western portion of the mitigation site and floodplain is occupied by very gravelly loam on 25-50 percent slopes (Map Unit TC), with some rock outcrops on steep slopes in the northwest portion of the mitigation site west of the Rock Creek floodplain. Soil samples SS-19 through 21 were taken within the mitigation area; soil profiles and laboratory analytical results for these samples are in Noel (1986, Tables 2 and 3).

3.2.9 Wildlife

Wildlife usage within the Project area is detailed in environmental baseline reports (ASARCO, Inc. 1987-1997, Vol. 2), Rock Creek Project FEIS (MDEQ and USFS 2001 – Vol. 1, Chapter 3), and USFWS's Biological Opinion for the Rock Creek Project (USFWS 2006). Discussion of wildlife and fisheries specific to wetlands within the Project area is in WESTECH 2012a.

Two federally listed threatened species, grizzly bear and lynx, and one candidate for federal listing, wolverine, are known to occur in the Cabinet Mountains, and evidence of grizzlies and wolverines has been documented within the Project area (MDEQ and USFS 2001; USFWS 2006). No specific evidence of any of the three species has been documented in any of the delineated wetlands within the Project area, although the wetland areas are considered subject to suspected incidental use by these species (WESTECH 2012a). Other federally listed T&E species discussed in the 2001 FEIS have been de-listed in subsequent years.

Mainstem Rock Creek, including the portion that flows through the Upper Rock Creek Mitigation Site, is designated critical habitat for bull trout, a federally listed threatened species (USFWS 2006; Federal Register 75FR63898). Westslope cutthroat trout, a MTNHP S2 species of concern, has also been documented in Rock Creek (MDEQ and USFS 2001; USFWS 2006; Littlejohn 2012). Other MTNHP species of concern that could potentially be present within the Project area are discussed in WESTECH 2012a.

3.2.10 Land Use

The Rock Creek watershed is predominantly forested land of the KNF and is managed for multiple uses including forest resources, wildlife habitat, and recreation (USFS 2011). Private lands within the watershed include timber holdings and small residential and commercial developments. Development is minimal and is concentrated near Highway 200.

Logging and recreation have been the primary land uses in much of the Rock Creek drainage, including the mitigation sites (MDEQ and USFS 2001, USFWS 2006). Recreational uses include fishing, hunting, trapping, hiking, camping, etc.

3.2.11 Watershed Context

MDEQ has listed the entire length of Rock Creek as impaired due to alteration in streamside or littoral vegetative cover (a non-pollutant type of impairment) (MDEQ 2010, Table 1-1). No other impairment is listed for the Rock Creek drainage.

Land use within the 33-square mile (21,120 acres) Rock Creek watershed is discussed above. Because development is minimal, the watershed has a high degree of landscape connectivity, with fragmentation primarily due to Highway 200, Government Mountain Road, a powerline corridor, and residential development near the lower portion of the watershed close to the Clark Fork River; Forest Road 150

along much of the length of Rock Creek; and other forest and logging roads. Road density in the watershed is low (1.2 mi/mi^2) (Littlejohn 2012).

Natural buffers for wetlands and waters in the Rock Creek drainage include streamside riparian zones and adjacent uplands. Riparian strips ranging from a few feet to several tens of feet wide are present along much of Rock Creek and its tributaries. Adjacent uplands are typically heavily vegetated, mostly with forest cover.

Within the Project area, 36.6 acres of wetlands have been delineated in the Rock Creek drainage. This represents 0.2 percent of the total acreage of the entire Rock Creek watershed. The Upper Rock Creek site has 6.15 acres available for mitigation, which is 0.03 percent of total watershed acreage.

4.0 MITIGATION SITE SELECTION AND JUSTIFICATION

Criteria used in developing compensatory wetland mitigation included:

- Avoiding disturbance to existing wetlands;
- Proximity to impacted wetlands, yet sufficiently removed from operations to minimize project-related disturbance;
- Hydrologic, edaphic, and topographic capability to support and maintain wetlands;
- Suitability for establishing similar functions as impacted wetlands;
- Areas where surface ownership favors long-term management of wetlands;
- Mitigation plans that do not rely on periodic maintenance;
- Minimal potential impacts of constructed wetlands to sensitive plant or animal species and to adjacent or downstream lands;
- Cumulative acreage of sites to achieve a minimum acreage replacement ratio of 1:1; and
- Relative cost of mitigation measures.

4.1 SITE-SPECIFIC OBJECTIVES

The applicant proposes to concurrently create at least 5.25 acres of wetlands (1.5:1 ratio) to compensate for the loss of 3.5 acres of affected non-jurisdictional wetlands. Sufficient additional acreage suitable for creating wetlands is available to compensate for potential impacts to jurisdictional wetlands at Engle Creek and other road/utility corridor stream crossings, if needed.

This acreage reflects a 1.5:1 mitigation ratio and would all be in the form of created wetlands. Figure 2 depicts five optional sites for additional wetland creation should proposed sites prove unfeasible or should projected wetland creation acreage fail to meet proposed goals, or should additional mitigation acreage be needed for unanticipated impacts to jurisdictional wetlands at road/utility corridor stream crossings. Acres of potential wetland creation are listed by site in Table 2.

TABLE 2
ACRES OF POTENTIAL WETLAND CREATION BY SITE,
ROCK CREEK PROJECT, SANDERS COUNTY, MONTANA

SITE NAME	AREA (Acres)
Proposed Wetland Mitigation Site	
Upper Rock Creek	**5.25 acres to be built**
Optional Wetland Mitigation Sites	
Miller Gulch Tributary	2.15
Lower Rock Creek	1.73
Access Road	3.0+
Middle Rock Creek	0.87
Clark Fork River Bench	5.0+
SUBTOTAL	**12.75+**
TOTAL AVAILABLE	**18+**

As final design is completed for the Project, some mine-related components such as borrow areas for reclamation material, diversion ditches, or other storm water control structures may be found suitable for wetland mitigation. If proposed mitigation is not successful, these additional alternative sites would be evaluated in consultation with involved agencies for suitability for wetland creation.

4.2 WATERSHED/REGIONAL OBJECTIVES

The objective of the design of the Upper Rock Creek Mitigation Site is to create new wetlands that will provide additional long-term beneficial wildlife diversity/abundance functions to the adjacent (as well as upstream/downstream) Rock Creek riparian/wetland areas. The design of a series of linear wetland areas excavated to varying depths will provide for saturation/ inundation by shallow groundwater, and will recreate wetland conditions characterizing the adjacent riparian/wetland areas. This will allow for the successful establishment of wetland vegetation and wildlife diversity/abundance functions currently being provided by the existing riparian/wetland areas along Rock Creek.

The proposed Upper Rock Creek Mitigation Site will rely on the demonstrated availability of shallow groundwater to successfully achieve and maintain long-term wildlife functions. Once the wetland wildlife functions have been established through successful revegetation, the functional life of the wetlands is anticipated to extend well beyond the life of the mining project, and to be similar to the functional life of the adjacent riparian/wetland areas.

4.3 CONTRIBUTION TO AQUATIC RESOURCE FUNCTIONS

The primary objective associated with wetland mitigation at the Upper Rock Creek site is to create wetland areas with long-term functions comparable to or greater than existing riparian/wetland areas located on lower terraces along Rock Creek or in abandoned or high-flow stream channels. These existing wetlands are dependent on seasonally high water tables or from periodic overflow of Rock Creek, and are classified as palustrine, forested wetlands.

The primary function associated with riparian and/or wetland areas located on lower terraces along Rock Creek is wildlife diversity and abundance. With respect to wildlife, important wetland factors in the Rock Creek drainage are size and distribution; wetlands are common, are distributed throughout the study area, and are present in mostlarger blocks of wildlife habitat and/or habitat complexes, but individual wetlands are small. Thus occurrence and availability do not limit wildlife use of wetlands, but wetland size may be a limiting factor for some species or species groups.

The existing riparian/wetland areas along the lower terraces of Rock Creek are the result of periodic overflow and the migration of the channel of Rock Creek, as well as overflow channels, in response to peak flow events. This has created a diversity of wildlife habitat in these areas adjacent to the main channel of Rock Creek, including cover and browse for larger species of wildlife, such as white-tailed deer (*Odocoileus virginianus)*, elk (*Cervus elaphus*), moose (*Alces alces*) and bear; habitat for lynx, fisher (*Martes pennanti*) and other furbearers; and resting and foraging areas for several species of birds, including limited seasonal waterfowl and shorebird habitat. In addition, muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*) and river otter (*Lutra canadensis*) likely use these areas. These areas also provide habitat for herptiles and aquatic macroinvertebrates. One Federally listed endangered or threatened species, the grizzly bear, may also use these riparian/wetland areas as a microsite habitat source of succulent forage.

4.4 FUTURE ADJACENT LAND USES AND COMPATIBILITY

Most of the lands surrounding the mitigation site are either national forest land or owned by the applicant. Foreseeable future land uses should be compatible with the proposed mitigation. RCR intends to provide a conservation easement that would permanently protect the wetlands mitigation site.

4.5 SITE PRACTICABILITY

Monitoring of demonstration cells at the Upper Rock Creek Mitigation Site indicates the feasibility and practicability of the proposed mitigation.

4.6 IN-KIND AND ON-SITE MITIGATION

The proposed mitigation at the Rock Creek Project will be on-site (within Project boundaries) and in-kind, by creating similar or more environmentally beneficial wetlands to those impacted. Created

wetlands at the Upper Rock Creek Mitigation Site are likely to provide better wildlife habitat than the impacted non-jurisdictional wetlands at the tailings management facility site, by augmenting existing extensive wetlands and riparian areas in the Rock Creek floodplain.

4.7 PROTECTIVE MEASURES

When RCR determines that final success criteria for mitigation have been met, a wetland conservation easement will be established for the wetland mitigation site.

The eastern-most portions of the Upper Rock Creek Mitigation Site would be located near the main access road and utility corridor for the Project. This road would be used by the general public, as well as by project-related vehicles during the exploration and operational phase of the mine project. Use by project-related vehicles, however, will be significantly reduced by the incorporation of employee busing in Alternative V. Mine employees will be bused from an employee parking lot to be provided near the water treatment plant at the lower end of the Rock Creek drainage. The use of busing will significantly reduce the potential for vehicle-related disturbance to the newly created wetlands and their beneficial wildlife functions.

4.8 SELF-SUSTAINING/MAINTAINING SYSTEM

At the Upper Rock Creek Mitigation Site, groundwater level observations in a test well and demonstration excavations that were monitored at two and five years post-construction demonstrated that sufficient groundwater is available for establishment of wetland hydrology, as detailed in Section 5.5. These tests found that wetland hydrology was established and maintained in the test excavations 5 years post-construction.

4.9 BIOLOGICAL OPINION

On October 13, 2006, USFWS issued a non-jeopardy biological opinion for the Project. The non-jeopardy opinion concludes that the project incorporates a conservative approach to ensure adequate measures to conserve grizzly bears and bull trout and that the mitigation plan for the Project will be protective of threatened bull trout and should produce a positive net effect for the Cabinet-Yaak ecosystem grizzly bear population. The Biological Opinion is available at:
http://www.fws.gov/mountain-prairie/species/mammals/grizzly/cabinet.htm.

4.10 CULTURAL RESOURCES CLEARANCE

The Montana State Historic Preservation Office found that all eight of the cultural resource sites documented during surveys of the Project area were ineligible for nomination to the National Register of Historic Places (MDEQ and USFS 2001, p. 3-138). The cultural sites were all related to mining, logging, and homesteading activities.

5.0 MITIGATION WORK PLAN

5.1 MAPS

The Upper Rock Creek Mitigation Site and five optional mitigation sites are shown on Figure 2. DGPS coordinates for the approximate center of the Upper Rock Creek Mitigation Site are: 597080 E, 5316850 N (NAD 1983, Zone 11, m).

5.2 TIMING

Construction of wetlands mitigation will begin concurrently with impacts to existing wetlands. This could occur as early as during initial stages of tailing facility constriction or may occur during later years of the mine if at all. Final design of the tailing facility will allow a detailed schedule to be estimated.

5.3 GRADING PLAN AND CONSTRUCTION METHODS

Proposed wetland channels for the Upper Rock Creek Mitigation Site shown on Figure 3 are conceptual. Actual locations will be determined in the field utilizing existing historical non-wetland channels and topographically lower areas. RCR commits to submitting a final construction design to the KNF for mutual agreement prior to the commencement of construction. The final design will include contour details, details as to pre-construction monitoring, depth of excavations, side slope steepness, and erosion control Best Management Practices (BMPs) for construction. RCR commits to having a wetlands specialist on site during construction to coordinate final construction design with the KNF and the construction contractor.

Prior to excavation and following tree and shrub removal, topsoil will be salvaged from all areas to be disturbed and stockpiled in non-wetland areas adjacent to the site. Material will be excavated in a linear configuration using scrapers, dozers, trucks and/or backhoes depending on availability and site conditions. Excavation depth will depend on groundwater levels encountered during construction, but is anticipated to be about 6 to 8 feet based on observed pre-construction groundwater levels.

Disturbance of existing vegetation will be avoided where possible or otherwise minimized. The limits of construction disturbance will be shown on a final grading plan that will be submitted to the KNF for mutual agreement prior to commencement of construction. Excavated material will be used for fill on the access road, tailing management facility or other project components.

The mitigation sites will be constructed with a slight (less than 1 percent) slope toward the south. Constructed channels will not be connected to Rock Creek to minimize potential scour from high flows.

Width of the bottom of the linear sites will vary from 10 to 25 feet. Uniform width will be avoided to create a more natural configuration. Small depressions will be constructed along the longitudinal profile of each linear site to increase water retention late in the season when groundwater levels may decline. Bench design is also conceptual and benches will be constructed on one or both sides of the bottom

(Figure 4) to create zones with variable periods of saturation or inundation. Final bench design will be submitted to the KNF for mutual agreement prior to the commencement of construction. The benches, at 6 to 12 inches above the bottom, will be saturated or inundated only during spring. The bottom will remain saturated later into the growing season. The shallow depressions will be inundated or saturated for the majority of the growing season. Sideslopes of the mitigation sites will vary reflecting excavation depth and natural topography.

In general, one side of the excavation will be constructed at a relatively steep slope (40 to 50 percent) with the opposite side constructed at a gentle to moderate slope (10 to 40 percent). Variable slopes will enhance topographic and resulting vegetative diversity.

5.4 CONSTRUCTION SCHEDULE

Creation of mitigation wetlands is not proposed in conjunction with development of the Project Phase I evaluation adit since wetlands will not be impacted at the adit site or support facilities. Mitigation wetlands will be created beginning in the first construction season concurrent with impacts to existing wetlands and will be staged over the life of the tailing management facility as described in the table below. Proposed design modifications in the tailing management facility result in incremental wetland impact over the life of the project as opposed to previous designs whereby most wetland impacts occurred earlier in project development.

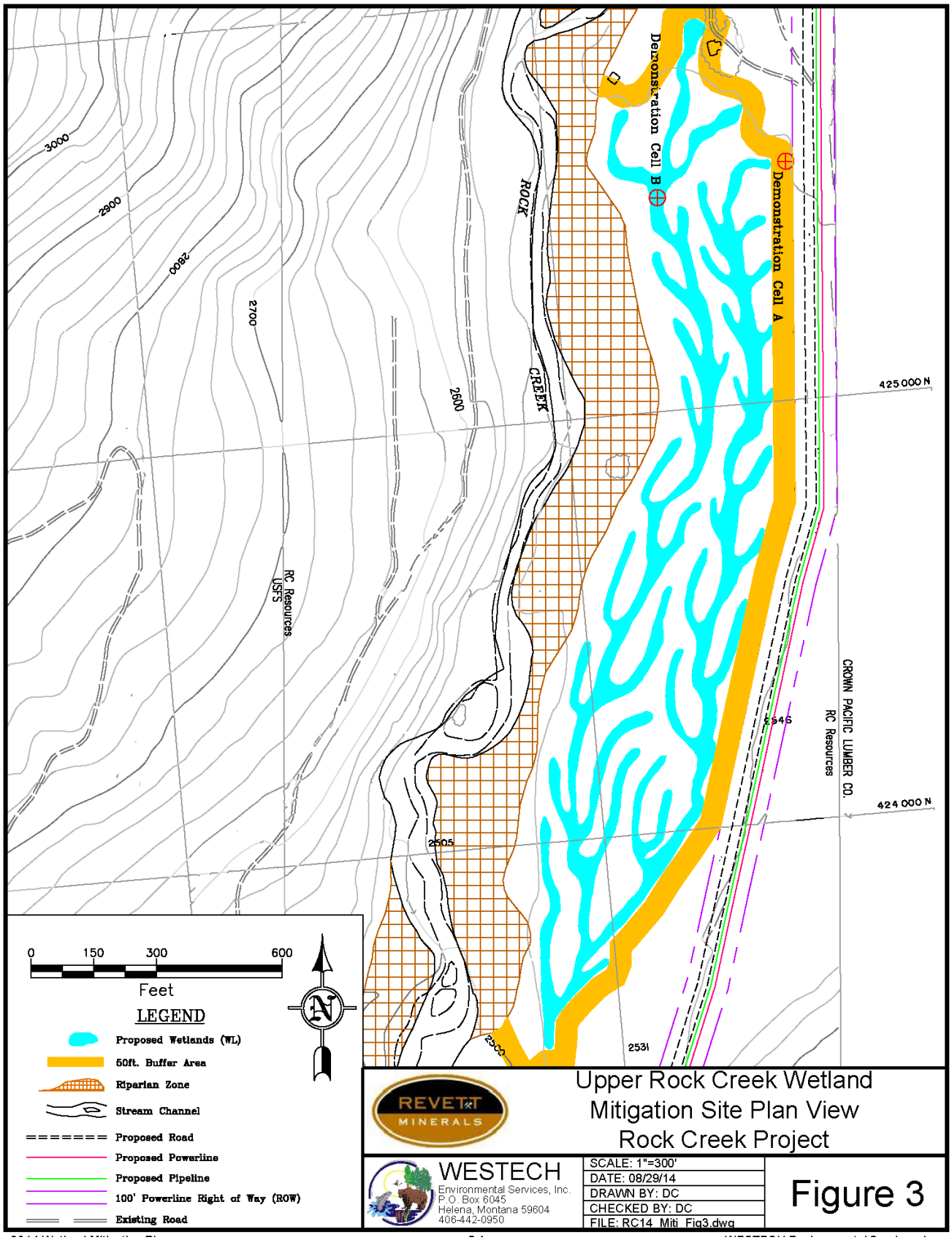
The proposed mitigation schedule for the mine development phase is:

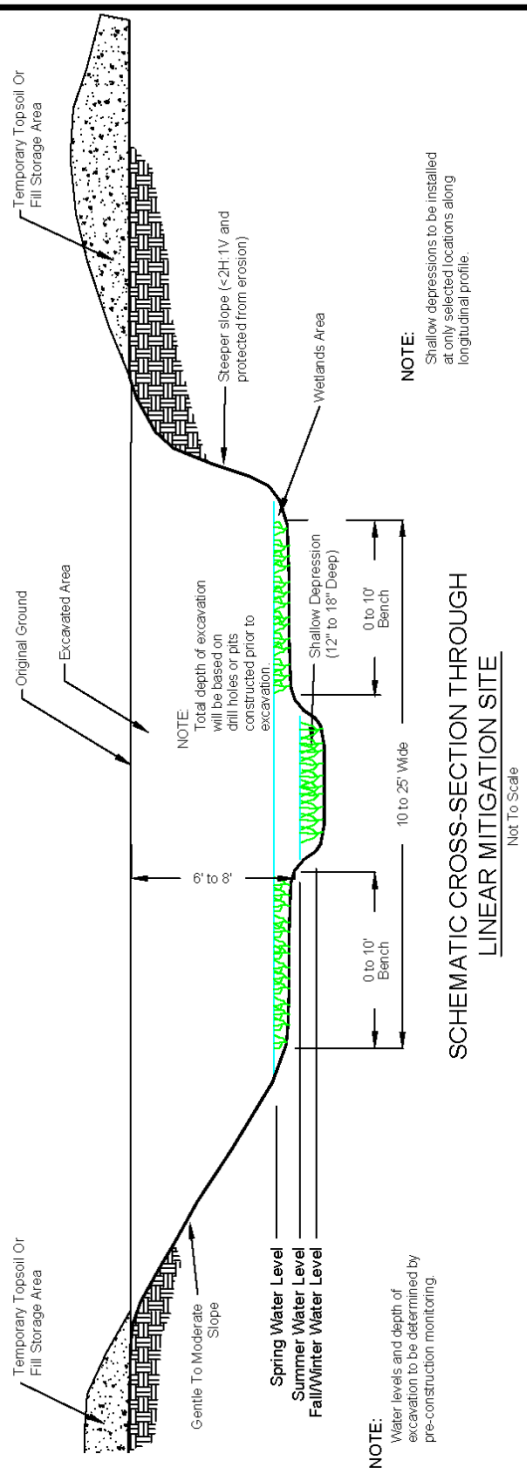
MITIGATION SITE	MITIGATION CONSTRUCTION	PROJECTED RESUMPTION OF COMPARABLE FUNCTIONS
Proposed Wetland Mitigation Site		
Upper Rock Creek		
Stage 1[1]	Concurrent with initial wetland disturbance	3 years after wetland mitigation construction
Stage 2	Within 1 year of evaluation of Stage 1 mitigation	3 years after wetland mitigation construction
Optional Wetland Mitigation Sites[2]		
Miller Gulch Tributary	Within 1 year of determination of lack of mitigation success and/or need for additional mitigation acreage	25 years after wetland mitigation construction[3]
Lower Rock Creek	Same as above	3 years after wetland mitigation construction
Access Road	Same as above	3 years after wetland mitigation construction
Middle Rock Creek	Same as above	3 years after wetland mitigation construction
Clark Fork River Bench	Same as above	3 years after wetland mitigation construction

[1]Upper Rock Creek Stage 1 will involve 1.1 acres of mitigation. Stage 2 will include the remaining acreage and will address any changes necessary based on results of Stage 1 mitigation.

[2]Optional wetland mitigation sites would be developed only if monitoring demonstrated that preferred sites were not developing towards meeting success criteria.

[3]This mitigation site is proposed as a forested wetland and 25 years are projected to allow trees to develop to provide comparable functions as disturbed forested wetlands.


Demonstration Cell B
Demonstration Cell A
ROCK CREEK
3000
2900
2800
2700
2600
2505
2531
2546
425 000 N
424 000 N
RC Resources
USFS
CROWN PACIFIC LUMBER CO.
RC Resources
0 150 300 600
Feet
LEGEND
Proposed Wetlands (WL)
50ft. Buffer Area
Riparian Zone
Stream Channel
Proposed Road
Proposed Powerline
Proposed Pipeline
100' Powerline Right of Way (ROW)
Existing Road
REVETT MINERALS
Upper Rock Creek Wetland
Mitigation Site Plan View
Rock Creek Project
WESTECH
Environmental Services, Inc.
P.O. Box 6045
Helena, Montana 59604
406-442-0950
SCALE: 1"=300'
DATE: 08/29/14
DRAWN BY: DC
CHECKED BY: DC
FILE: RC14_Miti_Fig3.dwg
Figure 3



REVETT MINERALS

Typical Cross-Section of Upper Rock Creek Wetland Mitigation Site
Rock Creek Project

WESTECH
Environmental Services, Inc.
P.O. Box 6045
Helena, Montana 59604
406-442-0950

SCALE: NTS
DATE: 08/29/14
DRAWN BY: DC
CHECKED BY: DC
FILE: RC14_Miti_Fig4.dwg

Figure 4

5.5 ESTABLISHMENT OF WETLAND HYDROLOGY

Numerous riparian and/or wetland areas occur along Rock Creek on lower terraces or in stream channels either abandoned or occupied infrequently during high flow events. These areas derive their water from seasonally high water tables (i.e., groundwater at shallow depths) or from periodic overflow of Rock Creek. Higher terraces, benches and abandoned channels are elevated above the water table and do not support wetland hydrology or wetlands. At the Upper Rock Creek Mitigation Site, linear wetlands will be established in this non-wetland zone by excavating to a depth which will allow saturation/inundation by shallow groundwater. Based on observation of a hand-dug domestic well (PW-6) located at the northern end of the mitigation area, groundwater level in this portion of the area is generally six feet or less below ground surface. Backhoe pits constructed in the area during November, 1996 encountered water-bearing gravels overlying clay at about 8 feet below ground surface.

In order to determine feasibility of the site to support wetlands, Demonstration Cells were constructed. Two Demonstration Cells were excavated on November 14, 1996 in depressional locations approximately 100 feet (Cell A) and 400 feet (Cell B) west of the Rock Creek forest road (Figure 3). Excavation at both locations encountered water-bearing gravels on a clay pan at approximately eight feet below the general grade of the recently logged area. This clay pan was left intact, and the area of each cell was expanded to accommodate slope reduction. Piezometers were installed at both locations.

The total disturbance area of Demonstration Cell A is approximately 600 square feet, including approximately 50 square feet at the bottom that had filled with shallow standing water within a few hours. The total disturbance area of Demonstration Cell B is approximately 1200 square feet, including approximately 100 square feet at the bottom that also filled with shallow standing water within a few hours. Monitoring of the cells in 1998 (July) and 2001 (September) showed that wetland hydrology had been established in the bottoms of the excavations. Subsequent observations through 2012 indicate that the wetland hydrology and vegetation has been maintained.

5.6 VEGETATION ESTABLISHMENT

The linear mitigation areas at the Upper Rock Creek Mitigation Site will be revegetated using the wetland revegetation mix (Table 3). The proximity of Rock Creek to the area will allow for natural reinvasion of additional hydrophytic species. Channel sideslopes and the berm will be seeded with the upland herbaceous mix presented in the Rock Creek Project Application for Operating Permit/Plan of Operations. Monitoring of the Demonstration Cells in 2001, five years after creation, has shown that both cells have developed a diverse hydrophytic community dominated by native species that have invaded.

Because the narrow configuration of the mitigation sites would preclude effective drill seeding, broadcast seeding (hand-held seeder or hydroseeder) will be used. The sites will be mulched with noxious weed-free straw (2000 pounds/acre) or cellulose fiber (hydromulch at 1500 pounds/acre).

TABLE 3
WETLAND REVEGETATION MIXTURE[1] ROCK CREEK PROJECT, SANDERS COUNTY, MONTANA

SPECIES				Planting Rate[3]
Scientific Name	**Common Name**	**Revegetation[2] Method**	**Wetland Status**	**Pounds PLS or No. Plants/acre**
GRAMINOIDS[4]:				
Agrostis alba	Redtop	Seed	FAC	0.25
Calamagrostis canadensis	Bluejoint reedgrass	Seed	FACW+	0.25
Carex lenticularis	Lentil-fruit sedge	Seed/stock	FACW+	0.50/ >200
Carex pachystachya	Chamisso sedge	Seed/stock	FAC	0.50/ >200
Deschampsia caespitosa	Tufted hairgrass	Seed	FACW	0.50
Elymus glaucus	Blue wildrye	Seed	FACU	1.00
Juncus tenuis	Slender rush	Seed/stock	FACW-	0.25/ >200
Luzula parviflora	Small-flower woodrush	Seed/stock	FAC-	0.10/ >200
Scirpus microcarpus	Small-fruit bulrush	Seed/stock	OBL	0.25/ >200
FORBS[5]:				
Coptis occidentalis	Western goldthread	Seed/stock	NI	0.10/ >50
Cornus canadensis	Bunchberry dogwood	Seed/stock	FAC	0.25/ >33
Epilobium angustifolium	Fireweed	Seed	NI	0.25
Epilobium ciliatum	Common willow-herb	Seed	FACW-	0.25
Equisetum arvense	Common horsetail	Seed/stock	FAC	0.50/ >50
Galium triflorum	Sweet-scented bedstraw	Seed	FACU	0.25
Gymnocarpium dryopteris	Oakfern	Seed/stock	FAC	0.25/ >50
Platanthera stricta	Slender bog-orchid	Seed/stock	FACW+	0.10/ >50
Coeloglossum viride	Frog orchid	Seed/stock	FACW	0.10/ >50
Senecio triangularis	Arrowleaf groundsel	Seed	FACW+	0.25
Smilacina stellata	Starry false Solomon's seal	Seed/stock	FAC-	0.25/ >50
Tiarella trifoliata	Trefoil foamflower	Seed/stock	NI	0.10/ >50
Viola glabella	Stream violet	Seed/stock	FACW+	0.10/ >50

TABLE 3
WETLAND REVEGETATION MIXTURE[1] ROCK CREEK PROJECT, SANDERS COUNTY, MONTANA

SPECIES				Planting Rate[3]
Scientific Name	**Common Name**	**Revegetation[2] Method**	**Wetland Status**	**Pounds PLS or No. Plants/acre**
SHRUBS[6]:				
Acer glabrum	Rocky Mountain maple	Stock	FAC	>33
Alnus sinuata	Sitka alder	Stock	FACW	>33
Berberis repens	Creeping Oregon-grape	Stock	NI	>33
Cornus stolonifera	Red-osier dogwood	Stock	FACW	>33
Crataegus douglasii	Black hawthorn	Stock	FAC	>33
Lonicera involucrata	Bearberry honeysuckle	Stock	FAC+	>33
Rubus parviflorus	Thimbleberry	Stock	FAC-	>33
Salix scouleriana	Scouler willow	Stock	FAC	>33
Spiraea douglasii	Douglas spirea	Stock	FACW	>33
TREES[7]:				
Pinus contorta	Lodgepole pine	Stock	FAC	>50
Populus trichocarpa	Black cottonwood	Stock	FAC	>100
Thuja plicata	Western redcedar	Stock	FAC	>50

[1]Seed and planting mixtures can be modified at any time with the agencies' approvals.
[2]Availability of seed and planting stock for wetland species varies considerably from year to year. When available, seed will be used for herbaceous species. If seed is unavailable, planting stock will be used at rates listed. Planting stock may include cuttings, bare root or containerized stock depending on plant material availability. In general, most shrubs and trees will be planted using containerized stock.
[3]Pounds pure live seed per acre (PLS/acre). Rates are based on drill seeding and should be doubled for broadcast seeding.
[4]Graminoids to be planted include both seeded and planted species. All four species with seed available to be seeded at a total rate of 2 pounds PLS/acre. Plus a minimum of 2 different graminoid species selected from the graminoid list and planted at a minimum of 200 stems per acre.
[5]Forbs to be planted include both seeded and planted species. All four species with seed available should be seeded at a total rate of 1 pound PLS/acre. Plus a minimum of 2 different forb species selected from the forb list and planted at a minimum of 50 stems per acre.
[6]All shrubs will be planted using stock. A minimum of 3 different species selected from shrub list and planted at a minimum of 100 stems per acre.
[7]All trees will be planted using stock. All three species should be planted at their minimum number of stems per acre.

5.7 SOIL HANDLING

Soil salvaged from areas to be disturbed by wetland creation (channels, sideslopes and berm area) will be respread on all portions of the Upper Rock Creek Mitigation Site (slopes, bottom, benches, depressions and berm). Soils in this area are formed in stream terrace sandy loam alluvium. These terrace soils exhibit good salvage quality to 13 inches. Respread soils will be placed with an excavator and hand- or machine-prepared to provide a proper seedbed. Since soil storage would be of short duration, fertilization is not proposed. Because wetland hydrology will be provided by groundwater, no amendments (such as silty lake sediments or clay) are proposed to decrease permeability of the constructed channel bottom.

5.8 HABITAT FEATURES

No special habitat features are currently planned.

5.9 BUFFER AREA

Undisturbed vegetated buffer areas will provide protection of water quality at mitigated sites. The proposed wetlands at the Upper Rock Creek Mitigation Site will be buffered on the west by an approximately 50 to 200 foot wide forested riparian zone on the east side of Rock Creek (Figure 3). Note that Figure 3 is conceptual; precise wetland locations will be determined in the field. A narrow berm may possibly be constructed along the west edge of the wetlands, as described in Section 5.3.1.; if so, the berm will be covered with topsoil and revegetated to serve as a buffer. A 50-foot-wide buffer area of natural vegetation will be designated at the upstream (north) and downstream (south) ends of the narrow wetland zone and on its east side, between the wetlands and the road/utilities corridor (Figure 3). Natural vegetation of the mitigation site is described in Section 3.2.7.

5.10 MITIGATION FOR JURISDICTIONAL STREAMS AND WETLANDS

Jurisdictional streams and wetlands occur between the tailings management facility and the mill site, between the mill site and the evaluation adit, and along the water discharge pipeline at the Highway 200 crossing and at the discharge at the Clark Fork River. These streams and their associated wetlands include Rock Creek, Engle Creek, Orr Creek, West Fork Rock Creek, Big Cedar Gulch, Clark Fork River, and several unnamed drainages tributary to the larger streams (Appendix A). Jurisdictional wetlands typically occur as a narrow fringe along the streams. Rock Creek has overflow channels supporting wetlands.

Primary Project components that could affect these streams and wetlands are access roads and utility corridors, including powerlines and pipelines. It is RCR's intent to mitigate impacts to streams and wetlands primarily by avoiding the placement of dredge or fill material into jurisdictional areas. Final project design will incorporate construction techniques to avoid impacts, including:

- using box culverts on small streams on the Chicago Peak Road (access to the evaluation adit) unless the KNF directs that standard culverts, concrete fords, or other crossing techniques are more consistent with USFS design criteria and forest planning objectives;
- placing bridge abutments at the Engle Creek crossing of the relocated access road outside of jurisdictional areas;
- using trenchless crossing methods for pipeline crossings of streams and wetlands. Crossing methods may include conventional slick bores, horizontal directional drills, spans on bridges, or self-supporting spans. Final design on KNF-administered land will be developed in conjunction with KNF;
- implementing erosion and sediment control features (such as silt fence) where construction occurs near and upslope of jurisdictional areas; and
- placing the pipelines and powerlines within the road prism of the abandoned portion of FR 150 (Rock Creek Road) where necessary to avoid jurisdictional areas.

Where final design or site-specific conditions preclude avoidance, RCR will implement measures to minimize placement of dredged or fill material in jurisdictional areas. An example would be where geotechnical conditions (loose gravel or boulders) preclude a bore or drill for a pipeline. In this case the disturbance corridor would be narrowed to the minimum necessary to safely bury the pipeline.

If avoidance is not possible at all sites, RCR will mitigate impacts in accordance with the applicable Nationwide Permit and in consultation with all relevant permitting agencies.

6.0 PERFORMANCE STANDARDS

The following minimal criteria for measuring success of wetland creation will be used:

1. The area of wetland creation should not be less than a 1.5:1 ratio to impacted wetlands.

2. Reestablished wetlands should meet the 1987 USACE criteria for a wetland.

3. Within a five-year period, percent vegetative cover should be equal to or greater than a) the percent cover of impacted wetlands or b) suitable reference area wetlands.

4. Within a five-year period, vegetative species composition and diversity should closely approximate the composition and diversity of native wetlands with 50 percent or greater cover of wetland species, 80 percent or greater cover overall, and with less than 10 percent noxious weeds. This will be evaluated by field comparisons of plant species lists and cover of dominant species between created wetlands and either a) impacted wetlands or b) suitable reference areas.

7.0 SITE PROTECTION AND MAINTENANCE

7.1 LONG-TERM LEGAL PROTECTION

When final success criteria for mitigation have been met, a wetland conservation easement or other appropriate legal transfer mechanism that is mutually agreeable between the KNF and RCR will be established for the new wetland site.

7.2 RESPONSIBLE PARTIES

RCR is responsible for site protection and maintenance.

7.3 MAINTENANCE PLAN/SCHEDULE

7.3.1 Short-Term Management

Following implementation of the wetland mitigation plans, wetland monitoring will be conducted to verify the establishment of appropriate wetland parameters. Post-establishment management of these wetland mitigation areas (to assure the perpetuation of wetland functions) will be carried out until it has been determined, based upon monitoring efforts, that the final success criteria have been met. Monitoring results will be reviewed with involved wetland regulatory agencies, and a decision reached cooperatively between the involved parties concerning the re-establishment of suitable wetlands.

Specific short-term management will address noxious weed control, grazing control and mitigation of any other conditions that may adversely affect wetland restoration.

The primary wetland mitigation site is not grazed by domestic livestock and fencing is not proposed for site protection. If wildlife grazing or browsing appears to be affecting revegetation success, site-specific control measures will be implemented, including but not limited to selective fencing, seedling protection caps or screens or chemical repellents.

If rills or gullies form on graded slopes or channels, selective filling and/or erosion control procedures (erosion control mats or nets, mulching, straw bales, filter fences or slash filter windrows) will be installed as necessary.

Specific remediation plans will be prepared for any site where problems develop. Such plans will be prepared in consultation with involved regulatory agencies.

7.3.2 Long-Term Management

Prior to a determination that final success criteria have been met, management will be the primary responsibility of the applicant with input from the regulatory agencies. Following a determination that final success criteria have been met, management will revert to the landowner or management agency.

For those wetland mitigation sites that are privately-owned, Wetland Conservation Easements or other appropriate legal transfer mechanisms that are mutually agreeable between the KNF and RCR will be established. The applicant will work with agencies to develop long-term management plans providing for continued protection of the mitigation sites.

7.4 INVASIVE SPECIES CONTROL

Noxious weeds, especially spotted knapweed, are abundant in the general vicinity of the mitigation site. Most noxious weeds in the area, however, do not tolerate saturated soils and should not pose a significant threat to reestablished wetlands. Noxious weeds found during monitoring will be controlled. Control methods will include mechanical and biological controls in addition to chemical control, depending on site conditions and land ownership. The applicant will cooperate with the USFS and Sanders County Weed Control Board to develop and implement appropriate noxious weed control measures.

8.0 MONITORING PLAN

8.1 RESPONSIBLE PARTIES

RCR is responsible for implementing the monitoring plan.

8.2 DATA COLLECTION AND ASSESSMENT METHODS

A photographic record will be established for wetland mitigation work. The record will include a) a photograph of affected wetlands prior to impact for documentation and comparison purposes, b) use of color film, c) photographs of mitigation wetlands during the mid-to-late growing season to depict development and diversity, d) photographs from fixed reference points, and e) photographs in monitoring reports.

8.2.1 Hydrology

The most pragmatic measure of the success of wetland hydrology development will be observation of the development of wetland vegetation communities. In a very basic way, success of wetland vegetation will indicate if saturation/inundation of the mitigation areas satisfies wetland criteria. However, because vegetation communities may take several seasons to fully develop, duration and frequency of saturation/inundation will be monitored to determine if the wetlands are performing as designed and if wetland hydrologic criteria are met.

Staff gages and piezometers and/or IRIS tubes will be installed to monitor depth of inundation and saturation. Monitoring will be conducted twice monthly through the snowmelt runoff and growing season (approximately March through October).

8.2.2 Soils

Topsoil stockpiled for longer than six months will be sampled for macronutrient content following redistribution to formulate any necessary amendments.

If plant nutritional deficiencies are noted during vegetation monitoring, macro- and micronutrient testing will be conducted and appropriate corrective measures will be implemented, e.g. fertilization, following consultation with involved agencies.

Soil monitoring will include:

- Measuring depth of respread soil;
- Noting soil color and texture;
- Checking for development of hydric soil characteristics; and

- Evaluating soil loss, especially in channels and slopes, to determine if corrective measures are necessary. Soil loss will be evaluated qualitatively using evidence such as rilling, gullying, plant pedestaling, removal of litter and percent bare ground.

8.2.3 Vegetation

Both qualitative and quantitative vegetation monitoring will be conducted to evaluate species composition, cover (by species and morphological class) and shrub and tree density on wetland mitigation areas. Vegetation monitoring will be conducted annually during summer to early autumn (typically June-October). Sampling sites will be established within each revegetation type (forested or herbaceous). Quantitative vegetation sampling methods consistent with wetland mitigation monitoring in Montana will be employed.

Monitoring will also include qualitative assessments of noxious weeds, wildlife damage and other factors that may be influencing revegetation success. If such factors are identified, a plan for corrective action will be developed and implemented in consultation with the involved agencies.

8.2.4 Wetland Functions

Wetland functional assessments will be conducted annually or at a less frequent interval mutually agreed upon by the regulatory agencies. RCR will use standardized wetland assessment techniques to determine success of reestablishing function and values. Monitoring will ensure that compensatory wetland mitigation areas are properly functioning and have comparable functions as impacted wetlands.

The applicant will use the "Montana Wetland Assessment Method" (Berglund and McEldowney 2008). If an alternative method is developed prior to monitoring and the new method is acceptable to the USACE and applicant, it will be used. As discussed by Berglund and McEldowney (2008), the objectives of the Montana Wetland Assessment Method are to provide a repeatable evaluation method that quantifies wetland functions while minimizing subjectivity and variability between evaluators. This method incorporates some of the principles of the hydrogeomorphic (HGM) assessment.

A six-page form (Appendix A of Berglund and McEldowney 2008) will be completed during monitoring. The form assesses and assigns ratings of "low," "moderate," or "high" to each of the following 12 parameters:

- Habitat for federally listed or proposed threatened or endangered plants or animals;
- Habitat for plants or animals rated S1, S2, or S3 by MTNHP;
- General wildlife habitat;
- General fish/aquatic habitat;
- Flood attenuation;
- Surface water management;
- Sediment/nutrient/toxicant retention and removal;

- Sediment/shoreline stabilization;
- Production export/food chain support;
- Groundwater discharge/recharge;
- Uniqueness; and
- Recreation/education potential.

Each rating is scored on a scale of 0.1 (lowest) to 1.0 (highest) functional points. Functional points are summed and expressed as a percentage of possible total score. The percentage is used in conjunction with other criteria to provide an overall ranking into one of four categories: Category 1 is the highest rating and Category IV is the lowest rating. This method, therefore, rates the 12 individual parameters and the overall wetland.

8.3 REPORTING FORMAT

Annual monitoring reports presenting monitoring results, including wetland hydrology, soils fertility and stability, vegetation establishment, and (in years when conducted) wetland functional assessments, will be submitted to the appropriate agencies. The reports will assess both attainment of yearly target criteria and progress toward final success criteria.

If the annual performance criteria are not met for all or any portion of the wetland mitigation plan in any year, or if the final success criteria are not met, an analysis will be prepared addressing the cause(s) of failure, and, if determined necessary by the appropriate agencies, a remedial action proposed for approval. The applicant has identified five optional mitigation areas that will be used to achieve a minimum acreage replacement ratio of 1:1 and for remedial action in the event that additional areas of wetland creation become necessary (Figure 2).

8.4 MONITORING SCHEDULE

Within six weeks of the completion of each wetland mitigation site, a report will be submitted to the appropriate agencies describing as-built status of each mitigation site. Topographic maps showing as-built contours (at two-foot intervals) of each mitigation area will be provided. The maps will identify the location and types of planting and any other installation of mitigation features.

Following construction, wetland mitigation sites will be monitored annually for five years to evaluate the success of mitigation to ensure that wetland functions are established and maintained. Thereafter, monitoring will be conducted every two years through the end of mining and production, unless it is mutually agreed with the regulatory agencies that final success criteria have been met.

9.0 ADAPTIVE MANAGEMENT PLAN

Adaptive management is the process to accommodate additional measures or revisions that may be necessary to ensure that compensatory mitigation meets goals and objectives of this Plan as well as regulatory requirements. In addition to a general description of adaptive management, this section includes a discussion of optional mitigation sites that may be used if the selected mitigation sites fail to meet compensatory mitigation goals and objectives (Section 9.5).

9.1 RESPONSIBLE PARTY

RCR is responsible for implementing adaptive management.

9.2 POTENTIAL CHALLENGES

Adaptive management will occur during planning, implementation (construction), and monitoring phases to identify potential challenges to achieving performance standards. Foreseeable issues, such as plant material availability, excavated material disposal, and survey control, will be addressed during final design. Unforeseen issues, such as invasive plant species, hydrologic conditions that vary from projections, or revegetation efforts that fail to meet objectives, will be identified during monitoring, with contingency planning during final design.

9.3 REMEDIAL MEASURES

Remedial measures will be developed and implemented to address challenges identified during planning, implementation, and monitoring. Remedial measures may include modifications to the grading plan, soil handling methods, revegetation techniques, long-term management, or other project components.

If changes to the Plan are necessary to meet mitigation goals, RCR will notify the appropriate agencies and will request approval for significant modifications. If monitoring indicates that mitigation is not trending toward meeting performance standards, RCR will notify the agencies as soon as potential problems are identified. If potential problems are identified, RCR, in consultation with the relevant agencies, will determine appropriate remedial measures.

9.4 PERFORMANCE STANDARD MODIFICATIONS

Performance standards (Section 6.0) may be revised, if necessary, to account for remedial measures and adaptive management. Performance measures will not be revised without relevant agency concurrence.

Should the selected mitigation sites fail to provide ecological benefits comparable to objectives of this Plan, RCR will develop a plan to utilize optional mitigation sites discussed in Section 9.5, or locate and evaluate alternative sites.

9.5 OPTIONAL MITIGATION SITES

Five optional wetland mitigation sites are identified that possess characteristics suitable for wetland creation. These sites can be used in the adaptive management process to replace or augment compensatory mitigation at the primary mitigation site, if needed. The five optional sites are listed in Table 2 and shown on Figure 2.

Most of the Miller Gulch Tributary Mitigation Site is on a northwest-flowing ephemeral drainage west of the proposed tailing management site and south of the Miller Gulch stream. Mitigation on this drainage would comprise creation of a series of small, seasonally inundated or saturated palustrine wetlands by construction of small detention dikes at approximately 200-foot intervals along the length of the drainage. The dikes would be 30 to 50 feet long with a maximum height of five feet. The detention dikes would retain flows for sufficient time during seasonal precipitation events (and snowmelt) to allow establishment of hydrophytic vegetation. Rock-lined spillways would be designed for each dike. The concept of this mitigation was based on observations of wetlands that naturally developed in the area as a result of logging disturbances (e.g. ground depressions, logs blocking drainages). A small portion of the mitigation site on the north side of the Miller Gulch stream would be provided with wetland hydrology from surface water diverted from the northwest side of the tailing management facility.

The Middle Rock Creek Wetland Mitigation Site occurs along Rock Creek on lower terraces or in stream channels either abandoned or occupied infrequently during high flow events. These areas derive their water from seasonally high water tables (i.e., groundwater at shallow depths) or from periodic overflow of Rock Creek. Higher terraces, benches and abandoned channels are elevated above the water table and do not support wetland hydrology or wetlands. Wetlands will be established in these non-wetland sites by excavating to depths which would allow saturation/inundation by shallow groundwater in much the same way as described in the discussion of the Upper Rock Creek Mitigation Site in Section 5.0.

The Lower Rock Creek Wetland Mitigation Site would rely on the diversion of surface water from the northeast side of the tailings paste management facility. The remaining two sites, the Access Road Wetland Mitigation Site and Clark Fork River Bench Wetland Mitigation Site, are located in areas that have soils with low percolation rates and that are suitable for surface water retention with some minor surface manipulations. Establishment of wetland hydrology in these areas would likely rely on some type of minor depressions or small flow barriers designed to increase surface runoff retention and duration of soil saturation/inundation. The applicant has observed that minor depressions created by past logging disturbance in drainages and downed logs across drainage bottoms provided sufficient increased moisture retention to support localized hydrophytic vegetation. The increased duration for surface water retention in these areas should allow hydrophytic vegetation to develop. Small detention dikes would likely be constructed in much the same manner as described above for the optional Miller Gulch Tributary Mitigation Site.

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APPENDIX N —

DISCUSSION ON R1-WATSED MODEL AND RESULTS

DISCUSSION OF R1-WATSED MODEL AND WASHINGTON ROAD SURFACE EROSION MODEL RESULTS, ROCK CREEK MINE

RI-WATSED MODEL

The Water and Sediment Yield Model (R1-WATSED) is used to predict existing and expected conditions within entire watersheds from logging, fire, roads, and other activities. It is an inclusive landscape-based model that is tailored to each national forest. R1-WATSED was designed to simulate the effects of natural disturbances and land management activities on sediment and water yields (peak and annual flows). It evaluates sediment production for watersheds of various sizes, but not for specific stream reaches or crossings. The model estimates total sediment production delivered to the lowest point of the watershed, including sediment from in-channel erosion. Although R1-WATSED does not provide sediment production values for site-specific locations, and does not consider the effects of increased road traffic, it is used for comparing changes due to various proposed land management activity alternatives and cumulative effects.

The Kootenai National Forest (KNF) used R1-WATSED to assess the impacts on sediment and water yields for the Rock Creek Mine Project. The values produced by the model are estimates and are used to compare existing conditions with alternative effects. The R1-WATSED model predicts the highest 30-day-average water yield increase and the annual sediment yield increase using naturally caused and human activities in the watershed as input. Water yield and sediment yield recovery is also predicted by the model. The model calculates disturbances based on the “ECA” (Equivalent Clearcut Acre) procedure; for example, a 100-acre harvest area with 50 percent canopy removal would equate to a 50-acre clearcut. The project file contains information on how the model functions and the data required to complete an analysis. Included in the project file are the values the KNF has input into the various databases required to run the model. The values for these databases have been adjusted for site-specific conditions found on the KNF. The predicted values generated by the model do not include the effects the predicted water and sediment yield increases would have on water quality, fish populations, or aquatic habitat.

For the 2001 FEIS analysis, KNF ran the R1-WATSED model for the projected life of the mine facilities (through year 2031) and added 10 years beyond closure to review project impacts on both sediment and water yield recoveries. Since the model runs were completed for the 2001 FEIS, no significant changes in natural disturbances or management activities have occurred in the model analysis watershed except the recovery of vegetation (Salmon Environmental Services 2012).

R1-WATSED requires the input of local adjustments for variables like delayed recovery for different disturbances and canopy removal due to natural causes, such as fire. The adjustments in Table N-1 and Table N-2 have been used during the completion of the R1-WATSED model runs for this project.

Table N-1. Canopy removal from fire.

Fire Intensity	Percent Canopy Removed
High	80
Moderate	55
Low	25

Table N-2. Delayed recovery (in years) by habitat and disturbance type.

Disturbance Types				
Habitat Type	**Harvest and Site Prep.**	**Fire (low)**	**Fire (moderate)**	**Fire (high)**
Fast Growing	5	0	5	8
Moderately Growing	7	0	7	11
Slow Growing	9	9	9	14

Model Validation. There has been only limited model validation work completed for the sediment portion of the WATSED model (KNF 2013). In trying to estimate a dynamic natural system, the validation results show ranges of model predictions that are good considering the natural variability in peak flows. Additional intense sediment data collection is needed for further validation of the sediment volume prediction abilities of the model.

Model Limitations. WATSED was not designed, nor is it used, to develop exact estimates of flow. The utility of the model is that it provides a consistent method for comparing alternatives. The values generated by the model are used, in concert with other water resource information to interpret the potential effects on a stream channel as a result of implementing a proposed land management activity. Values generated by the model are not to be considered an absolute measure against verifiable standards, nor by themselves provide an answer as to the effects of implementing the proposed land management activity (USDA Forest Service (USFS) 1991).

To focus the analysis and more clearly contrast the alternatives, it is important to note that effects are analyzed with regard to normal or average conditions and impacts on watershed processes. Episodic climatic events such as rain-on-snow, high-intensity thunderstorms, mass soil movement, or short-duration peak flows cannot be addressed in the model. Precipitation events with return intervals greater than six years are highly variable in nature and largely speculative in terms of quantifying effects (Grant et al. 2008). With large fires, major floods, and extreme precipitation episodes, higher flows, bank instability, and sediment movement are not uncommon (Benda et al. 1998). Analysis of these types of events, where needed, must be completed using professional judgment or other models (USFS 1991). The magnitudes of these events far overshadow the potential effects on peak flow from the Rock Creek Mine Project. Project impacts are not analyzed in this context, but rather within the context of the desired conditions in the watershed, such as stable banks, healthy riparian and aquatic habitat, and attainment of full support of all designated beneficial uses.

R1-WATSED Model Results for the Rock Creek Watershed

The Rock Creek watershed was initially divided into 10 subwatersheds for this analysis (Figure N-1 in the FEIS). The analysis looks at each subwatershed and then combinations of watersheds with a final analysis of the entire watershed. The analysis of the West Fork of Rock Creek, the East Fork of Rock Creek, and the entire Rock Creek watershed are discussed below. These were the most natural analysis areas since the bulk of the activities occur in only two watersheds (West Fork and Rock Creek downstream of the East and West forks). Minor mining activities would occur in four other watersheds. The activities were analyzed cumulatively with the proposed activities (road reconstruction, new road construction, powerline corridors, and facility development) in a three-year time span (1999-2001). The model was run to the year 2031 to review hydrologic and sediment recovery over the life of the mine. Results from the three major watersheds are discussed below.

West Fork of Rock Creek Existing Conditions (1997)

There are 36.3 miles of road in this 3,814-acre basin. This results in a road density of 6.5 miles of road per square mile of the watershed. This elevated amount of roading combined with the high watershed

delivery efficiency has left the watershed in a condition where it responds to large storm events with negative effects. Snort Creek, a subwatershed of the West Fork, has a road density of 10.8 miles of road per square mile of the watershed. Stream surveys of Snort Creek report that the combination of excessive roading, 23 percent of the basin in a clearcut condition, and the presence of riparian harvest have left this stream in a degraded condition. The channel is not able to store the sediment it produces because of its degraded condition. Thirteen percent of the entire West Fork basin is in a clearcut condition. All of the existing activities have resulted in a peak flow increase of 7 percent. Although this value is well within the forest plan standards, this watershed is showing negative effects of past management. Surveys of the main West Fork channel show a decrease in stream habitat through the increase of riffle habitats and a loss of pool habitats. Gravel and cobble-sized substrates are increasing. These materials would eventually be transported to the stream in lower Rock Creek. R1-WATSED predicted an existing annual sediment increase of 266 percent compared to natural conditions with no roads or other development. Because the sediment prediction capabilities of the model have not been validated, this value should not be viewed as exact. However, this large increase indicates that a sediment threshold has been crossed due to past activities and degraded conditions are present in the channel.

East Fork of Rock Creek Existing Conditions (1997)

There are 7.2 miles of road in this 10,115-acre basin. This results in a road density of 0.5 mile of road per square mile of the watershed. The roads in this basin are mostly low-standard roads that are closed to motorized travel. Although the watershed has a high water delivery efficiency, this amount of roading has not resulted in negative impacts on the stream channel. Currently, less than 1 percent of the basin is in a clearcut condition. All of the existing activities in this basin have resulted in no increase in peak flow. The model predicts an annual sediment increase of 32 percent compared to natural conditions with no roads or other development. Because most of this basin is located in the Cabinet Mountain Wilderness, its condition is considered to be within the natural range with respect to watershed function and condition.

Entire Rock Creek Watershed Existing Conditions (1997)

There are 102.6 miles of road in this 21,162-acre watershed. This results in a road density of 3.1 miles of road per square mile of the watershed. This amount of roading, combined with the high watershed delivery efficiency, is within a range in the KNF where watersheds normally continue to function in an adequate manner. The lower portion of Rock Creek is classified as an intermittent drainage. Currently, 6.5 percent of the watershed is in a clearcut condition. All of the existing activities have resulted in a peak flow increase of 3 percent. One small tributary to the mainstem of Rock Creek, Big Cedar Gulch, has an extremely high road density of 13 miles per square mile of watershed. This subwatershed has an existing ECA of 30 percent, a 17 percent peak flow increase, and a 790 percent annual sediment increase compared to natural conditions with no roads or other development. Stream surveys in this drainage have shown that the Big Cedar Gulch channel does not connect to Rock Creek except during flood events because the water goes subsurface in the alluvial fan at the mouth of the valley. The water resurfaces about 200 yards from Rock Creek and makes its way to Rock Creek via overland flow without creating a channel. Although the model run results in a high estimated percent annual sediment increase in Big Cedar Gulch, it does not necessarily indicate that degraded conditions are present. The peak flow increase for the entire Rock Creek watershed is well within the forest plan standards for allowable peak flow increases.

The lower portion of the Rock Creek stream channel has historically been intermittent and unable to sustain year-round flow. Stream “improvement” projects completed in the late 1980s in Rock Creek removed all large woody debris in the stream from Highway 200 to the East and West forks of Rock Creek, which left the lower stream channel in an unstable condition. Material transported from upstream has resulted in the formation of debris jams. Rather than helping to concentrate the flow and provide habitat, these jams caused the stream to migrate laterally around them, which has resulted in increased sediment production, loss of habitat, and unstable channel banks. The channel substrate concentrations in

the lower section of Rock Creek are heavily skewed to the large gravel and cobble sizes. These substrates are not well suited for the maintenance of perennial flow. Fish habitat surveys by Washington Water Power have determined that the loss of pools (rearing habitat) is the limiting factor controlling fish populations in this watershed (WWP 1996). The model predicts an annual sediment increase of 121 percent compared to natural conditions with no roads or other existing development.

Comparison of Alternatives

Alternative I - No Action

The implementation of this alternative would result in a continuation of the existing conditions and recovery rates within the Rock Creek watershed. The Cabinet Ranger District of the KNF has no activities planned in the near future for this watershed. The private lands in the watershed have seen harvest activities in the recent past that have already been accounted for in the existing conditions. Because of the limited amount of private lands in this watershed, additional activities would not likely have a measurable effect on the watershed.

Alternative II

West Fork of Rock Creek, Predicted Conditions (1999 - 2031). This alternative would result in the construction of 3.4 miles of new road, 1.1 miles of road reconstruction, 1.0 mile of road paving, 3.5 miles of road tread improvement (gravel placement), and 117 ECAs generated from facility development. These actions are predicted to result in a 1 percent increase in peak flow and a 277 percent increase in annual sediment yield. At the end of the life of the mine, peak flow is predicted to return to existing conditions and the annual sediment yield would be 54 percent greater than existing conditions. Because this would result in an overall increase within this watershed, it is expected that conditions would continue to worsen with the implementation of this alternative.

East Fork of Rock Creek, Predicted Conditions (1999 - 2031). This alternative would result in the construction of 0.2 mile of new road, 1.1 miles of road reconstruction, 1.0 mile of road obliteration, 1.1 miles of road paving, 0.2 mile of road tread improvement (gravel placement), and 16 ECAs generated from facility development. These actions would result in no increase in peak flow and a 13 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would be the same as existing conditions and the annual sediment yield would be 13 percent greater than existing conditions. Because this would result in an overall increase within this watershed, it is expected that conditions would continue to worsen with the implementation of this alternative.

Entire Rock Creek Watershed, Predicted Conditions (1999 - 2031). This alternative would result in the construction of 7.7 miles of new road, 6.8 miles of road reconstruction, 1.0 mile of road obliteration, 7.3 miles of road paving, 7.2 miles of road tread improvement (gravel placement), and 284 ECAs generated from facility development. These actions would result in a 1 percent increase in peak flow and an 80 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would return to existing conditions and the annual sediment yield would be 1 percent greater than existing conditions. Because this would result in a small overall increase within this watershed, it is expected that conditions would continue to remain the same or slightly worsen with the implementation of this alternative.

Alternative III

West Fork of Rock Creek, Predicted Conditions (1999 - 2031). This alternative would result in the construction of 1.5 miles of new road, 2.4 miles of road reconstruction, 0.9 mile of road paving, 3.0 miles of road tread improvement (gravel placement), and 106 ECAs generated from facility development. These actions would result in a 1 percent increase in peak flow and a 209 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would be 1 percent less than the existing conditions peak flow, and the annual sediment yield would be 28 percent greater than existing conditions. Because

this would result in an increase in sediment yield within this watershed, it is expected that conditions would worsen with the implementation of this alternative.

East Fork of Rock Creek, Predicted Conditions (1999 - 2031). This alternative would result in the construction of 0.2 mile of new road, 1.1 miles of road reconstruction, 1.0 miles of road obliteration, 1.1 miles of road paving, 0.2 miles of road tread improvement (gravel placement), and 15 ECAs generated from facility development. These actions are predicted to result in no increase in peak flow and a 14 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would return to existing conditions and annual sediment yield would be 6 percent less than existing conditions. Because this would result in an overall decrease within this watershed, it is expected that conditions would improve slightly due to implementation of this alternative.

Entire Rock Creek Watershed, Predicted Conditions (1999 - 2031). This alternative would result in the construction of 4.5 miles of new road, 8.1 miles of road reconstruction, 1.0 mile of road obliteration, 8.8 miles of road paving, 3.8 miles of road tread improvement (gravel placement), and 250 ECAs generated from facility development. These actions would result in a 1 percent increase in peak flow and a 56 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would return to existing conditions and annual sediment yield would be 7 percent less than existing conditions. Because this would result in a small decrease in sediment yield within this watershed, it is expected that conditions would slightly improve with the implementation of this alternative.

Alternative IV

West Fork of Rock Creek, Predicted Conditions (1999 - 2031). This alternative would result in the construction of no new roads, 0.5 mile of road reconstruction, 0.3 mile of road paving, 0.2 mile of road tread improvement (gravel placement), and 20 ECAs generated from facility development. These actions would result in no increase in peak flow and a 76 percent increase in annual sediment yield. At the end of the life of the mine, the peak flow would decrease by 2 percent below existing conditions and the annual sediment yield would be 11 percent less than existing conditions. Because this would result in a decrease in sediment yield within this watershed, it is expected that conditions would improve with the implementation of this alternative.

East Fork of Rock Creek, Predicted Conditions (1999 - 2031). This alternative would result in the construction of no new roads, 1.1 miles of road reconstruction, 1.0 mile of road obliteration, 1.1 miles of road paving, no road tread improvement (gravel placement), and 46 ECAs generated from facility development. These actions would result in no increase in peak flows and a 24 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would be the same as existing conditions and the annual sediment yield is predicted to be 2 percent less than existing conditions. Because this would result in a very small decrease in sediment yield within this watershed, it is expected that conditions would remain the same with the implementation of this alternative.

Entire Rock Creek Watershed, Predicted Conditions (1999 - 2031). This alternative would result in the construction of 2.8 miles of new road, 6.5 miles of road reconstruction, 1.0 mile of road obliteration, 8.0 miles of road paving, 1.0 mile of road tread improvement (gravel placement), and 195 ECAs generated from facility development. These actions are predicted to result in no increase in peak flow and a 44 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would decrease to 1 percent less than existing conditions. The annual sediment yield would be 11 percent less than existing conditions. Because this would result in a decrease in sediment yield within this watershed, it is expected that conditions would improve with the implementation of this alternative.

Alternative V

West Fork of Rock Creek, Predicted Conditions (1999 - 2031). This alternative would result in the construction of no new roads, 0.4 mile of road reconstruction, 0.2 mile of road paving, 0.2 mile of road tread improvement (gravel placement), and 16 ECAs generated from facility development. These actions would result in no increase in peak flow and a 46 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would be 2 percent less than existing conditions and annual sediment yield is predicted to be 21 percent less than existing conditions. Because this would result in a decrease in sediment yield within this watershed, it is expected that conditions would improve with the implementation of this alternative.

East Fork of Rock Creek, Predicted Conditions (1999 - 2031). This alternative would result in the construction of no new roads, 0.5 mile of road reconstruction, 1.0 mile of road obliteration, 0.5 mile of road paving, no road tread improvement (gravel placement), and 29 ECAs generated from facility development. These actions would result in no increase in peak flow and a 20 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would be the same as existing conditions and annual sediment yield is predicted to be 4 percent less than existing conditions. Because this would result in a slight decrease in sediment yield within this watershed, it is expected that conditions would slightly improve with the implementation of this alternative.

Entire Rock Creek Watershed, Predicted Conditions (1999 - 2031). This alternative would result in the construction of 2.7 miles of new road, 6.5 miles of road reconstruction, 1.0 miles of road obliteration, 6.5 miles of road paving, 2.6 miles of road tread improvement (gravel placement), and 170 ECAs generated from facility development. These actions would result in no increase in peak flow and a 38 percent increase in annual sediment yield. At the end of the life of the mine, peak flow would decrease by 1 percent from existing conditions. The annual sediment yield is predicted to decrease by 12 percent. Because this would result in a decrease in sediment yield within this watershed, it is expected that conditions would improve with the implementation of this alternative.

Alternative V Sediment Mitigation

The sediment mitigation needed for Alternative V was identified by the KNF through the following steps:

1. Subtract the tons/year sediment estimate for existing conditions from the tons/year estimate for Alternative V at the height of project construction:

   469.6 tons/year - 403.5 tons/year = 66.1 tons/year estimated increase

2. Based on limited WATSED validation monitoring, inflate the result from step #1 by 300 percent to account for an apparent underestimation of real-world effects on sediment production:

   66.1 tons/year * 3.0 = 198.3 tons/year probable increase in fine sediment

3. As an added measure of certainty, double the result in step #2 to compensate for the marginal accuracy of the model, the limited amount of validation data, and less than 100 percent effective mitigation:

   198.3 tons/year * 2.0 = 396.6 tons/year real increase in fine sediment

4. To dilute the aura of precision that 396.6 tons/year implies, round up the result in step #3 to the nearest hundred tons:

   369.6 tons/year ≈ **400 tons/year mitigation requirement**.

Three lines of evidence suggest that a 400 ton/year reduction in fine sediment would result in 1) no net increase, or 2) an actual long-term reduction in fine sediment in Rock Creek:

- WATSED predicts a 38 percent increase in sediment delivery from Alternative V at the height of construction, but then sediment transport falls below the present condition five years later with the implementation of sediment abatement Best Management Practices (BMPs). Thus, the model output matches the processes involved and predicts a net reduction over time. However, WATSED does not account for stream channel sediment production or less than totally effective sediment abatement measures.
- A decade of monitoring data (streambed McNeil sediment cores for a stream near Libby, Montana) are available for comparison with the WATSED modeled sediment production. The trend line for these two datasets mirror each other, with a time lag of four years between a change in sediment input and a change in streambed fine sediment. This four-year time lag nearly matches the WATSED assumption that the initial pulse of sediment from a disturbance lasts five years, and also is what is expected when a disturbance occurs far upstream of the streambed monitoring site.
- Several years of suspended sediment validation monitoring data are available that compare WATSED-predicted sediment production with actual sediment output from a managed watershed nearly identical in size, flow, and disturbance levels to Rock Creek. This validation monitoring indicates WATSED underpredicted effects by 320 percent.

Given that these lines of evidence are instructive, but not conclusive, it can be concluded that WATSED can track real-world processes. However, numeric estimates need to be inflated before they can be considered reasonably accurate. Hence, the calculations described above.

Quantifying Sediment Mitigation Measures Using the Washington Road Surface Erosion Model

As described above, the WATSED model uses average watershed scale data, such as average road gradients and widths and template designs, to determine sediment generation. While this provides a good estimate of the sediment generated on the watershed scale, to ensure the success of the Rock Creek Mine Project sediment mitigation plan, the USFS decided that a method for quantifying sediment reduction at specific proposed mitigation sites would be more suitable. The Washington Road Surface Erosion Model (the Washington model) (Washington Department of Natural Resources 2004) has been used extensively in Montana to estimate sediment production from forest roads and was approved by the KNF (Wegner, pers. comm. 2005) as an appropriate tool to evaluate site-specific sediment production and mitigation for the evaluation adit phase (Phase I) of the project.

The Washington model includes the following factors: soil erodibility, changes in traffic level, road tread (surface material and width), and cover for cut and fill slopes. When used for Rock Creek, the Washington model provides a detailed assessment of modeled erosion/delivery for individual road segments at specific crossing locations. At this level of detail, the model determines reduction in sediment delivery resulting from applying specific potential road maintenance practices and BMPs to individual road segments and allows evaluation of the increased traffic and increased vehicle size related to the proposed mine.

Prior to using the Washington model, extensive site data were collected in the Rock Creek project area on roads and streams to evaluate and quantify the benefits of sediment mitigation at numerous specific locations. Using methods suggested by the Washington Department of Natural Resources (2004), the model then calculated the amount of sediment delivered to streams by the current road system and the amount that would be delivered under various mitigation scenarios during Phase I of the project.

For the purpose of showing reductions in sediment load anticipated from mitigation implementation, the Washington model was used to estimate sediment increases from anticipated higher road use with no mitigation. While these unmitigated sediment increases predicted by the Washington model are interesting from a road management perspective, they are not realistic. Before approving any increase in road use for Phase I activities, the USFS would require implementation of standard BMPs. In addition, the Washington model likely overestimates total sediment loads in a watershed because it evaluates effects at specific sites and does not account for sediment that may be redeposited, entrained, or mitigated in-channel before reaching the bottom of a watershed. However, the Washington model is a useful tool to develop an accounting of individual site and total watershed sediment values for evaluating the effectiveness of a variety of mitigation measures for each road drainage crossing along the mine access route in the analysis watershed.

Washington Model Limitations. It is important in the use of the Washington model to keep in mind its limitations (WashingtonDepartment of Natural Resources 2004):

"The Washington Road Surface Erosion Model estimates the average annual amount of road surface erosion delivered to streams from each road segment. The computed amount of sediment should be regarded as a long-term estimate of sediment that would be produced from a road with similar characteristics under climatic conditions similar to those at the road location. The actual amount of sediment from any given road segment may be different than the predicted amount due to inter-annual variations in weather and traffic patterns and local changes in topography and soil characteristics that cannot be accounted for in the model. It is important to keep these limitations of the model results in mind when attempting to interpret the numerical results. It is appropriate to look at the relative differences in erosion estimates when comparing watershed areas or road segments, but the sediment values in tons/year should always be regarded as estimates not absolute values."

Alternative V Phase I Mitigation

Based on the WATSED model results, a sediment mitigation plan was developed for all phases of Alternative V. The total disturbed area for Alternative V used to calculate the 400-ton mitigation requirement is 482 acres (RC Resources, Inc. (RCR) 2010). The disturbed area associated with Phase I is 18.5 acres (RCR 2010). Applying the proportion of disturbed area for Phase I to the disturbed area for all phases of Alternative V to the 400 tons/year of needed mitigation for the entire mine operation results in a required sediment reduction of 16 tons/year for the Phase I activities. Based on the Washington model results (KNF 2013), BMPs would be implemented at 20 locations on USFS roads #150 and #2741 for sediment mitigation (Figure 2-17; Table N-3). Mitigation measures may include the following:

- installing water diversion structures (rolling dips, open tops, or rubber flaps);
- implementing sediment delivery mitigation in the form of slash filter windrows or settling basins installed at the outfall of each newly constructed water diversion structure;
- installing two new culverts on the Chicago Peak Road (USFS road #2741) at current stream ford locations;
- applying new 4- to 6-inch gravel surface to road segments between the new diversion structures and stream crossings;
- installing ditch relief culverts or crossdrains to alleviate excess road drainage to streams;
- installing ditch relief culverts;
- installing erosion-control fabric and rock-lined ditches; and
- hydromulching disturbed ground to ensure quick revegetation.

Table N-3 provides the modeled sediment loads for the 20 sediment mitigation sites. Implementation of Phase I sediment mitigation would reduce the current sediment load by about 234 tons/year, which would

be about 218 tons/year more than required to mitigate Phase I effects. Data collected at the sites shown in Table N-3 would be used to help determine road improvements and other measures required to mitigate for the 400 tons/year of predicted increase in sediment. After the road improvements were completed, sediment levels at the mitigation sites would be remeasured and the estimated reduction in sediment from the improvement work reevaluated. In some instances, road BMPs and instream sediment monitoring (streambed core sampling) would also be used to monitor the implementation and effectiveness of the sediment mitigation program.

Table N-3. Summary of modeled sediment load at proposed mitigation sites, Phase I Rock Creek Project.

Sediment Mitigation Site	USFS Road Number	Existing Sediment Load Total [1]	Phase I Modeled Sediment Loads with Mitigation [2]
0	150	0.02	0.01
1A	150	32.36	10.55
1B	150	0.90	0.58
17	150	2.92	1.75
18	2741	1.74	1.04
20	150	0.38	0.10
26	150	0.27	0.09
31	150	0.53	0.32
35A	150	67.28	11.20
35B	150	6.61	3.85
38	2741	11.12	7.99
41	2741	9.10	7.81
42	2741	56.11	15.53
45	150	99.71	14.42
46	150	26.53	10.51
59	150	0.26	0.15
61	2741	2.54	1.72
62	150	0.07	0.04
66	150	1.85	1.11
67	150	7.35	4.41
Total Sediment Load		**327.65**	**93.18**
Change in Sediment Load from Existing Conditions			**-234.47**

[1] Based on a Traffic Factor of 5.0 (Light Truck) for existing road use, would increase to 27.5 (Light-Heavy Truck) for mine-related travel.
[2] Traffic factor increased to 27.5 (Light-Heavy Truck) for mine-related travel.
Table adapted from Table N-2, Appendix N of the Rock Creek Evaluation Adit License Application (RCR 2010).

Data collected at the 20 sites would be used to help determine road improvements and other measures required to mitigate for the predicted increase in sediment. After the road improvements were completed, sediment levels at the mitigation sites would be remeasured and the estimated reduction in sediment from the improvement work reevaluated using the Washington model. In some instances, road BMPs and

instream sediment monitoring (streambed core sampling) would also be used to monitor the implementation and effectiveness of the sediment mitigation program.

Alternative V Phase II Mitigation

To achieve the total estimate of 400 tons/year needed for mitigation of the entire Rock Creek Mine Project, additional sediment mitigation of about 165 tons/year would be required during Phase II of the project. Because conditions may change before the start of Phase II of the Rock Creek Mine Project, specific sites for sediment mitigation for Phase II would be chosen late in the evaluation phase of the project. At that time, a field survey would be completed and the Washington model or other similar model would be used to quantify the baseline sediment loads and the expected sediment reduction for each site.

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APPENDIX Q —

SUBSIDENCE FAILURE MODES EFFECTS ANALYSIS

Appendix Q – Failure Modes and Effects Analysis for the Rock Creek Underground Mine

Introduction

This appendix contains the underground mine Failure Modes and Effects Analysis (FMEA) completed as a collaborative effort between the Forest Service (FS), ERO resources, Inc. (ERO), and Agapito Associates, Inc. (AAI). An FMEA is a step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service. "Failure modes" means the ways, or modes, in which something might fail. The FMEA was taken from AAI (2014) in their report detailing the Evaluation of Troy Mine Subsidence to Rock Creek.

Failure Modes Effects Analysis

An underground mine FMEA was completed as a collaborative effort between the FS, ERO, and AAI. The FMEA was an expansion of the 1998 Rock Creek Project FMEA that focused primarily on the tailings facility (Klohn Crippen Consultants, Ltd. 1998) and followed a methodology used in a Montanore Project FMEA by Klohn Crippen Berger Ltd. (2009). The main portion of the work was completed during a FMEA workshop held in Missoula, Montana, on April 28 and 29, 2014. Gabriel Esterhuizen, a pillar design expert from the National Institute for Occupational Safety and Health (NIOSH) Pittsburgh Research Center presented pillar design concepts and recent research results on the first day of the workshop; however, NIOSH was not a contributor to the FMEA. Outstanding issues related to the FMEA were resolved during a conference call on June 5, 2014.

In essence, the FMEA process involves conducting a risk assessment that identifies contributing factors or "failure modes" that could lead to subsidence affecting the environment. It also identifies compensating factors or mitigation measures that will reduce and help manage the risk. The likelihood and consequence of the underground failure modes are assessed and categorized (A through E for likelihood, and 1 through 5 for consequence). Risk is the product of likelihood and consequence; therefore, risk is represented as a five by five matrix. Within this matrix, six different risk categories are defined (1 through 5, and less than 1). Table 1 shows the matrix of consequences, likelihoods, and risk categories. Descriptors of each risk category are given in Table 2.

The process begins by identifying failure modes that could lead to subsidence, and identifying the project stages for which the failure modes are of concern. The likelihood of the failure mode occurring without mitigation is then assessed. Consequences to the environment are assigned to different resources, in this case to (1) water quantity, (2) biophysical (loss of stream habitat and aquatic life, and groundwater dependent ecosystems), (3) community/social (physical or socio-economic impacts to humans), and (4) wilderness character. One of three confidence levels is then assigned to each failure mode risk based on the perceived variability of likelihoods and/or consequences. The confidence levels are high (low variability), moderate (moderate variability), and low (potential for high variability).

Unmitigated risks are adjusted using a "binning" process. These adjustments were applied for the Rock Creek underground mine FMEA in one of two ways. Risks assigned a low confidence level were moved to the next highest likelihood category (for example, from a D to a C). Risks applicable to the

post-closure project stage were likewise moved to the next higher level. These adjustments were not cumulative, that is, post-closure risks with low confidence were adjusted one likelihood category, not two.

Two levels of compensating factors (mitigation) are then considered to possibly lower the likelihood of the risk: (1) compensating factors and adequacy of design controls contained in the proponent's proposed action, and (2) compensating factors included in the Kootenai National Forest's (KNF's) and Montana Department of Environmental Quality's (DEQ's) modified alternatives. The degree (if any) to which these factors lower the likelihood of the risk are based on judgment, and are not limited to single category reclassifications (for example, likelihood could be adjusted from "always certain" to "conceivable but improbable" if the mitigation were judged effective enough). On the basis of the binning process and compensating factors, a risk management plan can be developed for any high risk items identified. The risk management plan can include a number of components such as design studies, design changes, testing, monitoring, and quality control and quality assurance. In the case of the underground mine, RCR would incorporate the compensating factors into the mine plan submitted for agency approval.

Further details of the inputs to the FMEA are shown in Table 3 (Project Stages), Table 4 (Likelihood Definitions), and Table 5 (Summary of Consequences). Results of the FMEA are presented in Table 6.

As shown in Table 6, the risk levels for the Agency modified alternatives fall into two categories. Eight of the seventeen failure modes are categorized as Level 1 risks, meaning they are of concern to the engineering design and operations staff and require operating procedures and risk management plans to manage the risks. The remaining nine failure modes are categorized as less than Level 1 risks, meaning that if they are mitigated as envisioned by the KNF and DEQ, they are inconsequential.

Following are the mitigations specified by the FS that would be required as part of the mine plan and are used in determining the final risk levels in Table 6. The authority for the FS to require these mitigations to be implemented by Rock Creek Resources (RCR), and to ensure that they are carried out, is given in the Title 36 Code of Federal Regulations, Part 228, Subpart A – Locatable Minerals (36 CFR 228.8).

1) Prior to Phase I (Evaluation Adit), submit an updated mine plan that incorporates information from the Troy Mine pillar failures, and a Rock Mechanics Data Collection and Monitoring Plan. The updated mine plan may alter proposed pillar and drive sizes. Collected data is to include horizontal stress field measurements. Prior to Phase II (Construction), submit for agency approval a detailed mine plan, using the data collected during Phase I, that minimizes the risk of subsidence. Include the physical setting of the ore body and the planned extent of mining in the mine plan.

2) Fund biannual surveys of underground workings by an independent underground surveyor. Fund an independent technical advisor to assist KNF and DEQ with mine plan review. Complete a quarterly geotechnical assessment of underground workings by a qualified person and submit an annual assessment report. After data review, the FS would require RCR to modify the mine plan as necessary to minimize effects on National Forest System surface resources.

3) Pillar designs with less than a 0.8 w/h ratio would require justification by RCR as to their stability, and Agency[2] approval prior to construction.

4) Prior to Phase II, complete detailed mapping of surficial geology and evaluation adit geology to confirm major geologic structures. Maintain a buffer (barrier pillar) of 100 ft on either side of the Copper Lake Fault, the Moran Fault, and other faults as shown on Figure 3-2 of the SEIS. Minimize size and number of drives through the faults. KNF and DEQ review and approval of hydrologic and geotechnical studies and an updated hydrologic model is required before RCR could mine with a smaller fault barrier pillar. Perform probe drilling in advance of development near major faults.

5) Prior to Phase II, complete detailed mapping of surficial geology and evaluation adit geology to identify discontinuities. Review core logs for discontinuities. Incorporate information about discontinuities into mine planning. Submit a detailed mine plan as in item 1. During operations, include assessment of jointing and major structures in quarterly geotechnical assessments and annual reporting described in item 2. Perform probe drilling in advance of development to detect minor faults.

6) Describe blasting practices to minimize overbreak in Explosive Handling and Blasting Plan.

7) Explicitly state that no secondary mining (reduction in pillar width or length, or increase in pillar height from designed final dimensions) will be allowed.

8) Production mining at cover depths less than 450 ft would require justification by RCR and prior approval by the KNF and DEQ.

9) The detailed mine plan referenced in item 1 will include explicit analysis of sill pillar stability should multi-level mining geometries be proposed.

10) Maintain a 1,000-ft buffer from the north and south outcrop

In summary, the risk assessment identifies the main areas of risk associated with the underground mine and subsidence, identifies mitigation measures to manage the risks, and assists in the preparation of the Supplemental Environmental Impact Statement. The identified risks were low or inconsequential after compensating factors were applied. This risk assessment should also be used to guide the future development and updating of the mine design and safety plans, underground mine operations and maintenance, and monitoring programs. The risk assessment should be updated throughout operations to reflect ongoing changes and to incorporate relevant new information.

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Table 1. FMEA Risk Level Matrix

		Likelihood									
		E—Conceivable but Improbable		D—Rare		C—Possible		B—Likely		A—Certain	
Consequence	5—Catastrophic	Risk Level 1	E,5	Risk Level 2	D,5	Risk Level 3	C,5	Risk Level 4	B,5	Risk Level 5	A,5
	4—Major	Risk Level <1	E,4	Risk Level 1	D,4	Risk Level 2	C,4	Risk Level 3	B,4	Risk Level 4	A,4
	3—Moderate	Risk Level <1	E,3	Risk Level <1	D,3	Risk Level 1	C,3	Risk Level 2	B,3	Risk Level 3	A,3
	2—Minor	Risk Level <1	E,2	Risk Level <1	D,2	Risk Level <1	C,2	Risk Level 1	B,2	Risk Level 2	A,2
	1—Insignificant	Risk Level <1	E,1	Risk Level <1	D,1	Risk Level <1	C,1	Risk Level <1	B,1	Risk Level 1	A,1

Source: Klohn Crippen 2009

Table 2. FMEA Risk Level Summary

Risk Level	Description
5	Risk with a likelihood of "always certain" and "catastrophic" consequences (A,5), and are classified as "fatal flaws." Level 5 risks are unacceptable and mean that a new design is needed or the project should not go ahead.
4	Risk of "likely" likelihood and "catastrophic" consequences (B,5); and risk with "always certain" likelihood and "major" consequences (A,4). Level 4 risks are of concern to senior management, shareholders, and the potentially affected public. They require a high level of scrutiny and detailed risk management and contingency plans.
3	Risk with "possible" likelihood and "catastrophic" consequences (C,5); risk with "likely" likelihood and "major" consequences (B,4); and risks with "always certain" likelihood and "moderate" consequences (A,3). Level 3 risks are of concern of senior management, engineering design and operating staff. They require a risk management plan and contingency plan.
2	Risk with "unlikely" likelihood and "catastrophic" consequences (D,5); risk with "possible" likelihood and "major" consequences (C,4); risks with "likely" likelihood and "moderate" consequences (B,3); and, risks with "always certain" likelihood and "minor" consequences (A,2). Level 2 risks are of concern to the engineering design and operations staff and require operating procedures and risk management plans to manage the risks.
1	Risk with "conceivable but improbable" likelihood and "catastrophic" consequences (E,5); risk with "unlikely" likelihood and "major" consequences (D,4); risks with "possible" likelihood and "moderate" consequences (C,3); risks with "likely" likelihood and "minor" consequences (B,2); and, risk with "always certain" likelihood and "insignificant" consequences (A,1). Level 1 risks are of concern to the Engineering design and operations staff and require operating procedures and risk management plans to manage the risks.
<1	Risks which range from "conceivable but improbable" likelihood and "major" consequences to "likely" likelihood and "insignificant" consequences (B,1, C,1, C,2, D,1, D,2, D,3, E,1, E,2, E,3, E,4) are considered to be inconsequential; however, they are presented in the risk tables because they were discussed in the risk assessment workshop.

Table 3. FMEA Project Stages

Symbol	Stage	Duration (years)
C	Evaluation and construction	5
O	Operations	20
CL	Closure	5
P	Post-closure	In perpetuity

Table 4. FMEA Likelihood Definitions

Symbol	Description	Annual Probability	Likelihood of Occurrence	Return Period (years)
A	Certain	>0.10	>50%	<10
B	Likely	0.01 to 0.10	10% to 50%	10 to 100
C	Possible	0.001 to 0.010	1% to 10%	100 to 1,000
D	Rare	0.0001 to 0.0010	0.1% to 1%	1,000 to 10,000
E	Conceivable but improbable	<0.0001	<0.1%	>10,000

Table 5. FMEA Table of Consequences

Category	Water Quantity for Operations and Post-Closure without Adit Plugs	Water Quantity for Post-Closure with Adit Plugs	Biophysical		Community-Social	Wilderness Character
			Stream Habitat/Aquatic Life	Groundwater Dependent Ecosystems (GDE)		
1. Insignificant	No measurable change from baseline conditions	No measurable change from baseline conditions	No measurable change from baseline conditions	No measurable change from baseline conditions	No measurable change	No noticeable changes in wilderness resources or natural wilderness quality
2. Minor	Increased mine inflows during runoff in isolated areas; <10% change in mean annual flow in one or more drainages	Increased mine inflows during runoff in isolated areas; <10% change in mean annual flow in one or more drainages	ESA effect: may affect T&E species but not likely to adversely affect	<10% of GDEs overlying subsidence area affected	No adverse effect in the socio-economics of local communities; affects <10 people and no loss of life	Minor effects on wilderness resource (wetlands, streamflow, scenery, etc.) and natural wilderness quality not readily noticed
3. Moderate	Change in pattern of surface water runoff over 10 to 30% of mine void; change in mean annual flow in one or more drainages of 10 to 30%	Interconnected fractures change pattern of surface water runoff, reducing mean annual flow in one or more drainages of 10 to 30%	ESA effect: may affect and would likely adversely affect	10-30% of GDEs overlying subsidence area affected	Reduction in the social and economic conditions affecting 10 to 100 people; potential for 1 life lost	Effects on wilderness resource and reduction in natural wilderness quality noticeable in small areas overlying mine void

Category	Water Quantity for Operations and Post-Closure without Adit Plugs	Water Quantity for Post-Closure with Adit Plugs	Biophysical		Community-Social	Wilderness Character
			Stream Habitat/Aquatic Life	Groundwater Dependent Ecosystems (GDE)		
4. Major	Change in pattern of surface water runoff over 30 to 75% of mine void; change in mean annual flow in one or more drainages of 30 to 75%	Interconnected fractures change pattern of surface water runoff, reducing mean annual flow in one or more drainages of 30 to 50%	ESA effect: may affect and would likely adversely affect	30-75% of GDEs overlying subsidence area affected	Reduction in the social and economic conditions affecting 100 to 1,000 people; potential for 2-9 lives lost	Effects on wilderness resource and elimination of natural wilderness quality noticeable 75% or more of the area overlying mine void
5. Catastrophic	Change in pattern of surface water runoff over 75% or more of mine void; change in mean annual flow in one or more drainages of more than 75%	Interconnected fractures change pattern of surface water runoff, reducing mean annual flow in one or more drainages of more than 50%	ESA effect: may affect and would likely adversely affect	More than 75% of GDEs overlying subsidence area affected	Reduction in the social and economic conditions affecting >1,000 people; potential for 10 or more lives lost	Effect on wilderness resource and elimination of natural wilderness quality noticeable 50% of the area overlying mine void

Table 6. FMEA Results

Key: Likelihood	Annual Probability	Likelihood of Occurrence	Return Period (year)	Narrative Descriptor
E—Negligible	$< 10^{-4}$	< 0.1% chance of occurrence	> 10,000	Conceivable but improbable
D—Very Low	10^{-3} to 10^{-4}	0.1–1% chance of occurrence	1,000 to 10,000	Rare
C—Low	10^{-2} to 10^{-3}	1–10% chance of occurrence	100 to 1,000	Possible
B—Moderate	10^{-1} to 10^{-2}	10–50% chance of occurrence	10 to 100	Likely
A—High	$> 10^{-1}$	> 50% chance of occurrence	< 10	Certain

Key: Consequence
1—Insignificant
2—Minor
3—Moderate
4—Major
5—Catastrophic

Key: Confidence Level	
Low (L)	Potential for high variability
Moderate (M)	Moderate variability
High (H)	Low variabilty

Key: Project Stage Definitions
Operations (O)
Closure (C)
Post-Closure (PC)

Failure Mode and Effects						Consequences				Confidence		Proposed Action				Agency-Modified Alternative			
Mine Component	I.D. No.	Failure Mode / Potential Problem	Maximum Potential Effect	Project Stage	Likelihood (initial)	Water Quantity	Biophysical	Community/Social	Wilderness Character	Level of Confidence	Likelihood (adjusted)	Risk Parameter (initial)	Compensating Factors and Adequacy of Design Controls in Proposed Action	Risk Parameter (adjusted)	Risk Level	Mitigations	Risk Parameters (adjusted)	Risk Level (adjusted)	Rationale for Mitigation and Notes
Production Area Pillars (100.0)	100.1	Inadequate pillar design	Reduced pillar strength. Wide-area failure of multiple pillars. Trough subsidence in deeper areas.	O,C,PC	C	3	3	4	4	M	B	B,4	**Pillar and drive sizes:** Pillars 45 ft square and drives and crosscuts 45 ft wide. Where additional stability was required, slot pillars 30 ft wide and drives 50 ft wide on 80-ft centers. The overall length of the slot pillar would vary but could be on the order of several hundred feet long. **Width-to-height ratios:** In general, pillar width-to-height ratios for conventional room-and-pillar mining should not be less than 0.5. The slot mining method utilizing width-to-height ratios in the area of 0.4 has been shown to be satisfactory. Areas with ore thickness near 200 ft to account for the width-to-height ratio of the pillars. The best ratio using the slot pillar configuration was 0.4.	B,4	3	Prior to Phase I, submit an updated mine plan that incorporates information from the Troy Mine pillar failures, and a Rock Mechanics Data Collection and Monitoring Plan. The updated mine plan may alter proposed pillar and drive sizes. Collected data to include horizontal stress field. Prior to Phase II, submit for agency approval a detailed mine plan, using the data collected during Phase I, that minimizes the risk of subsidence. Include the physical setting of the ore body and the planned extent of mining in mine plan. **Fund biannual surveys of underground workings by an independent underground surveyor. Fund independent technical advisor to assist agencies with mine plan review. Complete quarterly geotechnical assessment of underground workings by a qualified person and submit annual assessment report. After data review, the KNF would require RCR to modify the mine plan as necessary to minimize effects on National Forest System surface resources under the authority under 36 CFR 228.8.** Pillar designs with less than a 0.8 width-to-height ratio would require justification by RCR as to their stability and agency approval prior to construction.	D,4	1	More specificity in mine plan required before and after Phase I. Funding of independent underground surveyor and technical advisor would provide agencies with means to monitor and assess underground development. **Bolded mitigation would apply to all failure modes assessed in this FMEA.** A 0.8 width-to-height ratio is recommended as a preliminary numeric criterion (see AAI 2014). Final ratio to be determined during final design.
	100.2	Presence of major geologic structures	Reduced pillar strength. Wide-area failure of multiple pillars. Chimney subsidence in shallow overburden or trough subsidence in deeper areas.	O,C,PC	C	3	3	4	4	M	B	B,4	Leave a large barrier pillar between the fault zone and the active mine area in the Copper Lake Fault area where ore thicknesses exceed 100 ft; use a horizontal pillar to facilitate extraction over the entire ore height in areas where the proposed ore extraction thickness exceeded the capacity of designed pillars.	B,4	3	Prior to Phase II, complete detailed mapping of surficial geology and evaluation adit geology to confirm major geologic structures. Maintain a buffer (barrier pillar) of 100 ft on either side of the Copper Lake Fault, the Moran Fault, and other faults shown on Figure 3-2 of the SEIS. Minimize size and number of drives through the faults. Agency review and approval of hydrologic and geotechnical studies and updated hydrologic model before RCR could mine with a smaller buffer area; probe drilling in advance of development near faults.	D,4	1	Faults shown on SEIS Figure 3-2 based on Balla (2000) require confirmation. Barriers would reduce the uncertainty of fault conditions.
	100.3	Geologic discontinuities (e.g., minor faults, weak bedding horizons, joints, clay infilling)	Reduced pillar strength. Wide-area failure of multiple pillars. Chimney subsidence in shallow overburden or trough subsidence in deeper areas.	O,C,PC	C	3	3	4	4	L	B	B,4	None proposed.	B,4	3	Prior to Phase II, complete detailed mapping of surficial geology and evaluation adit geology to identify discontinuities. Review core logs for discontinuities. Incorporate information about discontinuities into mine planning. Submit updated mine plan described in 100.1. During Operations, include assessment of jointing and major structures in quarterly geotechnical assessment and annual reporting described in 100.1. Probe drilling in advance of development for minor faults.	D,4	1	Because discontinuities only detected fully until excavation occurred, likelihood would be on the upper end of very low (likelihood level D) and risk would be greater than 100.1 and 100.2.
	100.4	Unfavorable rock type; low rock strength	Reduced pillar strength. Wide-area failure of multiple pillars. Chimney subsidence in shallow overburden or trough subsidence in deeper areas.	O,C,PC	C	3	3	4	4	M	B	B,4	Collect unspecified additional rock mechanics data.	B,4	3	See 100.1.	D,4	1	New information gathered from Troy Mine. Needed to protect the wilderness resource.
	100.5	Operations: pillar overshoot from blasting	Reduced pillar strength. Wide-area failure of multiple pillars. Chimney subsidence in shallow overburden or trough subsidence in deeper areas.	O	C	3	3	4	4	M	C	C,4	None proposed	C,4	2	During Operations, implement mitigation described in 100.2. Describe blasting practices in Explosive Handling and Blasting Plan.	E,4	<1	Current blasting technology would allow for more precision in pillar sizes post-blasting. Plan would describe techniques.
Production Area Pillars (100.0)	100.6	Undersided pillar from pillar robbing	Reduced pillar strength. Wide-area failure of multiple pillars. Chimney subsidence in shallow overburden or trough subsidence in deeper areas.	O	A	4	4	3	4	H	A	A,4	Future engineering studies to determine feasibility of selective pillar removal or reduction In pillar dimensions; modified in a 1996 letter to the Corps of Engineers indicating no pillar recovery.	E,4	<1	No pillar recovery.	E,4	<1	Specifying no pillar recovery ensures Alternative V would not allow secondary pillar recovery.
Mine Roof/Back (200.0)	200.1	Roof span too great	Chimney subsidence in shallow overburden in localized areas.	O,C,PC	D	1	1	3	2	M	C	C,3	See 100.1.	C,3	1	See 100.1; leave minimum of 450 ft unless agencies approve a thinner buffer based on rock mechanics data.	D,3	<1	A minimum of 450 ft is recommended as a preliminary numeric criterion given uncertainty of underground conditions. Final thickness to be determined during final design.
	200.2	Poor roof rock quality	Chimney subsidence in shallow overburden in localized areas.	O,C,PC	C	1	1	3	2	M	B	B,3	Collect unspecified additional rock mechanics data.	B,3	2	See 200.1.	D,3	<1	See 200.1.
	200.3	Presence of groundwater	Chimney subsidence in shallow overburden in localized areas.	O,C,PC	D	1	1	3	2	M	C	C,3	None proposed.	C,3	1	See 100.3.	D,3	<1	New information gathered from Troy Mine. Needed to protect the wilderness resource.

Key: Likelihood	Annual Probability	Likelihood of Occurrence	Return Period (year)	Narrative Descriptor
E—Negligible	$< 10^{-4}$	< 0.1% chance of occurrence	> 10,000	Conceivable but improbable
D—Very Low	10^{-3} to 10^{-4}	0.1–1% chance of occurrence	1,000 to 10,000	Rare
C—Low	10^{-2} to 10^{-3}	1–10% chance of occurrence	100 to 1,000	Possible
B—Moderate	10^{-1} to 10^{-2}	10–50% chance of occurrence	10 to 100	Likely
A—High	$> 10^{-1}$	> 50% chance of occurrence	< 10	Certain

Key: Consequence
1—Insignificant
2—Minor
3—Moderate
4—Major
5—Catastrophic

Key: Confidence Level	
Low (L)	Potential for high variability
Moderate (M)	Moderate variability
High (H)	Low variabilty

Key: Project Stage Definitions
Operations (O)
Closure (C)
Post-Closure (PC)

Failure Mode and Effects						Consequences				Confidence		Proposed Action				Agency-Modified Alternative			
Mine Component	I.D. No.	Failure Mode / Potential Problem	Maximum Potential Effect	Project Stage	Likelihood (initial)	Water Quantity	Biophysical	Community/Social	Wilderness Character	Level of Confidence	Likelihood (adjusted)	Risk Parameter (initial)	Compensating Factors and Adequacy of Design Controls in Proposed Action	Risk Parameter (adjusted)	Risk Level	Mitigations	Risk Parameters (adjusted)	Risk Level (adjusted)	Rationale for Mitigation and Notes
Mine Floor (300.0)	300.1	Poor floor rock quality	Widespread floor failure and pillar punching, leading to trough subsidence in deeper areas.	O,C,PC	E	3	3	4	4	M	D	D,4	Collect unspecified additional rock mechanics data.	D,4	1	See 100.1.	E,1	<1	New information gathered from Troy Mine. Needed to protect the wilderness resource.
	300.2	Presence of groundwater	Widespread floor failure and pillar punching, leading to trough subsidence in deeper areas.	O,C,PC	E	3	3	4	4	M	D	D,4	None proposed.	D,4	1	None proposed.	D,4	1	Water assumed to be managed appropriately during normal operations.
Sill Pillar (400.0)	400.1	Design: sill pillar too thin	Reduced pillar strength. More severe surface expression of failure than production pillars. Chimney subsidence in shallow overburden or trough subsidence in deeper areas.	O,C,PC	C	3	3	4	4	L	B	B,4	Areas with ore thickness near 200 ft to account for the width-to-height ratio of the pillars. The best ratio using the slot pillar configuration was 0.4. This will be equivalent to 75 ft of overall ore thickness using a 30 ft wide pillar. Placement of a horizontal pillar required to allow the safe mining of the ore in these thicker ore horizons. The pillar design lined up the pillars so that the stress forces do not create unacceptable stress in the floor or back of the adjacent mining block.	B,4	3	See 100.1; design would explicitly assess sill pillar stability.	D,4	1	Numerical modeling; review of mine plan described in 100.1.
	400.2	Unfavorable rock type; low rock strength	Reduced pillar strength. More severe surface expression of failure than production pillars. Chimney subsidence in shallow overburden or trough subsidence in deeper areas.	O,C,PC	C	4	4	4	4	M	B	B,4	Collect unspecified additional rock mechanics data.	B,4	3	See 100.1; design would explicitly assess sill pillar stability.	D,4	1	Numerical modeling; review of mine plan described in 100.1.
	400.3	Geologic discontinuities (e.g., weak bedding horizons, joints, clay infilling)	Reduced pillar strength. More severe surface expression of failure than production pillars. Chimney subsidence in shallow overburden or trough subsidence in deeper areas.	O,C,PC	C	4	4	4	4	M	B	B,4	Collect unspecified additional rock mechanics data,	B,4	3	See 100.1; design would explicitly assess sill pillar stability.	D,4	1	Risk slightly greater than 400.1; see discussion under 100.3.
Outcrop/Surface Buffer (600.0)	600.1	Too thin	Chimney subsidence in shallow overburden in localized areas.	O,C,PC	B	1	1	3	3	M	A	A,3	Leave a minimum 100 ft of overburden between any working area and the ground surface.	B,3	2	maintain 1,000-ft buffer at north and south outcrop; leave minimum of 450 ft unless agencies approve a thinner buffer based on rock mechanics data; see 100.1.	D,3	<1	Barriers would reduce the uncertainty of underground conditions.
Fault Crossings (700.0)	700.1	Too many fault penetrations	Chimney subsidence in shallow overburden in localized areas.	O,C,PC	C	1	1	3	3	M	B	B,3	See 100.2.	B,3	2	See 100.2 and 100.3.	D,3	<1	New information gathered from Troy Mine. Needed to protect the wilderness resource.
Adits (800.0)	800.1	Cover too thin	Chimney subsidence in shallow overburden in localized areas.	O,C,PC	C	1	1	3	1	M	B	B,3	Mine permit application is not specific as to whether or not mine adits would be sealed or left free draining; but it is probable that the mine adits as well as the evaluation adit would be plugged by concrete bulkheads leaving near vertical faces.	B,3	2	**Agencies' Closure Options in Alternative V:** One of three mine closure options: 1) mine adits closed at the portal and mine water drain freely from the adit portals; 2) mine adits plugged with reinforced concrete near the intersection of the adits and the mine void and the mine allowed to flood above this location; 3) mine adits plugged with reinforced concrete near intersection of the adits and the mine void, at adit entrances, and at several places along the adits, and the mine would be allowed to flood above the plugs. **Agencies' Mitigation in Alternative V:** Maintain minimum of 450 ft unless agencies approve a final closure plan with a thinner overburden thickness.	D,3	<1	A minimum of 450 ft is recommended as a preliminary numeric criterion. Final thickness to be determined during final design.