United States Department of Agriculture | Forest Service | Salmon-Challis National Forest Supervisor's Office | 1206 S. Challis Salmon, ID 83467 208 756-5100

File Code: 1950-3
Date: February 1, 2007

Dear Reader:

Enclosed is a copy of the Draft Environmental Impact Statement (DEIS) for the Idaho Cobalt Project in Lemhi County, Idaho. This document has been prepared in accordance with the National Environmental Policy Act (NEPA) and its implementing regulations. The DEIS has been prepared with the assistance of the US Environmental Protection Agency and the Idaho Department of Environmental Quality as cooperating agencies.

The Proposed Action is to approve a Plan of Operations for the Idaho Cobalt Project that would allow the development of two underground mines, a waste disposal site and associated facilities on National Forest System land west of Salmon, Idaho. The surface disturbance by the proposed project would be between 111 to 324 acres located within the Panther Creek Drainage on the Salmon-Cobalt Ranger District, Salmon-Challis National Forest, in or adjacent to sections 8, 9, 15, 16, 17, 20, 21, and 22, Township 21 North, Range 18 East.

The DEIS identifies Alternative IV (which includes agency modifications to the proponent's plan) as the Preferred Alternative.

Your comments are important and will help me make a decision. Comments that are specific to the Idaho Cobalt Project are the most valuable. It is important for you to respond to this DEIS within the comment period defined below with comments that can be meaningfully considered during the development of the Final Environmental Impact Statement (FEIS). The FEIS and Record of Decision (ROD) are anticipated to be completed in the third quarter of 2007. The appeal period and appeal resolution process are expected to be completed by November of 2007. The Plan of Operations can be approved once any appeals are resolved and the company has submitted a Plan incorporating the requirements contained in the ROD.

The comment period will be 60 days from the date the Notice of Availability (NOA) of the DEIS is published in the Federal Register, which is expected to be during the week of February 9, 2007. A Legal Notice will also be placed in the Recorder Herald (Salmon, Idaho), the newspaper of record. The publication date of the NOA in the Federal Register is the exclusive means for calculating the comment period for a proposed action documented in a DEIS. Those wishing to comment should not rely upon dates or timeframe information provided by any other source.

Written comments must be submitted to: Responsible Official William A. Wood, Forest Supervisor, 1206 S. Challis St., Salmon, ID 83467. The office business hours for those submitting hand delivered comments are 8:00-4:30 Monday through Friday, excluding holidays. Oral comments must be provided at the Responsible Official's office during normal business hours via telephone 208-756-5100 or in person, or at an official agency function (i.e. public meeting) that is designed to elicit public comments. Public meetings will be held in Salmon, Idaho, at the City Center on March 14, 2007, from 7:00 to 9:00 pm and in Challis, Idaho, at the Forest Service Office, March 15, 2007, from 7:00 to 9:00 pm.

Electronic comments must be submitted in a format such as an email message, plain text (.txt), rich text format (.rtf), and Word (.doc) to comments-intermtn-salmon-challis@fs.fed.us with Idaho Cobalt Project on the subject line. Comments must have an identifiable name attached or verification of identity will be required. A scanned signature may serve as verification on electronic comments. Those who provide comments during this comment period are eligible to appeal the decision. Comments must meet the requirements of 36 CFR 215.6.

For more information please contact Ray Henderson, Team Leader, at (208) 756-5231 or visit our Forest Web site at www.fs.fed.us/r4/sc.

Sincerely,

/s/William A. Wood
WILLIAM A. WOOD
Forest Supervisor

Enclosure

United States
Department of
Agriculture

Forest
Service

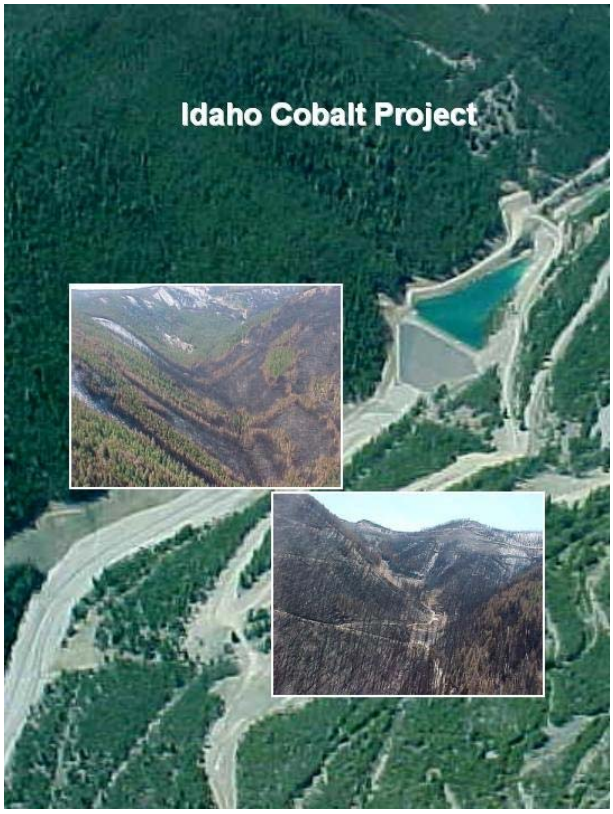
February 2007

Draft Environmental Impact Statement

Idaho Cobalt Project

Salmon-Cobalt Ranger District, Salmon-Challis National Forest

Lemhi County, Idaho



FEBRUARY 2007

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Idaho Cobalt Project
Draft Environmental Impact Statement
Lemhi County, Idaho

Lead Agency:	**USDA Forest Service**
Cooperating Agencies:	**US Environmental Protection Agency** **Idaho Department of Environmental Quality**
Responsible Official:	**William A. Wood** **Forest Supervisor** **Salmon-Challis National Forest** **1206 South Challis St.** **Salmon, Idaho 83467**
For Information Contact:	**Ray Henderson; Project Coordinator** **(208) 756-5231**
Salmon-Challis National Forest:	**Salmon-Challis National Forest** **1206 South Challis St.** **Salmon, Idaho 83467**

Abstract: The Idaho Cobalt Project Draft Environmental Impact Statement describes the land, people, and resources potentially affected by the proposed Idaho Cobalt Project underground cobalt mine and associated facilities. The lead agency's responsibilities consist of review and analysis of the impacts of the proposed action and reasonable alternatives, and review of public comment. The U.S. Forest Service Salmon-Challis National Forest will use this information to determine whether or not to approve the Plan of Operations for the Idaho Cobalt Project. The proponent's proposed project would consist of two underground mines, a mill, a tailings and waste rock disposal facility, access roads and utility corridors. Five alternatives, including no action, are analyzed. The proposed mine is within the area of ongoing CERCLA remediation and restoration activities directed at historic mining activities.

Review Of Draft Environmental Impact Statement: Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Send Comments to:	**Ray Henderson** **Salmon-Challis National Forest** **1206 South Challis St.** **Salmon, Idaho 83467**
Date Comments Must Be Received:	**April 10, 2007**

Summary

The Salmon-Challis National Forest (SCNF) is proposing to approve a Plan of Operations for the Idaho Cobalt Project that would allow the development of two underground mines, a waste disposal site and associated facilities on National Forest Land west of Salmon, Idaho. The area affected by the proposed mineral development project would consist of surface disturbance on approximately 111 to 324 acres located in the Panther Creek drainage on the Salmon - Cobalt Ranger District, Salmon-Challis National Forest (SCNF), in or adjacent to Sections 8, 9, 15, 16, 17, 20, 21, and 22, Township 21 North, Range 18 East (**Figure 1-1**). The Formation Capital Corporation (FCC) property is composed of several mineral deposits acquired by locating and filing mining claims within the Salmon-Cobalt Ranger District of the Salmon-Challis National Forest. The property consists of 145 unpatented mining claims for a total of 2,524 acres of mineral rights. This action is needed in response to submittal of the FCC Plan of Operation for the Idaho Cobalt Project (ICP), which describes the company's intent to develop a cobalt mine on unpatented mineral claims held by FCC. The SCNF is required to evaluate and process the proposed Plan under the authority of the U.S. Mining Law and in accordance with 36 CFR 228A as further defined by law, regulation, Agency policy and plans.

The SCNF received the initial proposed plan of operations in January 2001. An information Scoping packet was distributed to interested parties on July 10, 2001 with a request for written comments. A public meeting was held by the SCNF on July 20, 2001, in Salmon, Idaho, and a comment form was provided for those wishing to provide written comments. Subsequent to the July 20, 2001 public meeting, a Notice of Intent (NOI) to prepare an EIS for the proposed mining project was published by the Forest Service in the Federal Register on September 10, 2001. Public scoping meetings were held by the SCNF in Challis, Idaho, on October 10, 2001, and Salmon Idaho, on October 11, 2001. On February 4, 2005 FCC submitted a revised proposed Plan of Operations including supporting technical documents. On April 5, 2006 and June 6, 2006, FCC submitted additional revisions to the proposed Plan of Operations. On May 25, 2006 FCC submitted an application to the US Environmental Protection Agency (EPA) Region 10 to discharge wastewater to Big Deer Creek under the National Pollution Discharge Elimination System (NPDES) program. EPA deemed the application complete on July 14, 2006. EPA is a cooperating agency with the Forest Service in the development of the ICP EIS. A revised NOI was published in the Federal Register on November 1, 2006.

In response to these 2001 scoping activities, the SCNF received oral and/or written comments from 58 private individuals, federal agencies, groups, Native American Tribes and local governments. Significant issues raised in the scoping process include:

- Potential impacts or interactions with the nearby Blackbird Mine CERCLA remediation and restoration activities.
- Potential impacts to surface waters, groundwater and wetlands.
- Potential impacts to access routes and transportation of hazardous materials.
- Potential impacts to local communities and infrastructure from proposed development.
- Potential impacts to fish, wildlife and vegetation from proposed development and reclamation.
- Potential impacts to visual, wilderness and recreation uses in adjacent areas of the Forest.
- Potential impacts to tribal and cultural resources.
- Potential impacts to other Forest activities, land use and planning.

Alternatives Analyzed - These issues identified in scoping led the agency to develop alternatives to the proposed action. The following alternatives are analyzed in this EIS:

- Alternative I – No Action.

- Alternative II – Formation Capital Corporation has presented a proposal to develop two underground mines, construct a mill that utilizes conventional flotation technology to produce a

cobalt, copper and gold concentrate, dispose of mill tailings in a dry stack waste storage facility, utilize paste backfill to return a portion of the tailings underground as part of the mining process and collection and treatment of excess mine water with a reverse osmosis system and discharge to Big Deer Creek under a NPDES permit. The water discharge pipeline would directly affect a small area (0.14 acres) of jurisdictional wetlands and require a 404 permit from the US Army Corps of Engineers.

- Alternative III – Alternative III includes agency modifications to the company's proposal to reduce potential impacts to resources including surface water, groundwater, wetlands, public safety and native vegetation. The proposed modifications include relocation of the tailings and waste rock storage facility to avoid isolated wetlands, utilization of a land application water treatment and disposal system as an alternative to reverse osmosis water treatment, addition of amendments to waste backfilled into the mine to reduce risks to groundwater and surface water quality, long term mine dewatering rather than groundwater capture to reduce impacts to groundwater and surface water quality, changes to reclamation techniques to facilitate recovery of native plant communities, improvements to waste storage facilities, upgrades to access roads to improve safety and expanded water and geochemical monitoring to provide a better understanding of operational and post–operational water quality impacts.

- Alternative IV – Alternative IV includes agency modifications to the proposed Plan to reduce resource impacts to surface water, groundwater, wetlands and native vegetation. Alternative IV modifications include reducing the size of the tailings disposal site to match existing ore reserves and avoid direct impacts to isolated wetlands, addition of a backup groundwater capture system to ensure adequate post closure groundwater capture, utilization of an alternative water treatment system that would meet NPDES permit requirements with discharge to Big Deer Creek but also reduce the volume of water treatment waste products, addition of amendments to mine waste backfill to improve long term geochemical stability and re-routing of the water discharge pipeline to avoid impacts to a cultural site.

- Alternative V – Alternative V is similar to Alternative IV but includes the additional modification to reduce infrastructure requirements by utilizing the existing Blackbird Mine water treatment facility site for Idaho Cobalt water treatment facilities and discharge under NPDES authority into Blackbird Creek.

Table S-1 summarizes the major components of each alternative. The effects analysis presented in Chapter IV identifies a number of differences between the alternatives. Major environmental effects of the alternatives are summarized in **Table S-2**.

Preferred Alternative – The preferred alternative is the alternative that the agency analysis identifies as best meeting the purpose and need of the proposed action. The agencies have identified Alternative IV as the preferred alternative for the ICP. If this preferred alternative is selected in the Record of Decision (ROD), FCC would be required to modify their Plan of Operations to include mitigation and monitoring components outlined in the preferred alternative. Modifications to the Plan of Operations would include submittal of detailed plans and designs for a number of project components including the water treatment system, the groundwater capture system, commingled tailings disposal, waste (slash) amendment and water monitoring. These and other design details and operational system plans would require Forest Service approval prior to implementation.

TABLE S-1. IDAHO COBALT PROJECT – ALTERNATIVE COMPARISON

Issue	Alternative II FCC's Proposal	Alternative III Relocation of TWSF, Perpetual Mine Dewatering and Land Application Treatment Water Discharge	Alternative IV Modified TWSF, Modified Water Treatment to Reduce Waste Stream, Surface Discharge to Big Deer Creek	Alternative V Modified TWSF, Modified Water Treatment to Reduce Waste Stream, Surface Discharge to Blackbird Creek
Total Disturbed Acreage	129 acres	234 acres	112 acres	111 acres
Transportation	2.6 miles new road; 9.4 miles of site road upgrade; 10.9 miles of access road upgrade; 4.3 miles net total road reduction.	5.6 miles new road; 4.4 miles site road upgrade; 40 miles access road upgrade; 6.6 miles net total road reduction.	3.0 miles new road; 8.9 miles of site road upgrade; 40 miles of access road upgrade; 5.8 miles net total road reduction.	2.4 miles new road; 8.4 miles of site road upgrade; 40 miles of access road upgrade; 6.4 miles net total road reduction.
Tailings and Waste rock Disposal	55 acre, 2.6 Mcy (million cubic yards) TWSF; 3 ft. thick soil cap.	53 acre, 2.6 Mcy TWSF that avoids isolated wetlands; 4 ft. thick soil cap to protect liner.	36 acre, 1.7 Mcy TWSF that avoids isolated wetlands by moving site to north; 4 ft. thick soil cap to protect liner.	36 acre, 1.7 Mcy TWSF that avoids isolated wetlands by moving site to north; 4 ft. thick soil cap to protect liner.
Water Treatment and Disposal	Reverse osmosis water treatment and discharge to Big Deer Creek; NPDES permit.	Land application water treatment on 175 acre LAT site in Big Flat drainage; NPDES permit would be required.	Advanced Water Treatment and Direct Discharge to Big Deer Creek Under NPDES Permit.	Advanced Water Treatment at Existing Blackbird Treatment Plant Site and Direct Discharge to Blackbird Creek Under NPDES Permit.
Reclamation	Revegetation using non-native species and natural reseeding of trees & shrubs.	Revegetation using native species and planting trees and shrubs.	Revegetation using native species and planting trees and shrubs.	Revegetation using native species and planting trees and shrubs.
Tailings Placement Underground	Paste tailings placed underground as needed for fill; portions of tailings cemented for mining.	Paste tailings placed underground as needed for fill; all backfill tailings mixed with limestone to control post closure pH; amend waste rock (slash) backfill for pH control.	Paste tailings placed underground as needed for fill; all backfill tailings mixed with limestone to control post closure pH; amend waste rock (slash) backfill for pH control.	Paste tailings placed underground as needed for fill; all backfill tailings mixed with limestone to control post closure pH; amend waste rock (slash) backfill for pH control.
Post Mining Water Capture	Groundwater downgradient of mines captured by mid-slope bedrock capture wells, if necessary.	Groundwater captured from lower level of mines to improve capture efficiency.	Bedrock well capture system supplemented by alluvial capture system in lower Bucktail Creek drainage to improve capture efficiency.	Bedrock well capture system supplemented by alluvial capture system in lower Bucktail Creek drainage to improve capture efficiency.
Waste Management	Waste rock and tailings would be separated in TWSF.	Waste rock and tailings would be commingled in TWSF disposal to reduce oxygen to waste rock.	Waste rock and tailings would be commingled in TWSF disposal to reduce oxygen to waste rock.	Waste rock and tailings would be commingled in TWSF disposal to reduce oxygen to waste rock.
Water Monitoring	Monitor mine inflow rates and chemistry; install additional wells peripheral to mines and monitor drawdown during mine dewatering for purpose of confirming groundwater assumptions.	As in Alternative II plus additional groundwater monitoring wells, monitoring of mine water quality and quantity, and coordination of ICP with BMSG monitoring.	Same as Alt III; plus install wells in Bucktail Ck alluvium to determine alluvial groundwater capture requirements.	Same as Alt III; plus install wells in Bucktail Ck alluvium to determine alluvial groundwater capture requirements.

TABLE S-2. IDAHO COBALT PROJECT – EFFECTS COMPARISON

Issue	Alternative II FCC's Proposal	Alternative III Relocation of TWSF, Perpetual Mine Dewatering and Land Application Treatment Water Discharge	Alternative IV Modified TWSF, Modified Water Treatment to Reduce Waste Stream, Surface Discharge to Big Deer Creek	Alternative V Modified TWSF, Modified Water Treatment to Reduce Waste Stream, Surface Discharge to Blackbird Creek
Disturbed Acreage	Intermediate disturbed area.	Substantially greater disturbed area.	Least disturbed area.	Least disturbed area.
Transportation	Road improvements to improve trafficability and sediment delivery to streams.	Proposed road mitigation would increase safety on access route, reduce sediment delivery to streams and reduce risk of water quality effects from a spill of a hazardous substance.	Proposed road mitigation would increase safety on access route, reduce sediment delivery to streams and reduce risk of water quality effects from a spill of a hazardous substance.	Proposed road mitigation would increase safety on access route, reduce sediment delivery to streams and reduce risk of water quality effects from a spill of a hazardous substance.
Tailings and Waste rock Disposal	TWSF would eliminate 0.22 acres of non-jurisdictional wetland and provide a similar area of replacement wetlands.	Alternative TWSF site would mitigate risk to non-jurisdictional wetlands.	Initial reduced TWSF footprint would mitigate impacts to non-jurisdictional wetlands; potential future expansion would impact non-jurisdictional wetlands.	Initial reduced TWSF footprint would mitigate impacts to non-jurisdictional wetlands; potential future expansion would impact non-jurisdictional wetlands.
Water Treatment and Disposal	Reverse osmosis water treatment (only provided as a contingency) would create large waste stream requiring disposal; if post closure treatment were required off-site disposal could require two trucks per week to haul RO waste.	LAT would have largest surface disturbance; sulfate may locally exceed groundwater standards in Big Flat drainage.	Advanced Water Treatment would have smaller waste stream and lower costs than RO, but would not remove sulfate.	Utilizing Blackbird WWTP site would minimize infrastructure, particularly if post closure water treatment were required; requires agreement with BMSG/Noranda and modification of CERCLA water treatment system.
Reclamation	Use of non-native species could preclude or delay recovery of native plant communities.	Use of native species meets Forest objectives and National USFS direction.	Use of native species meets Forest objectives and National USFS direction.	Use of native species meets Forest objectives and National USFS direction.
Underground Backfill Amendment	Paste tailings placed underground in the Ram as needed for fill; portions of tailings cemented for mining.	Paste tailings placed underground as needed for fill; all backfill tailings mixed with limestone to control post closure pH; amend waste rock (slash) in both Ram and Sunshine backfill for pH control.	Paste tailings placed underground as needed for fill; all backfill tailings mixed with limestone to control post closure pH; amend waste rock (slash) in both Ram and Sunshine backfill for pH control.	Paste tailings placed underground as needed for fill; all backfill tailings mixed with limestone to control post closure pH; amend waste rock (slash) in both Ram and Sunshine backfill for pH control.
Post Mining Water Capture	Bedrock capture wells unlikely to be effective at capturing required volume of groundwater necessary for metals load removal.	Mine dewatering effective, but requires essentially perpetual capture and treatment .	Alluvial groundwater collection backup system effective, but may increase amount of water to be treated; increased disturbance.	Alluvial groundwater collection backup system effective, but may increase amount of water to be treated; increased disturbance.
Water Monitoring	ICP monitoring plan addresses surface and groundwater.	Improved monitoring system allows better understanding of potential impacts; increased information for making closure decisions.	Improved monitoring system allows better understanding of potential impacts; increased information for making closure decisions.	Improved monitoring system allows better understanding of potential impacts; increased information for making closure decisions.

Alternative IV provides the best combination of operational components and reduces risks to the environment by limiting the size of the Tailings and Waste Rock Facility (TWSF) (unless ICP can demonstrate that additional ore reserves require additional area), reducing the wastes produced in the water treatment system that would require disposal, increasing the amount of road reclamation, providing for amendment of backfill material to control risk of metals leaching following closure, providing a backup groundwater capture system to improve chances of collecting the post-closure entire chemical load from the mines and improvements to monitoring plans. These key components of the preferred alternative are included as modifications and mitigation measures. An important Agency objective addressed in the preferred alternative is the modification and clarification of the monitoring and reporting requirements that will allow the Forest Service to provide effective oversight during operations and reclamation. The ICP would also need to reach agreement with BMSG/Noranda for access across private land, use and maintenance of existing private roads and use and possible modification of a section of the powerline crossing the private lands to reach the ICP.

Alternative IV includes amendment of backfilled materials to minimize risk of metals leaching from the mine areas, modifies the water treatment system to reduce the water treatment waste stream requiring disposal, provides a backup groundwater collection system to ensure that post-closure groundwater potentially affected by the underground mining can be captured and treated if necessary. These modifications reduce the risk that metals from the ICP could adversely affect the ongoing Blackbird cleanup efforts. Other mitigation measures such as road improvements to reduce sediment yield and appropriate disposal of existing waste materials at the Sunshine portal would result in decreased environmental impact. The road improvements and enhanced emergency management requirements are intended to improve public and mine employee safety. Requirements in Alternative IV for detailed plans for winter tailings disposal, pond liner protection and inclusion of spillways on process water ponds will reduce risk of operational problems that could result in effects to water or other resources. Use of native vegetation in reclamation, addition of a weed control plan and application of Forest guidelines in soil disturbance and vegetation clearing are intended to reduce the length of time that is required to achieve reclamation goals. All of these components that are included in the Agencies' preferred alternative are intended to reduce impacts to the environment and contribute to the selection of Alternative IV as the preferred alternative.

Environmentally Preferred Alternative – The Forest Service is required to identify the environmentally preferred alternative in the EIS. The environmentally preferred alternative is the alternative that causes the least damage to the biological and physical environment and best protects, preserves and enhances historic, cultural and natural resources. Alternative V is identified as the environmentally preferred alternative because it would require the smallest physical disturbance, would minimize the footprint and infrastructure requirements if post closure water treatment were required and would result in water quality improvement in Blackbird Creek by discharging an increased amount of treated water to the Blackbird drainage. However, the agencies cannot require the ICP to obtain an agreement with another private party to operate a water treatment plant on property owned by Noranda.

Financial Assurance – Prior to approval of a plan of operations, the Forest Service Manual requires financial assurance such as a bond to cover the cost of reclamation if the company were to default on their obligations. The Forest Service will prepare a financial assurance estimate in accordance with Forest Service guidance, which includes regrading and recontouring of surface disturbances, removal of surface facilities, revegetation and costs for long term water treatment. The required amount of the financial assurance will be reflected in the Record of Decision and will be subject to an annual review and adjustment throughout the life of the project to reflect changed circumstances.

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APPENDIX B SURFACE WATER AND GROUNDWATER FLOWS AND PREDICTED WATER QUALITY

CHAPTER 1. PURPOSE AND NEED

Introduction

The Salmon-Challis National Forest (SCNF) prepared this Draft Environmental Impact Statement (DEIS) to analyze the environmental consequences of approving a proposed Plan of Operations, (POO - also referred to as the plan of operations or Plan) and alternatives to the Plan for the proposed Idaho Cobalt Project (ICP). The proposed Plan submitted by Formation Capital Corporation, U.S. (FCC) outlines a mineral development project located in the Panther Creek drainage on the Salmon - Cobalt Ranger District, SCNF, in or adjacent to Sections 8, 9, 15, 16, 17, 20, 21, and 22, Township 21 North, Range 18 East (**Figure 1-1**). The FCC property is composed of several mineral deposits acquired by locating and filing mining claims within the Salmon - Cobalt Ranger District of the SCNF. The property consists of 145 unpatented mining claims for a total of 2,524 acres of mineral rights.

The proposed ICP would consist of an underground cobalt-copper-gold mine to extract minerals from two separate ore bodies, a processing plant (mill), and associated facilities. The proposed project is located approximately 45 road miles (or 22 direct miles) west from Salmon, Idaho. Salmon, Idaho, is the county seat of Lemhi County, and has a population of approximately 3,000 people (**Figure 1-1**).

This DEIS has been prepared in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. The DEIS analyzes and discloses the direct, indirect, and cumulative environmental impacts on resources in and adjacent to the Idaho Cobalt Project area that would result from SCNF approval of the proposed action or an alternative. The document is organized into seven chapters and Appendices as follows:

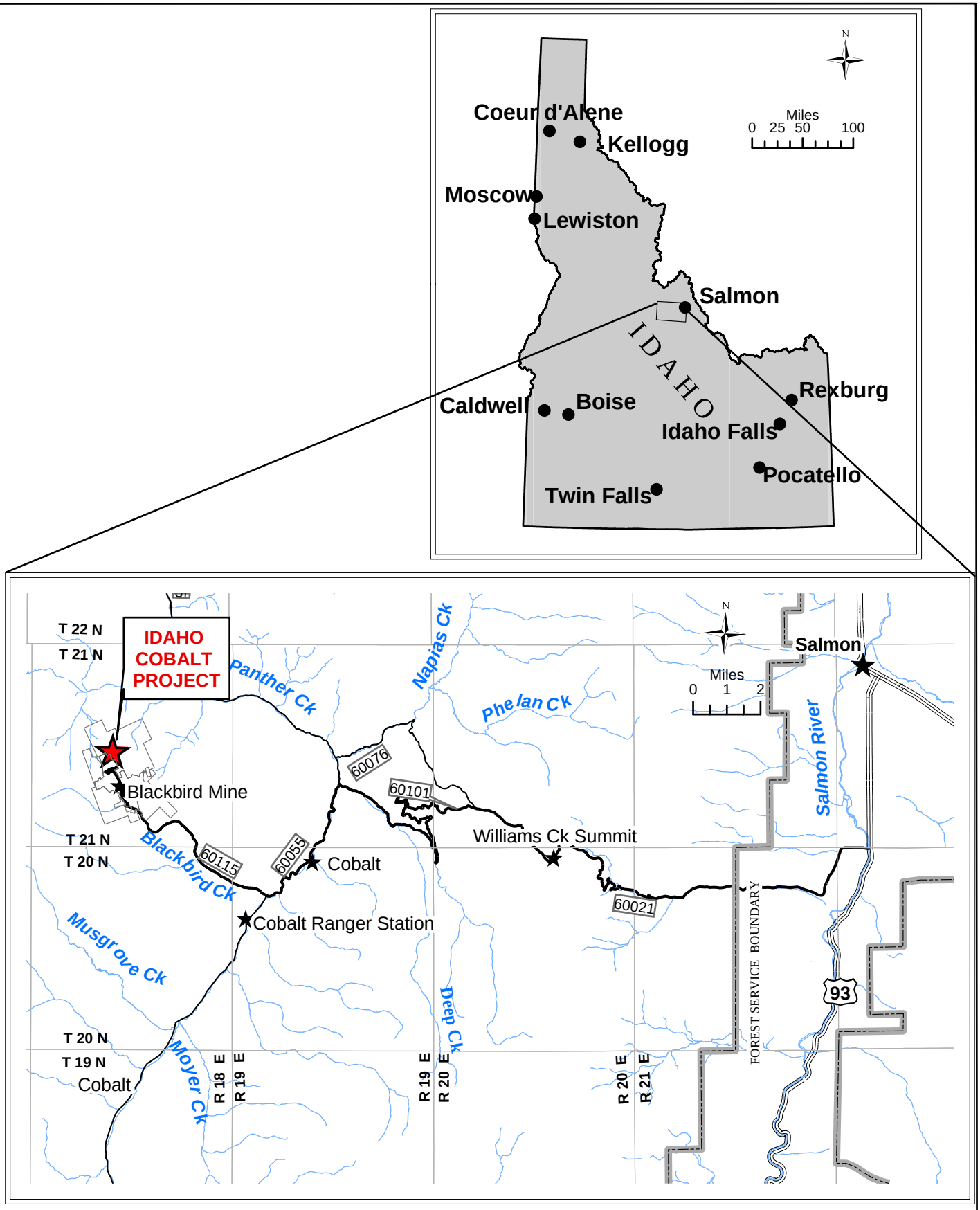
Chapter 1. Purpose and Need: This chapter includes information on the history of the project proposal. This chapter details how the Forest Service informed the public of the proposal and how the public responded. Based on the public response a range of issues has been identified. This chapter explains management direction and laws and regulations that guide the SCNF analysis of FCC's Plan of Operations.

Chapter 2. Alternatives: This chapter provides a more detailed description of the proposed action and alternatives identified for detail analysis. The alternatives were developed based on significant issues raised by the public, SCNF resource specialists, and other agencies and organizations. Alternatives that were considered, but eliminated from detailed analysis are described. This chapter also provides a table comparing the alternatives, and identifies mitigation requirements common to all alternatives, as well as monitoring requirements.

Chapter 3. Affected Environment: This chapter describes the affected environment associated with the proposed ICP Plan of Operations.

Chapter 4. Environmental Effects: This chapter describes the environmental effects of implementing the Proposed Action and identified Alternatives, including the No Action Alternative. This analysis is organized by resources as described in Chapter 3 and includes a description of the analysis and identifies impacts identified for the proposed ICP (Alternative II) and agency alternatives and mitigation measures to address identified impacts.

Chapter 5. Consultation and Coordination: This chapter summarizes the scoping and public involvement process and lists the Environmental Impact Statement (EIS) team, SCNF Interdisciplinary Team (ID Team), Cooperating agency members and other agency contributors responsible for preparing the DEIS.



IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**GENERAL LOCATION MAP IDAHO COBALT PROJECT**	Figure 1-1

Chapter 6. Acronyms and Glossary: This Chapter provides a listing of Acronyms, Abbreviations and a Glossary (definition) of terms used through this DEIS.

Chapter 7. References: This Chapter provides a listing of all document references used in the preparation of this DEIS, and supporting baseline and impact analysis information.

Appendices: The appendices provide more detailed information to support the analyses presented in the DEIS. Appendices include:

Appendix A – List of supporting documents used in the EIS analysis.
Appendix B – Water Quality tables from DSM hydraulic model.

Additional documentation, including technical reports containing a more detailed analyses of project-area resources used to provide the baseline resource descriptions located in Chapter 3, and the impact analyses located in Chapter 4, are found in the Project Record located at the Salmon-Challis National Forest Headquarters, in Salmon, Idaho.

The Proposed Action

On January 22, 2001, Formation Capital Corporation, U.S. (FCC) submitted a proposed Plan of Operations for the Idaho Cobalt Project (ICP). The proposed plan contained a description of the major activities that would take place during the construction phase, operating phase, and reclamation phase associated with the ICP, a proposed underground cobalt-copper-gold mining project. In addition, several supporting baseline environmental documents were provided by FCC. The proposed ICP is located on lands managed by the U.S. Forest Service within the Salmon-Cobalt Ranger District of the Salmon-Challis National Forest (**Figure 1-1**). The proposed ICP would result in surface disturbance of approximately 129 to 329 acres within 145 unpatented FCC mining claims totaling 2,524 acres of FCC mining claims. Since submittal by FCC of the January 2001 proposed Plan of Operations, the SCNF has requested additional information and clarification on the proposed activities, as well as the completion of additional environmental baseline studies. On February 4, 2005, FCC submitted a revised proposed Plan of Operations, including additional supporting technical information. On April 5, 2006 and June 6, 2006 FCC submitted additional revisions to the proposed Plan of Operations.

The proposed Federal action by the Forest Service is to respond to the proposed Plan of Operations submitted by FCC in accordance with 36 CFR 228.5. The Forest Service may respond either by approving the proposed Plan submitted by FCC or by notifying FCC of changes or additions to the Plan necessary to meet the requirements of the regulations. The requirements of the regulations include: minimizing adverse environmental impacts on National Forest surface resources to the extent feasible, including the following requirements:

(a) Air Quality. Operator shall comply with applicable Federal and State air quality standards, including the requirements of the Clean Air Act, as amended (42 U.S.C. 1857 et seq.).
(b) Water Quality. Operator shall comply with applicable Federal and State water quality standards, including regulations issued pursuant to the Federal Water Pollution Control Act, as amended (33 U.S.C. 1151 et seq.).
(c) Solid Wastes. Operator shall comply with applicable Federal and State standards for the disposal and treatment of solid wastes. All garbage, refuse, or waste, shall either be removed from National Forest lands or disposed of or treated so as to minimize, so far as is practicable, its impact on the environment and the forest surface resources.
(d) Scenic Values. Operator shall, to the extent practicable, harmonize operations with scenic values through such measures as the design and location of operating facilities, including roads and other means of access, vegetative screening of operations, and construction of structures and improvements which blend with the landscape.

(e) Fisheries and Wildlife Habitat. In addition to compliance with water quality and solid waste disposal standards required by this section, operator shall take all practicable measures to maintain and protect fisheries and wildlife habitat which may be affected by the operations.
(f) Roads. Operator shall 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.
(g) Reclamation. Upon exhaustion of the mineral deposit or at the earliest practicable time during operations, or within 1 year of the conclusion of operations, unless a longer time is allowed by the authorized officer, operator shall, where practicable, reclaim the surface disturbed in operations by taking such measures as will prevent or control onsite and off-site damage to the environment and forest surface resources.

On May 25, 2006 FCC submitted an application to EPA Region 10 to discharge wastewater to Big Deer Creek under the National Pollutant Discharge Elimination System (NPDES) permit program. EPA reviewed the application and after several supplementary submittals deemed the application complete on July 14, 2006. The Idaho Cobalt Project is considered a "new source", as defined in 40 CFR 122.29(b), and is subject to the New Source Performance Standards (NSPS) requirements at 40 CFR Part 440, Subpart J, (Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory). EPA's issuance of the new source NPDES permit is considered a major Federal action in accordance with the Clean Water Act (CWA) Section 511(c)(1), and is subject to the provisions of the National Environmental Policy Act (NEPA) at 40 CFR Parts 1500-1508 and EPA's NEPA implementing regulations at 40 CFR Part 6, prior to taking a final action on the NPDES permit. EPA is a cooperating agency with the Forest Service on development of the EIS.

Mineral development activities would be conducted pursuant to the 1872 Mining Law, as amended. The Forest Service is conducting an environmental analysis for its approval of the Plan authorized by Forest Service Mining Regulations at 36 CFR 228A governing activities authorized under the U.S. Mining Law, as amended. In accordance with these regulations, the Forest Service decision considered in this analysis is to respond to FCC's proposed plan either by approving it as submitted, or by notifying FCC of the changes needed in the proposed plan.

In their revised proposed Plan of Operations submitted June 6, 2006, FCC proposes to develop the Idaho Cobalt Project (ICP). The minerals to be mined would be cobalt, copper, and gold. Under their proposed plan FCC would develop, operate, and ultimately reclaim an 800-ton per day mine and mill complex. Underground mining methods would be used to extract ore from two deposits; the Ram and the Sunshine. Ore would be trucked from the mines to the mill. Ore from the Ram mine may eventually be conveyed by an overhead tram to the mill. Concentrate from the mill would be shipped to an off-site processing facility. There would be three main phases in the life of the ICP; the construction phase, the operating phase, and the reclamation phase.

- The construction phase would include preparing, constructing, and developing the mine and mill facilities.
- The operating phase would include mining, ore processing and disposal of waste products including tailings, waste rock and excess water. Mine development would include improving existing roads, construction of a power line, mill, mine facilities, TWSF, wastewater storage ponds, wastewater treatment plant, and pipeline for disposal of excess water during operations. Following development of the Ram mine, the Sunshine Mine would subsequently be developed to supplement production from the Ram mine.
- The reclamation phase would occur as facilities mature or are no longer needed. Reclamation would begin concurrently during the construction and operating phases where feasible.

Mine and mill facilities would include the Ram and Sunshine mine portals, the tram, the mill/plant, the tailings and waste rock storage facility (TWSF – see description in Chapter 2), water management ponds, water treatment and discharge facilities, new and existing improved roads, borrow areas, and a soil stockpile area. Ancillary facilities would include power lines, fuel storage tanks, water ditches,

warehouse and maintenance facilities, staff offices, change house, and domestic water disposal (septic and drain field). FCC's proposed Plan of Operations includes an operational and post-operational monitoring plan for surface water and groundwater quality. Detailed information regarding FCC's proposed monitoring plan, as well as monitoring plans associated with other project alternatives developed during the preparation of this DEIS, is provided in Chapter 2.

The Ram and Sunshine mine portals would be located on the slopes above Bucktail Creek. Declines would be developed from portals located above the groundwater level and would be designed to ensure that water does not drain from the portals. There would be two ventilation shafts at the Ram Mine and one at the Sunshine Mine. Ore and waste rock would be hauled directly to the mill or TWSF, as appropriate, in 20-ton trucks (approximately 0.8 mile distance from the Ram and 1.5 miles from the Sunshine).

The mill and ancillary facilities would be located on the Big Flat, a relatively flat area located between the drainages of Big Deer Creek and Little Deer Creek. At full production, the mill would produce approximately 32 dry tons of concentrate and 768 dry tons of tailings per day.

FCC's plan of operations provides for disposal of waste rock and tailings in a lined storage facility. The liner would consist of an impermeable soil (or engineered clay) layer and a synthetic liner. A drainage collection system would be constructed over the liner to collect water that infiltrates the tailings and waste rock. This water would be conveyed to the nearby water management ponds. Approximately half of the tailings produced at the mill would be used underground as mine back-fill.

A series of wells would be installed below the Ram and Sunshine mines to intercept groundwater from the mine after mining ceases. Water from the wells would be treated in a water treatment plant and discharged to Big Deer Creek under an NPDES permit.

Power for the project would be obtained from an existing power line that delivers power to the adjacent Blackbird Mine Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) site. Emergency power would be supplied with diesel generating equipment.

Access to the ICP from Salmon, Idaho would be via the Williams Creek, Deep Creek, Panther Creek and Blackbird Creek roads (see **Figure 2-2; Chapter 2)**. The anticipated personnel requirement at full production is 157 employees. The work force numbers are anticipated to be temporarily higher during construction and start up. During closure and reclamation, the work force would be reduced significantly. It is anticipated that most of the project employees would live in the Salmon, Idaho area. Personnel would be transported to the project in vans or buses.

A more detailed description of FCC's proposed plan is provided as Alternative 2 in Chapter 2.

Purpose and Need For Action

FCC is entitled to conduct operations that are reasonably incident to exploration and development of mineral deposits on its unpatented mining claims pursuant to the United States Mining laws. Under regulations of the Secretary of Agriculture, FCC must conduct mining operations in accordance with the regulations at 36 CFR 228A, and with a plan of operations that has been approved by the Forest Service. The need for the proposed Federal actions is that the Forest Service is required to respond to a proposed plan of operations to conduct mining operations pursuant to the Mining Laws.

Under applicable regulations, the Forest Service must determine whether to approve the Plan of Operations submitted by FCC as it is proposed, or to require changes or additions deemed necessary to meet the requirements of the regulations for environmental protection. The purpose of the proposed action and the evaluation of alternatives to the proposed action are to determine if changes or additions to the Plan of Operations are required to meet the requirements of the regulations for environmental protection set forth in 36 CFR 228.8.

Decisions to be Made

The Forest Supervisor of the Salmon-Challis National Forest, the deciding official for this project, has determined that preparation of an EIS is required for approval of the proposed plan of operations under Forest service (FS) regulations governing locatable mineral activities on National Forest System (NFS) lands (36 CFR 228A) and Council on Environmental Quality (CEQ) regulations implementing the NEPA (40 CFR 1500-1508).

Given the purpose and need for federal action, the Forest Supervisor reviews the proposed plan of operation, the other alternatives, and the environmental consequences in order to make the following decisions:

1. Approve the project as proposed; or
2. Notify the proponent of changes or additions to the plan of operations necessary to minimize or eliminate adverse environmental impacts from mineral development activities on NFS lands, as required by Forest Service regulations (36 CFR 228A); and
3. Determine if approval of a plan of operations will be consistent with the Forest Plan , or if an amendment to Forest Plan will be required.
4. Calculate the amount of financial assurance that may be required to cover costs of reclamation.

Prior to approval of a plan, the SCNF would require financial assurance or a reclamation bond to ensure that the lands involved with the mining operation are reclaimed in accordance with the approved plan of operation and reclamation requirements (CFR 228.8 and 228.13).

Once the DEIS is reviewed by interested parties, including the public, and the Final EIS is completed, the SCNF Supervisor will issue a decision on FCC's proposal in a Record of Decision (ROD). If the decision is to notify the proponent of changes or additions to the plan, the ROD will describe the changes and additions that are required. This decision will be appealable. FCC may appeal the decision pursuant to 36 CFR Part 215 or 251. Other parties may appeal the decision pursuant to 36 CFR Part 215.

Following resolution of any appeal, FCC must change the plan as described in the ROD and resubmit it to the Forest Service along with any reclamation bond or other financial assurance that is required. Once the FS determines that the plan has been changed as required, and that the bond or financial assurance instrument is acceptable, it will notify FCC that the plan is approved.

As a cooperating agency, EPA participated in the development of the EIS and in the identification of the Agency Preferred Alternative. EPA's decision whether to issue an NPDES permit will be based upon the analysis in the Final EIS. Following public review of the Final EIS, EPA will issue a ROD that will document EPA's decision on FCC's permit application.

Management Direction

Salmon National Forest Land and Resource Management Plan

This analysis is tiered to the EIS for the Salmon National Forest Land and Resource Management Plan (Forest Plan). The Forest Plan was approved in January 1988 by the Regional Forester. The Forest Plan establishes long-term direction for the management and use of surface resources on the Forest, including those which could be affected by locatable mineral exploration and development activities. Forest Plan direction will be referenced in this DEIS where applicable, and will be considered as part of all Project alternatives. The proposed ICP mining project is located in Management Prescription Area 5B, which carries a management emphasis on a medium level of commercial sawtimber production. Forest Service approval of a plan of operations must be

consistent with the Forest Plan. The Forest Plan includes as a management goal for minerals to: "Encourage the legitimate exploration and extraction of leasable and locatable minerals from National Forest lands while maintaining or improving other resource values."

Project Record

This DEIS hereby incorporates by reference the Project Record (40 CFR 1502.21). The Project Record contains Specialist Reports and other technical documentation used to support the analysis and conclusions in this DEIS. Many of these Specialist Reports and supporting documents are referenced in this DEIS; key reports are available on the Project website located through the Salmon-Challis National Forest home page www.fs.fed.us/r4/sc.

The use of Specialist Reports and the Project Record meets provisions of the Council on Environmental Quality (CEQ) regulations to reduce NEPA paperwork (40 CFR 1500.4), to make EISs analytic rather than encyclopedic, and to keep EISs concise and no longer than absolutely necessary (40 CFR 1502.2). The objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at the Salmon-Challis National Forest Headquarters located in Salmon, Idaho.

Public Involvement

The CEQ defines scoping as "...an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action"' (40 CFR 1501.7). Among other things, the scoping process is used to invite public participation, to help identify issues, and to obtain public comment at various stages of the EIS process. Although scoping is to begin early, it is really an iterative process that continues until a decision is made.

Scoping is a process designed to identify environmental issues related to the proposed action. The first opportunity for public involvement occurred when the SCNF received the proposed plan of operations in 2001 and public "scoping" was conducted.

An initial information packet was distributed to interested parties on July 10, 2001 with a request for written comments, concerns, or suggestions regarding the proposed ICP and EIS being developed by the SCNF. A public meeting was held by the SCNF on July 20, 2001, at the City Center in Salmon, Idaho, and a comment form was provided for those wishing to provide written comments. Subsequent to the July 20, 2001 meeting, a Notice of Intent (NOI) to prepare an EIS for the proposed mining project was published by the Forest Service in the Federal Register on September 10, 2001. The NOI invited comments on the proponent's plan of operations and the environmental analysis for the plan of operations. Formal public scoping meetings were held by the SCNF in Challis, Idaho, on October 10, 2001, and Salmon Idaho, on October 11, 2001. The SCNF also solicited comments from more than 150 interested parties on a Forest-wide mailing list. Outreach was made to the Nez Perce Tribe and the Shoshone-Bannock Tribe through formal letters to the Tribal Chairmen, meetings, and field review.

In response to these 2001 scoping activities, the SCNF received oral and/or written comments from 58 private individuals, federal agencies, groups, Native American Tribes, local governments, businesses, and the Blackbird Mine Trustees. Since the 2001 scoping meetings, several EIS project update and informational letters inviting project-related comments have been sent to Interested Parties on the Forest-wide mailing list. In addition, several Idaho Joint Review Process (JRP) meetings have been held to receive participating agencies' comments on identified Issues, Concerns, and Opportunities (ICOs). On November 1, 2006 the Forest Service published a second NOI in the federal register to supplement and update the Notice provided in 2001. Comments received are part of the Project Record and are available for public review pursuant to the Freedom of Information Act.

Additional information on public involvement is provided at Salmon-Challis National Forest in Salmon, Idaho or in Chapter 5.

Availability of the Draft EIS

Availability of the Draft EIS was announced in the Federal Register and in notices in local papers. These notices started a 60-day comment period. The DEIS was mailed to federal and state agencies, Tribal and municipal offices, and anyone else who had requested them. The DEIS is also available for review on the SCNF website at: www.fs.fed.us/r4/sc.

Issues

Using the comments from the public, the tribes, and other agencies and organizations, the Interdisciplinary (ID) Team developed a list of issues to address in the environmental analysis. Issues are defined as a point of discussion, debate, or dispute about environmental effects. Issues were separated into two groups: significant issues and non-significant issues. The CEQ regulations specify only significant issues be analyzed. Issues determined not to be significant or that have been covered by prior environmental review are discussed only briefly and eliminated from detailed study [40 CFR 1500.1(b), 1500.2(b), 1500.4(c), 1501.7(3), 1502.2(b), 1506.3].

Significant issues are issues used to formulate alternatives to the proposed action, prescribe mitigation measures, or analyze environmental effects. The major issues identified through the public scoping and JRP are summarized below.

Non-significant issues include issues that are: outside the scope of the proposed action; already decided by law, regulation, Forest Plan, or other higher level decision; irrelevant to the decision to be made; or are conjectural and not supported by scientific or factual evidence. Non-significant issues are identified below with rationale for why they are non-significant.

Significant Issues - The significant issues identified during the scoping and analysis process include:

Issue No. and Issue		Resource Section
1)	Blackbird Mine CERCLA Remediation & Restoration	Blackbird Mine Site Activities
2)	Groundwater Quality/Panther Creek Watershed	Water Resources
3)	Surface water Quality/Panther Creek Watershed	Water Resources
4)	Water Use, Management, Treatment and Disposal	Water Resources
5)	Sediment Delivery (Storm Water Management)	Water Resources
6)	Roads and Access	Transportation
7)	Transport of Product, Chemicals, and Fuel	Transportation
8)	Socio-Economics	Socio-Economics
9)	Vegetation/Reclamation	Vegetation/Reclamation
10)	Wetlands and Other Waters of the U.S.	Water Resources
11)	Fish Populations and Habitat of Concern	Aquatic Biology
12)	Air Quality/Visual Resource/Wilderness Experience	Air Quality/Visual Resources/Wilderness
13)	Wildlife Populations and Habitat of Concern	Wildlife
14)	Cultural Resources and Tribal Trust Responsibilities	Cultural Resources
15)	Planning	Land use

Issue #1: The effects of the proposed activities on the Blackbird Mine CERCLA Remediation and Natural Resources Restoration.

Issue #2: The effects of the proposed activities on groundwater quality/Panther Creek Watershed.

Issue #3: The effects of the proposed activities on surface water quality/Panther Creek Watershed.

Issue #4: The effects of the proposed activities on water use, management, treatment and disposal.

Issue #5: The effects of the proposed activities on sediment delivery (Bucktail Creek, Panther Creek and other streams).

Issue #6: The effect of the proposed activities on roads and access management in the analysis area.

Issue #7: The effect of the proposed activities on the transportation of product and hazardous materials, chemicals, and fuels.

Issue #8: The effect of the proposed activities on socio-economics within the analysis area.

Issue #9: The effect of the proposed activities on vegetation/reclamation in the project analysis area.

Issue #10: The effect of the proposed project activities on Wetlands and Other Waters of the U.S.

Issue #11: The effect of the proposed project activities on Fish Populations and Habitat of Concern (Federally listed species, sensitive species, and Management Indicator Species).

Issue #12: The effect of the proposed project activities on Air Quality, Visual Resources and Wilderness Experience.

Issue #13: The effect of the proposed project activities on wildlife populations and habitats of concern (threatened and endangered wildlife species; Region 4 sensitive species; Management Indicator Species; and Idaho Species of Concern).

Issue #14: The effect of the proposed project activities on cultural resources and tribal trust responsibilities.

Issue #15: The effect of the proposed project activities on Forest planning.

Non-significant Issues - The following issues were identified through the scoping process and project review and subsequently determined to be non-significant:

1. Claim Validity;
2. Water Rights;
3. Public Access and Recreation; and
4. Soil Productivity.

Non-significant Issue #1: Claim Validity

Summary of Issue Analysis - During the public scoping process, a comment was provided that there is "no] substantial evidence that mining claims covering this site meet the (validity) requirements." The Idaho Cobalt Project and associated mining claims are located on National

Forest system lands reserved from public domain and open to entry under the mining law. The Forest Service is not required to inquire into claim validity before processing and approving proposed plans of operations on these lands.

Non-significant Issue #2: Water Rights

Summary of Issue Analysis - During the public scoping period, a comment was provided requesting: "clarification in the water rights section as to where these rights come from, whom they are junior to and who is impacted as senior users." Idaho Department of Water Resources (IDWR) administers water rights in the State of Idaho. FCC has applied to the IDWR for several water rights necessary for the proposed pumping of groundwater from the underground mines.

Non-significant Issue #3: Public Access and Recreation

Summary of Issue Analysis - Public vehicle access to the proposed and potentially operational Idaho Cobalt Mine project site and FCC mining claims is controlled via the main access road to the Blackbird Mine CERCLA remediation site, and public access is restricted unless accompanied by either a Blackbird Mine representative, a FCC representative, or Forest Service representative. Future public access to FCC's proposed operational Idaho Cobalt Mine project site, via the Blackbird Mine CERCLA remediation site, would continue to be restricted and controlled, via Noranda CERCLA site access requirements.

The EIS/ID Team considered the effects of the proposed action to recreationists using portions of SCNF Forest Roads 021 (Williams Creek Road), 101 (Deep Creek Road), 055 (Panther Creek Road) and 115 (Blackbird Creek Road) proposed to be used for project-related transportation of employees, equipment, product, hazardous materials, chemicals and fuels, as well as along alternative transportation route(s). No public comments were received during the scoping process regarding the effects on recreational opportunities along the proposed or alternative transportation route(s). Recreation activities along these FS roads include use of small road-side campgrounds, sightseeing, travel to trailheads, hunting, fishing, and berry picking. Improvements in road condition may result in a slight increase in recreational road use and may benefit recreation users traveling through the area. Transportation impacts associated with increased mine-related traffic are addressed in Chapter 4, Roads and Access Management Section.

Non-significant Issue #4: Soil productivity

Summary of Issue Analysis - Forest Plan soil standards are designed to maintain soil productivity within a certain proportion of an activity area. The standards require:

- A minimum of 80 percent of an activity area will remain in a non-detrimentally disturbed condition. Detrimental disturbance is "The alternation of the natural soil characteristics which result in significant or prolonged degradation of off-site resource quality standards…"
- Total or essentially total soil resource commitment will not exceed 5 percent of an activity area. Total soil resource commitment is defined as: "A conversion of a productive site to an essentially nonproductive site for a period of more than 50 years."

The Forest Plan (USFS, 1988) defines an activity area as "The total area for which a ground impacting activity is planned…This definition excludes site intensive developments such as campgrounds, mines, drill sites, aggregate source areas, roads, and water development." Activities that could affect soils in the ICP project are mining and mining-related activities, including adits, portals, ore transportation tram, mine backfill tailing slurry pipeline, mill and associated ancillary facilities, tailing and waste rock storage, water management reservoir areas, surface water and ground water monitoring sites, and mining-related access road construction and use. However, the project effects are not significant to soil productivity as defined by the Forest Plan as total disturbance for all alternatives would be less than the 80% detrimental disturbance criterion and the "total soil resource commitment" is less than 5% of the Project Area. Impacts to soils from the proposed

activities in relation to slope stability and erosion are addressed in the Soil and Water Resources, Fisheries Resource, Roads and Access Management sections of Chapter 4.

Legal Requirements

Table 1-1 identifies major permits, approvals, and consultations potentially required for the Idaho Cobalt Project. Additionally, this DEIS addresses the following regulatory requirements.

TABLE 1-1. Major Permits, Approvals, and Consultations Potentially Required for the Idaho Cobalt Project

Issuing Agency/Permit or Approval Name	Nature of Permit Action	Applicable Project Component	Status of Permit or Approval Action
FOREST SERVICE (SALMON - CHALLIS NATIONAL FOREST)			
Approved Plan of Operations; Mine and Reclamation Plan	Compliance with the mining operation and reclamation requirements of 36 CFR 228A; compliance with the management direction of the Salmon National Forest Land Resource Management Plan	All ICP proposed mining and reclamation activities	On-going review and consideration of Alternatives; required for issuance of ROD
Endangered Species Act Section 7	Consultation with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA)	All ICP mining and reclamation activities	On-going consultation with the USFWS and NOAA; completion required prior to issuance of ROD
Migratory Bird Treaty Act of 1918	Compliance with 2001 Executive Order 131; Responsibilities of Federal Agencies to Protect Migratory Birds	All ICP mining and reclamation activities	On-going consideration of potential impacts/effects
1872 General Mining Law as amended (30 USC 22, *et. seq.*)	Compliance required as portion of FS review of ICP Plan of Operations, Mine and Reclamation Plan	All ICP mining and reclamation activities	On-going review; compliance required prior to issuance of ROD
Consultation with Indian Tribes	Compliance with the consultation requirements included in various Acts and Executive Orders	All ICP mining and reclamation activities that may potentially affect religious practices, other traditional cultural uses, as well as cultural resource sites and remains associated with American Indian ancestors	Consultation with the Shoshone-Bannock and Nez Perce Tribes is on-going
National Historic Preservation Act (Section 106)	Consideration of nonrenewable cultural resources that may be damaged or destroyed; completion of cultural and historic resources on-site surveys and recordation	All proposed surface disturbance associated with the ICP mining and reclamation activities	Cultural and Historic resources surveys have been completed and potential impacts/effects included in the DEIS
Forest Road Use Permit	Regulation of the construction, reconstruction, use, signing and maintenance of Forest System Roads, including direction for spill response for hazardous materials on Forest roads	ICP proposed transportation route on Forest roads, and all required Forest road improvements	A Forest Road Use Permit for the ICP transportation route and necessary safety improvements will be required prior to project implementation
Resource Conservation and Recovery Act program (RCRA)	Management of hazardous waste	Storage and off-site disposal of hazardous waste associated with ICP	A Spill Prevention and Response Plan (SPRP) has been prepared by the ICP
Storm Water Pollution Prevention Plan (SWPPP)	Compliance with Non-degradation Water Quality Standards	Storm water discharges from ICP facilities	Plan approval required for ICP operations

TABLE 1-1. Major Permits, Approvals, and Consultations Potentially Required for the Idaho Cobalt Project (continued)

Issuing Agency/Permit or Approval Name	Nature of Permit Action	Applicable Project Component	Status of Permit or Approval Action
Groundwater Quality Rules	Compliance with groundwater protection standards regarding contaminants.	Potential infiltration of contaminants to groundwater associated with project operations i.e. water management ponds, Land Application Treatment, and post-mining management of groundwater in underground mines	Demonstration of compliance with Idaho's anti-degradation standards will be required. Idaho may establish a groundwater Mineral Extraction Area within which certain groundwater requirements may be waived.
Water Quality Certification, Section 401, Clean Water Act	Certification of the U.S. Army Corps of Engineers (COE) Section 404, Clean Water Act permits (Waters of the U.S. and Wetlands) issued by the COE and NPDES discharge permits issued by EPA. IDEQ certifies that the permitted activity complies with Section 401 of the CWA and that discharges comply with state water quality standards.	Wetlands and Other Waters of the U.S. (as defined by Section 404 of the Clean Water Act) affected by the ICP and discharge of excess project water to surface water	Approval is required prior to approval of a plan of operations and issuance of CWA 402 (NPDES) and 404 permits
New sewage treatment facilities	Approval of plans and specifications for new sewage treatment facilities. Safe Drinking Water Act compliance. Compliance with Idaho Solid Waste Management Regulations and Standards	New sewage treatment facility (drainfield)	Approval required prior to project construction
U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)			
National Pollutant Discharge Elimination System (NPDES) Permits under Section 402 of the Clean Water Act	Authorizes the discharge of wastewaters and stormwater under conditions of the NPDES permit. Permit conditions based on CWA, NPDES regulations, and state water quality standards.	All project components that will result in a point source discharge of pollutants to waters of the US, including: mine drainage, runoff from waste storage areas, discharge from TWSF, stormwater.	A draft new source permit for the discharge of wastewater will be public noticed with the draft EIS. FCC intends to apply for coverage under the construction stormwater general permit and industrial multisector stormwater general permit prior to construction and operations, respectively. EPA will make decisions on stormwater permit coverage after FCC submits the NOIs.
Spill Prevention Control and Countermeasure (SPCC) Plan	Provides management direction for spills	Bulk petroleum products storage	Review of ICP's SPCC is on-going. An approved SPCC will be required within six months of starting operations
NEPA	Issuance of an NPDES permit to a new source triggers compliance with NEPA. Under Clean Air Act section 309, EPA reviews all federal EISs.	All parts of the project	EPA is a cooperating agency in development of the EIS. EPA will adopt the EIS and issue a NEPA ROD after the final EIS is issued.
ESA, Section 7	Consultation with the USFWS and NOAA	NPDES discharge and permit	Consultation must be complete before issuance of the NPDES permit and ROD.

TABLE 1-1. Major Permits, Approvals, and Consultations Potentially Required for the Idaho Cobalt Project (continued)

Issuing Agency/Permit or Approval Name	Nature of Permit Action	Applicable Project Component	Status of Permit or Approval Action
National Historic Preservation Act (Section 106)	Consideration of nonrenewable cultural resources that may be damaged or destroyed; completion of cultural and historic resources on-site surveys and recordation	All proposed surface disturbance associated with the ICP mining and reclamation activities	Required prior to issuance of Permit/ROD
Consultation with Indian Tribes	Compliance with the consultation requirements included in various Acts and Executive Orders	All ICP mining and reclamation activities that may potentially affect religious practices, other traditional cultural uses, as well as cultural resource sites and remains associated with American Indian ancestors	Consultation with the Shoshone-Bannock and Nez Perce Tribes is on-going
U.S. FISH AND WILDLIFE SERVICE(USFWS)/ NATIONAL OCEANIC ATMOSPHERIC ADMINISTRATION (NOAA)			
Endangered Species Act compliance (Section 9)	Protection of threatened and endangered species	Any ICP activity, including habitat disturbance, potentially affecting listed or proposed threatened and endangered species	Biological Assessment/Biological Evaluations (BA/BE) have been prepared; consultation is on-going
Magnuson Stevens Fishery Conservation and Management Act	Establishes Essential Fish Habitat (EFH)	Any ICP activity, including habitat disturbance, potentially affecting EFH	BA/BE has been prepared and consultation is on-going
Migratory Bird Treaty Act	Protects migratory birds	All ICP surface disturbing activities	BA/BE has been prepared and consultation is on-going
Bald Eagle Protection Act	Protects bald and golden eagles	All ICP surface disturbing activities	BA/BE has been prepared and consultation is on-going
U.S. ARMY CORPS OF ENGINEERS (COE)			
Permit to discharge dredged or fill material (Clean Water Act, Section 404)	Authorizes placement of fill or dredged material in waters of the U.S. or adjacent jurisdictional wetlands	Any ICP operating or reclamation activities directly affecting wetlands or waters of the US by dredge or fill	Jurisdictional wetlands would be affected by road and pipeline disturbance; ICP has not yet submitted a 404 permit application
Endangered Species Act Section 7	Consultation with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA)	Wetlands disturbances	Consultation with the USFWS and NOAA; completion required prior to issuance of ROD
National Environmental Policy Act	Required for significant federal actions including issuance of 404 permit	404 Permit	Required prior to issuance of Permit/ROD
National Historic Preservation Act (Section 106)	Consideration of nonrenewable cultural resources that may be damaged or destroyed; completion of cultural and historic resources on-site surveys and recordation	All proposed surface disturbance associated with the ICP mining and reclamation activities	Required prior to issuance of Permit/ROD
BUREAU OF ALCOHOL, TOBACCO, AND FIREARMS			
High Explosives Permit	Possession of explosives	Blasting in underground mines	Personnel involved in blasting activities require appropriate certification

TABLE 1-1. Major Permits, Approvals, and Consultations Potentially Required for the Idaho Cobalt Project (continued)

Issuing Agency/Permit or Approval Name	Nature of Permit Action	Applicable Project Component	Status of Permit or Approval Action
IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY (IDEQ)			
Air Quality Permit	Compliance with the requirements and air quality standards of the State of Idaho (Idaho Clean Air Act) regarding the release of air pollutants	Elements that contribute to air quality issues, such as blasting or hauling emissions	An ICP Air Quality permit application is pending
Resource Conservation and Recovery Act program (RCRA)	Management of hazardous waste	Storage and off-site disposal of hazardous waste associated with ICP	A Spill Prevention and Response Plan (SPRP) has been prepared by the ICP
Storm Water Pollution Prevention Plan (SWPPP)	Compliance with Non-degradation Water Quality Standards	Storm water discharges from ICP facilities	Plan approval required for ICP operations
Groundwater Quality Rules	Compliance with groundwater protection standards regarding contaminants.	Potential infiltration of contaminants to groundwater associated with project operations i.e. water management ponds, Land Application Treatment, and post-mining management of groundwater in underground mines	Compliance will require demonstration of compliance with applicable narrative and numeric ground water quality standards, except as allowed under the Active Mineral Extraction provisions in the Ground Water Quality Rule.
Water Quality Certification, Section 401, Clean Water Act	Application of state Water Quality Standards, including, but not limited to, Water Quality Certifications under section 401 of the Clean Water Act." In addition, please replace the language under Nature of Permit Action with "Application of state Water Quality Standards, including certification of any permit authorized by section 402 or 404 of the Clean Water Act.	Wetlands and Other Waters of the U.S. (as defined by Section 404 of the Clean Water Act) affected by the ICP and discharge of excess project water to surface water	Approval is required prior to project construction and issuance of CWA 402 (NPDES) and 404 permits
New sewage treatment facilities	Approval of plans and specifications for new sewage treatment facilities. Safe Drinking Water Act compliance. Compliance with Idaho Solid Waste Management Regulations and Standards	New sewage treatment facility (drainfield)	Approval required prior to project construction
IDAHO DEPARTMENT OF WATER RESOURCES (IDWR)			
Water Rights	Compliance with state requirements for protection of waters with Idaho (IAC IDAPA 58.01.02)	Extraction and management of groundwater associated with the ICP underground mines	FCC has applied for several water rights and the applications are under review by IDWR
Underground Injection Permit	Compliance with Injection Well requirements IDAPA 37.03.03	Mine tailings backfill and TWSF infiltration gallery	Notification or permit application would occur prior to backfill/injection
310 Permit	Compliance with the 310 regulations	Construction activities in stream channels	Permit required for some surface water monitoring sties; culverts, roads and bridges

TABLE 1-1. Major Permits, Approvals, and Consultations Potentially Required for the Idaho Cobalt Project (continued)

Issuing Agency/Permit or Approval Name	Nature of Permit Action	Applicable Project Component	Status of Permit or Approval Action
IDAHO STATE HISTORIC PRESERVATION OFFICE (SHPO)			
National Historic Preservation Act compliance (Section 106)	Protects cultural and historical resources	All ICP surface disturbing activities	Consultation with the SHPO regarding cultural and historical resource on-site surveys will be required
LEMHI COUNTY			
Building Permit	Compliance with Lemhi County building codes and approved land uses	Construction of all ICP buildings	Permit approval required prior to construction of ICP buildings

The Endangered Species Act (ESA) of 1973, as amended

The purposes of this Act are to provide for the conservation of threatened and endangered species and their habitats. Federal agencies (SCNF, EPA, COE) are required by the ESA to ensure that any actions it approves will not jeopardize the continued existence of threatened and endangered species or result in the destruction or adverse modification of critical habitat. The SCNF and EPA are preparing a biological assessment that evaluates the potential effects of proposed activities on threatened and endangered species or critical habitat that may be present in the analysis areas. The assessments include any measures the SCNF and EPA believe are needed to minimize or compensate for effects on the species.

The Migratory Bird Treaty Act of 1918

The purpose of this Act is to establish an international framework for the protection and conservation of migratory birds. Additional information on the Migratory Bird Treaty Act can be found in the Wildlife Resources section, Chapter 3.

The Federal Water Pollution Control Act of 1972 (PL 92-500) as amended in 1977 (PL 95-217) and 1987 (PL 100-4), also known as the Federal Clean Water Act (CWA)

The primary objective of this Act is to restore and maintain the integrity of the nation's waters by: 1) Eliminating the discharge of pollutants into the nation's waters; and 2) Achieving water quality levels that are fishable and swimable. Section 401 of the CWA requires that states certify that proposed major federal actions (in the case of the ICP permits under sections 402 and 404 of the CWA) will comply with applicable State laws and regulations; the State of Idaho will undertake 401 review and certification of the NPDES and 404 permits for the ICP. Section 402 of the CWA established the National Pollution Elimination Discharge System (NPDES) permit program that regulates discharge from point sources to waters of the U.S; NPDES permits for discharges of process wastewater and stormwater will be required for the ICP. Section 404 of the CWA regulates discharge of dredge or fill material to wetlands and waters of the U.S.; a 404 permit will be required for the ICP. The Clean Water Act establishes a non-degradation policy for all federally proposed projects to be accomplished through planning, application, and monitoring of Best Management Practices (BMPs). Identification of BMPs is mandated by Section 319 of the Water Quality Act of 1987 (also referred to as the Clean Water Act), which states, "It is national policy that programs for the control of non-point sources of pollution be developed and implemented."

The Clean Air Act, as amended in 1990

The purposes of this Act are "…to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to State and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs." Additional information on the Clean Air Act is provided in the Air Quality section, Chapter 3.

Federal Noxious Weed Act of 1974

This Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The Act requires that each federal agency develop a management program to control undesirable plants on federal lands under the agency's jurisdiction; establish and adequately fund the program; implement cooperative agreements with state agencies to coordinate management of undesirable plants on federal lands; establish integrated management systems to control undesirable plants targeted under cooperative agreements. Additional information regarding noxious weeds is provided in the Vegetation section, Chapter 3.

The Preservation of American Antiquities Act of 1906

This Act makes it illegal to "…appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned by the Government of the United States…". Concurrence has been reached with the Idaho State Historic Preservation Office regarding impacts to cultural resources in the Idaho Cobalt Mine project area. Additional information regarding cultural resource compliance is provided in the Cultural Resources section, Chapter 3.

The National Historic Preservation Act

This Act requires federal agencies to consult with State and local groups on Federal undertakings before nonrenewable cultural resources, such as archaeological sites and historic structures are damaged or destroyed. Section 106 of this Act requires federal agencies to review the effects that project proposals may have on the cultural resources in the project area. It requires agencies to consider the effects of undertakings on properties eligible to or listed in the National Register of Historic Places by following the regulatory process specified in 36 CFR 800. Additional information regarding compliance with Section 106 is provided in the Cultural Resources section, Chapter 3.

Consumers, Civil Rights, Minorities, and Women

All Forest Service actions have potential to produce some form of impacts, positive or negative, on the civil rights of individuals or groups, including minorities and women. The need to conduct an analysis of this potential impact is required by Forest Service Manual and Forest Service Handbook direction.

Environmental Justice

On February 11, 1994, President Clinton signed Executive Order 12898. This order directs each federal agency to make environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. The President also signed a memorandum on the same day, emphasizing the need to consider these types of

effects during NEPA analysis. To meet this direction, the USDA requires that where proposals have the potential to disproportionately adversely affect minority or low-income populations, these effects must be considered and disclosed (and mitigated to the degree possible) through the NEPA analysis and documentation. Additional information is provided in Chapter 3.

Salmon-Challis National Forest Responsibilities to Federally Recognized Tribes

American Indian Tribes are afforded specific rights under various federal statutes that include: the National Historic Preservation Act (NHPA) of 1966 (as amended); the National Forest Management Act of 1976 (P.L. 4-588); the Archaeological Resources Protection Act of 1979 and Regulations 43 CFR Part 7; the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 and Regulations 43 CFR Part 10; the Religious Freedom Restoration Act of 1993 (P.L. 103-141); and the American Indian Religious Freedom Act (AIRFA) of 1978. Federal guidelines direct federal agencies to consult with modern American Indian tribal representatives who may have concerns about federal actions that may affect religious practices, other traditional cultural uses, as well as cultural resource sites and remains associated with American Indian ancestors. Any tribe whose aboriginal territory occurs within a project area is afforded the opportunity to voice concerns for issues governed by NHPA, NAGPRA, or AIRFA.

Federal responsibilities to consult with Indian tribes are included in the National Forest Management Act of 1976 (P.L. 4-588), Interior Secretarial Order 3175 of 1993 and Executive Orders 12875, 13007, 12866, and 13084. Executive Order 12875 calls for regular consultation with tribal governments; and Executive Order 13007 requires consultation with Indian tribes and religious representatives on the access, use, and protection of Indian sacred sites. Executive Order 12866 requires that federal agencies seek views of tribal officials before imposing regulatory requirements that might affect them; and Executive Order 13084 provides direction regarding consultation and coordination with Indian Tribes relative to fee waivers. Another Executive Order that pertains to American Indian Tribes includes Executive Order 12898, which directs federal agencies to focus on the human health and environmental conditions in minority and low-income communities, especially in instances where decisions may adversely impact these populations (see the “Environmental Justice” discussion above). The 40 CFR 1500-1508 regulations of the NEPA invite Indian tribes to participate in forest management projects and activities that may affect them.

The Idaho Cobalt Mine project area is located within the ceded lands of Shoshone-Bannock Tribes. Ceded lands are federal lands on which the federal government recognizes that a tribe has certain inherent rights conferred by treaty. In the Fort Bridger Treaty of 1868, Article 4, the United States of America and the Shoshone-Bannock Tribes mutually agreed that the Tribes retain the right to:

> "…hunt on the unoccupied lands of the United States so long as game may be found thereon…"

The Tribes maintain that the word "hunt" in the Treaty also applied to fishing, since the word was used by the Tribes to mean the taking of all wild food. Information regarding the on-going FS consultation process with the Shoshone-Bannock, as well as the Nez Perce Tribe is provided in the Cultural Resources section of Chapter 3.

Financial Assurance

The Forest Service is required to hold a bond or other financial assurance for all plans of operations to assure reclamation of surface disturbances to prevent or control damage to the environment, to control erosion, landslides, water runoff and toxic materials and to provide for rehabilitation of fish and wildlife habitat (40 CFR 228.13). The Forest Service has developed guidance for calculating the amount of financial assurance required (USDA Forest Service, 2004). In developing the financial assurance amount for the Idaho Cobalt Project, the Forest Service has followed the 2004 guidance

and included costs to remove structures, regrade and recontour the surface, replace soil and revegetate the reclaimed land. The financial assurance also includes necessary administrative and overhead costs to complete the reclamation if the company were unable or unwilling to do so and costs for long term water treatment, if such treatment were to be required to meet water quality requirements.

Other Agencies Having Permit or Review Authority

Idaho State Historic Preservation Office (SHPO)

Actions that are permitted, approved, or initiated by the Forest Service and that may affect cultural resources must comply with provisions of the National Historic Preservation Act (NHPA) of 1966, as amended, and as implemented by federal guidelines 36 CFR 800. Section 106 of the NHPA requires a federal agency to take into account the effects of the agency's undertaking on properties listed on, or eligible for listing on, the National Register of Historic Places (NRHP). Before any federal undertaking begins, cultural resources eligible for listing on the NRHP must be identified and documented. Cultural resources recorded in the project area are evaluated in consultation with SHPO or the Federal Advisory Council on Historic Preservation (ACHP).

Additional information regarding consultation and the documentation of the site is available in the Cultural Resources section, Chapter 3.

U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Association (NOAA) Fisheries

The USFWS has responsibilities under the Fish and Wildlife Coordination Act (1934), Endangered Species Act (1973), and Bald Eagle Protection Act (1940). Responsibilities under the Fish and Wildlife Coordination Act require federal agencies issuing permits (i.e., Corps of Engineers § 404 Permit) to consult with the USFWS to prevent the loss of or damage to fish and wildlife resources where “waters of any stream or other body of water are proposed...to be impounded, diverted...or otherwise controlled or modified.”

NOAA-Fisheries is the federal agency responsible for the stewardship of the nation's living marine resources and their habitat. The public trust responsibility is derived from numerous laws, primary of which are the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA).

U.S. Army Corps of Engineers (COE)

COE is the permitting authority for the discharge of dredged or fill materials into the wetlands and non-wetland waters of the United States. Any activities that would result in disposal of dredged or fill materials into wetlands and non-wetland waters of the U.S. would require a “404 permit” and Section 401 Water Quality Certification under Sections 404 and 401 of the Clean Water Act (see **Table 1-1**). Additional information is provided in the Soil and Water Resources sections, Chapter 3.

U.S. Environmental Protection Agency (EPA)

EPA has primary responsibility for implementing the Clean Water Act (CWA) Sections 301, 306, 311, and 402. The EPA has oversight responsibility for federal Clean Water Act programs delegated to and administered by the Department of Environmental Quality. In Idaho, EPA administers the National Pollutant Discharge Elimination System program that regulates and grants permits to discharge to surface waters. EPA also has authority under CWA Section 404 to review project compliance with Section 404(b)(1) guidelines and 404 permit veto authority under Section 404(c). Under Section 404(c), EPA may prohibit or withdraw the specification (permitting) of a site upon

determination that use of the site would have an unacceptable adverse effect on municipal water supplies, shellfish beds, fishery areas, or recreational areas. EPA also has responsibilities under NEPA and the federal Clean Air Act Section 309 to cooperate in the preparation of EISs and to review draft EISs and federal actions potentially affecting the quality of the environment. EPA advises the lead agencies on the preparation of an EIS and evaluates the adequacy of information in the EIS, the overall environmental impact of the proposed action, and various alternatives.

Idaho Department of Water Resources (IDWR)

IDWR administers water rights in the State of Idaho regarding new appropriation and use of surface and/or groundwaters. Compliance with state requirements for protection of waters within Idaho (Idaho Administrative Code IDAPA 58.01.02) means: "The existing in-stream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected;" and "…wherever attainable, surface waters of the state shall be protected for beneficial uses, which for surface waters includes all recreational use in and on the water surface, and the preservation and propagation of desirable species of aquatic life."

IDWR also administers construction, operation and abandonment of injection wells under the authority of IDAP 37.03.03.

Idaho Department of Environmental Quality (IDEQ)

The IDEQ is responsible for implementing environmental protection laws and programs for the State of Idaho. IDEQ develops and implements state Water Quality Standards and Total Maximum Daily Loads and other surface water quality programs authorized by the Clean Water Act and state law. IDEQ is also responsible for applying the Idaho Ground Water Quality Rule. IDEQ administers the CAA and RCRA programs in Idaho, and also regulates non-hazardous solid waste and waste treatment and disposal facilities, including sewage disposal facilities.

Under the Idaho Ground Water Quality Rule (IDAPA 58.01.11), groundwater must (a) be managed in a manner which maintains or improves existing ground water quality through the use of best management practices and best practical methods to the maximum extent practical. (IDAPA 58.01.11.150.01 and 58.01.11.301); (b) not result in the violation of the ground water quality standards in section 200 of the Rule (IDAPA 58.01.11.150.01 and 58.01.11.200); and (c) not result in the violation of surface water quality standards or the impairment of beneficial uses for interconnected surface water. (IDAPA 58.01.11.150.03 and the Idaho Water Quality Standards, IDAPA 58.01.02.

Section 054 of the Idaho Water Quality Standards (IDAPA 58.01.02), requires that there be no new or increased discharge of pollutants which have caused the water quality impairment to impaired (303(d) listed) streams unless the total load of such pollutants remains constant or decreases within the watershed. Idaho's anti-degradation provision requires that the existing level of water quality necessary to protect existing uses be maintained (IDAPA 58.01.02.051). Section 080.01 and the numeric and narrative water quality criteria prohibit the discharge of pollutants from a single source, or in combination with pollutants discharged from other sources, which will or can be expected to result in violation of the water quality criteria applicable to the receiving water body or injure designated or existing beneficial uses.

CHAPTER 2. ALTERNATIVES

Introduction

This chapter describes and compares the alternatives considered for the project, summarizes how the alternatives meet the Purpose and Need and address the issues presented in Chapter 1. The alternatives represent a range of possible actions determined by the major issues, the Purpose and Need, Salmon National Forest Land and Resource Management Plan (Forest Plan), and federal and state laws and regulations. A range of reasonable alternatives was developed by the project's EIS team (EIS Team), Forest Service (FS) Interdisciplinary Team (ID Team), and other state and federal agency members of the Idaho Joint Review Process (JRP) and consultation with technical staff of the Nez Perce and Shoshone – Bannock Tribes. In addition to the alternatives considered in detail a number of alternatives were considered but eliminated from further analysis.

Alternatives Considered In Detail

The Agencies developed alternatives (including "No Action") that have been considered in detail along with the proponent's plan (Alternative II). The Agency alternatives (III, IV and V) were developed in response to FCC's proposed Plan of Operations using issues raised by the public, the EIS Team, the FS ID Team, Tribal Governments, and other participating state and federal agencies and organizations. A description of the five alternatives evaluated in detail in this DEIS follows. All alternatives considered in detail are consistent with the management direction identified in the Salmon National Forest Plan (USFS, 1988). A number of changes and mitigation measures have been developed by the agencies for Alternatives III, IV and V to address issues raised in the scoping process, to minimize impacts to resources or to provide an analysis of a wide range of reasonable alternatives.

The Agencies' objectives used to guide the development of the modifications and mitigation measures contained in the Agency alternatives include:

- Assure that the ICP does not interfere with the Blackbird Superfund cleanup.
- Assure compliance with relevant state and federal laws and regulations.
- Assure compliance with the Forest Plan.
- Minimize impacts to surface and groundwater quantity and quality and ensure that there are no material negative impacts to surface waters or groundwater quality.
- Provide for reclamation that returns disturbed lands to stable natural vegetation communities as quickly as practical.
- Minimize waste streams that would require treatment or disposal.
- Address uncertainties to minimize long term risks to the environment.
- Minimize surface disturbance to the extent practical.
- Assure that monitoring and reporting requirements allow efficient and effective oversight of project activities.

Alternative I - No Action

The National Environmental Policy Act (NEPA) requires consideration of a "No Action" alternative. However, under Forest Service mining regulations at Title 36 Code of Federal Regulations (CFR) 228 Subpart A, this option can only be considered for comparison purposes in processing a plan of operation, provided that it has been properly submitted under the authority of the U.S. Mining Laws. For example, some proposed plans or parts of proposed plans of operation may not represent logical and sequential development of mineral property, may not be feasible, may not comply with applicable

state or federal laws, or may not be reasonably incident to mining. In such cases, the Forest Service may not simply deny approval of the plan, but has the obligation to notify the operator as required under 36 CFR 228.5, of changes to be made that are necessary for its approval. Ultimately, in accordance with law and regulation, holders of valid mining claims have a legal right to develop their claims and a reasonable plan of operations must be identified and approved.

Alternative II - Formation Capital Corporation's Proposed Plan Of Operations

This alternative is Formation Capital Corporation U.S.'s (FCC or Formation) proposed plan of operations (POO) for the Idaho Cobalt Project. The proposed plan submitted by FCC would allow for mineral development of FCC mining claims located in the Panther Creek drainage on the Salmon-Cobalt Ranger District, Salmon-Challis National Forest. The FCC property is composed of several mineral deposits acquired by locating and filing mining claims. The property consists of 145 unpatented mining claims for a total of 2524 acres of mineral rights. FCC's proposed plan of operations consists of an underground cobalt-copper-gold mine consisting of two separate ore bodies, a processing plant, and associated facilities **(Figure 2-1)**.

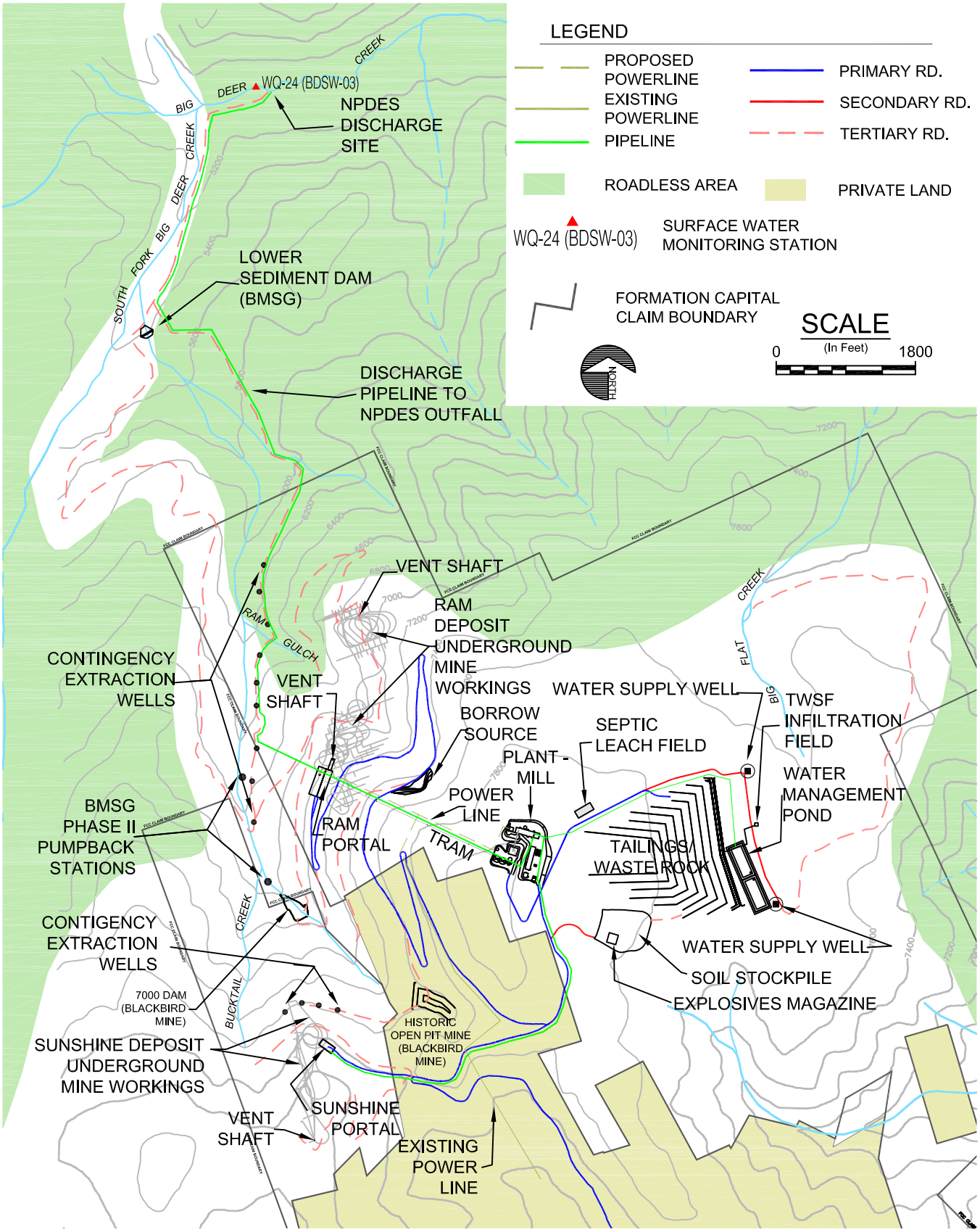
The proposed POO was described in the following documents provided by FCC to the Forest Service beginning in 2001:

- FCC Proposed Plan of Operations, January 22, 2001;
- FCC Proposed Plan of Operations, February 4, 2005;
- FCC Proposed Plan of Operations, replacement pages, February 18, 2005;
- FCC Revised Plan of Operations April 2006; and
- FCC Revised Plan of Operations June 2006.

A list of additional reports submitted by FCC in support of the proposed Plan of Operations is provided in Appendix A of this DEIS.

The following bullet statements provide a summary of FCC's proposed plan. Under the proposed plan (see **Figure 2-1**), FCC would:

- Develop two separate underground mining operations to extract ore from two deposits, the Ram and the Sunshine.
- Transport Ram ore and waste rock from the Ram portal to a mill (ore processing) facility located on the Big Flat area initially by haul truck and potentially later by overhead tram.
- Transport the Sunshine ore and waste rock via haul trucks to the mill and tailing and waste rock storage facility (TWSF).
- Construct and operate an ore processing mill (flotation) and ancillary facilities located on the Big Flat between the drainages of Big Deer Creek and Little Deer Creek. Ancillary facilities would include water treatment, offices, warehouse, change rooms, shipping and receiving docks, emergency sleep quarters, and other structures.
- Dewater tailings prior to placing them in the TWSF.
- Place stabilized water treatment waste in the TWSF including leaving the TWSF open post mining to accept stabilized waste if post closure water treatment is necessary.
- Utilize paste tailings in backfilling the Ram underground workings.
- Discharge excess treated water via a pipeline to Big Deer Creek in accordance with a discharge permit.
- At the end of the operational mining period, the mine workings would be allowed to fill with groundwater and groundwater and minewater from the mines would be released to the watershed. If operational water quality monitoring indicates that release of minewater would cause unacceptable water quality impacts, a bedrock groundwater capture well system would be used to capture mine water that flows out of the mine workings during the closure period. Captured water would be treated and discharged via a pipeline to Big Deer Creek.



July, 2006

IDAHO COBALT PROJECT FORMATION CAPITAL CORPORATOIN, U.S. LEMHI COUNTY, IDAHO	**GENERAL FACILITY LOCATION ALTERNATIVE II**	**FIGURE** **2-1**

- Provide replacement wetlands during operations to mitigate impacts to non-jurisdictional wetlands impacted by the TWSF.
- Conduct a comprehensive operational and post-operational (closure) surface water and groundwater quality monitoring and reporting program.
- Use a year-round transportation route as shown on **Figure 2-2** for employees and transportation of concentrate, equipment, reagents, and other freight.
- Post a bond or other financial security sufficient to allow the Forest Service to reclaim the project should the company be unable or unwilling to do so.
- Obtain agreements with Noranda to utilize existing roads on private property.

Project Development Schedule

There would be three main phases in the life of the ICP: the construction phase (approximately two years), the operating phase (ten to twelve years), and the reclamation/closure phase (two years for surface reclamation and up to thirty or more years of post mine water treatment and monitoring). There would also be concurrent reclamation in the construction and operating phases as existing disturbed areas or new disturbances are reclaimed post-use except if the TWSF remains open for disposal of stabilized water treatment waste.

The construction phase would include improving existing roads, constructing new roads, constructing the Ram portal, mill, and power line and substation, constructing additional groundwater monitoring wells and groundwater capture wells, constructing the first phase of the TWSF and preparing and constructing the water treatment plant.

The operating phase would bring the mill on line at 400 tons per day; increasing to 800 tons per day as the underground Ram mine expands. Ongoing mine development would include constructing the Sunshine portal and developing the underground Sunshine mine. The TWSF would be expanded to final capacity.

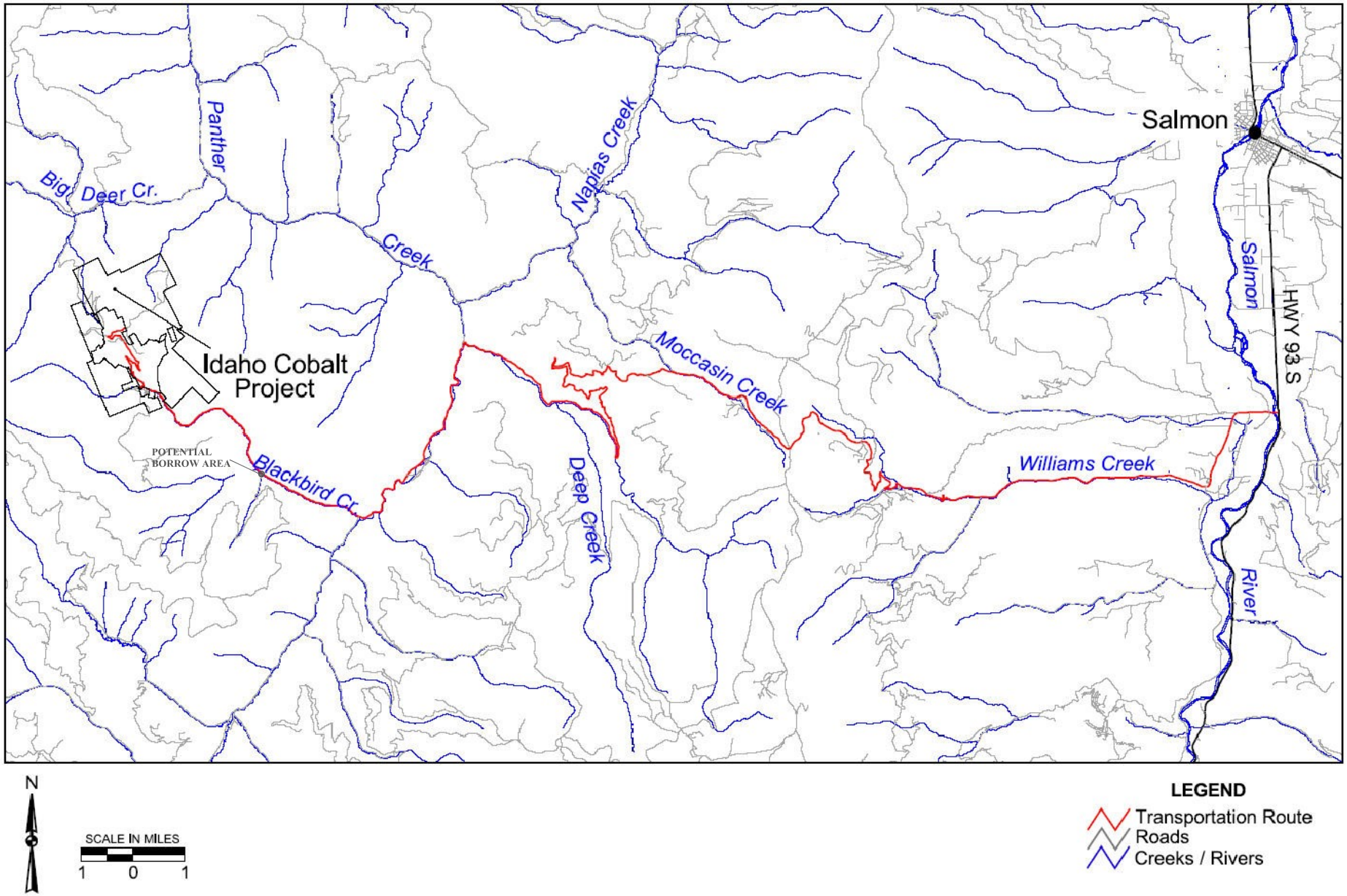
The reclamation and closure phase would focus on reclaiming lands disturbed by FCC's mining activities and providing for long-term management of the reclaimed facilities and mine water following cessation of mining and dewatering. There would be limited concurrent reclamation during the operations phase, primarily on completed portions of the TWSF. The reclamation phase would include final shaping, covering, and vegetation of the TWSF, sealing mine portals and demolishing the mill and tram system. Ultimately as they are no longer needed the water treatment system, power line, substation, and roads would be reclaimed.

Transportation

FCC's proposed transportation route for employees and supplies is via Williams Creek Road to the Williams Creek Summit, from there to the Deep Creek Road, then to the Morgan - Panther Creek Road, and Blackbird Creek Road (**Figure 2-2**). FCC estimates that 10 vans would be required daily to transport employees to and from the site. In addition to the above, four pickup trucks are anticipated to be required daily for management personnel. FCC's proposed employee transportation route is also proposed to be used for the transportation of concentrate, equipment, reagents, and other freight. **Table 2-1** outlines FCC's anticipated list of chemicals, reagents and operating supplies that would be transported to and from the mine.

Transportation Plan

FCC has developed Transportation Procedures and Plans (Appendix 12 of the Transportation Baseline Report and Transportation Plan, TTE, 2006) for access to and from the ICP site for personnel, contractors, equipment, and supplies, including transportation of concentrate.



IDAHO COBALT PROPERTY FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**PROPOSED TRANSPORTATION ROUTE**	**FIGURE** **2-2**

TABLE 2-1. Chemicals, Reagents and Operating Supplies – Idaho Cobalt Project				
Reagent / Chemical or Product	**Annual Use**	**Container Type**	**Container Size**	**Trucks/Year (per day)[1]**
AERO® 343 Xanthate	280 tons	Flo Bin	1 ton	14
AERO® 350 Xanthate	308 tons	Flo Bin	1 ton	16
Copper Sulfate	208 tons	Super Sack	1 ton	20[2]
AEROFROTH® 65 Frother	42 tons	Plastic Barrel	55 gallons	3
Sodium Sulfide	100 tons	Sacks	50 pounds	1 – 5
Superfloc	24 tons	Sacks	50 pounds	Ship w/frother
Lime	75 tons	Super Sack	1000 pounds	4
Diesel	750,000 gallons	Fuel Truck	4,500 gallons	150
Gasoline	5,000 gallons	Fuel Truck	4,500 gallons	Ship w/diesel
Cement	2,500 tons	Sacks	94 pounds	115
Oils, Lubricants, Grease, Antifreeze	10,000 gallons	Barrel	55 gallons	Ship w/diesel
Propane	40,000 gallons	Fuel Truck	9,400 gallons	5
Antiscalant	4,000 gallons	250 gallon tote	4,000 gallons	1
Ammonium Nitrate	450 tons	Bulk Container	10 tons	45
Bulk Concentrate	11,200 tons	Sealed	16 tons	700 (2)
Water Treatment Chemicals and Reagents				
Polymer Flocculant	20 gallons	Sealed Pail	5 gallons	0[3]
Hydrated Lime	2 tons	Super Sack	1,000 pounds	1
Sodium Hypochlorite	200 gallons	Plastic Drum	55 gallons	0[3]
Sodium Bisulfite	500 gallons	Plastic Drum	55 gallons	2
Hydrochloric Acid	400 gallons	Plastic Drum	55 gallons	2
RO Scale Inhibitor	50 gallons	Sealed Pail	5 gallons	0[3]
Methanol	500 gallons	Plastic Drum	55 gallons	2
RO Alkaline Cleaner	1.5 tons	Sealed Pail	5 gallons	0[3]
RO Acid Cleaner	1.5 tons	Sealed Pail	5 gallons	0[3]
Cement	520 tons	Sacks/bulk	94 pounds	24
Bentonite	145 tons	Sacks/bulk	50 pounds	7
Employees				
		Vans		3500 (10)
		Pickups		1400 (4)

[1] Average values and actual truck count will vary.
[2] Does not add to truck count, as the product will be backhauled from the refinery. More fully described in FCC's Storm Water Management Plan for the Idaho Cobalt Project (Telesto, 2006a).
[3] Does not add to truck count, as the small quantity will be transported with other materials.

Site Roads

Site roads, which are primarily on public lands, are shown on **Figure 2-1**. New project operations roads would be constructed to conform to Forest Service and Mine Safety and Health Administration (MSHA) regulations, as appropriate. Existing roads would be improved as necessary to handle ore haulage, larger trucks and increased traffic. Storm water ditches and sediment control measures on all roads would be constructed in accordance with Best Management Practices (BMP's) for Mining in Idaho guidelines (Idaho Department of Lands [IDL], 1992) to control storm water runoff. Site roads are classified as primary, secondary, and tertiary roads:

- Primary roads are all main access roads and roads over which ore or waste rock would be hauled.
- Secondary roads are roads that are proposed for daily, year-round use in the operations but are not ore haul routes or main access routes.
- Tertiary roads are site roads that are proposed for seasonal use or intermittent use such as roads required to access surface water and groundwater monitoring locations.

Primary Roads

Turnouts would be constructed in appropriate locations along the primary roads to allow safe passage of vehicles. Existing and proposed primary roads include:

- A road from the Big Flat to the Ram portal. This road requires improvements, as well as construction of approximately 0.4-miles of new road in two segments. Road distance from the Ram portal to the mill site is approximately 2.8 miles.
- An existing road is proposed for access to the Sunshine portal. The haul distance from the Sunshine portal to the mill site is approximately 1.1 miles.
- About 0.7 mile of new road is proposed for access from the mill site to the TWSF.

Secondary Roads

Approximately 0.7 miles of new secondary road construction is proposed for access to the TWSF, soil stockpile, and water management ponds. Where possible, existing roads would be used for proposed secondary roads.

Tertiary Roads

Tertiary roads are proposed to provide access to the tram tower corridor, the soil stockpile, and surface water and groundwater monitoring locations. This class of roads, as proposed, includes use of about 9.4 miles of existing roads and the construction of approximately 0.7 miles of new roads.

FCC proposes to negotiate an access agreement with the Blackbird Mine to use the existing mine road on private land (Noranda) through the Blackbird Mine CERCLA site to the Meadow Creek/Bucktail Creek divide. FCC, for the duration of use, would maintain BMPs, channels, culverts and other sediment/storm water control facilities that exist on sections of Noranda property that would be used by FCC. FCC would upgrade the road from the Noranda water treatment plant gate to the top of the ridge (5.8 miles), including vertical realignment of a 0.3 mile section known as Buddy's Grade.

A combination of newly constructed roads and existing improved roads are proposed to provide access to the ICP site. All roads would be constructed and improved in accordance with United States Forest Service (USFS) guidelines for road construction. The specifications for road design are provided in the ICP Conceptual Road Design (TTE, 2006).

The primary and secondary roads on the Project site would be maintained year-round, including snow removal during the winter months. Snow removal would generally be accomplished on these roads

with the use of a rotary snow blower/plow. The snow would be thrown above or below the road corridor into areas where snowmelt would not create sedimentation or where the snowmelt would be addressed by Best Management Practices (BMPs). If snow removal by rotary snow blower/plow were not possible, a grader or loader and truck team would remove the snow.

Transportation of Personnel and Supplies

Personnel - All ICP personnel would carpool to the site in FCC vans or pickups. All ICP personnel and contractors would be instructed regarding the ICP Transportation Procedures and Plans and the requirements of the FS Road Use Permit to enhance the safety of access to the site and to reduce the impacts of travel to the site.

Construction Equipment and Supplies - During construction, large mobile equipment, large loads of construction materials, and large equipment being installed at the ICP facility sites would be transported to the site by tractor-trailer. Supplies would be transported by single-frame trucks whenever feasible, although this may not always be feasible. Pilot cars would lead tractor-trailer loads and fuel trucks to the site to reduce accident risk. The operators of tractor-trailer loads and fuel trucks would also be instructed regarding the requirements of the Transportation Procedures and Plans.

Operating Supplies - Table 2-1 lists the type and quantity of operating supplies to be used by the ICP during operation. Single-frame trucks would be used to transport operating supplies. For materials transported via tractor-trailer, whenever possible, the tractor-trailer would be off-loaded in Salmon, Idaho, and supplies reloaded onto a single-frame truck for transport to the ICP.

Concentrate - Approximately 11,200 tons of concentrate is anticipated to be shipped from the ICP mill facility annually. Steel roll-off containers with locking lids would be used to transport the concentrate. Empty containers would be filled at the mill, sealed, and loaded on single-frame trucks for transport to Salmon, Idaho. In Salmon, concentrate containers would be transferred to tractor-trailer equipment for transportation to a processing facility.

Spill Control - FCC has prepared a spill control plan that addresses management of hazardous materials during shipping and storage. Their plan includes notification of the ICP facility prior to transport of fuels or chemicals, use of closed trucks, travel only during daylight hours, use of pilot vehicles, and continuous radio contact with pilot vehicle and facility during transport.

Mining Operation

Ore Reserves/Production Schedule

The ICP would consist of developing two deposits over the life of the project, the Ram (with 2,230,000 tons of ore currently known) and the Sunshine (with 340,000 tons of ore currently known), totaling 2,570,000 tons of known ore. Development of each deposit would use underground mining methods. The average rate of mining production would be 280,000 tons per year (tpy), or 800 tons per day (tpd) based on mine operation of 350-days-per-year. During start-up the rate would be approximately 400 tpd in the first year, increasing to full production in the third year of operations. It is possible, however, that mine and mill throughput could reach 1,200 tpd. Mining would begin initially on the Ram deposit, and mining of the Sunshine deposit would occur in subsequent years.

Exploration for additional ore reserves is anticipated to continue through the life of the ICP operations. If additional ore tonnage is identified and defined, the production life of the ICP may be extended beyond the currently proposed mine and mill life schedule.

Mining Method

Mine access to the Ram would be via a road from the Big Flat to a portal at the 7,060 feet above mean sea level elevation (**Figure 2-1**) and then via an underground decline driven at approximately 12 percent to the ore zones (**Figure 2-3**). The decline would be used to transport people and materials in and out of the mine and as a haul route for the waste rock and ore to the overhead tram at the portal, as well as for a portion of the tailings to be brought back into the mine. Crosscuts from the decline would provide access to the ore body (**Figure 2-3**). Two ventilation raises, or airshafts, approximately 8 feet in diameter, would provide ventilation and emergency escape ways.

An overhead tram would potentially be constructed from the Ram portal to the mill located on the Big Flat (**Figure 2-1**). The conceptual design for the tram includes an approximate 100-cubic-foot tramcar traveling on track cables and moved by a haul rope. Three or more towers, approximately 45 feet high, would support the track cables. The tramcar would be loaded with either waste rock or ore from a hopper at the Ram portal. Ore would be discharged onto an ore stockpile at the mill crusher. Waste rock would be discharged at the mill and trucked to the TWSF for final disposal.

At the Sunshine, an existing portal would be modified and an internal decline would be developed to access the ore. The decline would be used to transport people and materials in and out of the mine and as a haulage route for ore, waste rock, and tailings. One airshaft, approximately 8 feet in diameter, would provide ventilation and an emergency escape way. Sunshine ore would be hauled directly to the mill in 20-ton trucks and placed in the ore stockpile. The trucks would then be used to haul tailings for use as backfill in the mine.

Diesel equipment and the associated fumes and dust from mining would dictate the amount of fresh air required to maintain a good working environment and to minimize health hazards. Air would intake at the main portals of both mines and exhaust through the airshafts. Additional ventilation would be provided by auxiliary fans and ventilation tubing to working areas.

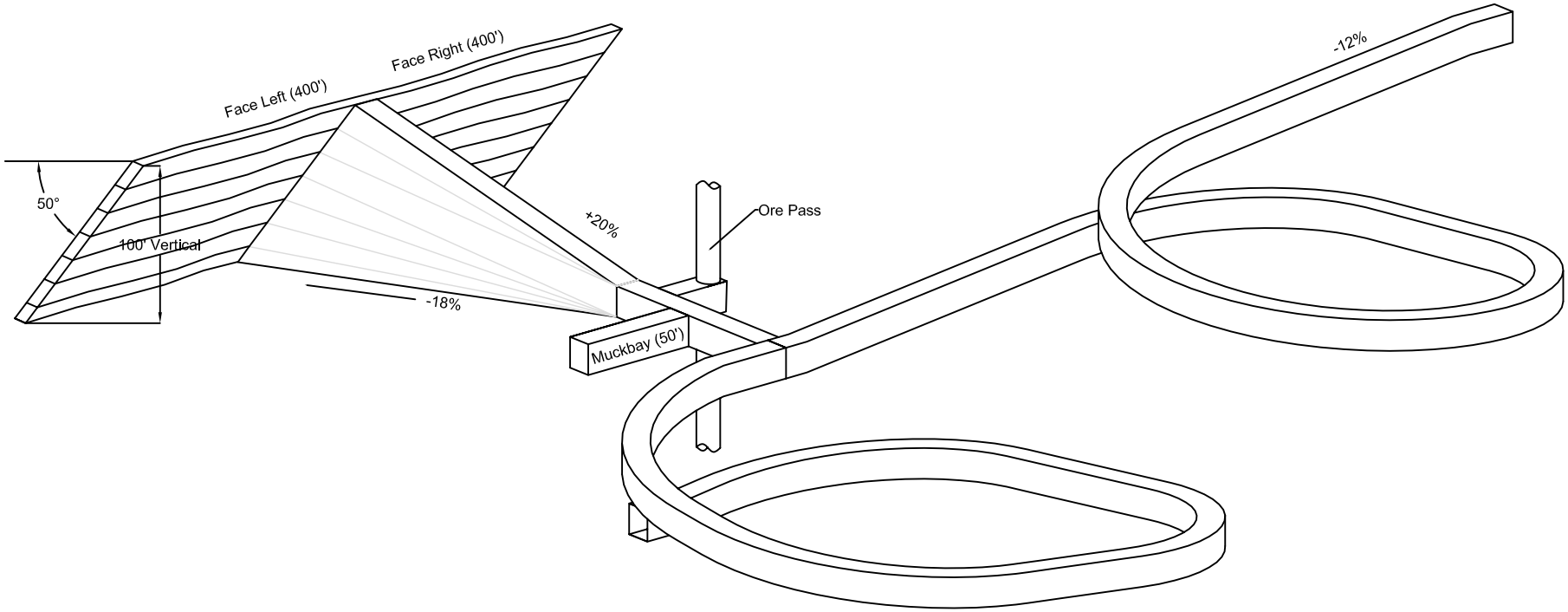
The mining methods for the Ram and Sunshine deposits would use cut and fill mining. The mining sequence would include drilling between 30 to 40 holes in the ore face, loading these holes with explosive, blasting, scaling loose rock from the back (ceiling) and ribs (walls), mucking the broken ore with a scoop tram, loading a haul truck with the scoop tram, and installing rock bolts for rib and back support. The openings (stopes) created from ore excavation would then be filled with paste tailings and waste rock while the access tunnels would be left open.

Air compressors would be located in the mine for operating pneumatic equipment, with service lines installed to the working areas. Maintenance of the mining equipment would be performed in underground shops.

Formation estimates that the mines at full development would produce an average of approximately 51 gallons per minute (gpm) of water. Mine water flows would be collected in sumps in the mine to allow suspended solids to settle. Water storage tanks would be located at the portals for storage of water pumped from the mines. The water would then be pumped to the mill for treatment and reuse, and then to the water management ponds for storage and handling. Water would also be used in the underground mine for dust suppression. Excess water would be treated and discharged to Big Deer Creek.

Tram Operation

The overhead tram would be built if and when economic conditions justify its construction. It would normally be operated in automatic mode. The loading and off-loading functions would be controlled by sensors at the Ram portal and at the mill coarse ore stockpile and monitored in the mill control room. Prior to construction of the tram, ore and waste would be hauled to the mill and TWSF by truck.



VIEW IN 3 DIMENSIONS

IDAHO COBALT PROPERTY FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**DETAIL RAM WORKINGS OBLIQUE VIEW**	**FIGURE** **2-3**

Mine Workings

The Ram deposit would be accessed by a decline. Two airshafts connecting into the workings would provide ventilation. Additional drifts and crosscuts would be developed to provide access to the ore blocks. The total length of mine workings for the Ram deposit is estimated to be about 38,000 feet. There would be approximately 9,800 feet of open stope at any given time. The Ram underground workings would also include a chamber to accommodate tailings dewatering equipment.

The Sunshine deposit would be accessed from an existing portal connecting to an internal decline. Additional drifts would be developed to provide access to the ore blocks. The total length of mine workings for the Sunshine deposit is estimated to be about 13,000 feet.

Ram Portal Platform

The Ram portal is located in an area of steep slopes. A retaining wall for the portal platform would be constructed using an engineered soil reinforcing technique. The platform would contain an office, tool/maintenance shed, surge water tank/pump station, and hoppers for loading ore and waste rock onto trucks or into the tramcar (**Figure 2-4**). Other equipment located on the platform would include a transformer, emergency generator, and diesel storage tank.

Sunshine Portal Platform

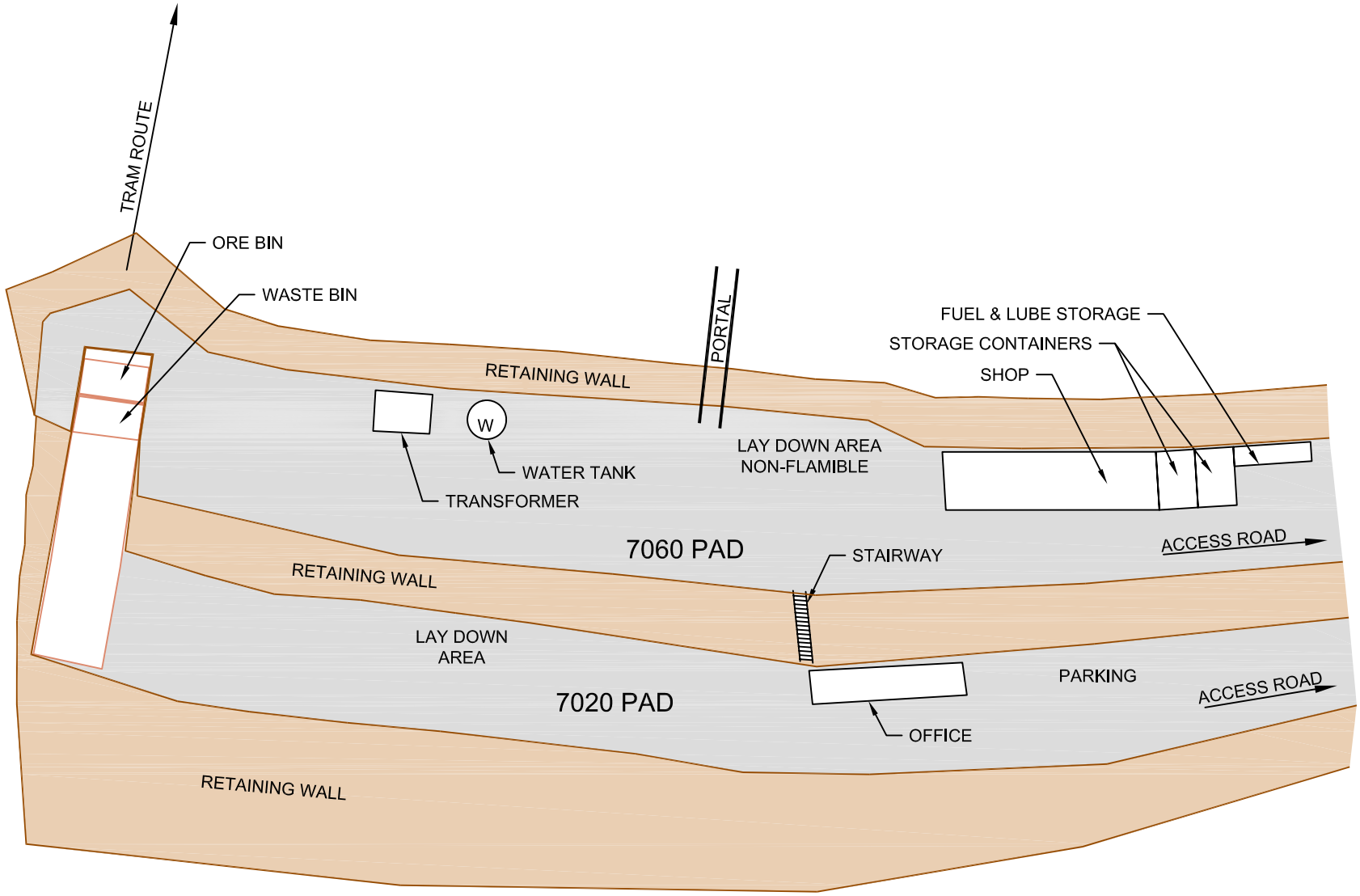
At the Sunshine, an existing portal would be upgraded to access the internal decline. The existing portal platform would be reshaped and backsloped to control runoff. An office, tool/maintenance shed, diesel storage tank, and water tank would be located on the platform.

Backfilling

A significant feature of the mining technology to be used for the ICP is the backfilling of paste tailings into the mined-out underground areas of the Ram mine. Tailings backfill is not proposed for the Sunshine mine. Backfilling serves the purpose of providing structural support in the mine while reducing the area required for surface tailings storage. Backfill is considered a construction material that is used to create a floor to mine on top of, a rib to mine next to, or a back to mine under. It provides important support to the surrounding rock mass, reducing the ground support requirements in active mining areas. Backfill reduces dilution of the ore by non-economic wall rock.

Tailings, for use as backfill, would have cement added to increase backfill strength and be delivered to the Ram dewatering facility as a paste. Cement will also add alkalinity that will reduce metals mobility in the backfill. The paste functions primarily as a void filler, and its strength need only be sufficient to support mine vehicles working in the stope. It would be a highly viscous mixture of mill tailings, water and cement. Nominal design parameters show a paste consisting of 65 to 70 percent solids and 30 to 35 percent water. Solids would include between 96 to 98 percent tailings and from 2 to 4 percent Portland cement. Testing shows that the paste would have a dry density of about 92 pound per cubic foot and a permeability of $1x10^{-6}$ centimeters per second.

A paste pipeline would enter the mine via a borehole and then be pumped to the location in the mine needing filling. Prior to receiving backfill, each stope would be prepared. Preparations would include cleaning the stope floor of any ore, installing pipe hangers and pipe to the far end of the stope, and installing a waste rock barricade at the stope entrance. Once the stope is prepared, backfilling can begin. A slug of water would be sent down the pipe from the paste plant to pre-wet the line. Paste would follow behind the water. It would discharge from the end of the pipe into the stope and accumulate on the stope floor. Periodically, as the stope fills, the pipe would be pulled back. When the stope is full, the paste would be stopped and a slug of water sent through the pipe for final cleaning.



SCALE IN FEET
0 50

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IDAHO COBALT PROPERTY FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**RAM PORTAL** **GENERAL ARRANGEMENT**	**FIGURE** **2-4**

The backfill schedule indicates that backfill would be required within the first six months of mining of the Ram deposit. By the end of the first year of mining, approximately 400 tons of backfill would be required each day. After each cut in a stope is made (approximately 15 feet on the first cut and 10 feet thereafter) and the ore has been removed, backfill material would be placed into the void. Backfill would only be used in ore zones and would not be used in access ramps. By the end of mining the ore zone stopes would be approximately 90 percent filled with backfill. Approximately 30 percent of the mine consisting of ramps, access decline and ventilation raises would be left open.

A portion of the backfill would be waste rock (slash) from ramp construction. Some of the slash would be potentially acid generating (PAG). This waste rock would be trucked from the ramp being slashed to the mined out area being backfilled, placed on top of previously placed tailings backfill, and subsequently covered by additional tailings backfill. This backfilling sequence would provide a suitable working platform as well as partially isolate the slash.

FCC indicates that an alternate method of backfill may be used. This would involve dewatering the tailings, hauling the tailings to the stope to be filled in mine trucks and dumping the tailings into the opening requiring filling. If this alternative were to be implemented the company would be required to submit a plan that demonstrates that the tailings can be thoroughly mixed with cement or other neutralizing material at levels adequate to ensure long term pH control of the backfill material.

Mine Dewatering

Mine dewatering would be accomplished by a series of skid-mounted, self-contained pump units. Discharge from the mine dewatering system would be delivered to a holding tank on the portal pad. This tank would be sized to contain the entire backflow from draining the pipeline from the mill on the Big Flat. The tank would be housed in the heated portal pump station to prevent icing in the winter.

The pump station would also house pumps for lifting water to the mill from dewatering the mine and tailings. Pumping from the Ram portal to the mill would be accomplished via a steel pipe with secondary containment. To reach the 8,050 elevation high point at the mill site, this pipeline would be approximately 2,300 feet long. An air intake with a check valve at the high point would allow the line to be self-draining in the event of a pump shutdown. The pipeline would follow the tram right-of-way (**Figure 2-1**) and would be winterized to prevent freezing. During an emergency shutdown or production curtailment, the mine pumps would continue to operate.

Secondary containment would include pipe-in-pipe for all areas where the piping is not within the mine or other secondary containment such as the mill building. The system would include leak detection at all low points and at pipe-to-pipe connections. The pumps would have the capacity to handle short periods of high-yield mine inflows caused by structure dewatering. However, it is possible a flow event could occur that exceeds the capacity of the mine pumps. Should that occur, water would build up in the mine sumps until the inflow once again falls below the pumping capacity at which time water levels would begin to return to their long-term operating level.

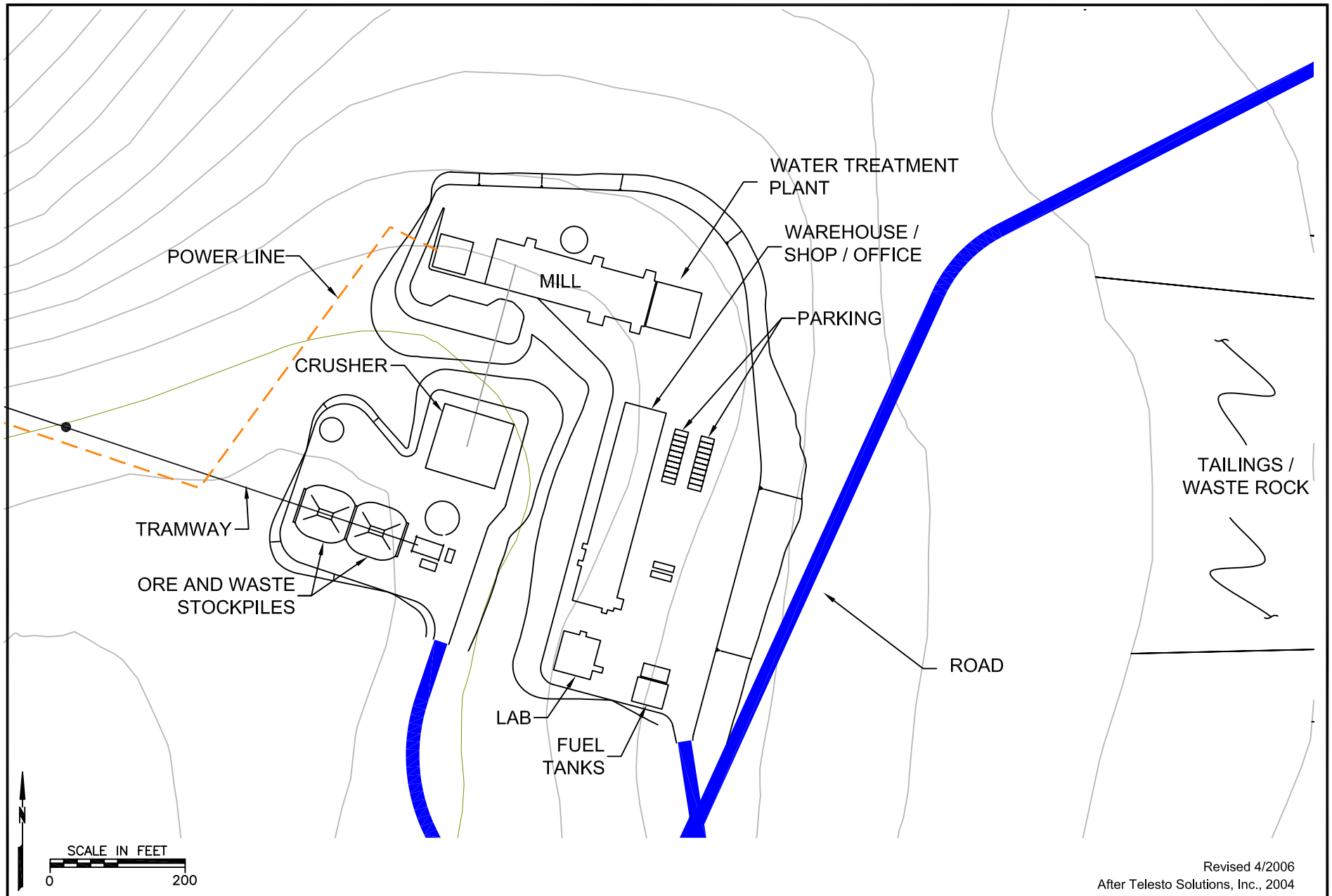
The Sunshine mine is not expected to produce enough water for dust suppression or drilling; makeup water would be supplied from the mill circuit. If excess water were produced, it would be pumped back to the mill.

Mine Equipment and Facilities

The mine facilities would consist of the mine office, change house, maintenance shop, emergency sleeping quarters, and warehouse. These facilities would be housed at the mill. Additionally, there would be a portable explosives magazine located in a suitable site with good access, but removed a safe distance from the mine buildings, and a start-up/backup generator. A list of anticipated mining and mill equipment is given in **Table 2-2** and the plant site layout is shown on **Figure 2-5**.

Table 2-2. Mine and Mill Equipment

Item	Number of Units
Mine Equipment	
Drill Jumbos	8
Long-hole Drill	1
Scoop Trams	10
20-ton Trucks	5
Rock-Bolter	1
Grader	1
Compressors	3
Service Trucks	5
Personnel Trucks	8
Slushers	6
Pug Mill	2
Water Tanks	2
Transformers	1 lot
Fans	1 lot
Pumps	1 lot
Shop Equipment	1 lot
Safety Equipment	1 lot
Misc. Equipment	1 lot
Mill Equipment	
Primary Crusher	1
Screening Section	1
Secondary Crusher	1
Ball Mills	2
Conditioner Circuit	1
Flotation Circuits	4
Concentrate Thickener	1
Concentrate Filter	1
Tailings Thickener	1
Tailings Filter	2



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LEMHI COUNTY, IDAHO

PLANT SITE GENERAL ARRANGEMENT

FIGURE 2-5

Waste Rock Characterization

Three main waste rock units have been identified at the ICP: quartzite, mafic dikes/sills, and quartz veins. Quartzite is the dominant component of the waste rock and, as the term is used here, may contain metasedimentary and exhalite rock as well. Waste rock was characterized in the baseline geochemical testing program (Telesto, 2004) by the analysis of 239 waste rock samples. The majority of the waste rock (approximately 80 percent) is not expected to present an acid generation problem as the quartzite has a low pyritic sulfide content. However, approximately 20 percent of the waste rock is predicted to generate slightly acidic solutions containing variable concentrations of soluble arsenic, cobalt, copper, and zinc.

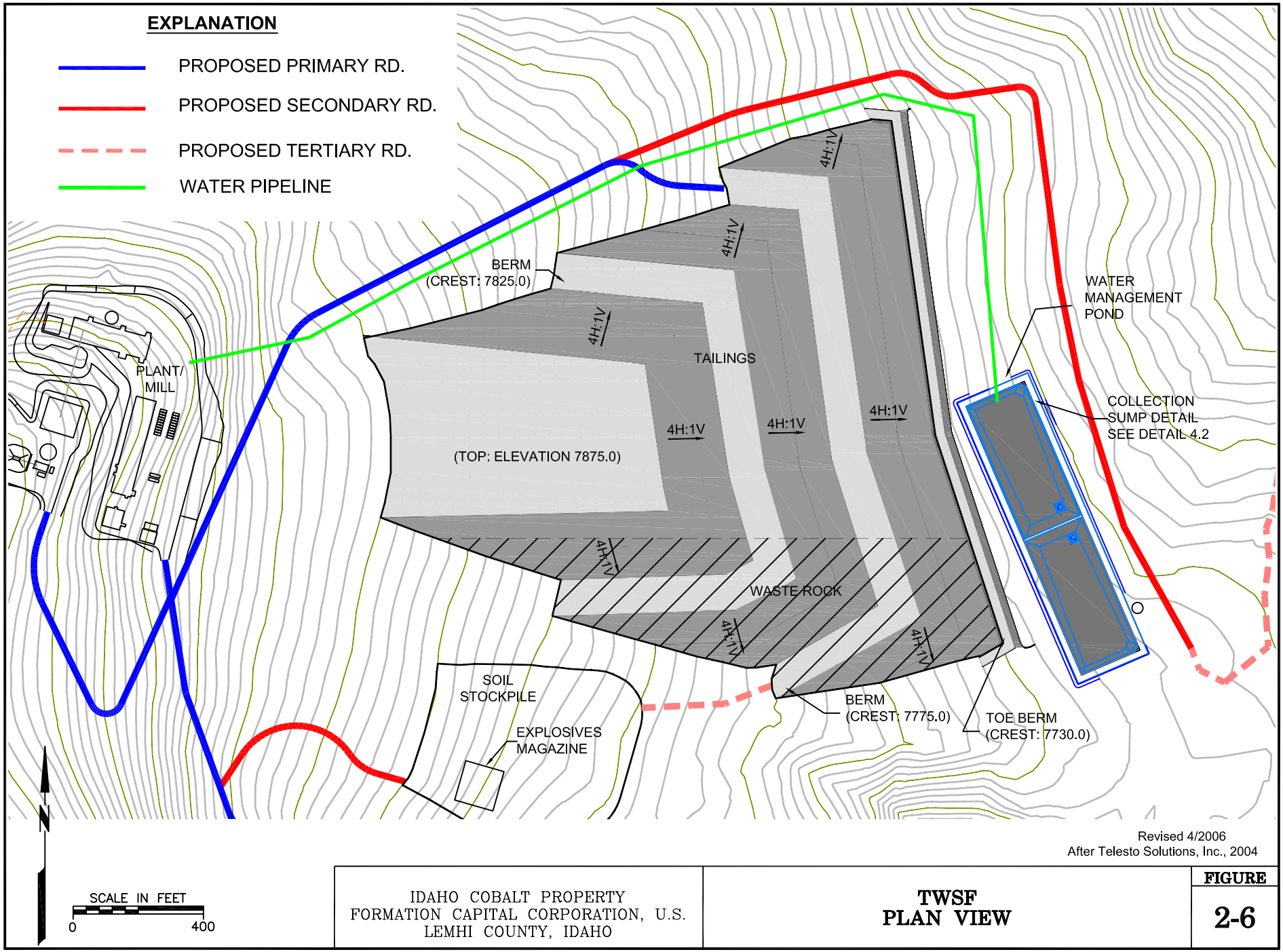
Tailings and Waste Rock Storage Facility

FCC would develop a surface disposal facility to store and contain tailings and waste rock material not otherwise disposed of undergound, termed the tailings and waste rock storage facility (TWSF). The TWSF would be constructed east of and downslope from the mill on the Big Flat. This location was chosen because of its relatively flat topography, soil characteristics, and distance from active drainages and streams. Specific design elements of the TWSF are:

- Storage of 2.5 million cubic yards (MCY) of tailings and waste rock. The storage capacity of the facility is approximately 35 percent greater than the current production estimates;
- Separation of tailings and waste rock to the extent practicable;
- Composite liner system with drainage collection;
- Staged construction and reclamation;
- Collection of runoff from waste rock and tailings with conveyance to the process pond;
- Inclusion of water treatment wastes in covered trenches within the TWSF;
- Snow removal storage area with conveyance to the storage pond; and
- Diversion of runoff around operating areas of the facility.

The proposed configuration of the TWSF is shown on **Figure 2-6**. Tailings and waste rock would be separated except for a commingled zone at the interface of the two materials. The TWSF would have 4 horizontal to 1 vertical (4H:1V) side slopes constructed in three 50-foot raises with two 100-foot wide benches. A toe berm would be constructed at the base of the tailings facility to provide containment for seepage and runoff water from the tailings stack and to enhance geotechnical stability. The facility would occupy an area of about 55 acres and would measure approximately 1,600 feet by 1,700 feet. The stack would reach a maximum depth of about 90 feet. The TWSF would be constructed in the following sequence:

- The area would be cleared and grubbed to ensure the surface is free of vegetation, large rocks or boulders, and other debris.
- The topsoil and subsoil would be removed and hauled to the stockpile area.
- A drainage system would be constructed within the subgrade to intercept and remove groundwater from the TWSF foundation soils. The system would consist of a series of French drains constructed upstream and within the footprint of the TWSF and would discharge to engineered wetlands located east of the TWSF.
- The foundation area subgrade would be graded and compacted in-place to create a suitable foundation for the liner.
- The toe berm would be constructed using materials excavated from the water management ponds and other borrow materials as necessary.
- The clay member of the composite liner would be placed. Final design would determine whether a 1-foot clay liner or a geosynthetic clay liner would be used.
- A synthetic liner (such as 60-mil PVC) would be placed over the subgrade in a scheduled construction sequence. Subsequent liner expansions would be installed as needed.



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LEMHI COUNTY, IDAHO

TWSF
PLAN VIEW

FIGURE
2-6

- A drainage collection system would be constructed over the synthetic liner to collect water infiltrating through the tailings and waste rock and to convey flow to the process pond. This system would be constructed within a protective sand layer, which would also act to protect the liner from damage during tailings and waste rock placement.
- Drainage channels would be constructed along the outside slopes of the TWSF, along the toe berm, and on the intermediate benches of the TWSF (as construction progresses) to collect surface drainage from the facility and convey it to the process pond. All drainage channels would be designed to handle runoff from a 25-year, 24-hour storm event. Perimeter drainage channels would be constructed to intercept storm water run-on to the TWSF, direct water around the TWSF, and convey water back to natural flow paths via BMPs and sheet flow.
- Snow would be removed from the active disposal areas prior to placing waste rock or tailings in the TWSF. The snow would be stockpiled in a designated area within the facility.
- Reclamation of the TWSF would occur incrementally after each phase of tailings and waste rock placement is completed. The TWSF would be left open to accept stabilized water treatment waste if post closure water treatment is required. The facility would be regraded to a continuous slope of 4H:1V or less to reduce potential for erosion.
- A cover system consisting of a 60-mil high-density polyethylene (HDPE) geomembrane, a geonet drainage layer, and a soil layer would be constructed over the TWSF to limit infiltration into the tailings and waste rock.
- The cover soil would be revegetated to help reduce infiltration and erosion.
- After reclamation, tailings drainage will continue to be conveyed to the process pond as long as closure water treatment is needed. After cessation of water treatment, tailings drainage will be conveyed to a one gpm infiltration field located east of the pond.

Waste rock would be delivered to the TWSF by truck or tram from the Ram and by truck from the Sunshine. Waste rock would be placed in approximately 5-foot lifts on the prepared surface by end dumping from mine trucks and would be spread and leveled with a dozer.

Milling Operations

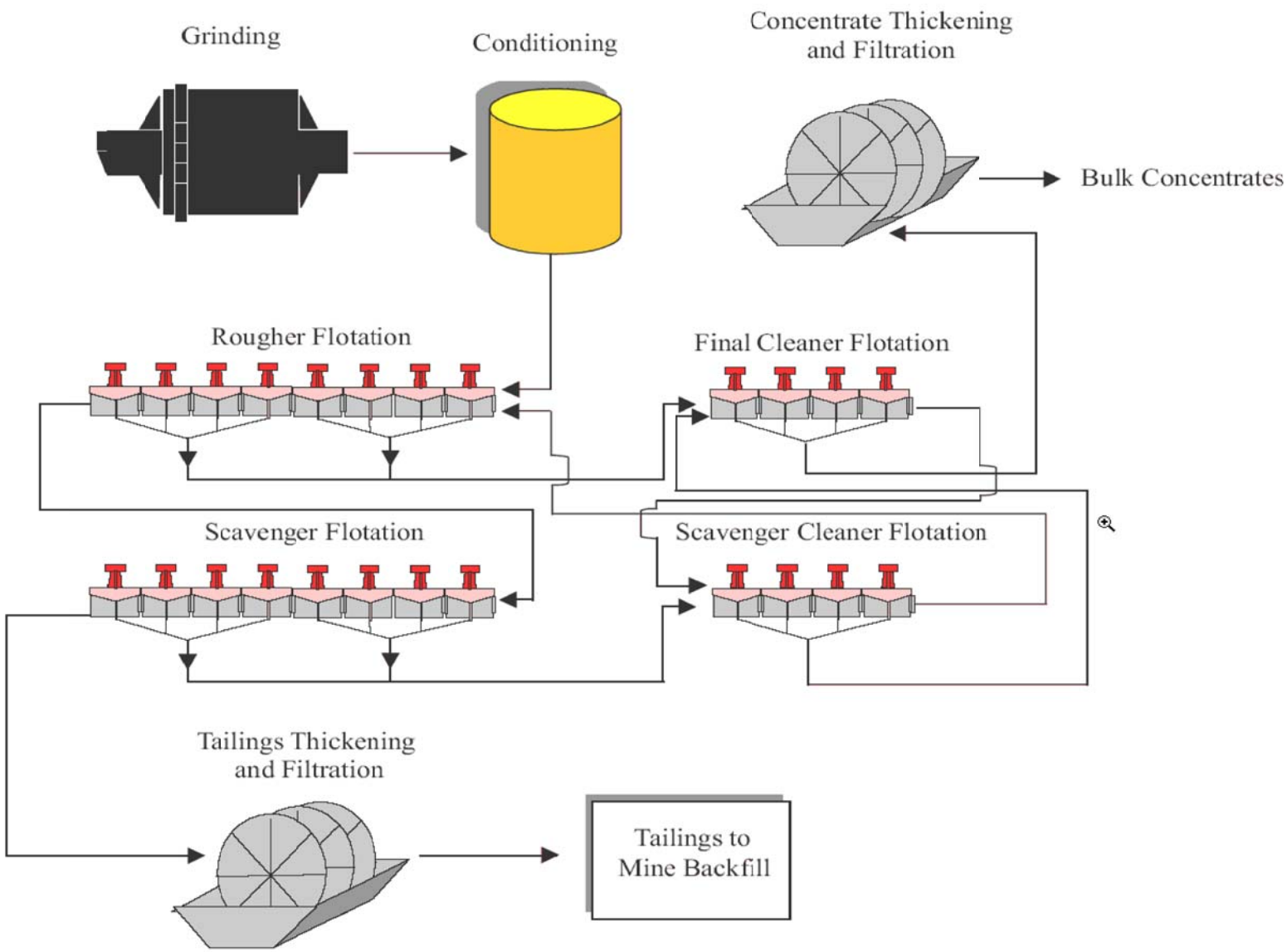
Mill Location and Description

The mill would be located at the Big Flat, an area of relatively flat topography east of the Ram deposit. The mill would include crushing and grinding equipment, flotation cells, concentrate thickeners, tailings thickeners, concentrate filters, tailings filters, and ancillary equipment. **Figure 2-7** depicts the general mill (concentrator plant) flowsheet.

The milling process would reduce the run-of-mine ore to minus 0.5-inch size in the primary and secondary crushing area. This material would then be reduced to minus 200 mesh size, in a liquid pulp, in the ball mills. The pulp from the ball mills would be conditioned and processed in the flotation circuits, where the ore minerals would be floated away from the waste (gangue). The concentrated ore minerals would be dewatered in a thickener and a drum filter prior to shipment. The waste material, or tailings, would also be dewatered prior to disposal at the TWSF or as backfill in the mine.

Ore Stockpile

A tramcar would hoist ore from the Ram to the mill where it would be dumped into a hopper. Ore from the Sunshine would be hauled by off-highway trucks and dumped into a hopper. A conveyor would lift the ore from the hopper onto the coarse ore stockpile. The stockpile area would have a maximum capacity of approximately 22,000 tons. The ore stockpile area would be a concrete pad designed to collect all surface water runoff and decant, which would be piped to the process pond.



IDAHO COBALT PROPERTY FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**CONCENTRATOR PLANT FLOWSHEET**	**FIGURE** **2-7**

Milling Production Rate

A flotation mill would be used to process ore from the mine. At a production rate of 800 tons of ore per day, the mill would produce approximately 32 dry tons of concentrate per day and approximately 768 dry tons of tailings per day. The concentrate would be shipped to an offsite processing facility. Mill production may vary from 800 to 1200 tpd, and the operating schedule may vary from 250 to 350 days per year.

Materials and Supplies

Mill reagents used to recover the minerals include copper sulfate, sodium xanthate, potassium xanthate, superfloc, and lime. An estimate of the annual quantity of the mill materials and supplies is shown in **Table 2-1**. The xanthates, frother, and superfloc are biodegradable polymers. The reagents, copper sulfate and lime, would largely be sorbed by the sulfides and with the exception of lime most of the reagents would report to the concentrate.

Concentrate Storage and Shipping

At full production, the mill would produce between 32 and 40 dry tons of concentrate per day. The concentrate would be dried to approximately 10 percent moisture content using a conventional thickener followed by a vacuum filter. The concentrate would be temporarily stored, prior to shipping to the offsite processing facility, in a shed adjoining the mill building.

Concentrate would be shipped in modified rolloff containers. Each container would hold approximately 16 to 20 tons of concentrate. The containers would be of steel construction with steel locking lids. Concentrate would be loaded into the containers, and the lids would be closed and locked. Excess concentrate would be removed from the exterior of the containers and the containers would be hoisted onto a truck and clamped into position prior to beginning the journey to the off-site processing facility.

Tailings Handling

The mill would produce between 768 and 1,152 dry tons of tailings per day at full production. Tailings would be dewatered in the mill through a thickener and vacuum filter. The dewatered tailings would either be trucked to the TWSF or delivered to the paste plant, also located at the mill, where they would be mixed with water and cement and pumped into the Ram mine for use as paste backfill.

Tailings Characterization

Samples of the tailings solids and the solution stripped from the tailings, after being passed through a filter press, were collected as part of the metallurgical testing activities. The tailings generated by metallurgical testing were then characterized in the baseline geochemical program (Telesto, 2004) by a variety of static and kinetic tests to determine the potential for tailings to generate acidic and metal-bearing solutions. During milling, sulfide minerals are removed from the ore. As a result, tailings are relatively low in sulfide minerals (including pyrite) and are considered not to be potentially acid generating. Results of static acid generation testing (acid-base-analysis or ABA) indicate that the tailings materials are neutral in pH and retain a relatively low level of sulfide-sulfur (approximately 0.05 percent). However, kinetic tests have indicated there is a potential for long-term release of low levels of metals from the tailings.

Tailings paste will consist of 65 to 70 percent solids and 30 to 35 percent water. Paste solids will consist of from 96 to 98 percent tailings and 2 to 4 percent Portland cement. Because of the addition of cement, tailings paste will be alkaline with long-term pH of approximately 9.

Tailings Disposal

Tailings would be placed in the TWSF, or the Ram mine as backfill. It is estimated that the amount of backfill material required for the mine would consume approximately 40 to 45 percent of the tailings stream.

Tailings slurry would be delivered to a dewatering station in the mill. A thickener and vacuum filter would separate the solids from the liquids. Details on the filter cake are provided in the *Conceptual Design of the Tailing/Waste Rock Facility and Water Management Ponds* (Telesto, 2006). The final filter cake would be approximately 80 percent solids after moisture conditioning. If not used as backfill, the filter cake would be trucked from the dewatering facility to the TWSF and end dumped. The tailings would then be leveled and shaped in 2-foot maximum lifts by a small tracked dozer. Compaction of the tailings to 90 percent standard Proctor density would be achieved by the truck and dozer traffic on the pile.

During winter operations, the working areas would be kept small. Snow would be removed from the working area and placed in the snow removal area. The tailings would be quickly spread and compacted once delivered from the dewatering facility. Once compacted, freezing of the tailings is not a concern. Operational procedures would specify requirements to prevent incorporating snow and frozen tailings into the pile prior to compaction.

The mine production schedule indicates that backfill would be required in the mine within the first six months of mining the Ram deposit. As the mining method is dependent on backfill as a working platform and for ground support, maintenance of the backfill schedule would be critical to mine production. The backfill paste would be produced in a paste plant located at the mill. The plant would consist of a spiral flow mixer, and a positive displacement pump with ancillary equipment and utilities. Tailings from the disc filter would be fed into the spiral flow mixer where water and Portland cement would be added in the correct proportions and thoroughly mixed. The mixer overflow would discharge into the feed hopper for the piston pump. The pump would force the paste through a pipe to the mine.

Water Treatment Residuals Storage

Residuals, or waste products from the water treatment plant would also be stored in the TWSF. Water treatment waste stabilized with bentonite and cement would be hauled to the TWSF by truck and placed in covered trenches within the facility. Disposal trenches would be located such that approximately four to six months of waste material can be contained within a single trench. Batches of stabilized waste would be hauled to the TWSF, placed within the trench and compacted. The waste would be covered with PVC liner to prevent downward percolation through the material. The PVC cover would be anchored within the adjacent tailings and the downstream end of the trench would remain open for the next batch of stabilized waste placement. The trench would be progressively filled and covered until full, with each cover section welded directly to the previous section. Trench locations would be surveyed and documented for future reference.

Tailings Disposal Quality Assurance/Quality Control

To meet material placement specifications for the TWSF, a quality assurance/quality control (QA/QC) Plan would be utilized to determine steps for tailings and waste rock placement. Tailings material received from the plant/mill facility would be dewatered to ±2 percent of the optimum moisture content prior to being placed in the TWSF. Once the tailings material has been dewatered to ±2 percent of the optimum moisture content, the material would be end dumped and compacted in two-foot lifts to 90 percent of the standard Proctor maximum density. During cold weather, dried tailings would be spread and compacted before they freeze. Any non-compacted material that does freeze would be stockpiled. Dried tailings material that cannot be placed because of snowfall events would also be stockpiled. The tailings stockpile would be located on the lined portion of the TWSF. Material that has been stockpiled through the winter that does not meet the stacking requirement of ±2 percent of

optimum moisture content would be mixed with newly processed material to ensure that the mixed material meets the stacking requirement. Field verification of the moisture content and density would be conducted once per week and documented.

Water Resources

The ICP's primary demand for water is for ore processing. The milling process would require approximately 960 gallons per ton of ore processed, which equates to about 768,000 gallons per day (gpd) for the nominal ore production of 800 tons per day (tpd). Except for water lost to the concentrate and the tailings, the effluent from the milling operation would report to the process pond. This water would mix with mine water and other waters reporting to the process pond and would be recycled back to the mill.

The primary source of water for the operation would come from the developed Ram deposit. Mine flow would be a function of the length and depth of mine workings, and flow would increase with the development of the mine. According to the POO the average flow during the life of the operation is expected to be approximately 45 gpm from the Ram. At full development, the POO estimates the Ram would produce approximately 43 gpm and the Sunshine is estimated to produce an average of 8 gpm. Additional water for the operation would come from the collection of runoff from the TWSF and storm water. During startup, process water would be provided by pumping groundwater from wells as needed.

The water supply for the mill is expected to vary throughout the life of the mining operation. Although sufficient water for processing is predicted to be available from the Ram workings and storm water, there is the possibility that additional water would be required to support operations. Two water supply wells would be constructed in the Big Flat area to meet additional demand.

Water for human consumption would be supplied as bottled water or from onsite wells. Human consumption water would be less than 100 gallons per day. Water for showers, toilets, and other human uses would either come from on-site wells or would be site water that has been processed through an on-site treatment plant to produce water of adequate quality for this use. Water from the storage pond would be used for fire protection. A septic tank and drain field would be permitted and installed north of the mill site.

Water Management

A water and chemical mass balance for the ICP has been developed using a dynamic system model (DSM) that considers the relationships between the Project components and the surrounding water environment, and predicts the impact on them throughout the life of the mine and during the post-closure period. The DSM is designed to determine water flows from the mine and surface facilities, water storage requirements, water chemistry of site waters, and to estimate the quantities of water that must be treated and discharged to maintain a balanced system. The DSM was developed by FCC to estimate impacts to water resources (Telesto, 2005). The agency EIS team independently evaluated, validated and modified the DSM to reflect their understanding of the hydrologic and geochemical characteristics of the site and the impacts the Project will have on water resources. This EIS team's modified DSM was used in the technical evaluation of hydrologic and geochemical impacts from FCC's proposal and the other alternatives (Hydrometrics, 2006). No model is perfectly accurate in representing the complexity of environmental conditions that occur in nature and at a mining site. Therefore, the technical analysis evaluated the sensitivity of the model to a variety of input parameters and looked at the possible range of environmental responses that may occur as a result of mining. Additional detail regarding the DSM can be found in *Environmental Response to Mining at the Idaho Cobalt Project* (Telesto, 2005), the *Water Resources Technical Report* (Hydrometrics, 2006), and Chapter 4 of the EIS.

The DSM includes specific water balance calculations for each year of the Project life. **Figure 2-8** shows a schematic of the ICP water balance for year five, a year in which the Ram workings are fully developed and the TWSF occupies its maximum area (footprint).

The ICP water management plan is based on operating a water treatment plant and releasing water in accordance with an NPDES permit in conjunction with temporary storage in a small water equalization pond adjacent to the water treatment plant and a larger water management pond to temporarily store process solutions. The water treatment plant would have the ability to treat up to 150 gpm of water for discharge through the NPDES outfall. Except during periods of very high inflow, the water treatment plant will treat incoming water on an as-received basis, with very little water stored in the water management pond. During periods of high inflow, water would accumulate in the water management ponds for treatment during lower inflow periods.

A conceptual illustration of the project water balance is shown in **Figure 2-8**.

Process Water Characteristics - Mine water quality has been evaluated by the Dynamic Systems Model, which includes chemical mass loading effects associated with: (1) wall rock weathering, (2) waste rock weathering in the stope access slash, (3) drainage from the cemented paste backfill tailings, and (4) ambient ground water inflow. The projected mine water chemistry results from the relative chemical mass loading from these four potential sources and makes up the supply water to the ICP process circuit. Process water chemistry then results from: (1) inflows of mine water and captured precipitation, (2) drainage from the TWSF, (3) the mill process, and (4) evapo-concentration.

The primary contaminants of concern (COCs) for the ICP are nitrate, sulfate, arsenic, copper, cobalt, nickel, and zinc. Primary COCs are constituents expected to occur at higher concentrations in the water management pondwater compared to natural waters and which may also have significant environmental effects if discharged into surface water or groundwater.

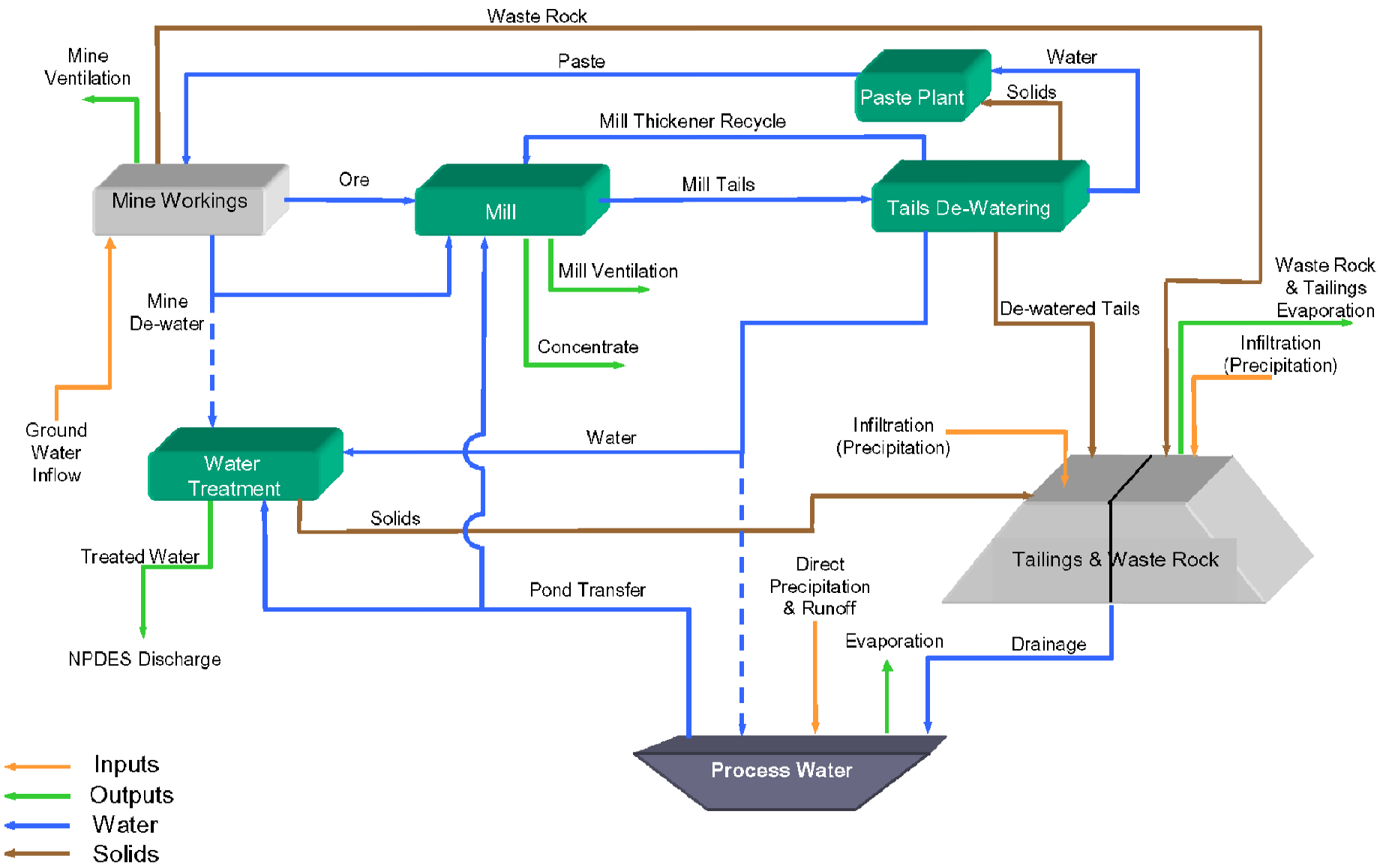
Water Management Pond - A key component to the Project and the water management program is the water management pond. It collects drainage from the TWSF and stores mining and milling process solutions if needed. The pond would be surrounded with an 8-foot high chain link fence for wildlife protection, double lined with HDPE liners, and would have a leak detection and recovery system between the primary liner and secondary liner (**Figure 2-9**). The pond would be sized to contain process waters and would also have the capacity to contain the runoff from a 500-year return period event plus 2 feet of freeboard. The design capacity for the pond is 10 million gallons. After adding the freeboard, the ultimate pond capacity is 12 million gallons.

Prior to commencing construction of the water management pond, Formation would provide a final engineering design to the USFS. The final design would include stability analysis based on actual material and site parameters, and specifications for materials, construction, and QA/QC. The QA/QC Plan would specify that construction monitoring would proceed under the supervision of a qualified professional engineer.

The water management pond would be operated to fully contain all waters from the operation prior to treatment and discharge, other than upgradient (clean) storm water and sanitary discharges.

In the event projections show that there would be insufficient water for winter operations, adequate water would be retained in the pond to prevent a water shortage. A minimum amount of water would be kept in the pond at all times to hold the liner in place. Water from the mine and effluent from the milling process would flow by gravity to the pond as needed during periods of mill shutdown, or other operational reasons when storage is required. Water accumulated in the pond would be recycled back to the mill by pumps controlled from the mill. The pipeline from the pond to the mill would be double contained and complete with leak detection at all low points and at pipe-to-pipe connections.

Equalization Pond – The equalization pond will receive water and solids from mine and mill process streams for temporary storage prior to treatment. This pond will serve to equalize inflows from the



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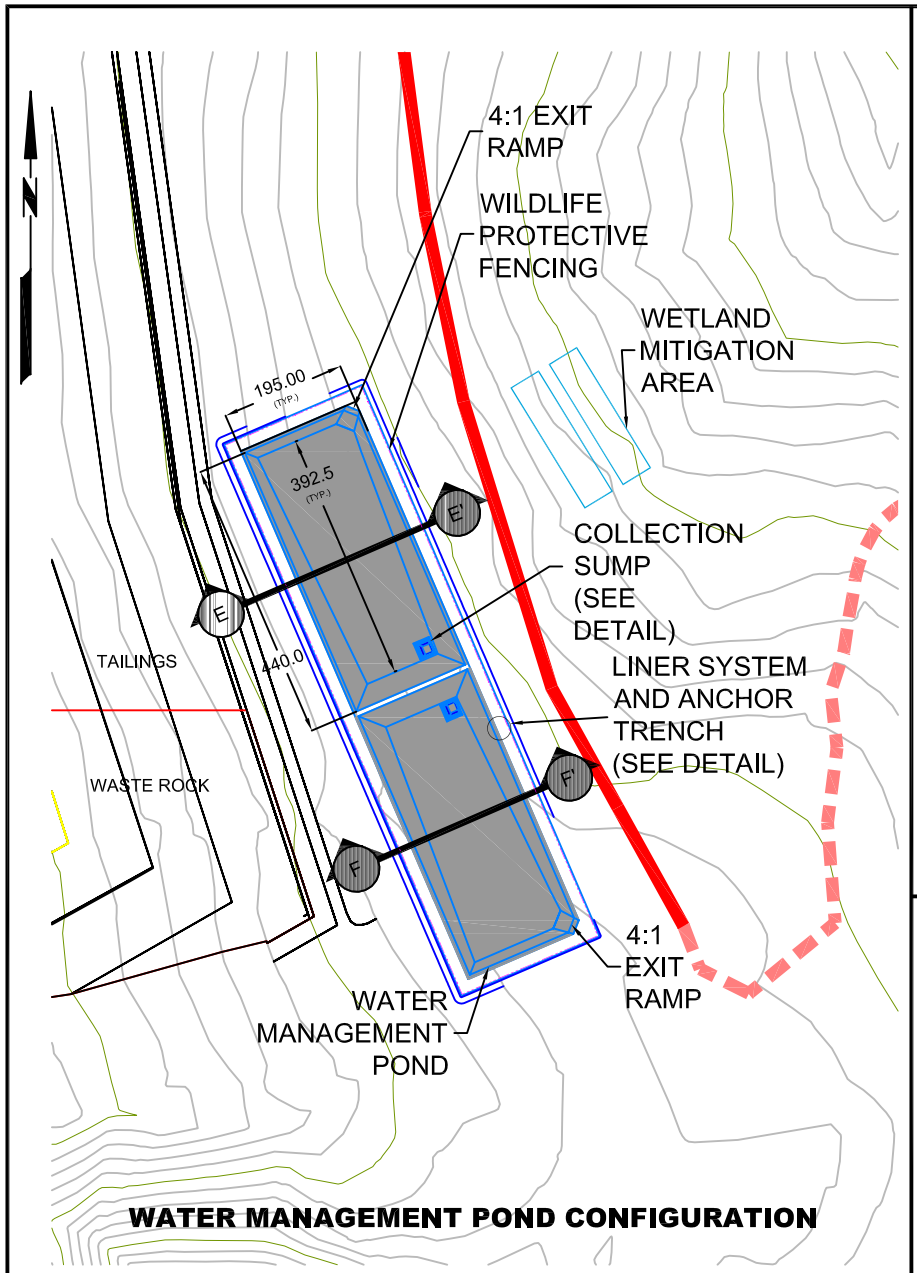
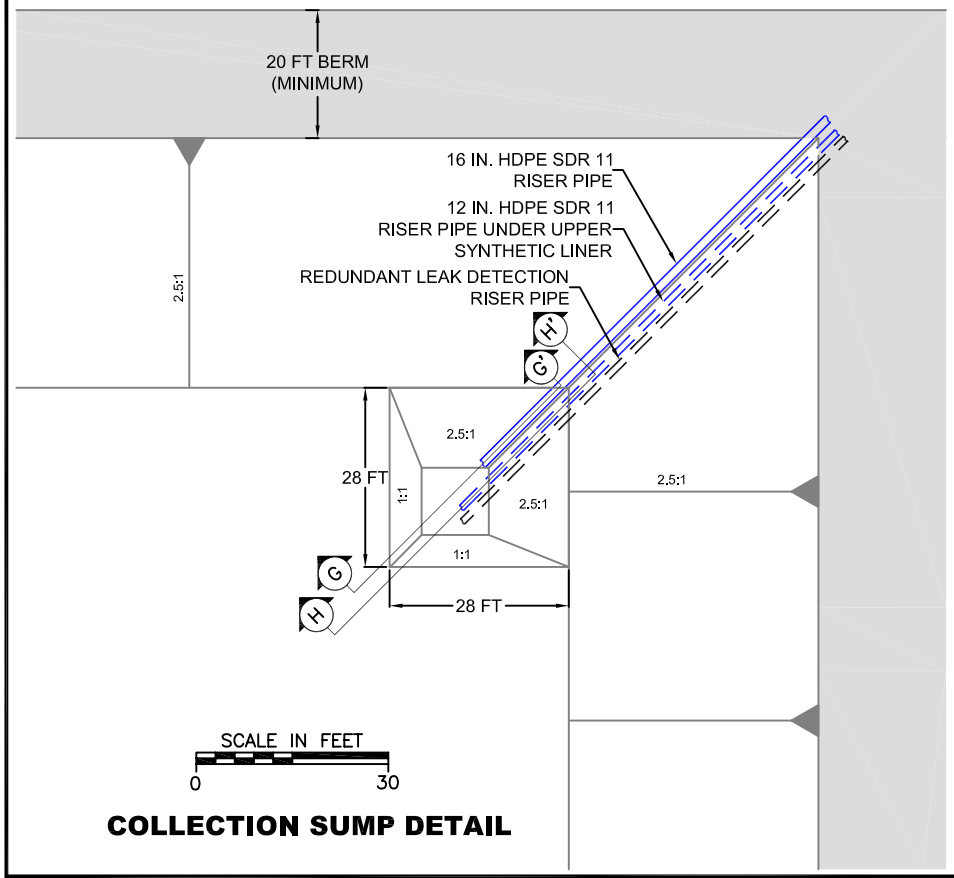
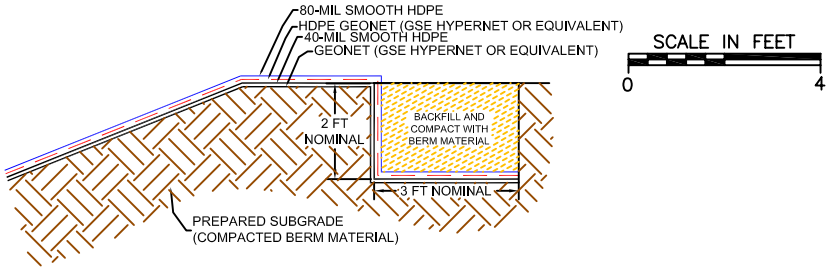
IDAHO COBALT PROPERTY FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**WATER FLOW DIAGRAM**	**FIGURE** **2-8**



WATER MANAGEMENT POND CONFIGURATION



COLLECTION SUMP DETAIL



LINER SYSTEM AND ANCHOR TRENCH DETAIL

SCALE IN FEET
0 300

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LEMHI COUNTY, IDAHO

WATER MANAGEMENT PONDS DETAILS

FIGURE
2-9

source waters to provide a more consistent flow quantity to the water treatment equipment. This pond is sized at 90,000 gallons (8 hours storage at 150 gpm plus 25 percent contingency).

Water Treatment

Mine water at the ICP is predicted to contain elevated concentrations of nitrate, sulfate, and metals (aluminum, cobalt, copper, iron manganese and zinc). A water treatment plant would be installed in the mill to treat excess mine water. The plant would be designed to process up to 150 gpm. Formation proposed to use pre-treatment consisting of chemical addition, clarification, filtration, plus reverse osmosis (RO) technology to treat the water prior to discharge.

Water Treatment System Design – The Dynamic Systems Model was used to determine the treatment plant capacity and to estimate process water quality. The treatment process has been developed on the basis of a 150-gpm maximum capacity in conjunction with the 10 million gallon storage volume in the water management pond. The treatment system capacity and pond volume were balanced to produce an efficient system.

FCC has indicated that the design objectives of the treatment system are to produce the highest quality discharge stream reasonably achievable. A secondary objective is to operate the system as close as possible to a zero liquid-waste discharge condition.

The treatment process would employ solids/liquids separation using chemical addition, clarification and filtration, followed by reverse osmosis (RO) membrane for dissolved ion removal. The treatment system also proposes to minimize liquid-waste discharge through successive high-recovery membrane separation steps to recover the feed stream volume at rates as high as 99.5 percent. The high recovery would be enabled by a combination of advanced system configuration and specialized technology for brine concentration. In addition to the RO process units, the following support processes are recognized as necessary components in the context of the primary treatment objectives: (1) pre-treatment coagulation and clarification, (2) sand media filtration, and (3) denitrification of a recirculating stream. A flow diagram of the proposed water treatment system is shown in **Figure 2-10**.

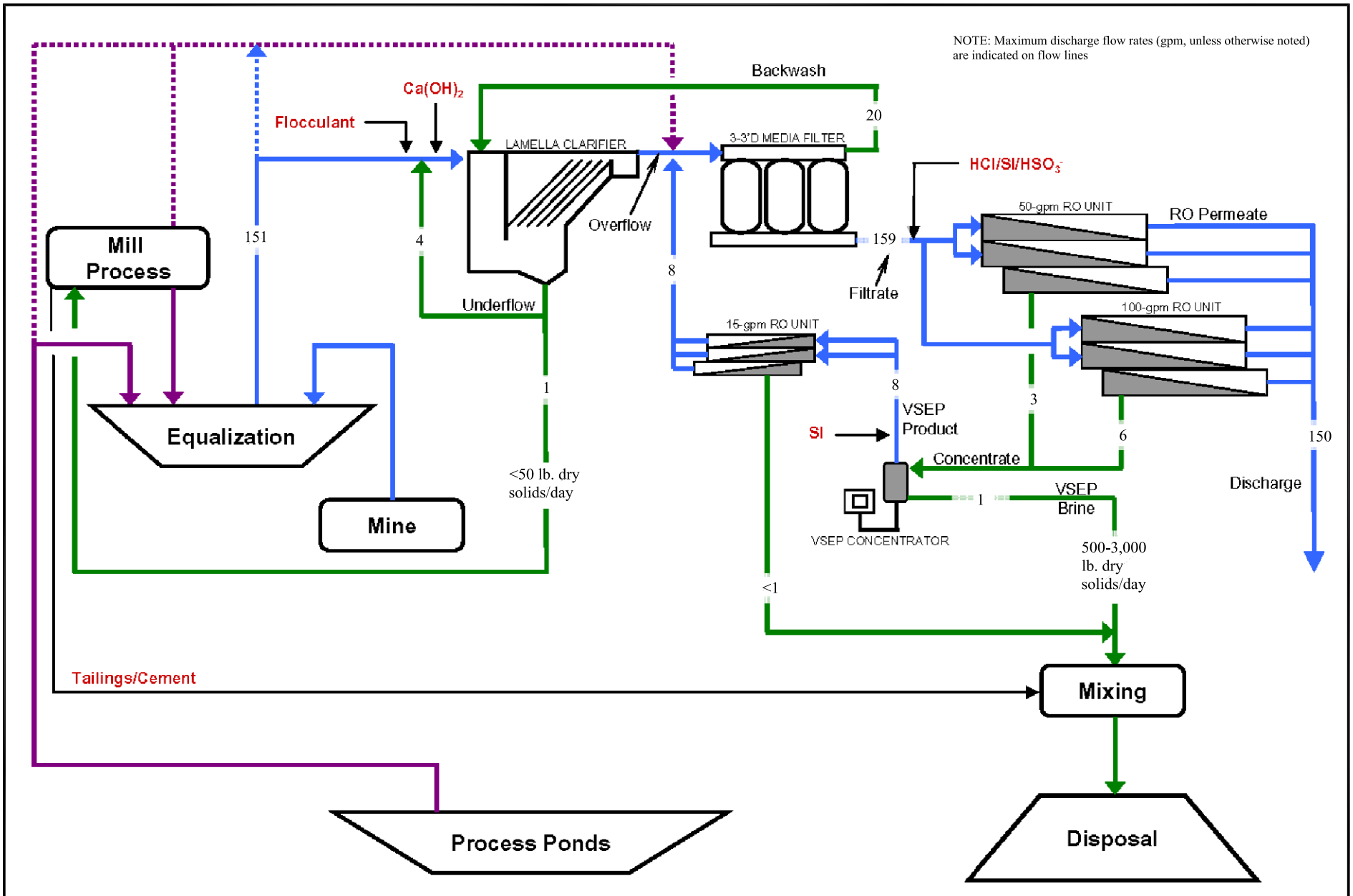
Final effluent from the treatment plant would be discharged through a pipeline to Big Deer Creek downstream from monitoring station WQ-24 (**Figure 2-1**).

Treatment Process Description - Feed streams to the water treatment plant would consist of mine water, mill process effluent, and/or process pond water. A 90,000 gallon equalization pond would be required at the treatment plant to equalize inflow to the treatment plant.

Pre-treatment Coagulation and Clarification - Pre-treatment removal of the metals is required to improve the performance of the RO system (both in terms of discharge water quality and system reliability/integrity). The pre-treatment would operate in conjunction with metals removal achieved by the mill process. Pre-treatment coagulation and clarification would be achieved by pH adjustment with hydrated lime and high-rate, clarification. Thickened solids in the clarifier underflow will be recycled to the pre-treatment stream while some fraction is bled from the system to the mill.

Media Filtration - Clarifier overflow from the pretreatment process would be further processed by sand media filtration to separate the residual solid suspension carried in the overflow from the pre-treatment clarification step. Media filtration typically produces high-quality filtrate that extends the life of down stream cartridge filters (integrated part of the RO unit), thus reducing RO system maintenance downtime. Medial filter backwash will be recovered by recycling to the pre-treatment coagulation reactor or equalization storage.

Reverse Osmosis Membrane Separation - The RO unit would be configured as two arrays, capable of producing a combined 150 gpm of permeate. The arrays would be designed to operate in parallel, one sized at 50 gpm and the other at 100 gpm to facilitate an incremental range of possible operating



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IDAHO COBALT PROPERTY FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**WATER TREATMENT CONCEPTUAL PROCESS FLOW SHEET**	**FIGURE** **2-10**

rates, 50, 100, and 150 gpm permeate. Typical system operation, for handling expected baseline water input to the system, is expected to require operation only of the 50-gpm train. During periods of increased input, the second, larger RO unit would be put into operation.

The feed stream to the RO units would be pH neutralized (with hydrochloric acid) and conditioned with scale inhibitor, to protect the membrane elements against scaling minerals, and bisulfite (e.g. $NaHSO_3$) for oxidant and bacterial control. FCC projects recovery rates of 90 to 95 percent (amount of clean permeate produced per feed volume) with the aid of scale inhibitor based on predicted feed water quality. The high recovery would be attained by recirculating a large fraction of the concentrate stream to the influent side of the RO unit.

Membrane element selection for the RO system would be dependent on the achievable reduction of sulfate and nitrate concentrations. Desired reduction levels for these two constituents indicate that the membrane elements would need to meet a minimum rejection criterion of 99 percent.

Vibration Membrane Separation - Permeate (treated water) from the RO unit would be discharged in accordance with an NPDES permit while the concentrate (waste stream) would be treated further to reduce the waste stream volume. The approach for waste volume reduction would be to employ a specialized technology referred to as vibratory separation (VSEP). In the VSEP process, highly concentrated streams, including solids, are passed through an array of RO membranes, which operate under a high-frequency oscillation or vibration. The vibratory motion allows mineral scale and other solids to form at the membrane surface without attaching, minimizing the risk of fouling.

Like the primary RO system,, FCC proposes to operate the VSEP membrane separation at high recovery (nominally >90 percent) to provide a high reduction in concentrate waste volume. The VSEP would process a commingled stream of RO concentrate and RO membrane spent cleaning solutions. The function of the VSEP is to reduce concentrate volume.

Secondary RO Separation of VSEP Product - Computer simulations of the VSEP unit indicate that nitrate (and potentially potassium) concentrations would be elevated in the product (permeate) stream. Since this stream will be recycled back into primary process, nitrate concentrations would need to be reduced to prevent a buildup in concentration. Nitrate reduction in the product stream would be achieved in a secondary 15-gpm RO unit. Target nitrate reductions in this unit would be dictated by the plant feed nitrate concentration with the objective to maintain a steady state or decreasing nitrate load through the process. Effluent and backwash rinse solutions from the process would be recycled to the primary process stream at the feed point to the sand media filter unit. Concentrate from the secondary RO would be combined with the VSEP waste (concentrate) stream for final stabilization and disposal.

The VSEP and secondary RO unit would produce a combined waste (concentrate) stream that constitutes a very small fraction of the plant feed volume. This final waste stream would contain high levels of dissolved constituents and precipitated mineral compounds. FCC projects that concentrations in this final waste stream would achieve a 99.5 percent total system recovery condition.

FCC proposes to stabilize the final process waste stream by combining it with bentonite and cement at the mill facility. The concentrated waste or reject water would be stored at the water treatment plant in a tank until there is enough material for a 3,000-gallon batch stabilization. FCC estimates that the total chemical mass of waste generated by the process (without bentonite and cement) would be in the range of 500 to 3,000 pounds per day (dry weight basis) and that the volume of the final waste stream including bentonite and cement would range from 7 to 26 cubic yards per day. This range represents the variability in process flow (50 to 150 gpm) and feed stream constituent concentrations. The average water treatment reject stream is estimated to be less than 1 gpm.

Stabilized Waste Disposal - Stabilized waste would be hauled to the TWSF by truck and placed in covered trenches within the facility. Disposal trenches would be located such that approximately four

to six months of waste material could be contained within a single trench. Batches of stabilized waste would be hauled to the TWSF, placed within the trench and compacted. The waste would be covered with PVC liner to prevent downward percolation through the material. The PVC cover would be anchored within the adjacent tailings and the downstream end of the trench would remain open for the next batch of stabilized waste placement. The trench would be progressively filled and covered until full, with each cover section welded directly to the previous section. Trench locations would be surveyed and documented for future reference.

Treated Water Discharge Pipeline - Treated water from the water treatment plant would be routed through a pipeline to a surface discharge located on Big Deer Creek. The pipeline would be routed along Ram Gulch to Bucktail Creek and along Big Deer Creek following existing roads where possible. Where no roads exist, the pipeline would follow an alignment that minimizes pipeline length and physical disturbance to soils and vegetation. The pipeline would affect 0.14 acres of jurisdictional wetlands at the crossings of two Bucktail Creek tributaries and at Big Deer Creek.

Storm Water Management Plan

FCC has proposed a Stormwater Management Plan (SWMP) with the goals of: 1) preventing storm water run-on to proposed facilities, 2) minimizing erosion, and 3) reducing sediment transport to downstream receiving waters. FCC would be required to obtain a Storm Water Permit or Permits from EPA prior to beginning construction. Facilities to be covered under the Permit for the proposed Project are as follows:

- Topsoil and borrow material stockpiles;
- Haul and access roads;
- Parking lots;
- Office buildings; and
- Ancillary disturbance areas not associated with milling process.

A construction storm water permit would be required to address construction activities proposed for the site.

A computerized soil erosion model was used to estimate sediment generation under existing and proposed developed conditions, and to compare erosion from existing road surfaces versus those that would be upgraded or modified (Telesto, 2006). The effectiveness of proposed sediment management, using constructed Best Management Practices (BMP) sediment control structures, has been evaluated for the developed condition to assess the resulting changes in sediment loading to area drainages.

Snow removal and storage is another component of the storm water management plan and includes a plan for snow removal for each major facility.

Design Criteria - FCC has proposed that the design storm for the proposed clean water channels, which would exist beyond the life-of-mine, would be either the 25-year, 24-hour storm or the 100-year, 24-hour storm depending on the association of channels with mine roads, process facilities or process materials. BMP facilities designed to cover mine roads and operations are proposed to handle the 2-year, 24-hour storm.

Separation of clean storm water runoff would be accomplished through the use of diversion channels to prevent upgradient water from coming into contact with proposed facilities or mined material stockpiles. The diversion channels would be V-shaped channels with one foot of freeboard and 1:1 side slopes. These upgradient diversion channels would route clean runoff around proposed facilities and disturbed areas and would distribute flows back to the watershed via sheet flow.

The sections of road adjacent to the TWSF would be outsloped to minimize concentration of flows. The storm water runoff generated from these sections of road would be dispersed by the use of slash (stacked timbers and brush). The remainder of roads would be insloped and runoff would report to storm water diversion channels. Channels would have erosion protection in the form of check dams and riprap at outfalls. Outfalls would be protected with brush barriers, biofiltration swales or rock structures, to dissipate runoff energy and prevent headcutting.

Storm water channels installed around proposed facilities would intercept runoff before it interacts with a facility. The intercepted runoff would report to BMP structures, which would also be used to entrap sediment carried by flow in the channels. Design elements of typical BMPs are included in Appendix D to the *Storm Water Management Plan for the Idaho Cobalt Project* (Telesto, 2006a).

Specific design elements of the SWMP are:

- Diversion of upslope clean runoff around the proposed TWSF, process ponds, and proposed borrow area.
- Maintenance of existing sheet and overland flow characteristics over undisturbed areas.
- Conveyance of collected runoff to frequently spaced, erosion-protected outfalls.
- Use of available forest slash (partially burned timber and brush), rock sediment basins, silt fencing, and biofiltration swales in BMPs.
- Revegetation of mining-disturbed areas, concurrently with operations as practical, to increase erosion protection and reduce sediment loading.

Spill Control

FCC's spill control plan that addresses management of hazardous materials during shipping and storage would be revised to address any changes in the plan of operations, reviewed and approved by the agencies prior to initiation of construction activities. The plan would include notification of the ICP facilities prior to transport of fuels or chemicals, use of closed trucks, travel only during daylight hours, use of pilot vehicles, and continuous radio contact with pilot vehicle and facility during transport.

Water Rights

Formation has applied for water rights on the groundwater from the mines and groundwater from two wells, for mining and milling purposes. Water from the wells would be used initially for drilling and other start-up water needs until the mine pumping and precipitation capture from the TWSF is adequate to supply operating water needs. The wells would also supply water for human use.

Water Resource Monitoring

FCC's proposed water resource monitoring plan is described in 2006 Water Monitoring Plan for the Idaho Cobalt Project (Telesto, 2006g). The proposed plan would provide for continuation of monitoring of baseline groundwater and surface water monitoring sites plus additional sites to monitor proposed mine facilities. A total of twenty-five surface water stations would be monitored on Bucktail Creek, South Fork Big Deer Creek, Big Deer Creek, Panther Creek, Big Flat Creek, Ram Gulch and several unnamed tributary streams/springs. A total of twenty-five groundwater monitoring wells would be monitored, upgradient and downgradient of all mine facilities in Bucktail Creek and Big Flat Creek drainages.

Formation would also install a cable car crossing of Panther Creek to facilitate baseline and operational monitoring of lower Big Flat Creek. The cable crossing would be installed south of the confluence of Big Flat Creek and Panther Creek and would be accessible from Forest Service Road #055. Design and construction of the cable car crossing would be similar to that of the BMSG crossing located upstream on Panther Creek and would consist of two, thirteen-foot high "A" frames anchored with concrete deadmen, with a 90 to 120 foot cable span. A platform would be built on

each “A” frame to allow passenger access. Equipment (e.g. backhoe or excavator) would be required to cross the creek in order to install the two or three yards of concrete for the deadman. The crossing would be installed in early spring prior to high flow.

Support Facilities

Tool rooms would be located at each of the decline portals to the Ram and Sunshine. Emergency power generators would also be located at the portals. Explosives storage magazines would be portable structures furnished by the supplier.

Power and Fuel

Idaho Power Company would supply power to the ICP substation from an existing 69-kilovolt powerline (see **Figure 2-1**). ICP would have to obtain an agreement with Noranda to utilize the powerline over private land from the Blackbird substation. From the ICP substation, located within the mill area, power would be distributed throughout the site via powerlines at 4,160 volts.

Emergency power would be supplied with diesel generating equipment. This equipment would be sufficient only for essential mill equipment and mine pumps.

On-site diesel, gasoline, and propane storage facilities would provide a two-day supply of diesel and a 30-day supply of the other various fuels (**Table 2-1)**. The storage tanks for diesel and gasoline would be placed within concrete containment measuring 25 feet by 40 feet.

Borrow Areas

During construction and reclamation there would be a need for road surfacing materials, drain rock, and riprap. FCC has identified two borrow areas. One borrow area is along Blackbird Creek on National Forest Land (**Figure 2-2**). The other borrow area is near the Ram Portal, also in an area previously used as a borrow source (**Figure 2-1**).

The materials in the borrow area near the Ram Mine would be used for surfacing materials for the underground mine roads and other construction and reclamation activities. Approximately 40,000 cubic yards of these materials would be required, and is available at this borrow area. The materials in the Blackbird Creek borrow area have been tested and found to be appropriate for use as road surfacing materials. It is estimated that 20,000 cubic yards of materials would be required for site roads, and is available at this borrow area.

Work Force and Work Schedule

The anticipated personnel requirements for the mine, mine maintenance, engineering and geology, and surface facilities support departments during the first year of production would be 69 persons, increasing to 109 persons at full production. The anticipated personnel requirements for the milling operation would be approximately 31 persons. Total Project employment would be approximately 157.

The work force numbers may be temporarily higher during construction and start up. During closure and reclamation, the work force would be reduced significantly.

FCC plans to operate the mine 24 hours per day, five days per week, for approximately 250 days per year. Mill production would operate 24 hours per day, seven days per week, for approximately 350 days per year.

Reclamation

The ICP's proposed reclamation plan involves approximately 129 acres of surface disturbance. This includes existing roads that would not be reclaimed and would become a part of the post-mining road system in the area. Additionally, some newly constructed Project roads would be incorporated into the post-mining road system. During Project construction, ICP proposes to reclaim about 23,000 feet of substandard and non-essential existing roads in the vicinity of the Project. Once mining has ceased or when no longer required for post-closure water management or other closure activities, all above ground facilities would be demolished, removed from the site, and their former location reclaimed.

FCC's proposed reclamation plan detailed in the ICP Plan of Operations provides the following goals:

- Conduct reclamation and revegetation concurrently with the mining program, as much as possible. Concurrent reclamation would be performed on areas no longer required for the mining operation.
- Keep all clearing and disturbance to the minimum consistent with Project needs.
- Place waste rock, tailings, roads, structures, diversions, and water management ponds such that they minimize subsequent shaping and recontouring and do not pose a hazard to human health and the environment.
- Re-establish stable and diverse surface topography and hydraulic features that are compatible with the surrounding landscape.
- Establish soil conditions that promote regeneration of stable, diverse, and self-sustaining plant communities through removal, storage, and redistribution of suitable soil materials.
- Revegetation of all areas disturbed by the operation to stable and diverse vegetation communities that provide wildlife habitat and minimize erosion (the land application areas would already be vegetated at the time of final reclamation; they may not require revegetation).
- Work with the USFS to identify opportunities to improve the post-mining land use of the site through reclamation of existing, unnecessary roads.
- Provide methods, procedures, and practices for seasonal activities, temporary shutdowns, and final reclamation.
- Maintain water quality such that there is no material negative water quality impact at the BMSG compliance points (WQ-24 and WQ-25).

Facility Reclamation

Once the ore reserve is exhausted and mining ceases, surface and underground facilities not needed for reclamation or closure activities would be removed.

Mines - Reclamation of the flat areas adjacent to the Ram and Sunshine portals would include removal of buildings, cables, piping, and concrete pads, regrading, ripping to alleviate compaction, applying available growth medium (and amendments if determined necessary), and revegetating.

Adit portals would be sealed to prevent human or animal access. This would include backfilling the entries of adits with clean waste rock and grading the area to fill the portal depression.

Grading would include bringing as much of the portal bench fill as possible onto the cut area and re-establishing a continuous hillside slope, to the extent practicable. Abrupt surface features would be smoothed to create uniform grades and to produce a near naturally appearing surface.

Mill - The combined mill, administration building, warehouse, shop, and ancillary facilities such as piping and tanks would be demolished and disposed. Buildings and equipment would be dismantled

and removed from the property. Equipment and facilities with salvage value would be sold. All remaining scrap and demolition debris would be disposed of off-site at an approved landfill.

Foundations and walls would be demolished to one foot below grade and covered with fill to eliminate any safety hazards for wildlife or humans. Sumps or other voids would be backfilled with sufficient soil so that depressions would not occur after settling. Slab foundations would be broken up for adequate drainage, placed in the deeper portions of the regraded fill, and buried under no less than two feet of cover.

Regrading of this area would include moving much of the fill into the original cut area to establish a natural looking topography. The edges of the area would be shaped to blend with the surrounding contours. The area would be ripped to relieve compaction prior to topsoil placement. Topsoil would be placed over the area to a minimum depth of 12 inches.

The water treatment plant will be attached to the mill building such that the mill building and equipment can be dismantled and removed without disturbing the treatment operation. Water treatment operations will continue as long as pump-back ground water wells are operated. At the cessation of pump-back well operation, the water treatment plant would be decommissioned by dismantling and removing all equipment, building, and support structures.

Decommissioning and reclamation activities described for the mill process area will be applied to the water treatment plant and surrounding area, including foundation demolition, backfilling, regrading, and reseeding. The equalization pond will be reclaimed in accordance with procedures described for the water management pond.

Tram - Reclamation of the overhead tram would include removal of the structures, pipelines, cables, and concrete pads that comprise the facility. Following removal of the equipment, the disturbed areas within the tramline corridor would be graded and revegetated.

TWSF - The TWSF would be constructed in three phases with construction beginning on the eastern side (the lowest end) of the facility and proceed upwards. As stacking on Phase I of the facility nears its ultimate capacity, Phase II would be constructed. Once material placement on Phase I is complete, that phase would be reclaimed. Likewise, as soon as material placement on Phase II is complete, it would be reclaimed. Incremental reclamation of the TWSF would reduce the precipitation catchment area, reducing the amount of excess water captured each year. Reclamation of the TWSF would include grading, cover installation, topsoil placement, and revegetation.

Grading of the TWSF would require minor surface shaping to smooth corners to give a more natural appearance to the pile. The 100-foot setback benches would remain in place and would be backsloped into the pile and sloped to drain laterally. Slopes of the reclaimed pile would be at 4H:1V or less. Setback benches and the pile top would be graded at three percent to drain. If post closure water treatment were required, the pile top would not be immediately reclaimed, but would be utilized for disposal of stabilized water treatment waste. FCC estimates the TWSF pile top would have adequate area to accommodate a ten foot layer of stabilized water treatment waste over the period of 17 years.

The TWSF cover installation would include placing a 60-mil HDPE cover, installing a geonet drainage layer over the HDPE cover, and placing 2 feet of compacted borrow on top of the drainage layer.

Topsoil placement would include a minimum of 12 inches of topsoil on top of the compacted borrow. Soil would be placed loose and scarified along the contour to provide micro traps for moisture and seeds.

Seeding would be by mechanical means where practical and safe, and by hand where necessary. Seeding would include grasses, forbs, and shrubs. Trees would not be planted to avoid tree root penetration into the cover.

During operation, drainage from the TWSF underliner would report to the water management ponds. Following active mining, for the duration of water pumpback and treatment at the Ram and Sunshine mines, TWSF drainage would continue to report to the water management ponds. After the ponds have been reclaimed, drainage from above the TWSF underliner would report to an infiltration field located east of the water management ponds. The DSM estimates long-term drainage at 0.4 gpm. The drainfield would be designed to accept up to one gpm.

Pipelines – Surface pipelines would be removed. To minimize re-disturbing revegetated areas, buried pipelines would be capped and abandoned in place.

Soil Salvage

During the construction of the Project, available soil would be stockpiled and stabilized in a discrete location adjacent to the area disturbed by mining-related activities. Soil removed during road and portal construction would be stockpiled downslope of those features. Soil removed during mill and TWSF construction would be stockpiled near the TWSF area (**Figure 2-1**). Total topsoil salvage is estimated to be 284,000 cubic yards. Approximately seven acres would be required for the topsoil stockpile area. Precipitation run-on would be diverted around the stockpile area by perimeter ditches. As topsoil materials are placed in this area, the topsoil would be seeded with a mixture of non-native species (smooth brome, mountain brome, orchard grass, and timothy) at an application rate of 4 pounds per acre each to temporarily stabilize the stockpile.

Soil types and depths vary across the site. In the Ram and the Sunshine areas, the salvageable soil depth is estimated to range from 0 to 8 inches. On the Big Flat, soil depths are estimated to provide between 12 and 14 inches of quality material suitable for reclamation purposes.

Reclamation Recontouring

The removal or disposal of all equipment and facilities would proceed as soon as practical after closure of the operation. Disturbed areas would be graded or shaped to blend with the surrounding area, to the extent practicable. Surfaces would be graded and scarified on the contour to increase available soil moisture, provide stability for the reclaimed areas, and to minimize erosion.

Replacement of Growth Medium

Following recontouring of the site, salvaged soil would be taken from the stockpiles and placed over the recontoured surfaces. Prior to placement on disturbed sites, the selected growth medium would be tested for comparison with pre-selected reference sites. Testing would include pH, electrical conductivity, lime, organic matter content, texture, saturation percent, nitrate–nitrogen, phosphorus, potassium, zinc, iron, manganese, and copper. Formation would review testing results and propose a soil amendment program (if needed) to the USFS. The decomposition of organic matter while growth medium is in stockpile has been documented. Nitrogen fertilizer and organic materials would be added as necessary to ensure adequate plant development.

Seedbed conditioning would consist of ripping or discing the recontoured surface with notched or straight edged discs set together in rows or “gangs” combined with harrows. This step would break up seedbed clods and turn under and cut brush, limbs, and weeds. Additionally, it would break up surface compaction and anchor any straw or hay mulch that has been applied.

Re-Vegetation

Following grading (or contouring), growth medium placement, and seedbed conditioning, the areas would be revegetated with species appropriate for the specific site and climate. Species used in revegetation would stabilize the area and allow the natural incursion of indigenous species. Lodgepole pine is expected to regenerate naturally over the Big Flat and other areas as a result of the

2000 Clear Creek fire. FCC would collect serotinous lodgepole pine cones from nearby sources and place those cones over the replaced soils for subsequent opening and seed germination.

Grass seed application would be performed with a seed drill, hydroseeding, or hand broadcasting depending upon the terrain. Broadcast seeding would be done in the fall prior to freeze up to produce the optimum germination. Areas seeded to grass would receive a light application of weed-free straw mulch at the time of seeding followed by the application of fertilizer in the spring prior to summer rains.

Water Management at Closure

At closure, FCC intends to allow the mines to flood. As groundwater floods the Ram and Sunshine mines, soluble metals and salts would be flushed from exposed rock surfaces and from the tailings and waste rock used as backfill. Metal concentrations in the initial groundwater flush during, and soon after mine refilling are predicted to be elevated as described in the Water Resources portion of Chapter 4. To mitigate the potential impacts, groundwater downgradient of the mines would be monitored and a series of pumpback wells would be installed downgradient of each mine, if necessary, to intercept contaminated groundwater.

Locations of proposed groundwater capture wells are shown on Figure 2-1. Groundwater interception rates for the Ram and Sunshine capture systems are estimated to be 75 and 14 gpm, respectively (Appendix C of FCC, 2006). Water quality of the groundwater captured by the wells is predicted to be similar to post-mining minewater quality as described in Table 4-7 (Chapter 4). This intercepted groundwater would be pumped to the mill where it would be treated, and discharged under the NPDES permit. FCC has committed to operating the pumpback system and water treatment system as long as needed to achieve long-term water quality goals.

Water Management Pond

Prior to reclamation of the water management pond, any remaining water would be treated and discharged. Any sediment or residual material in the pond would be analyzed for pH and metals. If the testing shows leachable metals exceeding the regulatory limits, the sludge would be either stabilized in place and retested, or removed from the site and disposed of in a permitted disposal facility consistent with federal and state regulations. Following testing, the liner would be folded into the pond, dikes would be pushed into the pond, and the area would be regraded to approximate the pre-construction topography. Following the regrading operation, the area would be covered with growth medium and revegetated. Seedbed preparation and seed application would be performed in one operation with a tractor pulling a chisel tooth harrow and seed drill.

The water management pond would be reclaimed after pumping in the Ram and Sunshine Mine pumpback well fields ceases.

Post-Closure Monitoring

All reclaimed sites would be monitored twice a year for a period of three years to evaluate the success of the reclamation work. Any areas not meeting the vegetation success criteria would be analyzed to determine the problems and the areas would be revegetated with a modified plan.

In addition, there would be quarterly monitoring of ground and surface water for three years following cessation of pumpback. Results of this monitoring would be used to evaluate the success of the measures taken to protect the water resources. Any changes in water quality would be evaluated to determine whether the changes are related to the reclaimed mining facilities.

Financial Assurance

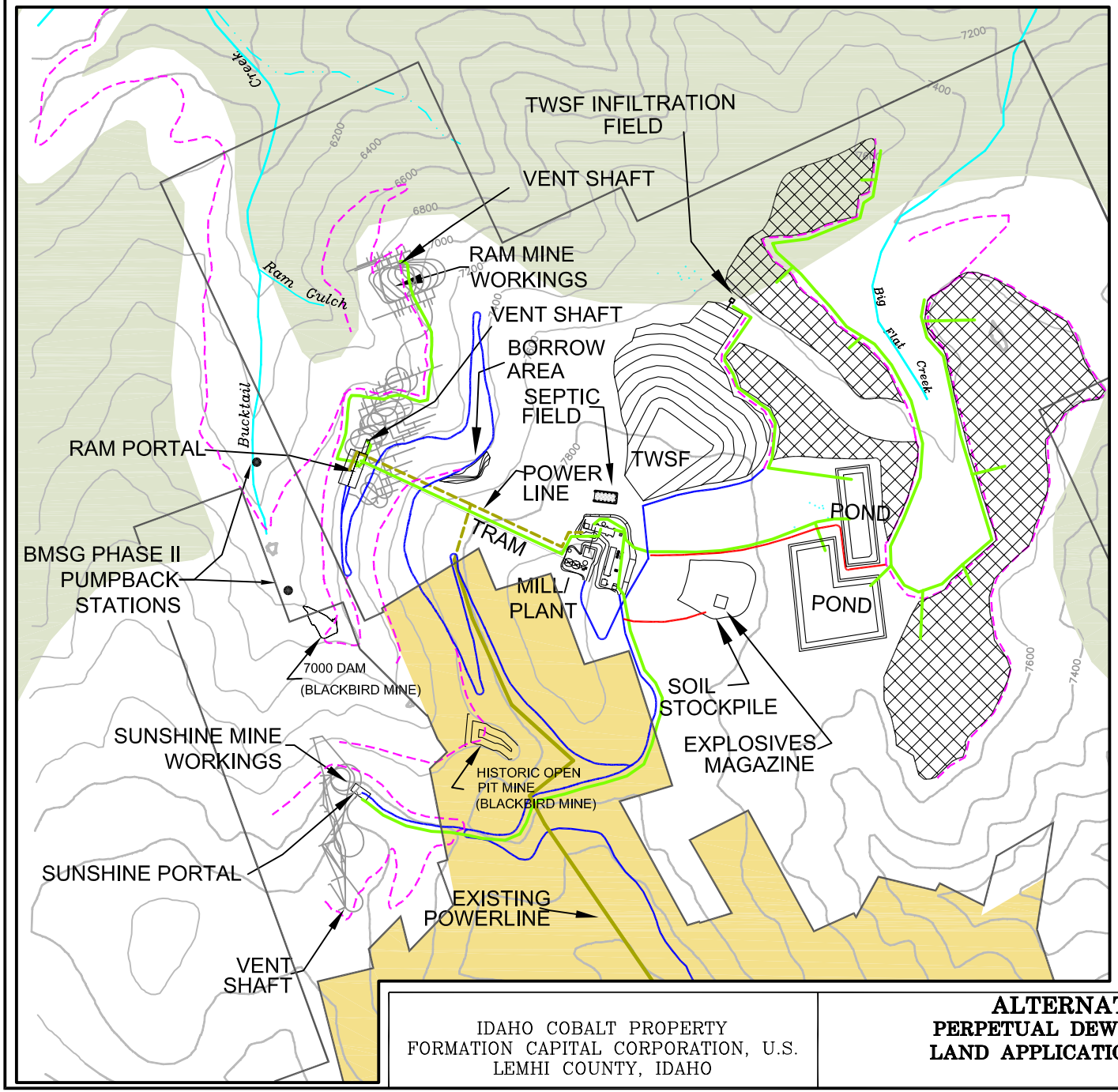
As part of the approval of a plan of operations for the ICP, the Forest Service would require FCC to post a financial assurance that would provide adequate funding to allow the Forest Service to complete reclamation and post-closure operation and maintenance activities and necessary monitoring for as long as required to return the site to a stable and acceptable condition. The amount of financial assurance would be determined by the Forest Service and would be adequate to allow the Forest Service to complete all necessary reclamation of the ICP at any stage if FCC were to abandon the project. The financial assurance would also cover potential costs to capture and treat water following closure if that were required to meet effluent or instream limits. The financial assurance may be in the form of a bond or other financial instrument and would be payable to the Forest Service in the event that FCC does not perform reclamation actions as required by the ICP Plan of Operations. The amount of the financial assurance would be calculated in accordance with USFS guidelines (USDA Forest Service, 2004).

Alternative III - Relocation of TWSF, Perpetual Mine Dewatering, and Land Application Water Discharge

Alternative III (**Figure 2-11**) incorporates modifications and mitigation measures developed by the Salmon-Challis National Forest (SCNF) and cooperating agencies to address identified environmental and operational impacts and to provide analysis of a broad range of reasonable alternatives. These measures would modify the Plan of Operations submitted by FCC. Proposed modifications have been developed in response to issues and potential impacts identified during the scoping and Idaho Joint Review Process (JRP) used by the EIS team to develop Issues, Concerns, and Opportunities (ICOs) for the ICP and during the impact analysis.

Modifications to FCC's proposed Plan of Operation (Alternative II) that are incorporated into Alternative III in response to identified ICOs include:

- Alternative III includes relocation of the TWSF to an alternative site with a footprint of 53 acres while maintaining the capacity of 2.5 MCY that FCC proposes under Alternative II. The TWSF is moved to the northeast of the mill and is sized to accept the identified ore reserves and avoid direct and indirect impacts to wetlands. Water management for waters associated with the TWSF would be as described in the Plan of Operations for Alternative II but modified to reflect the change in facility configuration. This TWSF site would potentially allow expansion of the footprint to address additional ore reserves without impacting wetlands; any such expansion may require NEPA review and modification of the plan of operations.
- Modification of the TWSF closure cap to provide greater routing depth and to protect the low permeability liner from damage from trees.
- Use of land application treatment (LAT) for water disposal which utilizes soil attenuation to supplement water treatment and dispose of water in the Big Flat drainage.
- Long-term (potentially perpetual) post closure mine water capture from lower level of mine workings to maximize groundwater capture efficiency.
- Increase the size of the process water management pond and addition of a storage pond to account for the water balance of this alternative.
- Incorporation of an NPDES permit for discharge to Big Flat Creek via a groundwater connection from the LAT site.



LEGEND

- PROPOSED POWERLINE
- EXISTING POWERLINE
- WATER PIPELINE
- PRIMARY ROADWAY
- SECONDARY ROADWAY
- TERTIARY ROADWAY
- WETLAND/WATER FEATURE
- ROADLESS AREA
- PRIVATE PROPERTY
- LAND APPLICATION AREA
- FORMATION CAPITAL CLAIM BOUNDARY

SCALE

0 (In Feet) 1600

APPROXIMATE

NORTH

REVISED 6/2006

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ALTERNATIVE III
PERPETUAL DEWATERING AND LAND APPLICATION\DISCHARGE

FIGURE
2-11

Modifications to ICP Plan to Address Specific Resource Concerns

The Alternative III proposed modifications to FCC's Plan (Alternative II) described in more detail in this section are intended to address concerns about predicted or potential impacts from FCC's proposal. **Table 2-3** contains a comparison of disturbance acreages between each of the alternatives. A major component of Alternative III, the land application water treatment and storage system, was originally developed and proposed by Formation; FCC later withdrew land application in favor of their proposed reverse osmosis water treatment system and direct discharge to Big Deer Creek. FCC's evaluation of soil properties and water management (Cascade Earth Sciences, 2005) provides the basis for the LAT system included in Alternative III.

If Alternative III or components of Alternative III were to be selected by the Forest Service, revised designs and new implementation plans for some of the Project facilities would be required prior to construction of the Project. This is due to the fact that this alternative differs from the facility design and implementation plans contained in the POO (Alternative II). The required designs and plans would include design of the TWSF, design of the water mine dewatering used at closure, a tailings and waste rock co-mingling plan, a revised water management and treatment process, revised pond designs to provide adequate storage for 100 year precipitation event and to include overflow spillways and design of access road improvements on the Williams Creek/Deep Creek route.

TABLE 2-3. Idaho Cobalt Project – New Site Disturbance

PROJECT FEATURE	ALT II (acres)	ALT III (acres)	ALT IV (acres)	ALT V (acres)
RAM PORTAL	1.8	1.8	1.8	1.8
SUNSHINE PORTAL	0.4	0.4	0.4	0.4
TRAM CORRIDOR	1.7	1.7	1.7	1.7
MILL\PLANT	10.9	10.9	10.9	10.9
TWSF	55.4	52.8	36.0	36.0
PONDS	6.6	28.1	6.6	6.6
ROADS[1] AND UTILITIES	38.9	34.5	38.0	37.0
BORROW AREAS[2]	6.0	9.0	9.0	9.0
LAND APPLICATION AREA	0.0	175.4	0.0	0.0
SOIL STOCKPILE	7.2	9.0	7.2	7.2
TOTAL	**129**	**324**	**112**	**111**

[1] Project Site Roads are all roads north of divide between Blackbird Creek and Big Deer Creek
[2] Borrow Areas Below Mill and on Blackbird Road

Waste Storage Facility

Formation has identified 2.57 million tons of ore in the Ram and Sunshine deposits, and has designed the TWSF to hold 3.4 million tons or 2.5 million cubic yards (MCY) of tailings and waste rock. Alternative III has revised the TWSF footprint by moving it to an area to the north of the mill site. This site has suitable area and slope characteristics to store the proposed tailings and waste rock volume. The TWSF footprint acreage would be nearly identical to that proposed by Formation (55 vs. 53 acres), but the height of the dump slope would be greater.

The TWSF cap would be modified to provide a thicker cover capable of supporting native forest trees that will eventually revegetate the site. The cover thickness will be increased from three feet to four feet and consist of three feet of subsoil and one foot of topsoil.

Water Management and Treatment

Alternative III would capture water by pumping from the mines and treat and discharge the mine water via a land application system.

Groundwater Capture - The post-closure groundwater capture system would be modified to improve the post-closure groundwater capture efficiency and to reduce the amount of water that would need to be treated and disposed of during the post-closure period. Rather than using wells downgradient of the mine, groundwater would be captured using wells installed into the lower levels of the Ram and Sunshine workings to prevent flooding and flushing of the mine backfill and groundwater outflow from the workings. This would allow more efficient capture of groundwater with a minimum of dilution, thus reducing the amount of water requiring treatment and disposal. However, long term dewatering of the mine would not allow mine flooding to rinse and remove soluble metals from the mine walls, waste rock and backfill. A water right for this dewatering system would be required from Idaho Department of Water Resources.

Water Treatment - A water pre-treatment system would be installed in the mill. The plant would be designed to recover trace metals from the mine and process water for the purpose of controlling the trace metal levels in both the mill process water and the land application solutions. Treatment would include pH adjustment and sulfide precipitation followed by sludge thickening. Sulfide precipitation of metals would be achieved by addition of sodium sulfide to the incoming water, and pH adjustment would be by lime addition. The resulting sludge would be a lime/gypsum waste that would incorporate metal sulfide precipitates. The plant would be designed to process up to 300 gpm. The sludge would be sent off-site for further processing or disposal.

The water treatment plant would include a reactor tank for lime and sodium sulfide addition and a thickener to recover the metal sulfides and other constituents in a sludge. The sludge would be sent to the concentrate filter where it would be incorporated into the concentrate. This initial treatment would remove the majority of the metals in the mine water. Treated water would be sent to the storage pond where it would await land application for further treatment and disposal.

Land Application Treatment and Disposal – Land application water treatment and disposal (LAT) as proposed in Alternative III would occur for the approximately 12 years of operations and for a number of years following closure. The land application water disposal area under Alternative III would take advantage of soil attenuation to provide some of the water treatment. The LAT would utilize 175 acres in the Big Flat area northeast of the TWSF for water treatment and disposal (**Figure 2-11**).

The proposed land application system would use sprinkler irrigation to seasonally apply water under specified and controlled conditions.

The suitability of the Big Flat for land application of process water was evaluated using site-selection criteria and rating factors for forested sites as presented in the *Process Design Manual for Municipal Land Treatment Systems* (USEPA, 1981) and *Handbook for Land Application of Municipal and Industrial Wastewater* (IDEQ, 1996). Using the EPA criteria, the Big Flat area has a moderate to high overall suitability rating for a land application system.

Land application would provide an additional treatment step by removing residual metals and nitrogen from the treated water by soil adsorption and biological nitrogen uptake. Metals would be strongly adsorbed by soils in the land application area with the result that negligible leaching of applied metals to groundwater and surface water is expected to occur. Nitrogen applied to soils would be assimilated by plants and low amounts of nitrogen would be leached from the site to groundwater. Additional details regarding DSM and HYDRUS model hydraulic parameters, solute parameters, and boundary conditions are presented in the *Land Application Analysis Report for the Idaho Cobalt Project* (CES, 2005), the Water Resources Technical Report, and in Chapter 4 of this EIS.

Land Application System Design - The land application area would be divided into a number of zones to allow the site to be developed in stages, equalize operating pressures on slopes, reduce the maximum required irrigation flow rate, and provide operational flexibility.

Prior to establishment of the irrigation system, the Big Flat land application site would be cleared of trees (much of the area was burned in the 2000 Clear Creek fire) and revegetated with non-native grasses and forbs to stabilize the soil, provide maximum evapotranspiration, and maintain soil structure for infiltration of applied water. The land application area would periodically be mowed and the hay removed.

The results of a detailed water balance (CES, 2005) indicate that in the wettest year, a maximum of about 11.6 inches of water could be applied over the 4-month period of June through September while avoiding soil water drainage below a depth of 24 inches. Thus, the capacity for water management to avoid deep soil water drainage over the 175-acre land application area is approximately 55 million gallons. Irrigation would be scheduled between June 1 and September 30 depending on soil moisture conditions and would result in water application on the order of 0.2 to 0.3 inches per day. In early June and late September, the anticipated irrigation cycles would be 1-hour intervals per day. During peak evapotranspiration demand in the warm summer months, the irrigation cycle would be lengthened from 1 to 2 hours per day.

EPA has indicated that a NPDES permit would be needed for the LAT discharge in the Big Flat drainage since the groundwater flow model indicates that irrigation discharge would quickly reach Big Flat Creek and soil attenuation would not totally remove nitrogen and would remove little, if any, of the sulfate. Sulfate discharged to groundwater is predicted to exceed the secondary drinking water standard and a variance of the Idaho groundwater standard within the vicinity of the Big Flat LAT would also be required.

Alternative III makes design changes to the water management system and adds a storage pond necessary because of the seasonal LAT. The process and storage ponds each would feature an emergency overflow spillway in this alternative. The spillway would not alter the nominal storage capacity of either pond. The spillway would safely route overtopping flows from a 100-year precipitation event across the pond embankment, minimizing erosion to the embankment should either pond overfill its design capacity. Should either pond overfill and discharge via the spillway, water would flow towards Big Flat Creek.

The storage capacity of the process and storage ponds would be based on the water balance for this alternative, which indicates that the projected storage pond would need to be sized for 48 million gallons (MG) plus two feet of freeboard, and the process pond would contain 23 MG plus two feet of freeboard. These ponds are sized to contain a 24-hour period volume requirement of a 100-year recurrence interval.

Water Monitoring

Alternative III would include changes to the water monitoring program to provide enhanced water monitoring to detect, document, and quantify effects of mining on groundwater and surface water quantity and quality. The modified monitoring strategy would support a performance-based approach to compliance assessment, where groundwater quality data from select operational monitoring wells to be located downgradient of the mines would be evaluated for compliance.

Water monitoring necessary for Alternative III would differ in some details from Alternative II to account for the changed location of the TWSF, the use of LAT, groundwater capture from the mine workings and NPDES permit monitoring related to the surface water impacts of the LAT groundwater discharge.

Road Upgrades

A number of additional road improvements described in the Monitoring and Mitigation Measures Included in Agency Alternatives section would be required under Alternative III.

A total of 13.1 miles of site roads including 5.6 miles of new construction would be required for Alternative III. Of this total, 1.1 mile lies within designated roadless area including 0.5 miles of new construction.

Other Mitigation

Other modifications, mitigation measures and monitoring requirements intended to reduce environmental impacts, improve agency oversight or reduce risk would be applied to Alternative IV. These include the following:

- ICP shall provide an annual report summarizing mining, reclamation and monitoring activities and projecting proposed activities for the coming year. ICP shall conduct an annual review with the Forest Service to determine if activities are in accordance with the approved Plan and if any changes to the Plan or financial assurance are needed;
- ICP shall provide notice to the Forest Service and make appropriate modifications to the Plan of Operations if there are significant changes to project permits (such as NPDES or Air Quality);
- Waste rock (slash) left underground in the Ram and Sunshine mines will be amended with lime or cement to provide alkalinity to reduce potential for metals leaching;
- Waste rock and tailings materials will be tested throughout the life of the mine to evaluate potential for acid generation and metals leaching;
- Process ponds will include spillways to reduce risk of failure if overtopping occurs;
- Permanent water control structures that will exist beyond the life of mine will be designed to handle flow from the 100-year storm event and standard state and federal best management practices will be utilized for Project sediment control;
- Soil disturbing construction activities will be conducted during a set construction season to minimize impacts to soils and sediment production;
- Modifications to the water resources monitoring plan to provide adequate data to evaluate potential impacts to surface and groundwater in a timely manner;
- Enhanced emergency management capabilities will be instituted for medical (including designating a helipad site), spill control and fire situations;
- Precautions will be taken to preserve or replace benchmarks and other existing survey controls;
- Native species and more detailed reclamation procedures will be used for reclamation to ensure achievement of self sustaining vegetation following reclamation;
- ICP will require as company policy that employees have no firearms on site or during travel to the site;
- Additional access road improvements will be made to reduce sediment release and traffic accident risk;
- Monitoring and inspection of roads and bridges to assure public safety and adherence to Forest Service engineering standards;
- Construction workers will be required to utilize van sharing or busing to minimize traffic during the construction period;
- Any surface vegetation clearing or timber removal will be conducted following USFS guidelines and practices and following Forest Service approval;
- The ICP shall institute a weed control plan that conforms to Forest Service and County guidelines;
- ICP will be required to submit a plan to monitor existing wetlands and constructed wetlands to determine impacts to wetlands functions and shall modify the constructed wetlands as

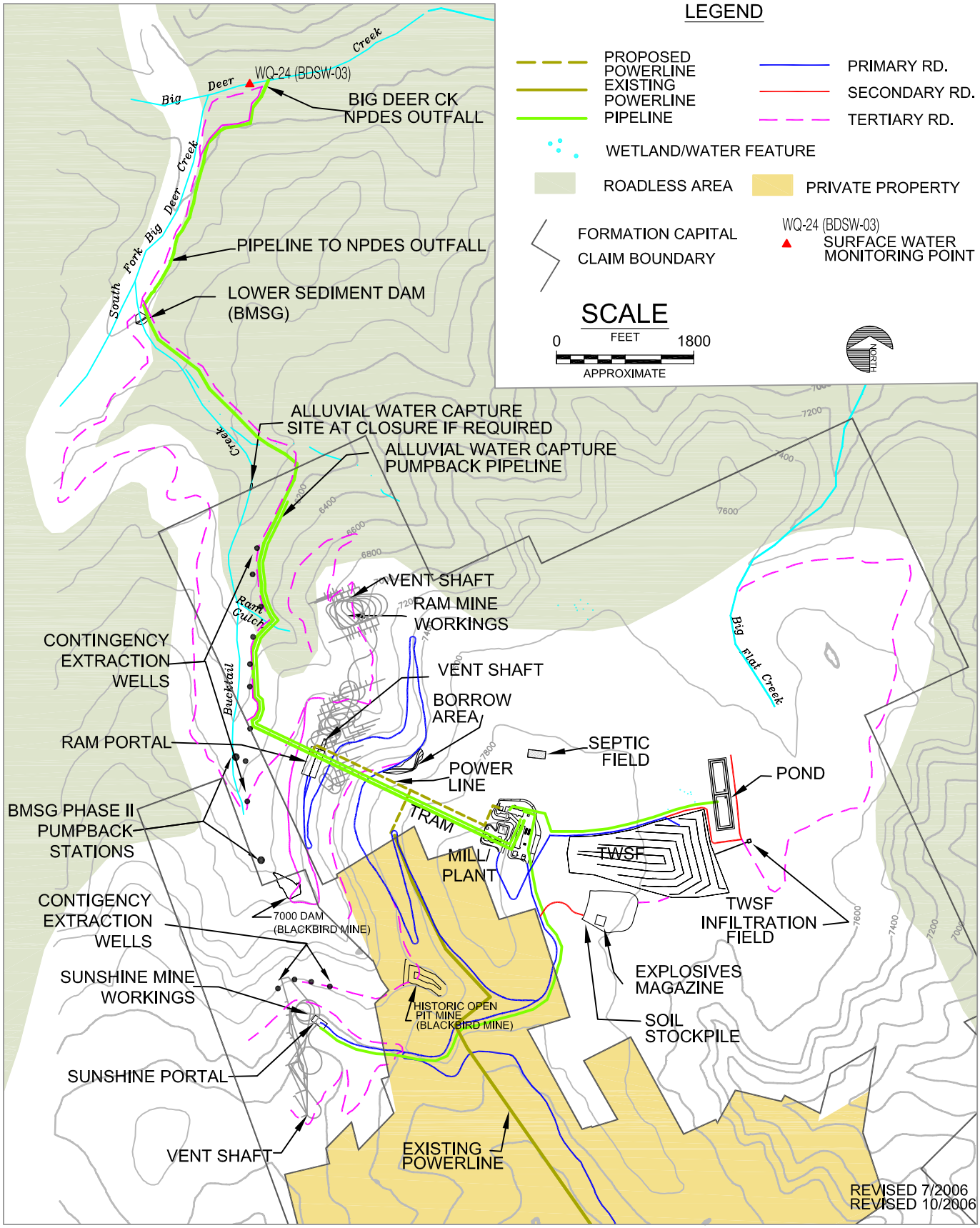
necessary to assure that they are providing suitable wetland habitat to compensate for Project impacts to natural wetlands;

- The ICP shall submit a modified design for the TWSF closure cap that includes a minimum of 4 feet of soil cover material to protect the liner from potential damage from trees growing on the reclaimed surface;
- The ICP shall submit a plan for approval by the Forest Service for placement of tailings into the TWSF during winter designed to maintain the design density and moisture content of the dry stack tailings;
- The ICP shall develop a waste rock disposal plan for any material disturbance on the Sunshine portal pad or any other location where preexisting wastes may be disturbed for Forest Service approval in accordance with all relevant federal, state, and local laws. Disturbance of any contaminated waste rock associated with the Blackbird CERCLA cleanup should be coordinated with EPA and Forest Service CERCLA Programs to minimize potential CERCLA liability;
- Tailings and waste rock disposed of in the TWSF would be commingled rather than kept separate to reduce the oxidation rate of the higher permeability waste rock component and reduce long term risk to the environment of metals release; and
- ICP will be required to submit a design for Forest Service approval to protect pond liners from potential ice damage.

Alternative IV - Reduced Size of TWSF, Modified Water Treatment to Reduce Waste Stream, Surface Discharge To Big Deer Creek and Backup Groundwater Capture in Lower Bucktail Creek

Alternative IV incorporates changes and mitigation measures proposed by the Agencies in an attempt to reduce the risk of operational and environmental impacts, to provide analysis of a broad range of reasonable alternatives and to improve agency oversight of the mine operation. The Alternative IV changes have been developed in response to issues identified during the scoping, review and analysis process.

Alternative IV is distinguished from Alternatives II and III in that while the TWSF would be located to the southeast of the mill site as in Alternative II, it would be reduced in size to accommodate only the amount of ore currently identified by FCC. The water treatment system would be designed to meet requirements of direct discharge to surface water in Big Deer Creek, but would not include reverse osmosis as a primary treatment step in order to reduce the amount of water treatment waste that would require on-site disposal (**Figure 2-12**). Alternative IV would require that FCC obtain a NPDES discharge permit. At the completion of mining the decision to cease pumping from the mine would be made based on results of water quality monitoring and predictions of impacts to groundwater and surface water. Post closure groundwater capture wells would be installed and tested during the initial construction phase to confirm that the system will capture a sufficient amount of groundwater to protect downstream water quality. If the bedrock groundwater capture system is not adequate, an additional capture system would be installed in Bucktail alluvium to assure capture of the metals load necessary to protect water quality goals. Alternative IV would require amendment of slash (waste rock) backfill in the underground mines to reduce metals mobility. These measures would require modification of the Plan of Operations submitted by Formation to include detailed plans for design and implementation of these components.



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ALTERNATIVE IV
LOWER BUCKTAIL GROUNDWATER CAPTURE - ADVANCED WATER TREATMENT AND DISCHARGE TO BIG DEER CK

FIGURE
2-12

In addition to these major changes (TWSF size, post closure groundwater capture and pumpback system and modifications to the water treatment system) a number of other changes and mitigation measures incorporated would be incorporated in Alternative IV. These include addition of a spillway to the water management pond to reduce risk of structural failure in event of pond overflow; use of native vegetation for reclamation to minimize time required to regain natural vegetation community and minimize spread of non-native species; co-mingling tailings and waste rock in the TWSF; additional access road improvements on the Williams Creek/Deep Creek route to improve traffic safety, reduce spill risk, and reduce sediment release to surface waters; and the other mitigation items common to all alternatives.

Should this alternative be selected by the Agencies, revised designs and new implementation plans for some of the Project facilities would be required prior to construction of the Project. This is due to the fact that this alternative differs from the facility design and implementation plans contained in the FCC's POO (Alternative II). These include the TWSF design, the water capture and pumpback system used at closure, a tailings and waste rock co-mingling plan, a revised water treatment plant process, revisions to the NPDES permit application reflecting the water treatment system, revised pond design to include an overflow spillway and design of access road improvements on the Williams Creek/Deep Creek route.

Modifications Included in Alternative IV

Waste Storage Facility

Formation has identified 2.57 million tons of ore in the Ram and Sunshine deposits, and has designed the TWSF to hold 3.4 million tons or 2.5 million cubic yards (MCY) of tailings and waste rock. A significant portion of the tailings would be disposed of underground as part of the mining backfill. Formation's TWSF design accounts for an approximate 35 percent increase in mining tonnage over that currently identified. Alternative IV has revised the TWSF footprint to more closely accommodate the identified ore reserves with a design capacity of 1.7 MCY and a footprint of 36 acres (**Figure 2-12**). Tailings and waste rock placement, and water management for waters associated with the TWSF are as described in the Plan of Operations for Alternative II but modified to reflect the change in facility configuration and co-mingling of waste rock and tailings. This design could be expanded if additional ore reserves were identified in the future. However, the smaller tailings footprint avoids impacts to non-jurisdictional wetlands and provides a minimum of disturbance. An increase in ore reserves or changes in operational parameters (tailings or waste density, amount of tailings used in backfill, variation in dilution estimate) could require changes to the TWSF design, the Plan of Operations and the required financial assurance.

The TWSF cap would be modified to provide a cover capable of supporting native forest that will eventually revegetate the site. The cover thickness will be increased from three feet to four feet and consist of three feet of subsoil and one foot of topsoil.

Water Management and Treatment

The water treatment process for Alternative IV would utilize the same basic process components as the pre-treatment system proposed by FCC in Alternative II,

but may not require reverse osmosis as a polishing step to remove dissolved solids, nitrogen and sulfate. This could eliminate the need for disposal of a stabilized RO waste stream, but might result in higher levels of sulfate in the discharge water. The treatment process would result in treated water (effluent) capable of meeting effluent limits imposed by an NPDES permit in Big Deer Creek.

Water treatment process confirmation testing using the treatment process train components described below is required as part of this alternative. A description of the water treatability testing program will be submitted to the Forest Service for their review and approval prior to these tests

being conducted. This testing will be completed and results submitted to the Forest Service prior to construction of the water treatment plant.

The treatment system for Alternative IV would utilize liquid/solid separation using chemical addition, and either (a) clarification and media filtration, or (b) membrane filtration (for example micro/ultra filtration membranes) for metals removal for the entire process stream; and biological nitrification/denitrification for nitrogen removal for all, or a portion of the process stream should nitrogen levels be in excess of anticipated NPDES effluent limits. If the NPDES permit contains an effluent limit for sulfate and anticipated inflow to the water treatment plant contains sulfate concentrations higher than this limit, this alternative would utilize biological sulfate reduction for all or a portion of the flow stream. If water treatability testing performed to support the final design of the treatment plant indicates that the above described treatment train cannot produce an effluent capable of meeting the NPDES limits, this alternative will allow additional water treatment processes using ion exchange or reverse osmosis for a portion or all of the flow stream. If this additional polishing treatment is shown through testing to be the only viable way to remove constituents down to NPDES effluent limits, a plan for managing the liquid brine (RO waste stream) or regenerant (ion exchange waste stream) will be presented to the Forest Service for approval of on- or off-site disposal.

This alternative does require that the treatment process be based on best available demonstrated technology, comply with New Source Performance Standards on the types and amounts of water that can be discharged, and be tested prior to implementation to confirm treatment efficiencies. An evaluation of several standard types of water treatment processes that could be used to treat site waters is contained in the Water Resources Technical Report (Hydrometrics, 2006).

The process (water management) pond capacity and footprint would be the same as described in the Alternative II POO. Use of the process pond would be the same as described in the POO. There would be no storage pond associated with this alternative.

Water treatment waste products would be disposed of in the TWSF as described in the Alternative II during operations. Once mining ceases and the mill is reclaimed, clarifier solids would be de-watered using an added filter press and hauled off site for disposal.

Treated water would be discharged through a pipeline to Big Deer Creek approximately two miles downstream from the water treatment plant. In Alternative IV the pipeline has been re-routed to avoid a cultural resource site near the confluence of South Fork Big Deer and Big Deer Creek (**Figure 2-12**) and discharge to an infiltration gallery adjacent to Big Deer Creek.

Groundwater Capture - The post-closure bedrock groundwater capture system proposed by ICP would be constructed and tested during the initial year of operations to assure that any contaminated groundwater could be quickly and efficiently captured. If testing indicated that bedrock wells could not capture enough of the groundwater metals load, an additional groundwater capture system consisting of an interception trench or series of wells across Bucktail Creek alluvium would be installed downgradient of the Ram mine. The Bucktail capture system would collect alluvial groundwater, and surface water if necessary. The Bucktail capture system would allow collection of additional groundwater and contaminants of concern (COCs) from the Ram and Sunshine mines, and would allow capture and treatment of additional metal load to ensure that the Idaho Cobalt Project does not contribute a net increase in metal loading to the South Fork Big Deer, Big Deer, Panther Creek system. Additional permitting related to disturbance in the streambed (404 and stream alteration permits) would likely be required if the backup lower Bucktail system were required. Additionally, because there would be a larger area of groundwater affected by mine contaminates (between the source and the capture system) the State of Idaho, who regulates groundwater quality, would have to sanction this capture system concept.

At mine closure, cessation of mine dewatering would be contingent on monitoring results and projections indicating no unacceptable effects to water quality objectives or cleanup goals. If appropriate, the Ram and Sunshine mines would be allowed to flood resulting in groundwater flow

through the mine workings toward Bucktail Creek. If the backup alluvial capture system is implemented, groundwater outflow (and associated metal loads) from the Sunshine Mine and potentially some load from the Ram would be allowed to discharge to Bucktail Creek drainage alluvium and be captured at a point downgradient of where the mine flow-through water enters Bucktail drainage. This alternative provides the advantage of greater certainty that the entire chemical load from any mine groundwater plume could be captured and returned for treatment as compared to groundwater capture from the bedrock as in Alternative II. A portion of the ICP chemical mass load originating from the Sunshine Mine would likely be intercepted by BMSG capture systems in upper Bucktail Creek drainage.

Based on documented flow rates and metals concentrations in lower Bucktail Creek (site WQ-21), the entire load introduced to Bucktail Creek drainage from the Ram and Sunshine workings could be captured from surface water alone during spring runoff, but would likely require capture of surface water and alluvial groundwater during the remainder of the year to achieve the removal of the required chemical load. The exact volume of water requiring capture would depend on future metals concentrations in Bucktail Creek following ICP development and additional (Phase II) capture and diversion of metals loads in upper Bucktail drainage by BMSG (scheduled for 2006). The bedrock capture system would likely have to capture some flow from Bucktail alluvium in order to remove the equivalent metals load produced by the mines. The backup capture system would consist of a series of pumpback wells and/or capture trench within the Bucktail Creek alluvium and provisions for surface water capture at the same location. The backup capture system would be located in lower Bucktail drainage between monitoring sites WQ-19 and WQ-21, upstream of the unnamed tributary where WQ-11 is located, and upstream of the proposed BT-5 pipeline system (see description of BT-5 diversion under Remedial Actions in Chapter 3, page 3-81). The captured water from the bedrock or lower Bucktail capture systems would be pumped to the water treatment plant. The treated water would be piped back to the discharge location in Big Deer Creek near monitoring station WQ-24.

The premise of the lower Bucktail capture system is that FCC would capture the entire metals load originating from the Ram and Sunshine workings after the mine loads discharge to Bucktail Creek drainage. The metals load attributable to the Ram and Sunshine workings would be determined through post-closure groundwater and surface water monitoring. Groundwater monitoring would include sampling of monitoring wells to be located downgradient of the Ram and Sunshine workings to determine post-closure groundwater concentrations downgradient of each mine. The groundwater concentrations would then be used with the groundwater flow rate through the re-flooded mine workings to determine the groundwater load exiting each mine. The groundwater flow rate, or flux, would be assumed equal to the steady state mine inflow rate during full mine development. This assumption provides a level of conservatism to the analysis since groundwater inflow to the dewatered mine workings would likely be greater than ambient groundwater flow through the mine sites. Surface water monitoring would also occur in Bucktail Creek upstream and downstream of the Ram workings to further quantify the metals load introduced from the Ram. Based on the monitoring results, the metals load requiring capture would be determined, most likely on a monthly basis. An additional load could be captured above the calculated required load reduction (i.e. capture of greater than the calculated chemical load) to assure that the entire mine related load is captured.

Treated Water Disposal - A surface water discharge to waters of the U.S. and NPDES permit is included in this alternative. Treated water from the water treatment plant would be routed through a pipeline to a surface discharge located on Big Deer Creek below monitoring site WQ-24 (**Figure 2-12**). The pipeline would be routed using existing roads where possible. Where no roads exist, the pipeline would follow an alignment that minimizes pipeline length and physical disturbance to soils, vegetation and cultural resources. The pipeline would be buried, and be made of materials suited for this application such as steel, poly-vinyl chloride (PVC), or high density polyethylene (HDPE). Where the pipeline crosses existing waterways, a culvert designed to pass the 100-year, 24-hour event will be placed in the stream channel, the pipe placed on top of the culvert, and fill placed over the pipe to prevent the water from freezing. The pipeline would affect jurisdictional wetlands at the crossings of two Bucktail Creek tributaries and at Big Deer Creek. Rather than an open pipe discharge to Big Deer Creek, a buried infiltration system adjacent to Big Deer Creek would be used for the discharge.

The infiltration system would be in Big Deer Creek alluvium within a few tens of feet from the stream and would result in a surface disturbance of less than 0.1 acre. The infiltration gallery would reduce the risk of a surface pipeline failing due to flooding in Big Deer Creek.

Alternative IV Modifications in Common with Alternative III

Commingle Tailings and Waste in TWSF

As under Alternative III, Alternative IV would require the commingling of tailings and waste rock as they are placed in the TWSF. This would result in the hydrologic and geochemical characteristics of the TWSF behaving as though it consisted almost entirely of tailings and reduce risk of metals leaching from waste rock.

TWSF Closure Cap

The TWSF cap would be modified to provide a cover capable of supporting native forest that will eventually revegetate the site. The cover thickness will be increased from three feet to four feet and consist of three feet of subsoil and one foot of topsoil.

Water Monitoring

Alternative IV would include changes to the water monitoring program as described in Alternative III to provide enhanced water monitoring to detect, document, and quantify effects of mining on groundwater and surface water quantity and quality. The modified monitoring strategy would support a performance-based approach to compliance assessment, where groundwater quality data from select operational monitoring wells to be located downgradient of the mines would be evaluated for compliance.

Water monitoring necessary for Alternative IV would differ in some details from Alternative III to account for the changed location of the TWSF, the elimination of LAT, groundwater capture from Bucktail alluvium rather than the mines and include NPDES permit monitoring related to the surface discharge.

Road Upgrades

A number of additional road improvements described in the Monitoring and Mitigation Measures Included in Agency Alternatives section would be required under Alternative IV. A total of 15.0 miles of site roads including 3.0 miles of new construction would be required for Alternative IV. Of this total 1.7 miles lies within designated roadless area including 0.6 miles of new construction.

Other Mitigation

Other modifications, mitigation measures and monitoring requirements intended to reduce environmental impacts, improve agency oversight or reduce risk also apply to Alternative IV. These include the following:

- ICP shall provide an annual report summarizing mining, reclamation and monitoring activities and projecting proposed activities for the coming year. ICP shall conduct an annual review with the Forest Service to determine if activities are in accordance with the approved Plan and if any changes to the Plan or financial assurance are needed;
- ICP shall provide notice to the Forest Service and make appropriate modifications to the Plan of Operations if there are significant changes to project permits (such as NPDES or Air Quality);
- Waste rock (slash) left underground in the Ram and Sunshine mines will be amended with lime or cement to provide alkalinity to reduce potential for metals leaching;
- Waste rock and tailings materials will be tested throughout the life of the mine to evaluate potential for acid generation and metals leaching;

- Process ponds will include spillways to reduce risk of failure if overtopping occurs;
- Permanent water control structures that will exist beyond the life of mine will be designed to handle flow from the 100-year storm event and standard state and federal best management practices will be utilized for Project sediment control;
- Soil disturbing construction activities will be conducted during a set construction season to minimize impacts to soils and sediment production;
- Modifications to the water resources monitoring plan to provide adequate data to evaluate potential impacts to surface and groundwater in a timely manner;
- Enhanced emergency management capabilities will be instituted for medical (including designating a helipad site), spill control and fire situations;
- Precautions will be taken to preserve or replace benchmarks and other existing survey controls;
- Native species and more detailed reclamation procedures will be used for reclamation to ensure achievement of self sustaining vegetation following reclamation;
- ICP will require as company policy that employees have no firearms on site or during travel to the site;
- Additional access road improvements will be made to reduce sediment release and traffic accident risk;
- Monitoring and inspection of roads and bridges to assure public safety and adherence to Forest Service engineering standards;
- Construction workers will be required to utilize van sharing or busing to minimize traffic during the construction period;
- Any surface vegetation clearing or timber removal will be conducted following USFS guidelines and practices and following Forest Service approval;
- The ICP shall institute a weed control plan that conforms to Forest Service and County guidelines;
- ICP will be required to submit a plan to monitor existing wetlands and constructed wetlands to determine impacts to wetlands functions and shall modify the constructed wetlands as necessary to assure that they are providing suitable wetland habitat to compensate for Project impacts to natural wetlands;
- The ICP shall submit a modified design for the TWSF closure cap that includes a minimum of 4 feet of soil cover material to protect the liner from potential damage from trees growing on the reclaimed surface;
- The ICP shall submit a plan for approval by the Forest Service for placement of tailings into the TWSF during winter designed to maintain the design density and moisture content of the dry stack tailings;
- Tailings and waste rock disposed of in the TWSF would be commingled rather than kept separate to reduce the oxidation rate of the higher permeability waste rock component and reduce long term risk to the environment of metals release;
- The ICP shall develop a waste rock disposal plan for any material disturbance on the Sunshine portal pad or any other location where preexisting wastes may be disturbed for Forest Service approval in accordance with all relevant federal, state, and local laws. Disturbance of any contaminated waste rock associated with the Blackbird CERCLA cleanup should be coordinated with EPA and Forest Service CERCLA Programs to minimize potential CERCLA liability;
- ICP will be required to use an alternative route for the water discharge pipeline to avoid potential impacts to cultural resources; and
- ICP will be required to submit a design for Forest Service approval to protect pond liners from potential ice damage.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Alternative V (**Figure 2-13**) incorporates a change in the location of the water treatment and discharge facility; in most other aspects Alternative V is the same as Alternative IV. Alternative V is distinguished from Alternative II in that the Tailings and Waste Rock Storage Facility is reduced in size as in Alternative IV and post-closure groundwater capture is supplemented by an alluvial groundwater/surface water capture system in lower Bucktail Creek. Alternative V is distinguished from Alternative III in that the TWSF is reduced in size to the minimum volume required for identified ore reserves and is located as in Alternative II to the southeast of the mill site, the storage pond is eliminated, and an alternative water treatment technology would be employed to meet discharge requirements to Blackbird Creek. Alternative V is distinguished from Alternative IV in that rather than constructing water treatment facilities at the Formation mill site, water would be pumped to the site of the Blackbird water treatment plant and treated there prior to discharge to Blackbird Creek. Alternative V would require that FCC enter into an agreement with the Blackbird Mine Site Group/Noranda for use and maintenance of the water treatment system. FCC would be required to obtain a NPDES discharge permit into Blackbird Creek. Although Noranda currently discharges under CERCLA authority, the addition of FCC mine water to their treatment system would require changes to their agreements with EPA. Changes to the Blackbird water treatment system (including additional facilities at the site) would be required to handle the additional flow and to meet modified effluent limits. Alternative V would modify the Plan of Operations submitted by Formation. Alternative V has been developed because it appears to minimize physical disturbance and impacts to the existing environment by utilizing existing infrastructure.

Should this alternative be selected by the Agencies, revised designs and new implementation plans for some of the Project facilities would be required prior to construction of the Project. This is due to the fact that Alternative IV differs from the facility design and implementation plans contained in the POO (Alternative II). These include the TWSF design, the water capture and pumpback system used at closure, a tailings and waste rock co-mingling plan, a tailings and slash amendment plan, a revised water treatment plant process selection, revised pond designs to include overflow spillways, and design of access road improvements on the Williams Creek/Deep Creek route. Additionally, the necessary agreements with BMSG and the approval of the CERCLA authorities would need to be obtained. Requiring these agreements with BMSG and of the CERCLA authorities is outside of the Forest Service's authority and thus Alternative IV, although a reasonable alternative that potentially minimizes some environmental impacts, is not something that the Forest Service can require FCC to implement.

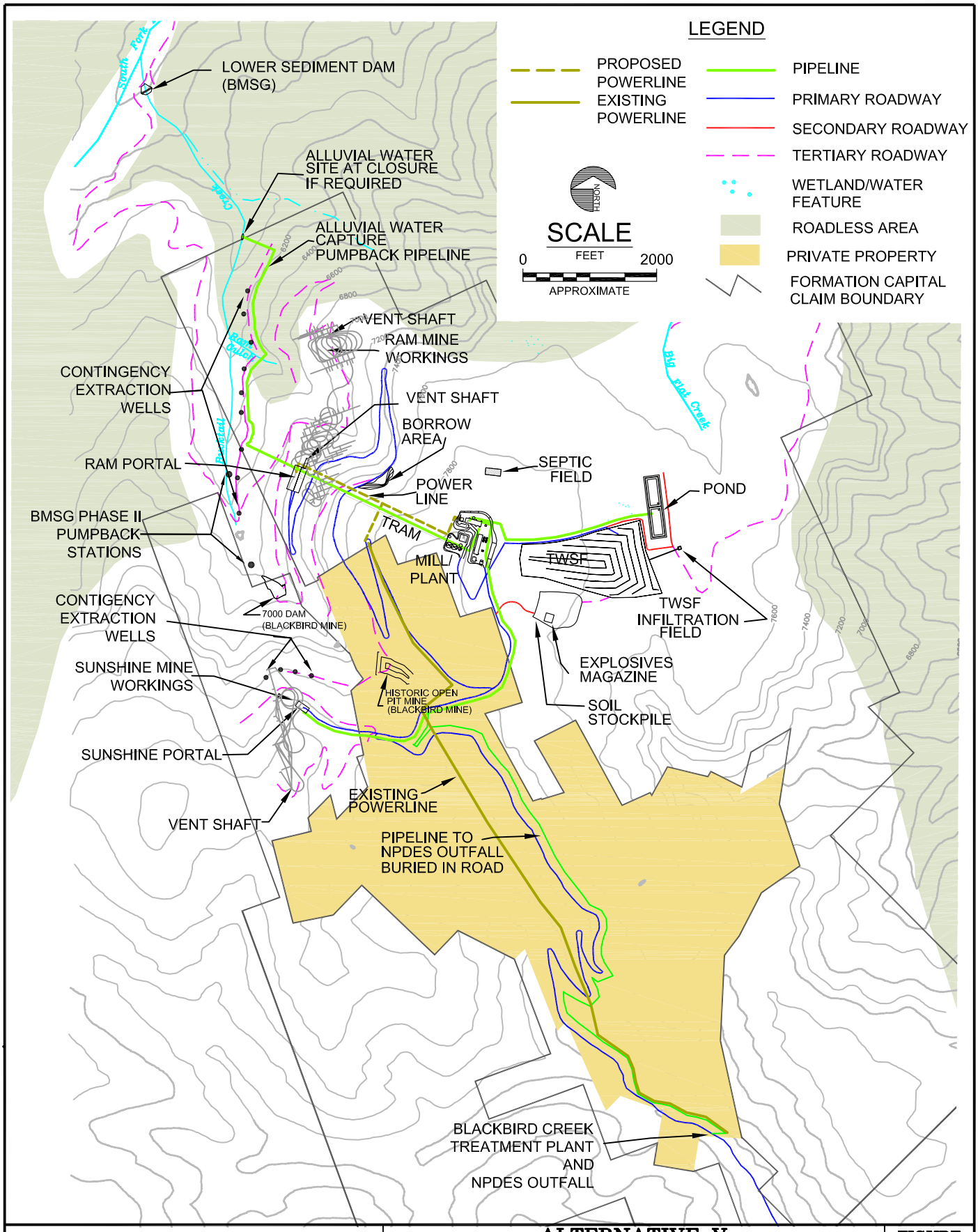
Modifications Included in Alternative V

Waste Storage Facility

Alternative V would utilize the 1.7 million cubic yard TWSF site located to the southeast of the mill site as described in Alternative IV. The TWSF closure cap would be modified to include a minimum of 4 feet of soil cover material to protect the liner from potential damage from trees growing on the reclaimed surface.

Water Management and Treatment

The water treatment process for Alternative V would be moved to the current location of the BMSG treatment plant on Blackbird Creek to decrease the amount of disturbance and infrastructure required in the post-closure period. The water treatment process would include the precipitation process utilized by Noranda (or a similar process) and would include changes or additions to the existing water treatment facilities to meet required effluent limits in Blackbird Creek. A description of water



IDAHO COBALT PROJECT FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**ALTERNATIVE V** **LOWER BUCKTAIL GROUNDWATER CAPTURE - ADVANCED WATER TREATMENT AND DISCHARGE TO BLACKBIRD CK**	**FIGURE** **2-13**

treatment processes that could be implemented at the Blackbird treatment plant is found in the water technical report (Hydrometrics, 2006). Alternative V assumes that the treatment system would result in an effluent capable of meeting end-of-pipe effluent limits imposed by a NPDES permit that would be required for the water discharged from the ICP. These limits would likely be more stringent than those currently required under CERCLA but would be similar to those anticipated for discharge to Big Deer Creek in Alternatives II and IV. This Alternative would require an agreement with BMSG on long-term operation of the water treatment system.

Treated water from the water treatment plant would be discharged to Blackbird Creek at the current discharge site adjacent to the treatment plant. Excess water from the mine and mill would be piped to the Blackbird treatment plant site in a pipeline installed in the existing access road or transferred underground via existing Blackbird mine workings with water collected by BMSG in the upper Bucktail drainage. The pipeline would be buried, and be made of materials suited for this application such as steel, PVC, or HDPE.

Groundwater Capture System - The Alternative V post-closure groundwater capture system would be modified as in Alternative IV to utilize an interception system in Bucktail Creek alluvium to allow more complete capture of groundwater and contaminants of concern (COCs) from the Ram and Sunshine mines if the bedrock system is not adequate.

Road Upgrades

As under Alternative III and IV, additional road improvements would be required by the agencies to improve traffic safety, to reduce sediment production and reduce risks of spill of transported materials. A total of 14.0 miles of site roads including 2.4 miles of new construction would be required for Alternative V. Of this total 1.2 miles lies within designated roadless area including 0.1 miles of new construction.

Water Monitoring

Alternative V would include changes to the water monitoring program as described in Alternative III and IV to provide enhanced water monitoring to detect, document, and quantify effects of mining on groundwater and surface water quantity and quality. The modified monitoring strategy would support a performance-based approach to compliance assessment, where groundwater quality data from select operational monitoring wells to be located downgradient of the mines would be evaluated for compliance.

Water monitoring necessary for Alternative V would differ in some details from Alternatives III and IV to account for the changed location/size of the TWSF, the elimination of LAT, groundwater capture from Bucktail alluvium rather than the mines and different NPDES permit monitoring location in Blackbird Creek.

Other Mitigation

The following mitigation measures would also be included under Alternative V:

- ICP shall provide an annual report summarizing mining, reclamation and monitoring activities and projecting proposed activities for the coming year. ICP shall conduct an annual review with the Forest Service to determine if activities are in accordance with the approved Plan and if any changes to the Plan or financial assurance are needed;
- ICP shall provide notice to the Forest Service and make appropriate modifications to the Plan of Operations if there are significant changes to project permits (such as NPDES or Air Quality);
- Waste rock (slash) left underground in the Ram and Sunshine mines will be amended with lime or cement to provide alkalinity to reduce potential for metals leaching;

- Waste rock and tailings materials will be tested throughout the life of the mine to evaluate potential for acid generation and metals leaching;
- Process ponds will include spillways to reduce risk of failure if overtopping occurs;
- Permanent water control structures that will exist beyond the life of mine will be designed to handle flow from the 100-year storm event and standard state and federal best management practices will be utilized for Project sediment control;
- Soil disturbing construction activities will be conducted during a set construction season to minimize impacts to soils and sediment production;
- Modifications to the water resources monitoring plan to provide adequate data to evaluate potential impacts to surface and groundwater in a timely manner;
- Enhanced emergency management capabilities will be instituted for medical (including designating a helipad site), spill control and fire situations;
- Precautions will be taken to preserve or replace benchmarks and other existing survey controls;
- Native species and more detailed reclamation procedures will be used for reclamation to ensure achievement of self sustaining vegetation following reclamation;
- ICP will require as company policy that employees have no firearms on site or during travel to the site;
- Additional access road improvements will be made to reduce sediment release and traffic accident risk;
- Monitoring and inspection of roads and bridges to assure public safety and adherence to Forest Service engineering standards;
- Construction workers will be required to utilize van sharing or busing to minimize traffic during the construction period;
- Any surface vegetation clearing or timber removal will be conducted following USFS guidelines and practices and following Forest Service approval;
- The ICP shall institute a weed control plan that conforms to Forest Service and County guidelines;
- ICP will be required to submit a plan to monitor existing wetlands and constructed wetlands to determine impacts to wetlands functions and shall modify the constructed wetlands as necessary to assure that they are providing suitable wetland habitat to compensate for Project impacts to natural wetlands;
- The ICP shall submit a modified design for the TWSF closure cap that includes a minimum of four feet of soil cover material to protect the liner from potential damage from trees growing on the reclaimed surface;
- The ICP shall submit a plan for approval by the Forest Service for placement of tailings into the TWSF during winter designed to maintain the design density and moisture content of the dry stack tailings;
- The ICP shall develop a waste rock disposal plan for any material disturbance on the Sunshine portal pad or any other location where preexisting wastes may be disturbed for Forest Service approval in accordance with all relevant federal, state, and local laws. Disturbance of any contaminated waste rock associated with the Blackbird CERCLA cleanup should be coordinated with EPA and Forest Service CERCLA Programs to minimize potential CERCLA liability;
- Tailings and waste rock disposed of in the TWSF would be commingled rather than kept separate to reduce the oxidation rate of the higher permeability waste rock component and reduce long term risk to the environment of metals release;
- The ICP will be required to obtain an agreement with BMSG for modifications and operation of the water treatment system; and
- ICP will be required to submit a design for Forest Service approval to protect pond liners from potential ice damage.

Monitoring and Mitigation Measures Included in Agency Alternatives

Administration and Monitoring

Federal mining laws authorize mineral exploration and development on Federal Lands and state and federal environmental laws are intended to ensure that adverse impacts are minimized and long term productivity of the surface resources preserved to the extent practicable.

The Forest Service as the lead federal agency for the ICP EIS has a primary role in approving and administering the Project.

The Forest Service accepts certification and other approvals issued by state or other federal agencies as compliance with similar or parallel requirements of its mining regulations. Besides the Forest Service, other agencies that required permits for the Project are: US Environmental Protection Agency (EPA), Idaho Department of Environmental Quality (IDEQ), US Corps of Engineers (COE) and the Idaho Department of Water Resources (IDWR).

The plans and permits submitted to or to be submitted to these agencies by ICP include:

1. A National Pollution Discharge Elimination System (NPDES) Permit Application submitted to the Environmental Protection Agency, describes Project discharges to surface waters that would be regulated under Section 402 of the Clean Water Act. This permit must be obtained prior to the discharge of any wastewater to waters of the United States. Prior to issuance of the NPDES permit, the State of Idaho must complete CWA Section 401 certification.
2. An Application for Permit to Construct and Operate to be submitted to the Bureau of Air Quality, Idaho Department of Environmental Quality, which will describe Project impacts to air quality, as well as measures, which will be taken to reduce impacts.
3. Application for beneficial use of surface and/or groundwater submitted to the Idaho Department of Water Resources. These water rights are required prior to the diversion and use of surface or ground water.
4. Stream Channel Alteration Permit(s) submitted to the Idaho Department of Water Resources required for any activities that would occur below the mean high water mark of a perennial stream.
5. The initial Plan of Operation submitted to the Forest Service on January 22, 2001; a revised Plan of Operations was submitted on, February 4, 2005; further revisions were submitted February 18, 2005; April, 2006; and June 8, 2006. A revised Plan of Operations would be required to address issues in the Record of Decision once a preferred alternative is selected.
6. An application to the US Corps of Engineers for a nationwide 404 permit(s) related to the water discharge pipeline for dredge and fill in wetlands and/or waters of the U.S.

ICP must obtain approved plans and permits from the state and federal agencies described above. Approval of this Plan is required prior to beginning any surface disturbing activities on National Forest System Lands. ICP will be required to change its current Plan of Operations to incorporate any requirements stated in the Record of Decision. Because the Forest Service recognizes parallel requirements of other state and federal agencies, approval of the Plan of Operation is contingent upon these approvals. The following sequence of events illustrates the relationship:

> Following issuance of the Record of Decision, ICP will submit a revised Plan of Operation and provide the necessary reclamation bond, which complies with the Preferred Alternative described in the Record of Decision and other state and federal permits in effect at that time. If acceptable, the Forest Service could approve this Plan contingent upon receiving the other required state and federal permits. At this point, those activities that do not require approval by other state and federal agencies could proceed. These activities may include road construction and timber

harvest activities, which do not affect cultural resources, or Threatened and Endangered (T&E) plant or animal species.

Prior to beginning any surface disturbing activities, ICP would submit supplemental information as described in their Plan of Operation and required by the Record of Decision. In the first year of operation, ICP will provide additional details on the location, schedule, and surface resources that would be affected by the planned activities. A construction schedule shall be submitted to the Forest Service indicating the order of activities and indicating which activities and mitigation measures are required prior to initiation of construction. The Forest Service will review these supplements to ensure that they are within the scope of the ICP EIS and approve Plan changes. If the effects of the proposal are within the scope of the EIS, approval to proceed will be granted following submittal of a bond to reclaim the surface resources affected.

EPA must issue the NPDES permit prior to discharge of any water to surface water. Any stipulations, conditions and monitoring required by the NPDES permit must be in place as required by the permit.

After the first year of operation, additional details on the next year's operation will be submitted as annual work plans. These annual work plans will include a summary of the previous years activities; describe the schedule of operations for the next year; and include a statement verifying that all proposed operations are as approved in the Plan of Operation. The Forest Service will annually review project status and proposed activities to assure that the project is covered by a sufficient reclamation bond. If after review of these annual supplements, the Forest Service determines that proposed activities are outside the scope of the selected alternative and approved Plan of Operation, a modified Plan of Operation would be required and the appropriate analysis conducted as required by the NEPA Regulations and Forest Service Mining Regulations.

As other state and federal permits are approved, ICP shall submit them to the Forest Service as supplements to their Plan of Operation if National Forest System Land would be affected by the approved operations. The Forest Service will review the conditions of the approved permit(s) to ensure that they are equivalent to the terms of the ROD and the current Plan of Operation, and would not result in any adverse environmental impacts that have not been considered in the NEPA analysis and documented in the FEIS. After this review, the Forest Service will either accept the permit as a supplement to the Plan of Operation or notify the company that the permits constitute a modification of their approved Plan, and additional NEPA analysis and documentation is required.

The above procedures will also be used to handle changes in state or federal permits. Modifications to the Plan of Operation may be required if environmental impacts occur which are outside the scope of the Record of Decision for the ICP. Such modifications may require additional environmental analysis and documentation.

Compliance with the approved Plan of Operation is conditioned upon compliance with the terms of the state and federal permits, which govern actions that could affect the surface resources on National Forest System lands. If, for example, the Air Quality were violated the Department of Environmental Quality would take the lead role in enforcement, but the Forest Service could also issue a notice of noncompliance under its mining regulations, identify what needs to be fixed and provide a reasonable timeframe to bring the project back in compliance with the terms of its Air Permit.

Although the Forest Service and other state and federal agencies will coordinate with each other to the extent possible, ICP has a legal and financial interest in seeing that the Project is implemented as described in its approved plans and permits. There has been a considerable investment in time and money during exploration evaluation and permitting of the Project. The success of the mining venture depends on implementing and coordinating all of the facilities, activities and personnel in an economically viable and environmentally sound way.

To accomplish the objective of documenting compliance with permit requirements, a system of self-monitoring, and Quality Assurance/Quality Control techniques is proposed. To achieve this objective, ICP shall provide the Forest with a description of how environmental protection standards contained in approved Plans and Permits would be implemented. This plan would specify company and contractor personnel who are responsible for performance, inspection and approval of all work that affects the surface resources. The ICP would designate an environmental coordinator as the primary contact with the Forest Service on permit compliance, monitoring and mitigation.

An interagency task force will be formed to administer the ICP. The Forest Service, IDEQ and US EPA (plus other agencies as appropriate) will be members of the task force. This group will oversee regulatory compliance and quality assurance issues related to the ICP.

Annual Reporting

The ICP will submit an annual report to the Forest Service that contains a description of all activities conducted during the previous year, summarizes the amount of acreage disturbed, status of reclamation, number of employees, spills or releases of chemicals or fuel, results of all monitoring plans in a format approved by the Forest including a complete data summary and illustrating any data trends, status of mining plan (tons of ore and waste mined and any changes to methods or equipment) and plans for the coming year. Significant changes will be required to be incorporated into the Plan of Operations and reflected in the financial assurance. Past, on-going or projected impacts to the environment may also require amendment of the Plan of Operations or financial assurance held for the Project.

Mitigation Common to All Alternatives

The agencies have identified a number of mitigation measures, monitoring requirements and operational practices that provide environmental benefits, reduce risk or improve the agencies ability to efficiently administer the proposed mining operation. Those measures that the agencies have determined to be appropriate and that can be applied to all alternatives are described in this section. These measures are referred to as “common” to all alternatives meaning that they would be applied to the project no matter which alternative is selected.

Air Resources

The ICP proposes to control fugitive and process related dust generation by watering or chemical treatment of roads and disturbed areas, installing scrubbers and baghouses to capture dust from process components and otherwise comply with provisions of the State of Idaho’s rules and regulations pertaining to protection of air quality.

The ICP shall obtain Air Quality Permit from the State of Idaho prior to initiating construction activities. This Permit shall be incorporated into ICP’s Plan of Operation.

The ICP’s Plan of Operation shall be supplemented to include the reduction of impacts of dust along primary access roads by watering, surfacing, or treating the surface of the road with an approved chemical amendment. Treatment shall be as directed by the Forest Service, based on the level of use, and shall focus on the areas adjacent to established recreation sites and private dwellings.

Monitoring

The Forest would meet with the ICP annually to review the Plan of Operation. A summary of results of any air quality monitoring required by the Idaho Department of Environmental Quality will be supplied to the Forest Service in an annual monitoring report. Air quality mitigation measures shall be modified or supplemented as necessary to address air quality concerns.

Geochemistry and Metals Leaching

Metals leaching and acid drainage is a potential concern for the TWSF and post closure mine discharge. Operational, closure and post closure monitoring is designed to identify mobilization of metals into the groundwater and surface water. The results of these monitoring programs shall be forwarded to the Forest Service on a quarterly basis.

The ICP shall provide the Forest, for review and approval, with a geochemical monitoring program for waste rock and tailings. This plan shall identify action limits or thresholds of concern, and feasible methods of neutralizing or isolating materials that exceed identified action limits. The plan shall also include a quality control and quality assurance (QA/QC) component to assure that an adequate quantity and quality of data is being collected to identify any acid generation or metals leaching problems.

The requirements for monitoring and treatment of discharges from the TWSF and underground mines, and the short and long term monitoring of surface and ground water are described in the Water Resources Technical Report (Hydrometrics, 2006) and elsewhere in this Monitoring and Mitigation section.

The ICP shall add an alkalinity amendment (limestone, lime or cement) to the slash waste rock left in the underground mines as a control to metals leaching to the groundwater. ICP shall submit a plan for slash amendment and receive Forest Service approval prior to placement of slash in underground mine areas.

Commingle Tailings and Waste in TWSF

The agency alternatives would require the co-mingling of tailings and waste rock as they are placed in the TWSF. Tailings have a much smaller particle size than waste rock, and thus have a much lower permeability. Therefore, air and water movement through tailings is much less than through waste rock. Commingling the tailings and waste rock would effectively encapsulate the waste rock, which would help minimize air and water movement through the waste rock. The ARD potential of water moving through the waste rock would be substantially reduced as a result of this encapsulation. This would result in the hydrologic and geochemical characteristics of the TWSF behaving as though it consisted almost entirely of tailings.

Placement of tailings and waste rock on the TWSF would be coordinated such that both materials are properly placed and the tailings compacted according to TWSF final design requirements. Tailings placement in winter would follow the same requirements as described in Alternative II. Waste rock encapsulation would need to occur at least once per year in order to achieve the desired water quality effects. A detailed plan for placement and co-mingling tailings and waste rock would be prepared by FCC and submitted to the Forest Service for approval prior to TWSF construction.

Annually, the ICP shall summarize the results of the previous year's geochemical monitoring program, update the geochemical model based on additional data and describe any changes to their Plan of Operation necessary to meet the geochemical standards which are established. The Forest Service prior to the next year's operation shall review this summary.

Post Mining Monitoring, Action Limits and Response

Post-mining monitoring of water quality in, and/or discharging from the mines and TWSF shall be for a period of not less than five years. This monitoring must demonstrate that water quality meets established standards (including a statistical groundwater baseline established by the ICP), and is stable over time and a range of hydrologic events prior to bond release. Quality standards for these facilities will be established to protect all beneficial uses of the receiving stream. Initially these standards will be set at the limits in the approved NPDES Permit. If acceptable levels of water quality are not reached, then additional levels of treatment will be required. The results of all water quality

monitoring shall be submitted to the Forest within 10 days of receiving such information from the laboratory. Annual summaries of monitoring programs shall be forwarded to involved state and federal agencies.

Geotechnical Stability of Facilities and Consequences of Failure

A minimum static factor of safety of 1.5 and a minimum pseudo-static factor of safety of 1.15 are required for the TWSF and Ram and Sunshine portal patio fills. A 500-year earthquake shall be the minimum used for seismic design at both sites.

Process ponds shall have overflow spillways designed to pass a 100-year event in order to preserve the integrity of the pond and liner in case of overflow.

The ICP shall submit a plan for approval by the Forest Service for placement of tailings into the TWSF during winter months that will maintain the design density and moisture content of the dry stack tailings. At a minimum, the plan shall address the following: any accumulated snow greater than 1-inch in thickness, or ice greater than 1/2-inch in thickness will be removed from the active tailings placement surface prior to placement of additional lifts of tailings. ICP will utilize a daily inspection form during winter months to document the presence and removal of snow and ice on the TWSF. Snow and ice will be pushed to an inactive area of the tailings facility (see below). Daily field-testing will be conducted during the first winter season and the conditions during placement will be documented during that time. Tailings that cannot be placed due to obvious freezing will be sent to storage immediately. Otherwise, density and moisture testing upon placement will determine if the tailings are properly compacted, or if they need to be removed and stored until conditions improve. The documentation obtained during the first season will help to develop procedures for identifying unfavorable conditions prior to tailings placement. At all stages in the development of the TWSF an adequate surface area for storing frozen tailings and snow/ice will be maintained. Prior to each winter season, a specific tailings placement plan will be developed, including the reservation of space for storage. Any frozen tailings storage area will require a location where at least two lifts of tailings have been placed to specification (i.e., the frozen tailings storage area shall not be directly on the liner protection layer, nor shall it be on exposed liner). After the spring thaw, the tailings will be tested for moisture content and moisture conditioned as needed by spreading them in lifts to either dry, or to have moisture added prior to compaction. The stored tailings will be completely removed from the storage area and the surface of the storage area will be graded and recompacted prior to placement of any additional tailings.

The ICP shall maintain a record of volume and location of stabilized water treatment waste within the TWSF. Any stabilized water treatment waste shall be located a minimum of 150 feet from the ultimate exterior slope of the TWSF and a minimum of five feet from contact with the underlying liner. The depth of the stabilized waste at any point within the TWSF shall never be greater than half the height of the TWSF pile. Cover liners placed over the stabilized waste to minimize potential for leachate from the water treatment waste shall extend a minimum of 10 feet horizontally outside from the edge of the waste trench.

Mitigation Measures for Stability - If geotechnical problems arise during construction or operation, the responses shall include but are not limited to: stopping the addition of more material; removal of failed material and repair of liners if affected; reducing slope angle or buttressing slopes to increase stability; redesign and construction of the facility to avoid a future recurrence of the failure.

Sediment

Runoff from undisturbed areas would be diverted around all surface disturbances through ditches or berms. Diversions that will exist beyond life of mine shall be designed to safely pass flows from the 100-year, 24-hour storm event.

Non-point source sediment control measures will consist of practices such as: disturbing the smallest area practical, concurrent reclamation when feasible, intercepting and treating runoff from disturbed areas in accordance with best management practices and the Storm Water Pollution Prevent Plan (SWPPP) to prevent sediment from leaving the site, and diversion of all runoff from undisturbed areas around areas of disturbance. No surface disturbing activities shall commence until provisions for erosion and sediment control have been reviewed and are in place.

Berms and ditches will control runoff from road surfaces. The ditches will have settling basins, hay bales or silt fences to control sediment. Culverts sized to meet Forest Service Standards will be installed at all known springs and natural small drainages and where needed for road drainage. Sediment control devices such as stormwater dispersion terraces, silt fences, gabion sediment traps, grass filter waterways or straw bale barriers will be placed as needed to minimize road runoff on the undisturbed areas between and downhill of the roads. Road cuts and fills will be seeded with a quick growing cover consisting of native or short lived non persistent species adapted to site conditions as soon as practicable after construction, to minimize the sediment transport from these disturbed areas. Road revegetation would use hydroseeding, fertilization, dry mulch and tackifier on areas adjacent to streams, or on steeper or more erodible cuts or fills as appropriate.

Undisturbed vegetative buffers will be maintained along all surface waters as described in the Forest Plan, Soil and Water Guidelines (USFS, 1988). Room between filter strips and construction activity will be maintained to allow construction of emergency control measures using earth moving machinery. Field review to confirm these filter strips shall be required prior to clearing.

The normal operating season for construction of earthen structures will be from June 1 to October 30 each year. Operations outside this period will be approved on a case-by-case basis after considering the potential for resource damage. Operations outside of this period shall include provisions for ensuring that operations and facilities will not cause adverse surface resources impacts due to the effects of snow and freezing temperatures.

Snow plowing on Forest Roads will be regulated under an approved Forest Road Use Agreement.

Sediment Control Monitoring

All diversions and sediment control or treatment measures will be inspected by ICP employees or contractors, who will certify that the facility was constructed as planned, prior to use. Inspection and maintenance of sediment control measures shall include:

1. Seasonally prior to and after snowmelt, after severe storm events, and prior to the winter season.
2. Sediment control devices will be cleaned to maintain at least 50 percent of their storage capacity prior to spring runoff.

The results of these inspections will be documented and available for review and submitted to the Forest Service annually.

The ICP shall supplement its Plan of Operation as deemed necessary by the Forest Service, with site specific plans for erosion and sediment control facilities and practices in areas that are proposed for disturbance. The Forest shall review these plans prior to construction to ensure that they meet the intent of the approved Plan of Operation and the Forest Service Preferred Alternative. Design and location of sediment control structures shall be approved by the Forest prior to installation.

Annually, the ICP and the Forest shall review and approve the effectiveness of ongoing erosion and sediment control measures prior to next year's operation.

Soils

The ICP shall recover soil material from all areas of project disturbance in sufficient quantities to place a minimum of a one foot layer on features identified for reclamation in the Reclamation Plan. Additional topsoil may be required based on site specific analysis of the substrate material being covered.

The following shall be required under all action alternatives: earth fill construction will be confined to the normal operating season unless specifically approved by the Forest; unless otherwise authorized, stabilize and reclaim all exposed soil materials in the same season as the disturbance; all slopes with exposed mineral soil materials shall be kept to a minimum; surface disturbance will be recontoured to the extent practicable except where authorized to achieve other resource objectives; and disturbed and reclaimed slopes shall be shaped to prevent the concentration of water except at points specifically designed to handle such flows without erosion. The ICP shall comply with USFS Region 4 Reclamation Guidelines except where otherwise authorized by the Forest (USFS, 1988).

Monitoring

The Forest and the ICP shall review the Plan of Operations including the Reclamation Plan and financial assurance on an annual basis. The Plan shall be modified or supplemented as necessary to address soil issues.

Ongoing review of soil erosion and productivity shall be conducted by FCC and reviewed by the Forest Administrator. This monitoring shall follow all surface disturbing activities, as well as spring runoff, large storm events and the fall reclamation effort. The results of this monitoring will be documented by FCC and used to update the plans for erosion, surface water control, and reclamation.

Water Resources

ICP has proposed a water monitoring plan to address operational and closure assessment of water resources. In order to allow a thorough and more timely evaluation of potential impacts of the proposed mining activities on groundwater and surface water quantity and quality the ICP shall modify their water resources monitoring program to provide enhanced water monitoring to detect, document, and quantify effects of mining. The modified monitoring plan shall support a performance-based approach to compliance assessment, where groundwater quality data from select operational monitoring wells to be located downgradient of the mines would be evaluated for compliance. If performance criteria exceed pre-established targets (e.g. if the calculated groundwater load were to result in exceedance of a surface water compliance target), a response action would be required by the mine to reduce the groundwater load to acceptable levels.

The purpose and rationale for these changes in the water monitoring program include:

1. To provide alternative-specific monitoring of facilities not included in, or modified from, facilities in Alternative II;
2. To collect information to support source identification and/or source allocation to differentiate effects of ICP from those of BMSG;
3. To collect information needed for final design of the reclamation and closure plan; and
4. To more closely reflect agency preferences in monitoring protocols, especially to make ICP monitoring consistent and comparable to BMSG monitoring and to support compliance monitoring.

The water monitoring plan proposed by ICP was developed for monitoring of facilities located and sized according to Formation's proposed mining plan. If another alternative were selected, ICP would be required to submit a water resources monitoring plan tailored to the specifics of that alternative. Another component of the modifications to the water monitoring plan is to support source

identification and/or source allocation to differentiate effects of ICP from those of BMSG, under all alternatives the monitoring plan would include:

- Additional groundwater monitoring wells located to the north of the Ram underground workings to monitor for possible groundwater flow along a fault that is present in the area;
- Monitoring of storm water outfalls to determine effects of storm water on streams and to judge effectiveness and adequacy of storm water controls;
- Installation, testing and monitoring of monitoring wells/recovery wells downgradient of the Ram workings in the first years of mining to determine the effectiveness of FCC's proposed recovery system and to monitor groundwater release from the mine;
- Monitoring of mine water quality (drainage from tailings backfill, groundwater inflows, mine water sumps); and
- Coordination of ICP and BMSG monitoring activities to ensure consistency and comparability of data.

To collect information needed for final design of the reclamation and closure plan, the modified monitoring plan would also include:

- Monitoring of mine inflow quantity and quality. This information would be used in assessing mine recharge rates after shutdown and in design and operation of the post-closure mine dewatering system; and
- Operational monitoring of mine water quality (drainage from tailings backfill and mine water sumps). This data would be used in assessing and predicting the effectiveness of tailings amendment in reducing the leaching of metals to groundwater and would characterize underground mine water sources.

To more closely reflect agency preferences in monitoring protocols, the revised monitoring plan would include:

- Minor modification to monitoring locations, frequency and parameters.
- Coordination of ICP and BMSG monitoring activities in the timing, frequency, sampling methods, analytical methods and quality assurance/quality control requirements of monitoring to ensure consistency and comparability of data.
- Consistency with agency guidance and BMSG cleanup requirements in the evaluation of monitoring data to determine compliance with surface water and groundwater water quality standards, performance standards and limits. For surface water, this would include compliance testing compatible with the Blackbird Unilateral Order on Consent (UAO) statement of work (SOW) requirements for Big Deer Creek/Panther Creek watershed (compliance based on 96-hour testing). For groundwater, this would include compliance testing based on IDEQ guidance (e.g. test for difference in mean concentrations with standards/limits).
- Consistency with DEQ guidance on development of a statistical significant baseline data set for surface and groundwater.
- Adaptive management to enhance monitoring as needed to support compliance monitoring.
- Reporting of all monitoring data to the Forest Service, IDEQ and EPA.

Additional detail regarding the justification for and requirements of a revised water monitoring plan can be found in the *Water Resources Technical Report* (Hydrometrics, 2006) and Chapter 4 of the EIS.

Emergency Management, Spill Control and Fire

Spill Control

The ICP shall update its plans for spill prevention and control of hazardous materials in supplements to its Plan of Operation, prior to any change in transportation route or method or prior to transporting any chemical of fuel not previously listed in the Plans. These Plans shall describe the toxic or hazardous materials at the site, and how they are transported, stored, used and disposed of. They will describe the emergency procedures, equipment and personnel that would be used to respond to an accidental spill, both on site and during transport on National forest System Lands. It shall describe spill response training of all company employees, subcontractors and their employees.

ICP shall have a documented Plan describing monitoring procedures to ensure: that all storage and contained facilities meet the prescribed standards; all emergency first aid and spill response materials are available and stored in the proper place; that all radio communications equipment is in working order; and that all shipping companies are complying with the terms of their road use permit for shipments on Forest Roads and on the mine site.

Two separate plans are required to address transportation and storage of chemicals and fuels under different regulatory authorities.

1. A Spill Prevention Control and Countermeasures Plan (SPCC) is required by federal law for storage of petroleum products at the Project. It addresses design standards for storage facilities, and response strategies in the event of a spill.
2. A Spill Response Plan is required by the Forest Service for transport of hazardous materials on Forest Roads and management and storage at the Project site. It will be incorporated into the Forest Service Road Use Permit, which is a required part of the ICP's Plan of Operation. Under the terms of this permit, all suppliers of such material will be required to submit spill response plans which describe the procedures, equipment and personnel which will be used in case of a spill during transport. All suppliers of hazardous materials or petroleum products shall be required to comply with the ICP's approved Transportation and Spill Response Plans insofar as it affects any part of their operation.

Requirements for transport of hazardous or petroleum materials on Forest roads shall include: use of single unit haul (4,500 gallon maximum, no tractor-trailer) vehicles not tandem trailers for transport of fuel; locations of spill response materials; provisions for radio contact with the mine site and the Lemhi County Sheriff; hazardous materials and petroleum products shall be hauled in daylight hours on Forest roads unless otherwise approved; commercial haul may be limited on National holidays; experienced drivers shall accompany new drivers for a minimum of one trip over the permitted road; maximum speed for over width vehicles shall be 20 miles per hour; advance plans for diversion of streams which could be affected by spills of hazardous materials; notification procedures in the event of a spill; and the use of pilot vehicles for hazardous material haulage.

Pilot vehicles shall be a legal width two-axle vehicle identified with approved signing. They shall be equipped with VHF radios for emergency use only and CB radios for vehicle to vehicle communication. The VHF radios shall be capable of communicating with the Lemhi County Sheriffs Office and Salmon National Forest Fire Dispatcher. First aid and containment equipment shall be carried in all pilot vehicles piloting hazardous materials and petroleum products along with a copy of the most recent spill response plan. All pilot vehicles drivers shall complete spill response, and safety training, at least once annually prior to piloting hazardous materials and petroleum products.

The ICP will request that all suppliers of toxic or hazardous materials provide evidence of spill response training, plans, and spill cleanup materials that will be used in transporting materials to the mine. They will request certification that all trucks used to transport materials to the mine site meet or exceed Department of Transportation standards for use material being transported. The ICP shall provide this information to the Forest Service prior to shipping hazardous materials or fuels. The ICP

shall notify the Forest Service prior to changing types of transport vehicles, materials or material containers for hazardous materials.

Annually the Company shall inspect and review: all storage and containment facilities to ensure they are maintained to standard and adequate to contain spills; all emergency first aid and spill response materials to see that they are current and stored in the proper place; radio communications equipment to see that it is in working order; transport companies to ensure that they are complying with the terms of their road use permit for shipments on Forest roads, and on the mine site. The ICP shall document the results of this annual review, certifying to the Forest Service and other appropriate agencies that all Plan requirements are being met.

Fire Protection

The ICP proposes to comply with all rules and regulations pertaining to fire protection and health and safety of project employees.

The Forest requires operators on Forest land to comply with procedures for protecting against starting and suppression of accidental wildfires. State of Idaho Forest Codes also apply.

The ICP shall supplement its Plan of Operations as necessary to include requirements for burning of slash and other debris, maintenance of fire tools as required by State and Federal requirements, approved mufflers and spark arresters for all internal combustion equipment, fire extinguishers, pumps or other fire fighting equipment.

The ICP shall designate an individual to be responsible for all aspects of the Plan of Operation related to fire. This individual shall inspect and certify that the fire cache contains the required type and number of tools and equipment.

The Forest Administrator shall conduct an annual inspection of the ICP fire cache, and a spot check of muffler and spark arresters. The Administrator shall review and approve the fire plan on an annual basis. The Plan of Operations shall be modified or supplemented as necessary to address fire and emergency issues identified by ICP or the Forest.

Emergency Management

Mine Safety and Health Administration (MSHA) governs provisions for ensuring worker safety. The ICP training program will comply with Mine Safety and Health Administration standards to include annual first aid and hazardous materials training for all employees.

The ICP shall have the necessary trained personnel and equipment to respond to fires and/or medical emergencies at the mine site.

The ICP shall meet with the Lemhi County Ambulance Service to discuss coordinated response to vehicle or other emergencies on Forest roads and within the mine area. The Company will provide emergency medical technicians and its own land based emergency transport service from the mine to Salmon. The ICP shall also make a standing agreement for “Life Flight” services to allow rapid transport in the case of extreme emergencies and designate a helicopter landing facility at the mine property.

Heritage and Cultural Resources

The management of heritage and cultural resources on federal lands or federally funded, licensed, or permitted projects is governed by Section 106 of the National Historic Preservation Act and associated regulations. The procedures prescribed in this legislation and regulations are applicable to ICP development activities. If heritage or cultural resources are discovered during any earth disturbing activities, the activities will immediate cease and the Forest archeologist be notified.

ICP shall utilize the alternative water discharge pipeline route identified in Alternative IV to avoid potential impacts to cultural resources in the lower Bucktail drainage.

Monitoring

The Forest, in consultation with other state and federal agencies, shall meet the ICP annually to review the Plan of Operation. The Plan shall be modified or supplemented as necessary to address cultural resource measures.

The ICP shall have a qualified individual inspect and/or monitor surface disturbing activities in the vicinity of any identified cultural resource.

Land Use

Benchmarks, section and corner monuments shall be protected or referenced prior to being disturbed. Prior to disturbing any benchmark, section or corner monument, ICP shall submit a plan that describes plans to protect or reference them.

Noise

The ICP proposes to comply with all health and safety requirements pertaining to noise generation. MSHA governs worker health and safety, which includes requiring noise protection for workers in high noise areas.

Reclamation

Reclamation activities will be required to comply with Forest Service guidelines on seasonal disturbance and vegetation removal to control erosion and use of native vegetation. The Agency goal for water quality is to maintain water quality such that there is no material negative surface water quality impact at the BMSG compliance points or elsewhere in the surface waters and such that there is no material negative groundwater quality impact. No material impact is defined as no interference of attainment of BMSG cleanup goals, compliance with groundwater and surface water quality standards including the Idaho Groundwater Quality Rule, and compliance with applicable water permits including NPDES permits.

Mitigation and Management

Mitigation and monitoring measures designed to meet reclamation objectives under all alternatives would be required as conditions to Forest Service approval of the Plan of Operations and are as follows:

The ICP shall submit cross sections and topographic maps, which display post mining topography for all reclaimed areas. Slopes on these areas shall be 3 to 1 or less unless it can be demonstrated to the satisfaction of the Forest Service that a steeper slope can be reclaimed to the same standard and stocking criteria. Edges of topographic disturbances shall be blended with adjacent undisturbed land and shall have no sharp topographic breaks.

ICP shall submit a revised design for Forest Service approval of the TWSF cap that includes a soil cover layer that is at least 4 feet thick over the impermeable liner in order to allow the growth and long term sustainability of native forest tree species without damage to the liner system.

Ore processing and other ancillary facilities shall be removed, including foundations, and the areas returned to as near the original contour as practicable, topsoil replaced and the area revegetated.

Soil storage sites shall be restored to pre-mine topography upon removal of stockpiles.

All roads, including haul roads that are not needed for long term access needs shall be recontoured to the extent practicable, covered with topsoil and revegetated. Reclamation of roads will occur as soon as the lack of need for future use is identified. Forty thousand feet of existing roads identified in the Transportation Technical Report (Hydrometrics and Smith, 2006) will be reclaimed during the initial startup and construction period (within the first two years following project initiation). Roads that are retained for long term use shall have the traveled way reduced to that needed for the anticipated traffic, and any excess road surface recontoured and revegetated.

Sediment control facilities shall be recontoured and reclaimed once they are not needed and areas above them have been reclaimed to standards.

Interim reclamation measures shall be presented to the Forest Service for review and approval prior to a temporary mine closure.

Prior to interim or final reclamation, the ICP shall certify that chemical and physical characteristics of the material in the TWSF are as described in the baseline characterization. If material properties change, a modified Plan of Operation shall be submitted including plans for neutralization, isolation, and reclamation of the materials.

Soils and suitable overburden material (as defined in the soil report) shall be salvaged from disturbed areas sufficient to cover all disturbed areas with one foot of topsoil. Soil shall be handled only when it exhibits good tilth and is moderately dry. Soil stock piles shall be placed in locations that are stable, isolated from surface and subsurface water, gently sloping and well drained. Stockpiles shall be convex in shape and have no more than 3 to 1 slopes. They shall be revegetated immediately to prevent erosion. Sediment control structures shall be used to ensure that no soil material is lost.

Prior to topsoil salvage, trees shall be cleared to facilitate removal. Some of the tree material shall be piled and stored for later use in reclamation.

Appropriate reference sites will be identified in the ICP project vicinity to determine native species occurrence and cover. This information will be used to develop a long term site reclamation plan. A minimum of two reference sites will be identified to represent: 1) warm, dry sites and 2) wet, cool sites. Based on the reference site data, appropriate native seed mixes and/or plant lists will be reviewed and approved by the Forest Service prior to any site revegetation.

Short term site reclamation, such as seeding topsoil stockpiles, will utilize native species or short lived non-native species, such as annual grasses or cereal grains. No persistent non-native species shall be used in reclamation.

Seeding shall normally be done in the fall after September 30th and before the ground freezes. Seeding rates should be in the range of 60 to 80 pure live seeds (PLS) per square foot. The lower seeding rate should be used on the drier sites and the higher seeding rates on the wetter sites.

If the approved reclamation plan includes tree and shrub plantings the planting shall be done in the fall or spring using bare-root stock or container-held seedlings. Tree and shrub stock shall be from sources appropriate for the elevation and climate.

For the ICP, the following reclamation criteria are also required to minimize impacts to the environment:

1. Recontoured topography shall be gently sloping, at a maximum grade of no more than 3 to 1 unless specifically authorized by the Forest Service. Convex slopes will predominate to avoid concentration of water except in areas specifically designated to handle the flows. Drainage patterns shall be designed to handle the anticipated surface runoff and designed to accommodate such runoff without erosion or stability problems.

2. Vegetative species shall be selected based on the following priorities: native species capable of being self sustaining on the selected site; erosion control and stability; no noxious weeds. Sediment and erosion control measures will be used to prevent erosion to the extent possible on reclaimed surfaces, and to retain sediment onsite if erosion does occur. All sediment control measures will be maintained by the ICP until the reclamation effort has met established standards and bonds have been released.
3. Vegetation reestablishment criteria for bond release is that reclaimed areas shall achieve 90 percent of reference site groundcover conditions.
4. All toxic or hazardous substances shall be isolated from the surface environment.

Revegetation with native species would minimize the amount of time to return to near natural conditions and to minimize the spread of non-native species.

The ICP shall consult with the Forest Service prior to final closure of underground mines to determine if complete backfilling of adit entrances or bat-gates are the most appropriate closure method.

Noxious Weed Control - A weed control plan will be included in the Idaho Cobalt Project Reclamation Plan that will be submitted to the Forest Service for review and approval. This plan shall include specifics on reducing noxious weed introduction and weed control in the Project Area. Noxious weed control activities at the site shall be ongoing to prevent the establishment of noxious weed populations.

Monitoring

Annually the Forest Service shall meet with ICP to review the Plan of Operation. ICP will submit a summary of reclamation activities including monitoring. This report shall include the use of maps and photos to allow the accurate accounting of disturbed and reclaimed acreage. The annual report will include plans that project the following seasons disturbance and reclamation work. This plan shall include details on vegetation removal and treatment, topsoil salvage, storage and revegetation, and seasonal reclamation requirements. The Forest Administrator shall conduct an annual inspection of site reclamation.

Reclamation Monitoring - Monitoring would be conducted to determine success of revegetation and assess if maintenance activities are needed. Vegetation growth would be monitored in June and August following the first growing season. Species composition and canopy cover of seeded/planted and “volunteer species” would be recorded. If seeded/planted species have not become established following the first growing season, supplemental seedings and plantings may be undertaken. If noxious weeds invade revegetated areas, they would be removed by mechanical or other approved methods specified in the weed control plan. Additional monitoring would be conducted during August for a minimum of three years (until successful revegetation is confirmed by Forest Service) following initial planting to ensure that desired vegetation has become established. A report would be prepared assessing the status of the revegetation program and submitted to the Forest Service and other appropriate agencies.

The Plan of Operations shall be modified or supplemented as necessary to address reclamation issues.

Financial Assurance

The Forest Service will require a bond or other financial assurance sufficient to cover the actual cost of reclamation, post closure water treatment and post mining monitoring.

Recreation

The ICP proposes to include an environmental awareness segment as part of new employee training. Hunting, fishing and other recreation issues are expected to be explained to employees as part of the

training. The ICP shall establish a company policy that employees are not allowed to have firearms within the Project Area or during the commute to the job site.

Employees will comply with federal and state hunting and fishing regulations as well as other Forest policies applicable to recreation on Forest lands.

Socioeconomic Issues

The issues within this category (Land Use, Housing, Public Services, and Schools) are generally governed by State and Local laws and regulations and are not under the jurisdiction of the Forest Service. The Forest Service will work closely with State and local jurisdictions and the ICP to develop solutions to social and economic issues that arise in association with mine construction and operation.

Transportation

The ICP shall obtain a Forest road use permit that specifies the conditions under which they can use the Forest roads. State and Federal regulations pertaining to the transport of materials (hazardous and other) will be applicable to the ICP and its suppliers.

The ICP's Plan of Operation and/or Road Use Permit shall include the following:

1. Access road design shall meet Forest Service specifications (USDOT Federal Highway Administration, 2003) for road width, grade, alignment, surfacing, drainage, quality control and signing. Exceptions to these standards may be used only with Forest approval. Forest Plan requirements for road construction and natural resource protection will be followed. The ICP shall submit designs for road construction and improvements to the Forest Service for review and approval prior to initiating construction.
2. Develop busing for all mine employees. The ICP shall monitor the use of the provided busing to establish the rate of use, and shall furnish an annual summary of use to the Forest. If an 80 percent usage rate for all mine employees including management is not achieved on an annual basis, revisions to the plan may be required by the Forest Service.
3. The ICP shall require contractors to comply with requirements for van pooling or busing of employees including the 80 percent participation goal. In addition, the ICP shall ensure that small deliveries or partial loads of materials are delivered to a staging area in Salmon, for consolidation prior to proceeding to the mine site to the extent practicable. Occasional site visitors such as sales people shall be authorized access to the site as necessary.
4. The ICP shall develop a written policy for compliance with all Forest traffic rules and require that all contractors comply with State and Forest rules for oversize and overweight loads.
5. The Forest Service must approve all location or design changes for access and haul roads.
6. The ICP will be responsible for maintaining all signs, fencing and other features of the mine safety and security program.
7. The ICP shall implement or provide payment to the Forest Service for deferred road maintenance (such as surface, culvert or bridge replacement), and recurrent (grading, cleaning culverts) maintenance based on road use, as specified in the Road Use Agreement.
8. The ICP Plan of Operations shall describe plans to control public access to mine areas such as fencing and posting to prohibit unauthorized entry to hazardous areas. The Plan will provide for administrative traffic, as well as access for Forest permittees, contractors or operators.
9. For all access roads, the ICP shall guarantee administrative, permittee, and contractor use of the mine access road during the active life of the mine including construction, reclamation and long-term monitoring.
10. The ICP shall obtain a right of way for existing roads through the Cobalt townsite and Blackbird mine property and provide those to the Forest Service.

11. The ICP transportation and/or spill control plan shall include training requirements for all drivers including a requirement that all new drivers transporting fuel, chemicals or concentrate make their first trip to the site accompanied by a company representative.
12. All fuel, chemical supply and concentrate trucks, all tractor trailer units and any single unit vehicles more than 24 feet in length shall be accompanied by a pilot car.
13. No secondary trailers (pups) will be allowed for ICP or their suppliers.
14. Fuel tankers shall contain no more than 4500 gallons per load.

During the construction period, the ICP shall coordinate all use of approved and alternative access routes with the Forest Service under an approved Road Use Permit.

Mitigation

Road Improvements - Formation proposes improvements to the Williams Creek/Deep Creek access road consisting of 10.9 miles of surface treatment. In addition to these improvements, the ICP would implement road improvements in a phased approach, as approved by the Forest Service, to mitigate additional road wear due to mine related traffic. The phased improvements, along with the 10.9 miles of improvements proposed by ICP, would eventually lead to reshaping the subgrade and resurfacing the entire 40 mile project access route. Other mitigation would include raising sections of road lying within the floodplain to reduce sediment delivery to streams. Sections to be raised include approximately 1.2 miles of Morgan Creek-Panther Creek Road, No. 60055 between Deep Creek Road and Blackbird Road and 1.7 miles (MP 35.7 to 37.4) of Blackbird Road (No. 60115). Reconstruction from MP 35.7 to 37.4 would also include improving channel width on Blackbird Creek. A new section of road on Williams Creek Road No. 60021 between mile point (M.P.) 7.1 and 8.1 would be constructed to bypass switchbacks that are a safety problem and create a steady grade climbing to the upper bench. During the construction, the section of bypassed road will be reclaimed. Five turnouts on Blackbird Creek Road, No. 60115 between M.P. 36.6 and 38.7 would be constructed to allow safe passing of vehicles. ICP would apply dust abatement to the entire project access route to address safety issues and protect investment in resurfacing. The section of road from the intersection of the Ram portal road and the Sunshine portal road to the mill facility would be widened to at least 40 feet under Alternatives III through V and have a safety barrier separating haul truck traffic and other traffic (i.e., vendors, mine personnel vans, regulators, visitors).

Borrow Areas – In addition to the two borrow areas proposed by FCC, additional road improvement work on the Williams Creek Road would utilize borrow from the existing Leesburg East pit located on Forest land in Section 27, T21N, R20E. Use of the Leesburg East Pit would require an estimated three acres additional disturbance at this site which would be reclaimed following its use.

Road Reclamation – FCC plans on reclaiming approximately 23,000 feet of site roads during the construction phase. The agencies have identified an additional 17,000 feet of site roads to be reclaimed during the construction phase. All new roads constructed under all Alternatives will be reclaimed at closure, except those roads identified by the agencies as roads to be used for administrative purposes.

Monitoring

The Forest shall meet with the ICP annually to review the Plan of Operation, including the transportation plan. The Plan shall be modified or supplemented as necessary to address transportation and safety issues.

1. The ICP shall develop a testing and inspection scheduled as outlined in Forest Service guidelines (USDOT, 2003), acceptable to the Forest for all construction and reconstruction of mine access and haul roads, and shall be responsible for providing “as-built” certification of all items by a licensed professional engineer. The Forest Administrator shall review the project construction during construction to ensure compliance with approved Plans.

Certification, results of tests and inspections shall be forwarded to the Forest for review and approval.

2. The ICP and the Forest shall review all access and haul roads, during and after spring runoff, and prior to winter operations. The purpose of this inspection shall be to certify that all design features are functioning as designed, and/or to identify any needed improvements or changes.

Visual Resources

The ICP proposes to use non-reflective earth-tone paints, as approved by the Forest Service, for all buildings and other major project features.

Vegetation and Timber Resources

The ICP proposes to clear timber on areas scheduled for disturbance by mining operations in accordance with Forest management requirements for timber harvesting.

The Forest Plan contains management requirements for timber cut in connection with locatable mineral operations, as well as disposal of slash. In addition, it contains standards and guidelines for timber harvest in general. The ICP will submit its plans for clearing and disposal of vegetation prior to beginning operations, and each year thereafter for the following years clearing requirements. The areas to be cleared will also be delineated on the ground to facilitate Forest review. The Forest will review these plans and specify the measures that will be needed to ensure proper utilization of the timber, disposal of slash and protection of the surface resources.

The ICP may elect to purchase the timber from the Forest as an alternative to clearing and decking the timber for disposal by the Forest. Volume estimation and payment shall be estimated on an average per acre basis. If the ICP does not elect to pay for the timber, they will harvest it according to Forest utilization standard and deck it for disposal by the Forest. If the ICP mis-manufactures timber under this alternative, they will be responsible for payment equal to the volume affected. All merchantable timber shall be utilized. All slash and unmerchantable timber shall be piled for burning in location that will not cause damage to surrounding vegetation. The ICP shall burn slash piles as directed by the Forest Service. The Forest will designate piles to be left for wildlife habitat or reclamation use. Debris left from burning will be spread or buried depending on the volume of material. Standard resource protection measures as specified in the Forest Plan and timber sale contract provisions will be applied on a site specific basis.

Weed Control

The ICP will prepare a weed control plan for Forest Service review and approval. The ICP shall use weed-free mulch and seed mixtures, promptly reclaim disturbed areas and control noxious weed annually. Herbicide selection and use shall be in accordance with the approved State, county and Forest Service Weed Control Plans.

Wetlands/Riparian

The only dredge or fill in jurisdictional wetlands associated with the ICP would be for the water discharge pipeline crossing Ram Gulch, an unnamed tributary of Bucktail Creek and where that pipeline crosses the riparian zone of Big Deer Creek and discharges into Big Deer Creek. It is anticipated that these activities would be covered by Nationwide 404 permits. In addition the ICP has agreed to provide mitigation for direct impacts to isolated nonjurisdictional wetlands and indirect impacts to jurisdictional wetlands as part of their Plan of Operations. The ICP proposes to construct 0.5 acres of wetlands in the headwaters of Big Flat Creek to offset impacts to 0.22 acres of isolated wetlands that would be destroyed by construction of the TWSF and indirect impacts that are predicted to result in the dewatering of 0.22 acres of jurisdictional wetlands downgradient of the Ram mine for the duration of the mining and closure activities.

Monitoring

Clearing, harvest and slash disposal shall be monitored by the ICP to ensure compliance with the Plan of Operation. Special attention will be paid to product utilization, slash disposal, and resource protection measures.

The ICP and the Forest will inspect for noxious weeds on the property in conjunction with their erosion control and surface water monitoring. The ICP will be responsible for conducting any necessary spraying of noxious weeds on the property. Herbicide purchase, use, storage, and disposal shall be addressed in the ICP's hazardous materials and/or spill response plans. Herbicide applicators shall be properly trained and licensed.

ICP shall monitor both the jurisdictional and isolated wetlands in the vicinity of the mining operations and the constructed wetlands to determine mine related impacts to natural wetlands and effectiveness of the constructed wetland features. Monitoring shall include seasonal soil water conditions and species composition. Results will be documented and reported to the Forest Service annually.

The Forest shall meet with the ICP annually to review the Plan of Operation. The Plan shall be modified or supplemented as necessary to address, timber, wetland/riparian and weed control issues. The ICP shall be responsible for monitoring and reporting on wetland construction and function. If the constructed wetlands fail to operate as designed, the ICP will develop alternative wetlands mitigation to supply equivalent wetland values in the Project Area.

Wildlife

The final reclamation plan would restore wildlife habitats to existing vegetation type (generally lodgepole pine forest) and/or mitigate long term loss of wildlife habitat. In addition, the ICP shall educate their employees on: state and federal laws relating to hunting; avoidance of inadvertent or purposeful harassment of wildlife; recognition and protection of state and federal threatened and endangered species and Forest sensitive species in the Project Area; and reporting of any T & E or sensitive plant or animal species to the Forest Service or Idaho Department of Fish and Game (IDFG).

The ICP's Plan of Operations includes the following:

1. Reclamation of Project disturbance shall include measures designed to produce high value wildlife habitat. These measures shall include creation of maximum amount of edge effect in reclaiming large areas; reseeding with mixtures of native plants of value to wildlife; and creation of diverse habitats for game and non-game animals.
2. New power pole construction should follow the guidelines in *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC, 1996) to prevent accidental electrocution of raptors.
3. Company busing of employees.
4. Possession or discharge of firearms by company employees or subcontractors within the Project Area shall be against Company policy.
5. ICP will report vehicle/wildlife collisions on Forest roads to the IDFG.

Alternatives Considered But Dismissed From Detailed Consideration

A number of alternatives raised during scoping and analysis process have been considered but determined by the Agencies to be technologically or economically infeasible, to provide no

environmental benefit or are otherwise unreasonable or unacceptable. The alternatives considered but dismissed from further consideration are summarized in this section. Evaluation of these alternatives included comparison with objectives of the Forest Plan (USFS, 1988), analysis conducted by the applicant as part of their project development planning and analysis conducted as part of the EIS process.

Alternatives considered but dismissed from further consideration fall into the following general categories:

- Facility Design, Location and Sizing;
- Mining Methods;
- Process Water and Tailings Transport;
- Sediment Control;
- Utility/Powerline Corridors; and
- Reclamation and Closure.

Facility Design, Location and Sizing

A number of facility location alternatives have been considered during the evaluation of FCC's POO. These include alternative sites for the mill, TWSF and water treatment facilities.

Mill

FCC's mill site location is in the Big Flat drainage. The Agencies looked at other locations within the Big Flat, but did not identify any that provided quantifiable environmental benefits. Placement of the mill underground was also considered. However, the risks of the additional traffic down the steep hillside to the Ram portal and the logistic difficulties of an underground mill servicing both the Ram and Sunshine mines make an underground mill infeasible.

TWSF

Alternatives to FCC's placement of the TWSF have included several sites on the Big Flat both to the north and south of the proposed location. The primary objective in alternatives to the proposed site is to avoid potential direct or indirect impacts to isolated wetlands downgradient of the TWSF. Sites directly north of the mill and immediately south of the proposed TWSF were evaluated, but dismissed because of potential impacts to small areas of jurisdictional and non-jurisdictional wetlands. A site northeast of the mill has been retained for detailed evaluation in Alternative IV.

Scoping raised a concern about identification of additional ore reserves and expansion of the mine. FCC has sized the TWSF to contain substantially more (35 percent) material than currently identified ore reserves. This buffer is intended to account for potential variation in tailings and waste rock density, percentage of tailings that would be able to be placed underground, amount of dilution of the ore during mining and total amount of ore mined from that predicted. The Agencies do not think there is sufficient information available to evaluate and analyze the range of potential impacts from a significantly increased mine size. Therefore consideration of a larger tailings and waste disposal area just to account for potential future expansion was not evaluated. However, the disturbed area footprint as proposed by FCC (55 acres in Alternative II versus 36 acres in Alternative IV) may be justified based on existing ore reserves and accounting for the uncertainty in a number of the physical properties of the waste materials and by the known mineral resource. There may be variations in the density of the materials as deposited, the amount of tailings produced as a result of dilution of the ore with waste or in the amount of material that can reasonably be placed underground. The larger TWSF pad size would also provide the advantage of increased storage area for tailings material during the winter if freezing conditions requires temporary storage rather than immediate placement and compaction. Additionally, changes in the price of metal values could change the value of some of the material within the current mine plan from waste to ore (or visa versa). ICP would be required

to submit information demonstrating that any additional ore and waste material are similar to those analyzed in this EIS prior to approval of TWSF expansion. Alternative III contains an alternative TWFS location. Alternative IV TWSF has a reduced waste storage volume to match the current mine plan and assumptions on tailings and waste characteristics. The TWSF reduction in Alternative IV also uses FCC's proposed TWSF site but avoids placing the facility directly upgradient of some small isolated wetlands. Alternative III avoids the wetlands by moving the TWSF location, but retains the same storage volume proposed by FCC. Other sites evaluated did not have adequate area or had other environmental impacts that made them infeasible.

Water Treatment Facilities

As post-closure water treatment would likely be required for potentially many years, it might be beneficial to have the water treatment facility located where less pumping head was required or closer to the discharge point. Locating the water treatment facilities at the Ram portal, along lower Bucktail or Big Deer Creek or utilizing the Blackbird Site Group water treatment plant on Blackbird Creek were considered. The logistic and access difficulties associated with maintaining an active water treatment facility in the Bucktail or Big Deer drainages was considered too great. Road maintenance, power reliability and steep terrain all add risk particularly to winter operations. Utilization of the existing Blackbird water treatment facility was retained for detailed analysis in Alternative V.

Water Treatment Discharge Location – Locating a surface water treatment discharge at Big Deer Creek (WQ-24), South Fork Big Deer (WQ-22), Big Flat (WQ-7), Little Deer (WQ-5), Panther Creek (WQ-25), and Blackbird Creek at the Blackbird Water Treatment Plant outfall were considered in considerable detail including analysis of several of the sites in preliminary DSM runs. A non-discharge option was also considered. The South Fork Big Deer location was dropped from consideration due to its proximity to the Big Deer Creek location, and the sediment quality limitations on South Fork Big Deer Creek, which would result in less dilution. Discharge of treated water to South Fork, which still contains metal contaminated sediments, would also likely result in dissolution and re-entrainment of metal load in the lower South Fork. While this is expected to occur over time as the BMSG cleanup progresses, discharging clean water that reaches Big Deer and Panther Creeks after picking up an additional metals load does not seem to be in the best interest of the fishery. The logistics and access difficulties associated with constructing and maintaining a pipeline down Little Deer Creek was considered too great, and this alternative was dismissed by the Agencies. The no-discharge option was dismissed due to the positive water balance at the site. Discharge to Panther Creek would require a very long pipeline along the existing road system with associated cost and maintenance issues or new access in designated roadless area in the Big Deer Creek drainage. Additionally, the removal of the treated water volume from the South Fork and Big Deer Creek Drainages results in potential increase in metals concentrations. Discharge to Big Flat Creek would involve transfer of water out of the Bucktail/Big Deer Creek subbasin and affects metals concentrations in South Fork and Big Deer Creek. Formation requested in a September 5, 2006 letter to the Forest Service and EPA that a Big Flat Creek discharge location be considered in the EIS. Although a Big Flat Creek discharge would have less surface disturbance because of the shorter pipeline distance there are some uncertainties associated with how the increased flow would affect the channel in the ephemeral portion of the drainage downstream from WQ-7. FCC provided some additional information on potential road alignment to a Big Flat Discharge site and subsequently withdrew their request that this alternative be considered in detail in the EIS. In this reach flow is largely in colluvium and alluvium. Alternative III contemplates an NPDES discharge permit to Big Flat Creek from groundwater discharge to the LAT system. Impact analysis of Alternative III indicates discharge of treated mine water to the Big Flat drainage would likely have significant impacts to Big Flat Creek as there would be no dilution during portions of the year. Existing data indicate that a Big Flat Creek surface discharge site would be feasible, however, based on the lack of significant benefits over the proposed Big Deer Creek discharge location, the interbasin transfer issue and the need for over ½ mile of new road in the designated roadless area a surface water discharge alternative to Big Flat was not carried forward.

The discharge location in Blackbird Creek at the Blackbird Water Treatment Plant outfall was retained in Alternative V. Discharge to Big Deer Creek (WQ-24) was considered to be the most environmentally beneficial and was retained in Alternative IV.

FCC submitted an option to discharge water through an infiltration gallery in the Big Flat drainage, hoping to avoid a NPDES discharge permit. The EIS team considered discharge via infiltration galleries in the South Fork Big Deer, Big Deer, Little Deer, and Big Flat drainages. An infiltration gallery would consist of a French drain type of pipe and gravel configuration, whereby effluent from the water treatment plant would discharge though a perforated pipe into a gravel bed, and the water would infiltrate into the shallow soils. The agencies believe that this type of discharge would eventually come to the surface and connect to a surface water stream, and thereby behave as if it were a direct discharge to surface water. As this alternative would still require an NPDES permit and there was no perceived benefit from this type of discharge, this option was eliminated from further study. However, the agency preferred alternative does include an infiltration gallery discharge to Big Deer Creek alluvium with an NPDES permit as a way to minimize environmental concerns at the discharge site.

Work Camp

A work camp near the mine site was considered to reduce traffic and because a private trailer park facility is already in existence at the confluence of Blackbird and Panther Creeks. An area of several acres along Panther Creek would be available for expansion of a trailer park facility for construction workers or potentially for mine workers. The area has shallow groundwater and does not currently have adequate water or sewer facilities to house seasonal or year around construction workers. There is little soil at this site to provide attenuation of wastewater. The area of potential expansion for additional trailer usage at this site is near Panther Creek and much if not all of this area does not have adequate setback to meet Idaho Health Department requirements. Expansion of the trailer facilities at the Panther Creek Inn site to house 30 to 50 workers would likely require a sophisticated water treatment system and a NPDES discharge permit. Lemhi County regulations limit permanent habitation in mobile trailers to a period of less than one year. Based on the regulatory issues with this site and lack of other suitable and available camp locations, use of a worker camp in the general Project Area was dropped from further consideration.

Mining Methods

Shaft Access

FCC's mine plan calls for accessing the ore by a decline driven from the hillside in the Bucktail Creek drainage. This minimizes the time needed, cost and waste rock produced in developing the mine. Access via a shaft in the vicinity of the mill site could reduce the footprint of the mine and reduce impacts and risks to the environment associated with the transport of men, materials, ore, waste and water over the steep terrain in the headwaters of Bucktail Creek. Additionally, if future exploration identified additional ore reserves below, or to the south of, the currently identified ore a shaft would probably be the most reasonable way to develop a deeper mine.

A shaft would have a relatively small disturbance footprint including a headframe and hoist house (about one half acre). Utilities including water, power and tailings pipelines could be routed down the shaft rather than down the hillside.

If a shaft were used for initial access replacing the decline it would significantly change the capital costs and economics of the mine. Shaft construction cost would be on the order of two or more times the cost of installing the decline and there would still have to be an opening in the vicinity of the planned decline to provide for ventilation and a secondary escape way. Additionally, the length of time required to construct the shaft and begin production from the mine would be longer, perhaps delaying production for a year or two. This would have a significant impact on the economics of the mine by increasing costs and delaying the period when revenue would start to be generated. If a

shaft were added later in the life of the mine in addition to the decline access there would be minor incremental impacts consisting of the additional surface disturbance and an additional estimated 115,000 tons of waste material generated as a result of constructing the shaft and access to the shaft from the existing workings. Shaft access was dismissed from further consideration based on the time required to bring the mine into production, logistics and cost.

Process Water and Tailings Transport

Dewatered vs. Slurry

FCC proposes to transport tailings from the mill to the Ram mine and the TWSF as slurry. The tailings would be dewatered at the Ram and the TWSF. The dewatered tailings at the Ram would be used for mine backfill and the removed water pumped back to the mill. The dewatered tailings at the TWSF would be placed in that facility and the removed water pumped back to the mill. The slurry and return water pipelines would have containment and leak detection, however if there were a pipeline break on the steep hillside down to the Ram, containment could be difficult. The Agencies looked at relocating the dewatering facilities to the mill site and transporting the dewatered tailings to the Ram by truck or with the tram, and to the TWSF by truck or conveyor. Truck haulage on the steep hillside down to the Ram, particularly in winter, would have higher accident and spillage risk as well as higher energy costs. Tram haulage would still have some spillage risk, but would have significant technological difficulties with winter operations when dewatered tailings would tend to freeze in the tram bucket. The tram would need an additional unloading station at the Ram, further congesting the portal pad and probably requiring enlargement of the pad. This option was dismissed as not providing a significant environmental benefit over a well designed double pipe and leak detection system.

Sediment Control

Sediment control practices including BMPs described in the POO and Jersey Barriers and outsloped roads were evaluated by the Agencies. The agency evaluation concluded that maintenance issues associated with the Jersey Barriers would likely limit the effectiveness of stormwater dispersal, causing additional road erosion and stormwater management problems. Use of in-sloped roads and BMPs to control sediment is used in all alternatives to control road runoff.

Utility Corridors

Powerline

An alternative powerline that avoided private land in the vicinity of the Blackbird Mine was considered at the request of FCC. Although a feasible route was identified, the powerline alternative would require additional disturbance, consisting of as much as 7,000 feet of new road for construction. This alternative route was dismissed from further consideration because the company dropped it from their proposal and because of the additional disturbance over the route presented in FCC's POO.

Project Access Routes

Alternatives to FCC's proposed Project Access Route were considered and dismissed. These alternatives were dismissed based on one or more issues relating to road maintenance standards, public safety, incursion into roadless areas, and conflicts with Wild and Scenic river issues.

Moccasin-Napias Route – This route would take Williams Creek Road (FS#60021) to Phelan Road (FS#60098) to Moccasin - Napias Road (FS#60076) to Morgan Creek - Panther Creek Road (FS#60055) to Blackbird Road (FS#60115) to the project site and was dismissed from further consideration because it would require extensive upgrades, is too steep for loaded truck traffic, and is not currently maintained in winter.

Salmon River Route – This route would take Salmon River Road (FS#60030) to Morgan Creek - Panther Creek Road (FS#60055) to Blackbird Road (FS#60115) to project site and was dismissed from further consideration because the greater length of road immediately adjacent to the Salmon River and Panther Creek would present greater risk from spills. Additionally, this route would require extensive upgrades for safety issues due to the large amount of recreational traffic that would be sharing the Salmon River Road with project traffic.

Big Deer and Little Deer Routes - These routes would use Williams Creek Road (FS#60021) to Deep Creek Road (FS#60101) to Morgan Creek - Panther Creek Road (FS#60055) and then require new road along either Little Deer Creek or Big Deer Creek to the project site. Developing either route would require one or two new bridges over Panther Creek adversely affecting the creek's eligibility as a Wild and Scenic river. Additionally, these routes would require new road construction in areas currently managed under a roadless classification.

Morgan Panther Route – Access on the Morgan Creek road, which intersects Highway 93 about five miles north of Challis was evaluated more extensively than the other dismissed routes. The Williams Creek, Deep Creek Panther Creek route was selected in preference to the Morgan Panther route because of less road in proximity to streams, significantly longer distance (44 miles) for employees and materials emanating from Salmon, and the fact that the Morgan Creek road in not currently kept open in the winter.

Reclamation and Closure

Based on analyses performed by FCC, contaminants of concern (primarily metals) would be released to groundwater from both the Ram and Sunshine mine workings following the cessation of mining and reflooding of the underground workings. According to FCC's analyses, containment of the metals load from each mine would be required for some period of time after mine closure to ensure protection of downgradient water resources. The EIS Team considered several alternatives for control of metals migration through groundwater from the Idaho Cobalt Project underground mine workings.

Upgradient Alluvial Capture System

As an alternative to the lower Bucktail water capture system proposed in Alternatives IV and V, installation of a capture system in Upper Bucktail drainage was evaluated to address possible metals loading from the Ram and Sunshine workings to Bucktail Creek via groundwater. Under this alternative, one capture system would be constructed in Upper Bucktail drainage to capture a metals load from the Bucktail Creek surface water/alluvial groundwater system equivalent to the load attributable to the reflooded Ram and Sunshine mine workings. An advantage of this approach is that it may be possible to capture the required load in a smaller volume of water due to the presumed higher metals concentrations in the upper portion of the drainage. Possible disadvantages include the need for adoption of a waste trading approach to water quality control since FCC would be capturing and treating metals derived from sources other than that attributable to ICP facilities (the upgradient capture scenario would capture "background" metal loads instead of the load attributable to the Ram workings), and the need for closer coordination with BMSG due to the proximity of the capture system to BMSG's existing Phase I capture facilities and Phase II capture facilities added in 2006.

Feasibility of this alternative would require that sufficient load be available in Upper Bucktail drainage to be captured in lieu of the metals load anticipated from the downgradient Ram Mine workings. Based on current information and groundwater flux estimates, the "peak" groundwater metals loads originating from the Ram workings are estimated to be on the order of 2 pounds/day (0.9 kg/day) copper and cobalt, and 0.2 pounds/day (0.09 kg/day) arsenic. Based on available information from Upper Bucktail Creek (site WQ-18) and middle Bucktail Creek (site WQ-19), current surface water loads exceed these values during high flows but not during low flows at both sites. Therefore, the waste trading approach to capture and treatment in Upper Bucktail drainage may not be feasible

based on current metal loads in Upper Bucktail Creek and the estimated metals loads in groundwater exiting the backfilled Ram Mine workings. The discrepancy between the Upper Bucktail Creek loads and estimated Ram Mine loads would be even greater taking into account BMSG's plans to collect an additional 60+ percent of the copper load from Upper Bucktail drainage. For these reasons, this alternative was dismissed from further consideration.

Bedrock Capture System Using Tunnels

As an alternative to the bedrock groundwater pumpback well field proposed by FCC, the EIS team evaluated the potential use of combined horizontal tunnels and intersecting vertical drain wells downgradient of the Ram and Sunshine workings to capture bedrock groundwater exiting the mine workings. The captured water would be treated as necessary prior to discharge. Advantages of this alternative include capture of the Ram and Sunshine groundwater (and metal loads) upgradient of Bucktail Creek and BMSG-related COCs, and increased capture efficiency as compared to pumpback wells alone. Disadvantages include the potential difficulties associated with groundwater capture in a fractured bedrock media, although this concern should be lessened as compared to FCC's proposal for use of pumpback wells alone.

Under this alternative, one or more horizontal tunnels would be bored in the bedrock downgradient of the Ram and Sunshine workings. The tunnel(s) would be oriented perpendicular to the direction of groundwater flow to collect outflow from the workings. If necessary, a number of vertical boreholes would be drilled from the ground surface down to the lower tunnel. The vertical boreholes would drain groundwater from the bedrock into the bottom tunnel. From there, the water would be pumped from one or more pumping wells for treatment as necessary. Once the capture system water attains suitable quality, pumpback could be terminated, the groundwater system allowed to recover and the approximate premining groundwater flow field restored.

Although some of the same concerns regarding groundwater capture from a fracture flow media raised for the pumpback well field option apply to this option as well, the tunnel/vertical borehole system could provide a much higher level of capture efficiency as compared to bedrock pumpback wells. The greater drainage area provided, and the combination of horizontal and vertical drains resulting in a bedrock drainage grid downgradient of each mine, could potentially provide adequate groundwater capture to assure protection of downgradient water resources. However, due to the uncertainties associated with bedrock groundwater capture, increased disturbance area and probably high cost, this alternative was dismissed from further consideration.

Capture Location at the Base of Ram Gulch

The base of Ram Gulch was evaluated as an alternative supplemental groundwater capture location. The potential advantage of this capture location could be the capture of Ram mine water closer to the mine before mine water is further diluted by unaffected groundwater. Thus, reducing the amount of mine water and groundwater captured. The disadvantage of this location is that If the system were located at the base on Ram Gulch, there is a potential for contaminants originating from the North Ram Mine workings to bypass the capture system. Additionally, The proposed Alternative IV lower Bucktail Creek location is in a relatively narrow, steep portion of the drainage, upstream of where the drainage widens and the stream becomes a losing stream. This site was selected in part because it is within the narrowest part of the drainage where bedrock outcrops exist, meaning there should be little alluvial underflow and the required capture volumes can be largely obtained from surface flows, thus facilitating capture. It is purposely located upstream of where the drainage widens and the stream loses flow to the subsurface, and downstream of where potential contaminants from the Ram Mine are expected to enter Bucktail Creek through groundwater. Based on current knowledge, the disadvantages of the Ram Gulch location are believed to outweigh the potential benefit of this location. However, field testing to be performed during the mine development and operating phases will determine the need for, and optimum location of a Bucktail drainage surface water/alluvial groundwater capture system.

Water Treatment Process

FCC's proposal calls for using a water treatment process involving coagulation, clarification, filtration and reverse osmosis. The water balance for Alternative II shows water being pumped from the process pond to the water treatment plant. Treated water would be routed to the discharge location in Big Deer Creek. Several types of treatment process were evaluated by the agencies and described in the water technical report (Hydrometrics, 2006). These alternative types of treatment processes include oil and grease separation, sedimentation, chemical precipitation, clarification and thickening, filtration, ion exchange, reverse osmosis, land application and biological denitrification. Although these processes are discussed individually, some of these processes could be used in series in a single treatment plant to achieve the necessary effluent water chemistry. For the purposes of configuring and evaluating water treatment aspects of Alternatives III, IV and V, general water treatment processes were described. However, other processes not selected for detailed analysis could potentially provide adequate treatment. These commercially available processes were not carried forward for further analysis other than evaluating the implementability of these processes and acknowledging that one or more of the processes discussed in the water technical report (Hydrometrics, 2006) would be appropriate to use for this application, and that effluent produced from one or more of these treatment processes could meet applicable effluent limits.

CHAPTER 3. AFFECTED ENVIRONMENT

Introduction

This chapter describes the existing environmental resources in the Idaho Cobalt Project (ICP) study area. Components of the environment that could be affected by the proposed Project have been reviewed and analyzed. NEPA regulations at 40 CFR 1502.15 have been used to guide the baseline investigations, as well as comments received from the general public, local, state, and federal agencies, Tribes, and other organizations during the Project's public scoping process and Scoping Content Analysis conducted in 2001 (see Public Involvement Section in Chapter 1). NEPA regulations require that the EIS "succinctly describe the environment of the area" and further requires that the "data…shall be commensurate with the importance of the impact."

Since completion of the 2001 public scoping process, a review of issues key to the preparation of this DEIS has been ongoing between the FS and EIS team, Idaho State agencies, other federal agencies, and Tribes. This review and comment process has been, and continues to be accomplished through the Idaho Joint Review Process.

As a portion of FCC's initial January 2001 submittal to the FS of a Plan of Operations (POO), FCC provided several baseline environmental studies to support the POO. The FS and EIS multidisciplinary team with expertise in earth, biological, and social sciences reviewed the baseline studies submitted by FCC. This team examined existing information, determined additional information needs, and developed data collection strategies. Following the initial 2001 review, and a review of FCC's February 2005 modified POO, additional baseline environmental studies and characterizations have been conducted regarding key environmental subjects related to the completion of this DEIS for the proposed ICP. These additional baseline studies and characterizations have included vegetation, wetlands, wildlife, fisheries, cultural and historic resources, noise, recreation, visual, and wilderness resources, socio-economics, and expanded surface water and groundwater quality monitoring. Baseline environmental study updates regarding key elements will continue throughout the EIS process. If the proposed ICP is approved by the FS following completion of the Final Environmental Impact Statement (FEIS) and issuance of a Record of Decision (ROD), comprehensive surface water and groundwater quality monitoring will extend through the life of the project, including the post-mining reclamation period.

A complete discussion of the analyses conducted by the FS and EIS multidisciplinary team has been documented in technical reports and can be reviewed at the Forest Supervisor's Office. On the following pages the significant features of the environment that may potentially be affected by the proposed ICP are discussed. Disciplines addressed in this chapter include:

- Air Quality;
- Geology;
- Soils;
- Hydrology and Water Quality/Quantity (Surface Water and Groundwater);
- Jurisdictional Wetlands and other Waters of the U.S.;
- Aquatic Biology/Fisheries and Threatened, Endangered, and Candidate Species;
- Vegetation and Threatened, Endangered, and Candidate Species;
- Wildlife and Threatened, Endangered, and Candidate Species, including FS Management Indicator Species (MIS);
- Land Use/Management;
- Cultural and Historic Resources;
- Recreation, Visual, and Wilderness Resources;
- Noise;
- Transportation;
- Socio-Economic Resources; and
- Blackbird Mine/CERCLA.

Geology and Geotechnical Characteristics

Physiography

The Idaho Cobalt Project is located in the Rocky Mountain physiographic province. Elevations at the ICP range from 6,000 to 8,200 above sea level. Slopes range from less than five percent on some ridge locations to over 80 percent. Proposed mining operations are located in the upper reaches of Bucktail Creek, a tributary to South Fork Big Deer Creek, which after joining Big Deer Creek flows to Panther Creek drainage, which is a tributary to the Salmon River and Big Flat Creek, which is a tributary of Panther Creek.

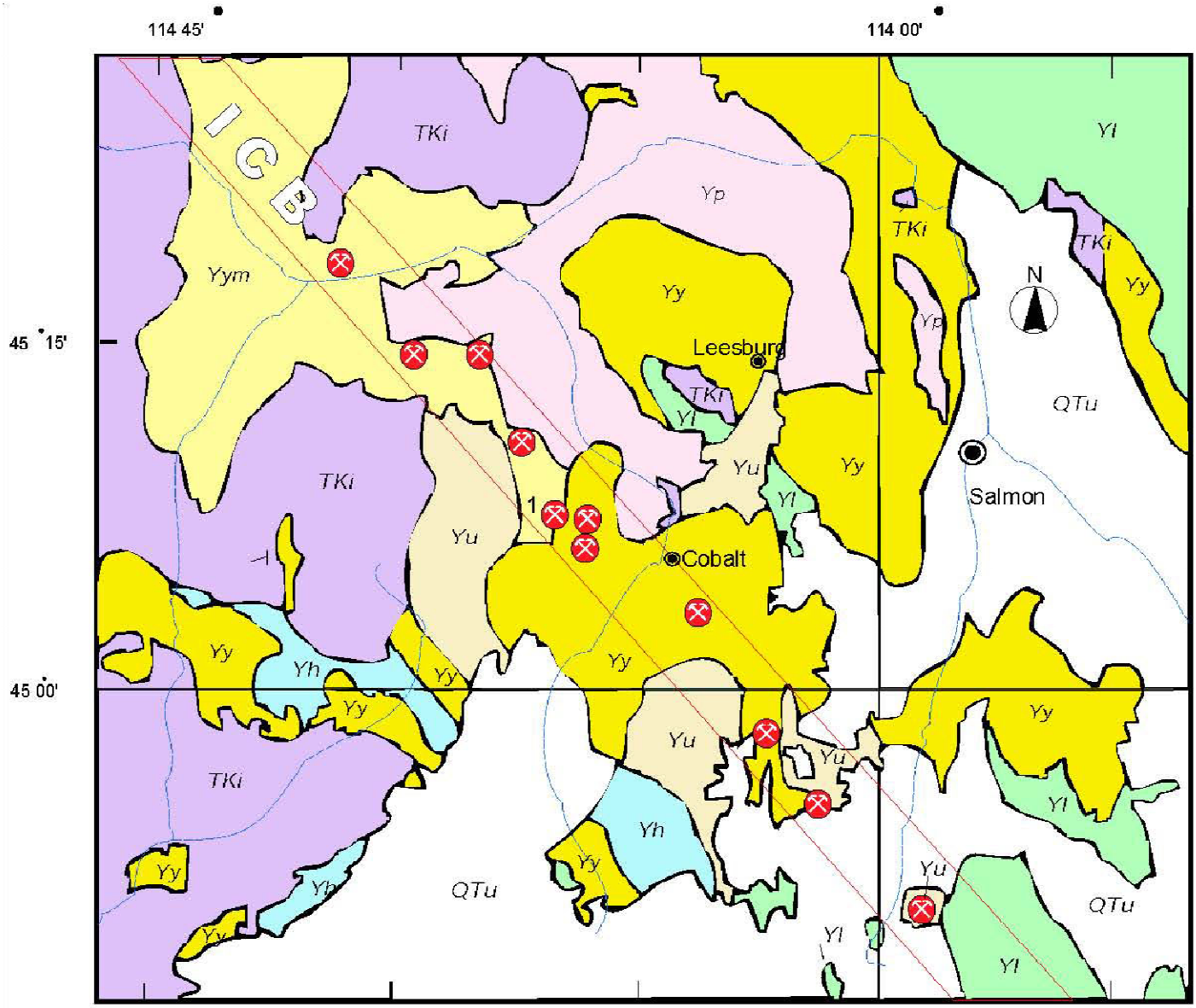
Regional Geology

The Idaho Cobalt Project is located within the Idaho Cobalt Belt (ICB), which is a 35 mile long zone containing Pre-Cambrian rocks enriched in cobalt, copper and gold aligned in a northwest trending belt in east central Idaho (Pegg, 2001) (**Figure 3-1**). These sedimentary rocks were deposited approximately 1.5 billion years ago in a sedimentary basin covering much of northern Idaho and western Montana. The basin was expanding along faults where hot fluids brought cobalt, copper and gold to the seafloor where the metals were deposited as "sedimentary exhalites" similar to black smokers that are currently active along sea floor spreading ridges. The sediments eventually metamorphosed by heat and pressure from burial by younger strata. The metamorphism changed the appearance of the rocks, more so in some places than in others, but the original composition of the rocks, including the metals, stayed the same. These sediments were then again exhumed by uplift and erosion and brought to light in the ICB. Mineralization in the ICB provides a rare opportunity to find and develop primary production of cobalt in the U.S.

Geology of the Idaho Cobalt Project Area

Quartzites, pelites and biotite-rich strata historically interpreted as Yellowjacket Formation host the Ram and Sunshine deposits (Pegg, 2001). Various authors (e.g. Link et al., 2003) have correlated these strata with the Apple Creek Formation. The quartzites and pelites are the metamorphosed sand, mud, and silt originally deposited in the Proterozoic Belt Supergroup sedimentary basin. Biotite-rich strata are interpreted as metamorphosed volcanic rocks that were episodically deposited in the basin, perhaps along the same faults that carried mineralizing fluids. Strata typically strike northwest and dip moderately to steeply toward the east (**Figure 3-2**). The project area is transected by several steep, north-trending faults. Two of these faults, the White Shear and the Northfield appear to demark the limits of mineralization in the district. Mineralization in the Ram and Sunshine deposits typically occurs in stacked bedding parallel horizons dominated by the biotite-rich strata. Ore consists of predominantly bedding concordant cobaltite, chalcopyrite, minor pyrite +/- pyrrhotite bands, blebs, stringers and disseminations. Mineralization remobilized during metamorphism occurs in discordant quartz veinlets and stringers.

Within the Idaho Cobalt belt, the seafloor sediments were locally enriched with sulfides due to exhalation of arsenic rich copper and cobalt sulfides (principally chalcopyrite ($(CuFe)S_2$) and cobaltite ($CoAsS$) from hot solutions that emanated from vents called "black smokers." Pyrite (FeS_2) is present but is not the dominant sulfide mineral in the ICP ore zones (typically less than 1 percent), making them quite distinctive in their geochemical make-up. Like many syngenetic deposits, the contact between ore and unmineralized rock is relatively sharp (Evans et al., 1995), occurring over a distance of less than one meter.



Phanerozoic

- QTu — VOLCANIC AND SEDIMENTARY ROCKS
- TKi — INTRUSIVE ROCKS, EOCENE AND LATE CRETACEOUS
- Yl — LEMHI GROUP

Middle Proterozoic

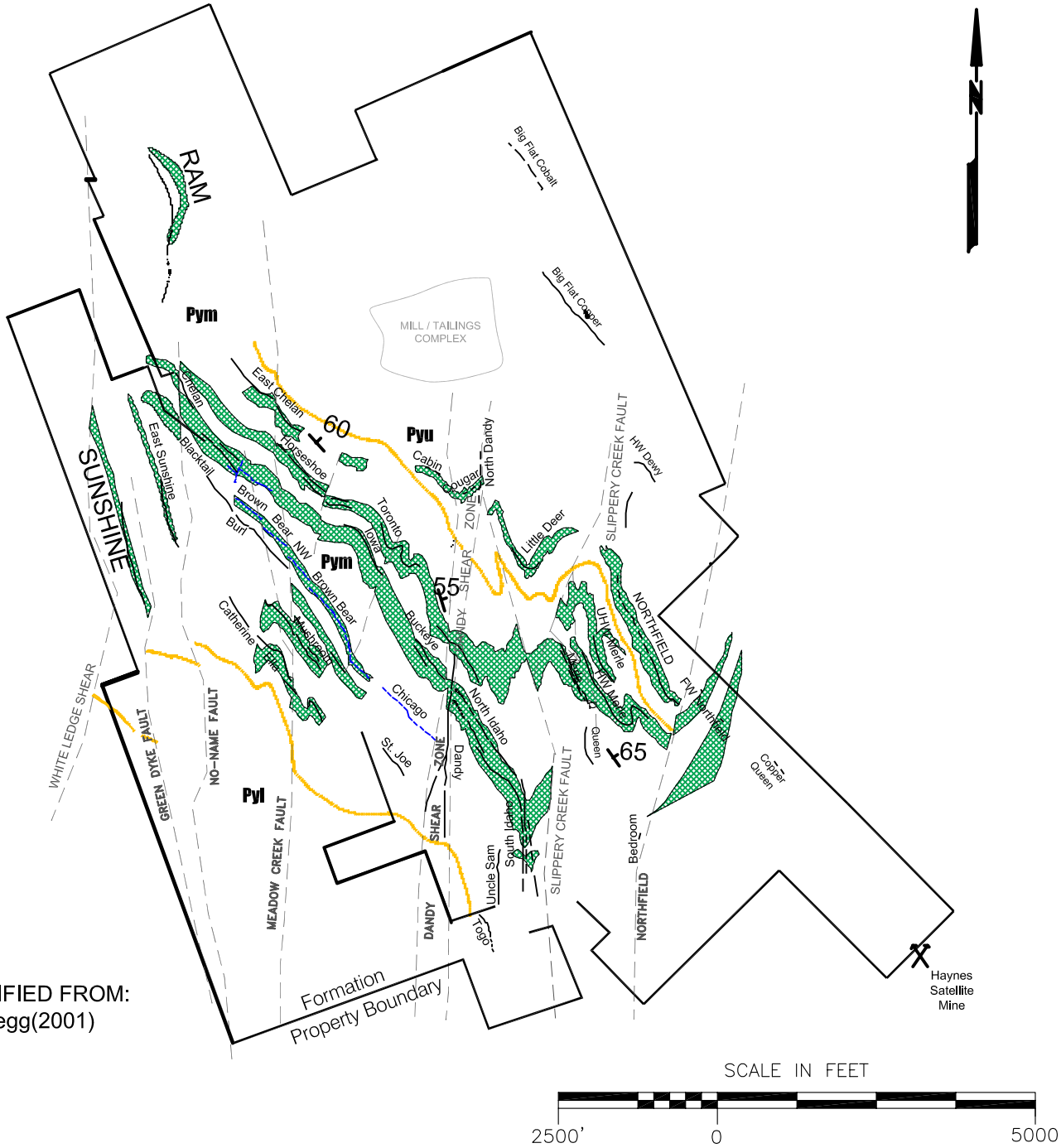
- Yu — METASEDIMENTARY ROCKS OF UNCERTAIN CORRELATION
- Yp — PLUTONIC ROCKS
- Yh — HOODOO QUARTZITE
- Yy — YELLOWJACKET FORMATION
- Yym — YELLOWJACKET FORMATION - Metamorphosed to gneiss and schist

ICB IDAHO COBALT BELT

Cobalt (Copper, + Gold) Prospects

1 Blackbird Mine / Idaho Cobalt Project

IDAHO COBALT PROJECT FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**REGIONAL GEOLOGY IDAHO COBALT BELT**	**FIGURE** **3-1**



MODIFIED FROM:
Pegg(2001)

LEGEND

- MAFIC SEQUENCES
- CONTACT
- COBALT/COPPER MINERALIZATION (ZONES)
- MAIN MINE SEQUENCE MINERALIZATION (ZONES)
- FAULT
- STRIKE AND DIP OF BEDDING

YELLOW JACKET FORMATION

- **Pyu** UPPER UNIT
- **Pym** MIDDLE UNIT
- **Pyl** LOWER UNIT

IDAHO COBALT PROJECT FORMATION CAPITAL CORPORATION, U.S. LEMHI COUNTY, IDAHO	**IDAHO COBALT PROJECT AREA GEOLOGY**	**FIGURE** **3-2**

Mining History of Idaho Cobalt Project Area

Blackbird Mine District

Mineralization in the ICP area was discovered in 1892 when a prospector found copper mineralization along Blackbird Creek. Cobalt was recognized in 1901 but there was no market at that time. Exploration and development of copper and cobalt ores in the district has continued sporadically ever since. Several million tons of ore have been produced from both underground and surface mines in the district, primarily from the Blackbird Mine. Development at the Blackbird Mine eventually consisted of some 15 miles of underground workings, an open pit mine, and milling facilities.

Idaho Cobalt Project

Mineralization contained within ICP holdings received relatively minor attention until 1994 when the Blackbird Mining Company dropped claims peripheral to their holdings and FCC restaked those claims. Formation began exploration in 1995, completing geologic mapping, soil sampling and drilling programs. Early exploration efforts by ICP were focused on the Sunshine Deposit that Calera Mining Co. identified and explored in the 1950's. Formation identified mineralization in the Ram deposit area through geologic mapping and soil sampling. ICP plans on producing from the Ram and Sunshine deposits and ongoing exploration may identify additional mineralization. As of 2006, FCC had completed 184 drill holes totaling approximately 123,213 feet of drilling, collected 8,427 soil samples and 1,025 rock chip samples.

Formation completed a pre-feasibility study in 1998 and updated the study in 2001, 2005 and 2006 incorporating additional metallurgical, geotechnical, and drill hole data. Mineral resources identified to date and described in the Plan of Operations (FCC, 2006) total 2,654,400 tons. This number forms the basis for sizing facilities such as the tailings-waste rock storage facility (TWSF) mine, and mill. The amount of ore that can be economically mined depends in large part on the metal prices, and could increase or decrease if metals prices change in the future. Additional undiscovered ore reserves may also be present in the FCC claim area.

Other Mining Activity

There is no significant mining production coming from the immediate ICP area. The most recent production came from the Beartrack project near Leesburg approximately 15 miles to the northwest. The Beartrack project is currently undergoing final reclamation. Historic impacts from mining operations on Blackbird Mining Company property are currently being remediated by the Blackbird Mine Site Group (BMSG) under superfund (CERCLA) authority. Exploration of other mining prospects in the area occurs when metal prices provide incentive.

Cobalt Production and Uses

Cobalt is considered a strategic metal because of its uses in the defense industry and the fact that the U.S. relies heavily on imports for supplies. It is used in industrial, high-tech, medical, environmental, and strategic applications. It is used in radial tires, prosthetic limbs, and jet engines. Demand for cobalt is expected to increase with higher demands for high-tech products such as cell phones, fuel cells, and solar panels.

The U.S. currently consumes over 20 percent of the world production of cobalt, nearly all of which is imported. U.S. production of cobalt is byproduct from mines producing other metals such as copper and nickel, and from recycling. There are no current primary producers of cobalt in the U.S. The ICP will supply approximately 4 percent of global demand and 10 percent of U.S. demand for cobalt.

Property Status

The ICP property consists of 147 unpatented lode claims totaling approximately 2,262 acres of land administered by the U.S. Forest Service (**Figure 3-3**). These claims are peripheral to patented and unpatented claims held by the Blackbird Mining Company.

Existing Geotechnical Environment

Soils at the "Big Flat," within the ICP Project Area, consist of a surface layer of colluvium derived from weathering bedrock. Bedrock below the colluvium is generally at a depth less than six feet. Slopes on the "Big Flat" are generally around six or seven percent.

The upper six-inches of colluvium consist of loose, silty sand with a trace of organics and gravels. Large cobbles and boulders are scattered throughout the site in this upper soil layer. Beneath the surface soil layer, the colluvium gradually grades to a denser, non-stratified silty sand with some subangular gravel and then to bedrock. Bedrock in the Big Flat is comprised of weathered, highly fractured, bedded siltites and greenstones with a weak fabric of mica interspersed in bands within the bedrock.

Earthquakes (Seismicity)

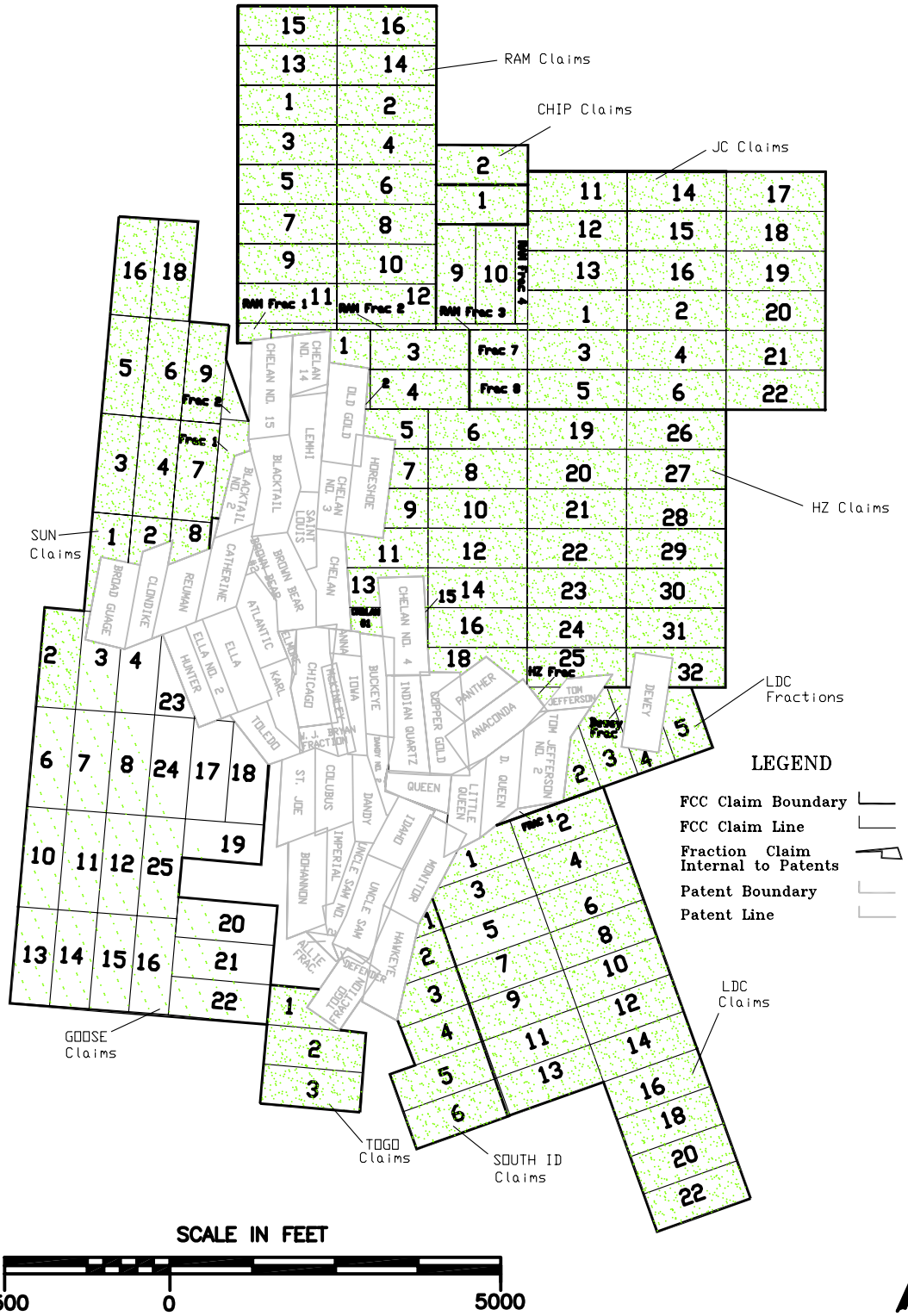
The Big Flat is located in International Building Code's (IBC) Seismic Region 2. Region 2 is often referred to as the Intermountain Seismic Belt and is classified as having 'moderate' earthquake potential. A branch of this belt, called the Centennial Tectonic Belt, extends west from Yellowstone Park, through southwestern Montana, into central Idaho and includes at least eight major active faults. Two of the largest historic earthquakes in the northern Rocky Mountains, the 1959 Hebgen Lake and 1983 Borah Peak Earthquakes, occurred along this branch of the Intermountain Seismic Belt. These earthquakes were magnitude 7.5 and 7.3 and were centered 260 and 125 kilometers from the site, respectively. The largest recorded earthquake in the past 60 years, within 100 kilometers of the site, occurred in February of 1945. The earthquake's epicenter was located approximately 99 kilometers south of the site, and had a recorded Richter Magnitude of 6.0.

Available data suggests that an earthquake as large as Richter Magnitude 6.0 can be expected within 100 kilometers of the site approximately every 60 years. On a more infrequent basis, larger earthquakes may be possible near the site. Constructed buildings must be designed to withstand the expected earthquake magnitudes associated with IBC's Region 2.

Water Resources

This section on water resources recognizes five primary categories and the interactions between these components: climate, groundwater, surface water, sediment and geochemistry. Additional information regarding project geology and mineralogy can be found in the Geology, Geotechnical Characteristics and Geochemistry section of this Chapter. The emphasis on the description of geochemistry in this Section is placed on characterization of the potential for ore, waste rock, and tailings to impact water resources through the release of acidity and soluble metals. As identified during Scoping, the Panther Creek drainage, is the area of concern for water quality. Primary areas of concern include Blackbird, Bucktail, Big Flat, Little Deer, and Big Deer Creeks. Secondary areas of concern are those streams which could be indirectly impacted by the proposal or which could be affected by accidental spills of hazardous materials, Salmon River, Panther Creek, Deep Creek, and Williams Creek.

The ICP lies within the Panther Creek drainage, which flows to the Salmon River near Shoup, Idaho. Panther Creek, Salmon River, and various tributaries form the Middle Salmon River-Panther Creek subbasin (HUC #17060203), which encompasses approximately 1,800 square miles with nearly



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IDAHO COBALT PROJECT PROPERTY OWNERSHIP AND CLAIMS

FIGURE

3-3

2,000 stream miles (**Figure 3-4**). Elevations of the subbasin area range from 2,085 feet in the Salmon River valley to 10,985 feet at Lemhi Peak. Other major or notable streams in the subbasin include the North Fork Salmon River, Williams Creek, and Napias Creek.

The ICP lies near the headwaters of several drainages: Bucktail Creek, Big Deer Creek, Big Flat Creek, Little Deer Creek, and Blackbird Creek. All of these drainages ultimately flow into Panther Creek. In addition, the transportation route to the ICP lies in portions of the Williams Creek and Deep Creek drainages. Williams Creek is tributary to the Salmon River upstream of the city of Salmon. Deep Creek is tributary to Panther Creek between Blackbird Creek and Napias Creek.

Past and Ongoing Actions Relevant to Current Conditions

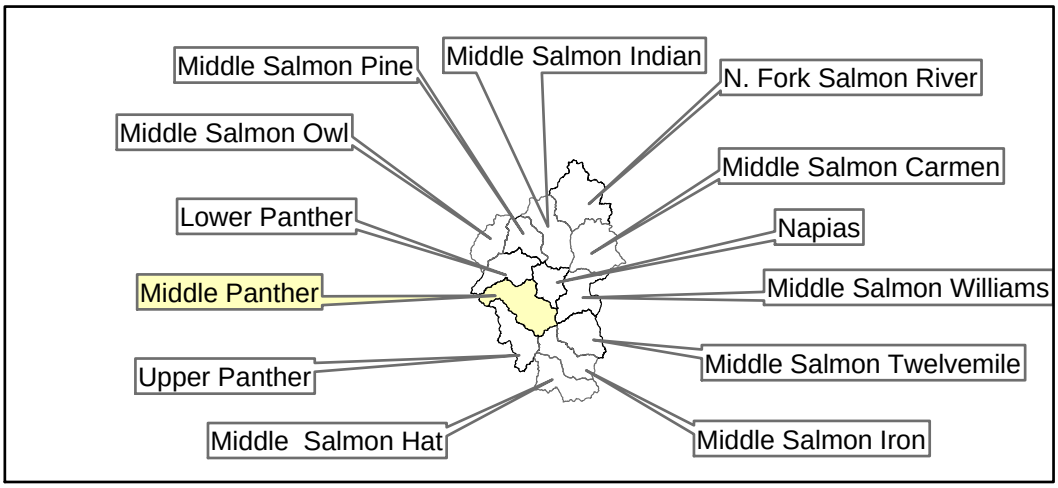
Current water resource conditions in the ICP are affected by historic mining at the Blackbird Mine Site that occurred from the late 1800s until 1982 and cleanup actions associated with the Blackbird superfund (CERCLA) site that began in 1995 and are ongoing. The Clear Creek fire which burned most of the ICP area and a large portion of the surrounding watersheds in 2000 has also had a significant impact on the Project Area. These past actions have resulted in effects to stream sediments, water quality, and watershed yield.

Blackbird Mine Site - The Blackbird Mine Site is an inactive mine located in Lemhi County, Idaho approximately 13 miles south of the Salmon River, 25 miles west of Salmon, Idaho and adjacent to the ICP (see **Figure 1-1).** The Blackbird Mine Site covers approximately 830 acres of private patented mining claims within the Salmon-Challis National Forest. Mining activity resulted in about 14 miles of underground workings, a 12-acre open pit, 4.8 million tons of waste rock deposited in numerous piles, and two million tons of tailings disposed of at a tailings impoundment.

The Blackbird Mine site spans the Bucktail Creek and Meadow/Blackbird Creek drainages. These drainages flow into Panther Creek. Acid rock drainage from the waste rock piles, the underground workings, the tailings impoundment, and tailings deposited along streams have resulted in the release of elevated levels of hazardous substances to the environment (groundwater, surface water and soils), including but not limited to copper, cobalt and arsenic. These releases have contributed to elevated levels of dissolved copper and cobalt in Panther Creek and some of its tributaries. Contaminated soil, sediments, waste rock and tailings were also released from the Blackbird Mine site during high water flows from thunderstorms and snowmelt and deposited in soil along the banks of downstream creeks (referred to as overbank deposits/soil) including Panther Creek and its tributaries. Investigations show that irrigation also spread contaminated material along Panther Creek in the overbank soil as well as in pastures. The fisheries and aquatic resources downstream of the Blackbird Mine have been impacted by copper and cobalt releases. Dissolved copper concentrations in area creeks downstream from the mine frequently exceed the State of Idaho water quality standard (WQS) (IDAPA 58.01.02) for protection of aquatic life (Shaw, 2004; Golder, 2005). The current Idaho WQS for arsenic is 50 parts per billion (ppb). The Idaho WQS for copper for protection of aquatic life is variable depending on water hardness and is approximately 4 ppb at hardness values typically found in ICP area streams. Idaho does not currently have a water quality standard for cobalt, however EPA has proposed a cleanup standard of 86 ppb (Allans, 2005) for Blackbird.

Ongoing CERCLA Response and Restoration Action - Several actions have been conducted and are ongoing at the Blackbird Mine Site to address the releases of contaminants and the injuries to natural resources which resulted from the releases. In 1995, the M.A. Hanna Company, Hanna Services Company, Noranda Mining, Inc., Noranda Exploration, Inc., Blackbird Mining Company Limited Partnership, and Alumet Corporation settled litigation brought by the United States and the State of Idaho under the Comprehensive Environmental Response, Compensation, and Liability Act, the Clean Water Act, the Endangered Species Act, and State law. Under a 1995 Consent Decree, the companies agreed to take response actions at the site to clean up the contamination, and to implement a detailed natural resources restoration plan known as the Biological Restoration and

Middle Salmon-Panther Subbasin 17060203



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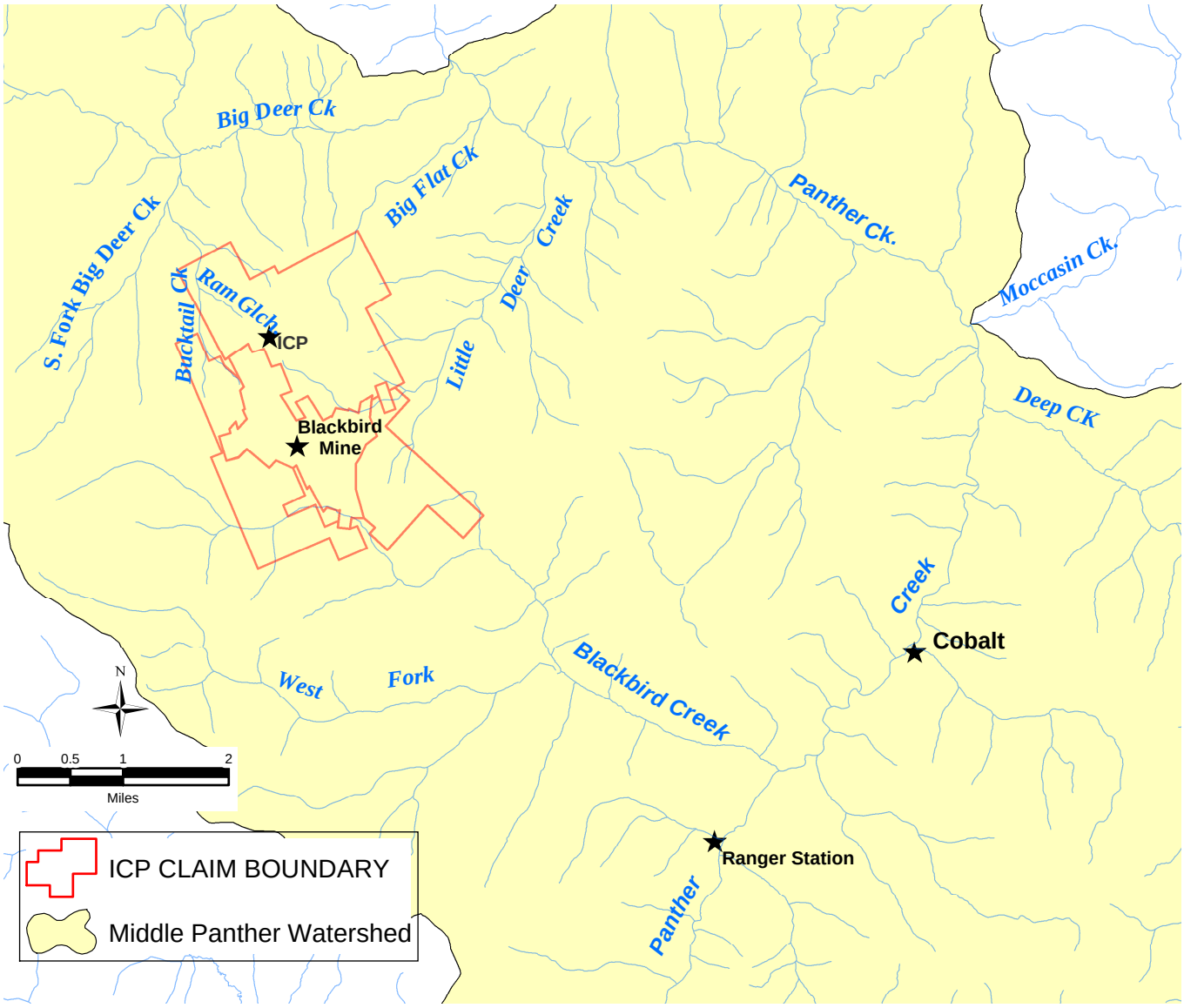


IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**STREAMS AND WATERSHED BOUNDARIES IDAHO COBALT PROJECT AREA**	Figure 3-4

Compensation Plan (BRCP) (*State of Idaho, et al. v. The M.A. Hanna Company, et al.*, Consolidated Case No. 83-4179(R) (D. Idaho, 1995)).

The Blackbird Mine Site Group (BMSG), composed of current owner/operator Noranda Mining, Inc., and former owners and operators M.A. Hanna Company, Hanna Services Company, and Intalco (formerly Alumet) was formed to represent the companies in the cleanup and restoration of the site. Response actions at the site have included emergency actions to address imminent releases from the West Fork Tailings Impoundment; non time-critical removal actions (the Early Actions) conducted in the Bucktail Creek basin, in the Meadow/Blackbird Creek basin to address water quality and along Panther Creek to address human health concerns; and investigations and studies to complete the Remedial Investigation/Feasibility Study (RI/FS). A Record of Decision (ROD) for the site was issued in February 2003, and the BMSG is currently implementing the remedy outlined in the ROD under a Unilateral Administrative Order issued by EPA in 2004. Although there have been significant improvements in surface water and sediment quality as the result of ongoing cleanup actions, streams in the area of the Blackbird Mine and the ICP continue to routinely exceed water quality standards as the result of historic mining at the Blackbird Mine Site.

The BMSG also continues to have significant resource restoration obligations at the site under the BRCP. The primary objective of the Blackbird cleanup is the achievement and maintenance of the copper water quality standard in Big Deer and Panther Creeks so that all like stages of salmonids may be sustained. The BRCP includes three primary components integral to the restoration of Chinook salmon to Panther Creek basin once water quality criteria have been met and maintained to the satisfaction of the natural Resources Trustees: 1) a Hatchery Operations Plan; 2) a Smolt Survival Plan and 3) a Performance Monitoring Plan.

Clear Creek Fire - A significant portion of the Panther Creek watershed was burned during the Clear Creek fire in 2000, including a majority of the Area of Potential Impact (12,575 acres including and adjacent to the proposed development areas), and the Project Area (2,620 acres that will be affected by the mine and ancillary facilities). Prior to the Clear Creek fires, vegetation in the Area of Potential Impact consisted of forest plant communities dominated by an overstory of Douglas-fir, lodgepole pine, subalpine fir, and Engelmann spruce (Douglas-fir and subalpine fir climax habitat types). The Clear Creek fires burned 99 percent of the Area of Potential Impact with 60 percent of the area burning at high severity (80 to 90 percent crown or canopy removal), 30 percent burning at medium severity (20 to 80 percent crown removal), and 9 percent burning at low intensity (0 to 20 percent crown removal) (Intermountain Resources, 2004).

Fire can have significant effects on water resources, primarily on sediment yield and watershed yield. Studies of the affects of fire on watersheds document that there is an increase in surface water runoff and sediment yield after a fire. The size of the increase varies greatly, depending on the intensity of the fire, forest cover, and other basin characteristics. An analysis and comparison of pre-fire versus post-fire streamflows (Water Resources Technical Report; Hydrometrics, 2006) in the vicinity of the ICP indicates that current watershed yields (average annual volume of water per unit area of watershed) are approximately 50 percent higher than pre-fire conditions. Sediment yield modeling (Water Resources Technical Report; Hydrometrics, 2006) estimates that the Clear Creek fire caused sediment yields to area streams to increase by a factor of 2 to 5 times over pre-fire conditions. By 2006, sediment monitoring data shows that sediment levels in Panther Creek have returned to pre-fire levels (Rieffenberger, 2006). The effects of the fire on surface water runoff and sediment yield will continue to decrease over time as vegetation and soils recover.

Groundwater Resources

Groundwater at the ICP site occurs primarily within fractured bedrock underlying the site and unconsolidated alluvial deposits within the drainage bottoms. These two hydrostratigraphic units are identified as individual (although interconnected) site aquifers for purposes of the ICP groundwater evaluation. Relatively minor, isolated pockets of groundwater also occur within unconsolidated

materials overlying bedrock in the Big Flat area. Due to the discontinuous and seasonal nature of this groundwater, the Big Flat unconsolidated material may not be considered an aquifer.

Occurrence of Groundwater

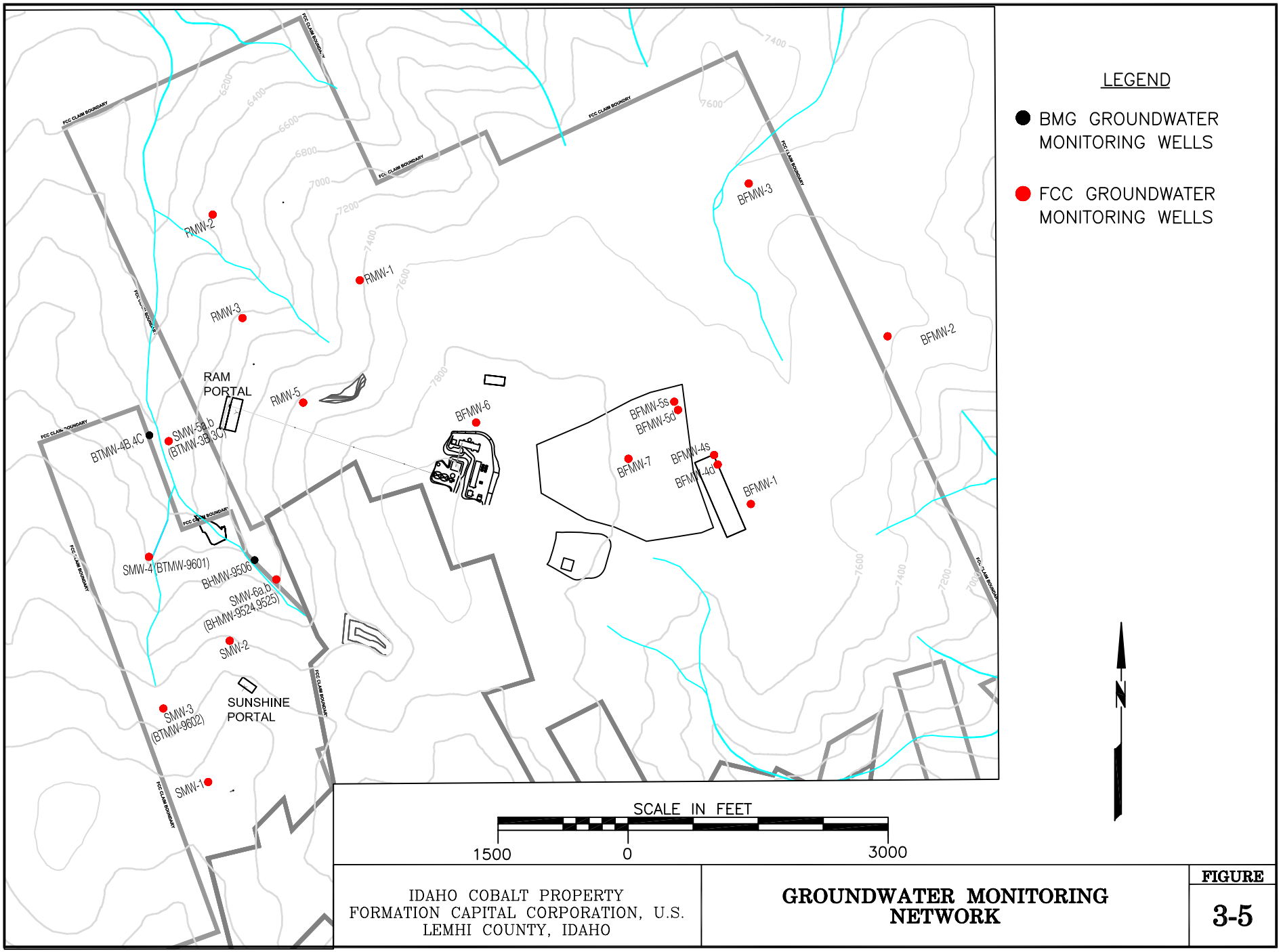
Bedrock Aquifer - The ICP bedrock groundwater occurs within the middle unit of the Precambrian Yellowjacket Formation, comprised of fine to medium grained quartzite interbedded with biotitic and chloritic tuffaceous interbeds. Groundwater flow within the bedrock, which dips to the east, occurs through fractures, with insignificant primary bedrock porosity and permeability. Groundwater flow is therefore controlled by the density, width, and interconnectivity of the bedrock fracture network. On a site-wide scale, the fracture density and interconnectivity is believed to be adequately developed so that the fractured bedrock aquifer can be approximated as an equivalent porous media aquifer (i.e., a sand or gravel aquifer) for certain analytical and evaluation purposes. On a localized scale however, groundwater flow may deviate markedly from this simplified approximation, and use of an equivalent porous media (EPM) model may not be appropriate. One example of where the EPM may not be applicable is in evaluating potential contaminant transport pathways through the bedrock aquifer, where individual fractures may cause particle transport pathways to deviate on a local scale from those predicted by the EPM approach. The "uncertainties" associated with the EPM analysis approach need to be acknowledged when reviewing the analysis presented here and are further addressed through stipulations and contingencies applied to the mine operations and monitoring programs.

Groundwater flow through the bedrock aquifer is also influenced by a number of significant bedrock structures identified in the ICP area. Four major faults have been identified within the project area (Pegg, 2001) including, from west to east, the White Ledge Shear, Meadow Creek Fault, Slippery Creek Fault, and Northfield Fault (**Figure 3-2**). A number of smaller, north trending faults and shear zones have also been identified, including the Green Dike and No-Name faults. These structures have the potential to affect groundwater flow through the ICP site by acting as either conduits and/or barriers to groundwater flow, depending on specific characteristics of the structure and adjacent bedrock.

Depths to groundwater in the bedrock vary with season and location across the ICP site. Monitoring well locations are shown in **Figure 3-5**. Depths to groundwater measured in the bedrock monitoring wells range from about 10 to nearly 400 feet below ground surface. Water levels in the monitoring wells rose higher in the wells than the depth at which water was first encountered during drilling. This indicates that the groundwater in the fractured bedrock aquifer is under pressure. Additional information on the seasonal fluctuation of groundwater levels in fractured bedrock system are provided in the ICP Water Resources Technical Report (Hydrometrics, 2006) and in FCC's water monitoring report (Shaw, 2005 and 2005a).

Alluvial Aquifer - Groundwater also occurs within unconsolidated alluvial deposits occupying drainage bottoms in and around the ICP site. Major drainages containing alluvial aquifers include the Bucktail Creek/Big Deer Creek drainage system, Blackbird Creek to the south, and Panther Creek to the east. Although groundwater does occur at least seasonally in other ICP-area drainages, including Big Flat Creek and Little Deer Creek, these units are not identified as aquifers due to their size and lack of continuity.

Groundwater investigations in Upper Bucktail drainage, where the ICP mine workings would be located, show the alluvium/colluvium to range from 20 to 30 feet thick downstream of the confluence of the east and west forks (Golder, 2004 and 2004a). The saturated thickness of the alluvium as documented through well drilling and water level monitoring is on the order of 10 to 15 feet. The alluvium consists primarily of silty sand with little gravel, to interspersed coarse gravel and cobble layers. The alluvium in Upper Bucktail Creek drainage is overlain by up to 20 feet of landslide deposits along the drainage margins.



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GROUNDWATER MONITORING NETWORK

FIGURE

3-5

Aquifer Properties

Aquifer properties such as hydraulic conductivity, transmissivity and storativity determine the rate at which groundwater flows through an aquifer, and how the aquifer responds to external stresses such as pumping. Hydraulic conductivity and transmissivity determine an aquifer's ability to transmit water. Transmissivity is equal to the hydraulic conductivity times the saturated thickness of an aquifer. Storativity measures the amount of water released from storage within an aquifer in response to a decline in potentiometric head. Aquifer properties at the ICP site have been determined through a variety of field testing programs and analytical methods including pumping tests, packer tests and slug tests.

Overall, the aquifer test results for the Project Area show the bedrock aquifer have low permeability, with average hydraulic conductivity values from the nine tests ranging from 0.006 to 12.6 feet/day with a median value of 0.13 feet/day.

Test results for the alluvium/colluvium show the hydraulic conductivity ranges from 25 to 221 feet/day with an average value of 91.75 feet^2/day or two orders of magnitude greater than that in the bedrock. The corresponding transmissivity values range from 357 to 3,100 feet^2/day, and average 1,237 feet^2/day. A storativity value of 0.002 was obtained from the tests, indicating that the Upper Bucktail drainage alluvial/colluvial aquifer is confined or semi-confined.

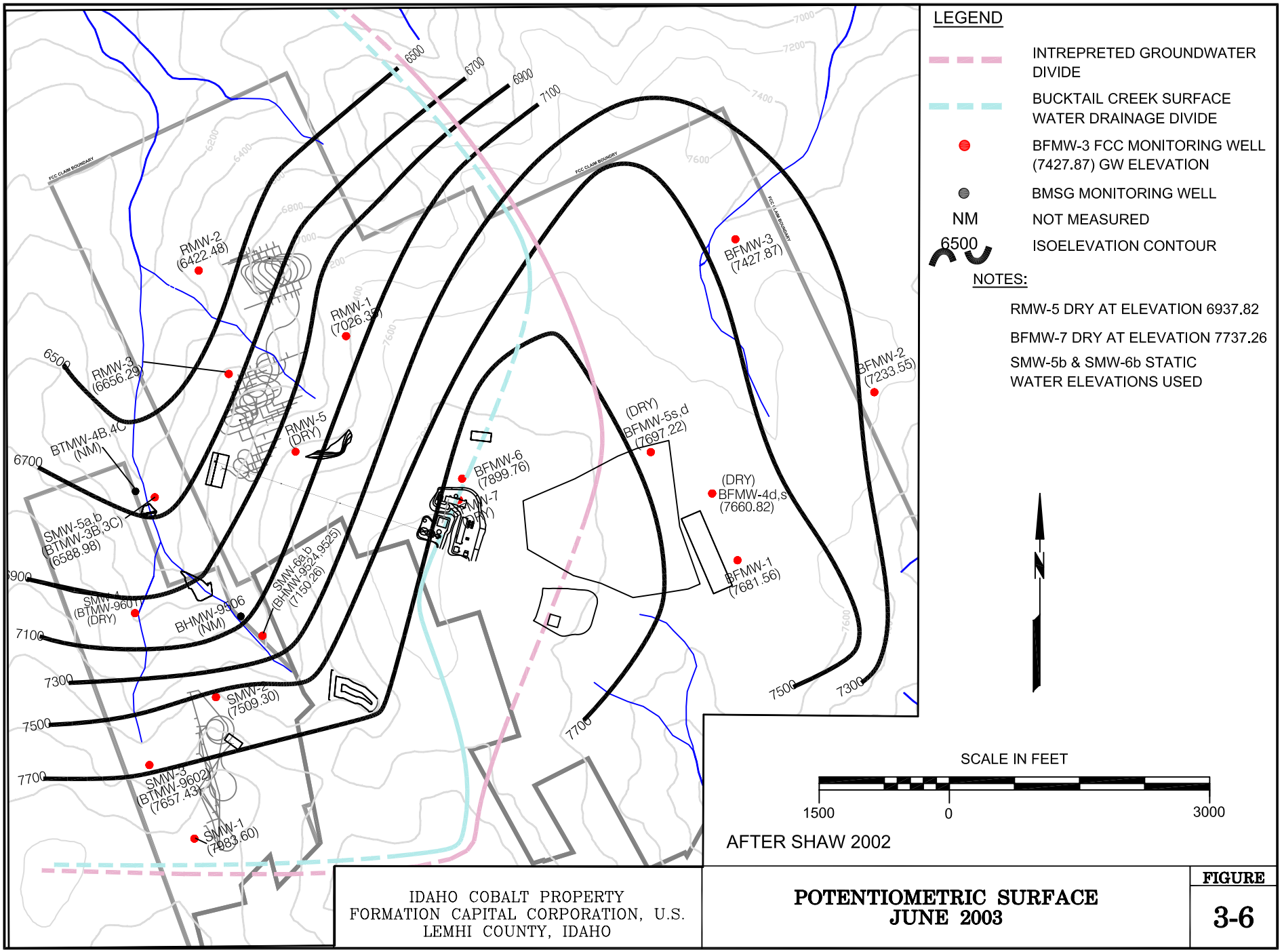
Groundwater Flow

Groundwater flow properties include groundwater flow directions and controlling factors (fracture-controlled flow verses porous media flow), groundwater flow rates (velocities and fluxes), groundwater recharge and discharge mechanisms, and surface water/groundwater interactions. Each of these properties is summarized below for the bedrock and alluvial aquifers.

Bedrock Aquifer - Figure 3-6 shows the generalized potentiometric surface for June 2003 in the bedrock aquifer in the Project Area. The potentiometric surface, represented by the contour lines on the figure, shows the potentiometric head within the bedrock aquifer, or the elevation to which groundwater would rise in a well completed within the aquifer. The general direction of groundwater flow is perpendicular to the potentiometric contour lines, or from areas of high potential head to areas of lower potential head. As a result, the generalized direction of groundwater flow in the bedrock aquifer is radially away from the topographic divide between the Big Flat area and Bucktail Creek drainage, eastward and westward towards Panther Creek drainage and Bucktail Creek drainage, respectively, and northward towards Big Deer Creek.

Groundwater flow through the bedrock aquifer generally mimics that of a porous media aquifer, and generally follows the topography (flows from areas of high elevation to areas of low elevation). In this manner, the bedrock aquifer can be approximated as an equivalent porous media (EPM) aquifer. However, on a localized scale of a few tens to hundreds of feet, detailed groundwater flowpaths may deviate significantly from this simplified model, with groundwater flow potentially occurring perpendicular to the generalized groundwater flowpaths assumed for the EPM. Furthermore, major bedrock structures such as faults and shear zones have the potential to cause groundwater flowpaths to deviate from the generalized model over larger distances. These potential influences on groundwater flow have implications for aspects of the site hydrogeology, such as potential contaminant transport pathways and velocities.

The primary source of recharge to the bedrock aquifer is deep percolation of precipitation in the ICP site and surrounding area. Based on watershed modeling conducted by FCC (Telesto, 2005), the bedrock aquifer recharge rate is estimated at nine percent of annual precipitation, or about 2.3 inches per year. Although not indicated by current information, it is possible that the ICP bedrock aquifer receives recharge via lateral groundwater inflow to the ICP site from the south. The bedrock aquifer discharges primarily to the alluvial groundwater/surface water systems surrounding the site (Bucktail, Big Deer and Panther Creek drainages), and through a limited number of springs and seeps.



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POTENTIOMETRIC SURFACE
JUNE 2003

FIGURE
3-6

Alluvial Aquifers - Groundwater within alluvial aquifers at the ICP site flows in the general direction of stream flow. Groundwater within the alluvial aquifer system is recharged by infiltration of snowmelt and rainfall on the alluvial surfaces, and by discharge of bedrock groundwater to the alluvium. The alluvial groundwater discharges primarily to surface water, and to a lesser extent through evapotranspiration and bedrock groundwater recharge.

Synoptic stream flow monitoring conducted by FCC and BMSG shows that streams in the ICP area are generally gaining streams, meaning that groundwater recharges the streams as opposed to stream water seepage recharging the groundwater system. Therefore, surface water/groundwater interactions at the site are characterized by the flow of groundwater from bedrock to alluvium, and discharge of alluvial groundwater to associated streams. Localized variations in the thickness and permeability of the alluvium, as well as bedrock constrictions within the drainage bottoms, can cause localized deviations from this general relationship. However, the groundwater-to-surface water flow pattern holds true on a site-wide scale.

Groundwater Quality

FCC has been collecting groundwater chemistry data from the ICP area on a regular basis since 2000. The FCC monitoring well network includes 15 monitoring wells installed by FCC in 2000 and 2001 and six wells installed by BMSG. Well locations are shown on **Figure 3-5**. Although 21 wells have been included in the groundwater monitoring program, three of these wells (RMW-5 in the Ram area, and BFMW-4s and -5s in the Big Flat area) have been dry since installation and therefore have not yielded any groundwater samples. In addition to the FCC monitoring program, the State of Idaho, EPA and BMSG have conducted groundwater monitoring activities in and near the ICP Project Area.

For consistency with the dynamic systems model (DSM) being employed in the EIS impacts analysis (Telesto, 2005), and to avoid discrepancies often associated with total metals groundwater data due to well completion and sampling procedures, the following discussion of current groundwater quality conditions focuses on dissolved metals concentrations. Total recoverable groundwater concentrations are presented in the Water Resources Technical Report (Hydrometrics, 2006), and in the Baseline Hydrology Report (Shaw, 2004). **Table 3-1** includes a summary of the 2002 through 2005 groundwater quality data by area.

Ram Area - Dissolved metals concentrations in the Ram area groundwater show general increases from upgradient to downgradient of the Ram ore zone. For instance, average dissolved copper concentrations in wells RMW-1 (upgradient), RMW-2 and RMW–3 (both downgradient) are 0.007, 0.008 and 0.041 milligrams per liter (mg/L), respectively. Consistent downgradient concentration increases are also observed for iron, while arsenic and cobalt concentration trends are more variable through the Ram ore zone.

Sunshine Area - Based on dissolved metals concentrations, groundwater quality trends are variable through the Sunshine ore zone, with concentrations of some metals (copper and iron) greater at topographically upgradient well SMW-1 as compared to downgradient wells SMW-2 and SMW-3. For example, the average dissolved copper concentration is 0.023 mg/L at SMW-1, as compared to 0.006 and 0.010 mg/L at SMW-2 and SMW-3, respectively. Conversely, the average arsenic and cobalt concentrations are greatest at well SMW-2, and lowest at SMW-3. This indicates that groundwater quality in the vicinity of the Sunshine ore zone is variable with no clear upgradient to downgradient trends. Additionally, historic mine wastes in upper Bucktail drainage (and the Sunshine Mine area) have been identified as having an affect on groundwater quality (USEPA, 2003).

Upper Bucktail Drainage - Current groundwater quality in Upper Bucktail Creek drainage has been quantified through seasonal sampling of five bedrock monitoring wells by FCC. The five wells, SMW-4, -5a, -5b, -6a and –6b were originally installed and monitored by BMSG, and were incorporated into the FCC monitoring program in either 2001 or 2002. Groundwater quality in this area is impacted by historic mining activities, with dissolved metals concentrations in excess of 100

TABLE 3-1. Summary of 2002-2005 Groundwater Quality Monitoring Results by Area From the Idaho Cobalt Project

PROJECT AREA		TDS mg/L	SO_4 mg/L	Cu mg/L	Co mg/L	As mg/L	Ni mg/L	Zn mg/L
RAM AREA								
Wells RMW-1, RMW-2, RMW-3	# SAMPLES	31	30	28	28	28	28	28
	MIN	14	4	<0.0001	0.0011	0.0002	<0.001	<0.01
	MAX	252	35	0.119	0.174	0.0088	0.010	0.12
	MEAN	*108*	*21.3*	*0.022*	*0.045*	*0.0030*	*0.002*	*0.018*
SUNSHINE AREA								
Wells SMW-1, SMW-2, SMW-3	# SAMPLES	32	32	32	32	32	29	32
	MIN	13	3.0	<0.0001	<0.0001	<0.0001	<0.001	<0.005
	MAX	92	26.3	0.149	0.366	0.176	0.02	0.10
	MEAN	*51*	*11.7*	*0.013*	*0.152*	*0.046*	*0.005*	*0.02*
UPPER BUCKTAIL AREA								
Wells SMW-4, SMW-5a and 5b, SWM-6a and 6b	# SAMPLES	33	31	25	25	25	17	17
	MIN	231	128	0.025	0.023	0.0004	0.013	0.002
	MAX	2220	2010	258	60.6	0.20	1.08	1.15
	MEAN	1092	740	57.6	20.3	0.054	0.388	0.392
BIG FLAT AREA								
Wells BFMW-1, BFMW-2, -3, -4d, -5d, -6, and –7	# SAMPLES	61	57	52	52	52	40	37
	MIN	15	<0.5	0.0029	<0.0001	<0.0001	<0.001	<0.005
	MAX	136	9.0	0.121	0.113	0.0033	0.0071	0.13
	MEAN	38	1.7	0.029	0.009	0.0010	0.0014	0.015
GROUNDWATER QUALITY STANDARD		500[2]	250[2]	1.30[1]	---	0.05[1]	---	5.0[2]

TDS - Total Dissolved Solids
SO_4 - Total Sulfate
Cu - Dissolved Copper
Co - Dissolved Cobalt
As - Dissolved Arsenic
Ni - Dissolved Nickel
Zn- Dissolved Zinc

1- Idaho Primary Constituent Standard
2- Idaho Secondary Constituent Standard
--- No numeric groundwater standard exists

Below detection limit values replaced with detection limit for calculating means

mg/L in some cases. The Upper Bucktail drainage area is the focus of ongoing field characterization and remediation activities by BMSG.

The highest metals concentrations in Upper Bucktail Creek drainage have been recorded at monitoring well SMW-6a, completed in bedrock from 65 to 85 feet below ground surface in the east fork of Bucktail Creek. Maximum dissolved metals concentrations at this site include 0.02 mg/L arsenic, 60.6 mg/L cobalt, 258 mg/L copper, and 3.63 mg/L iron. Metals concentrations are also very high in complimentary well SMW-6b, completed at a depth of 151-171 feet below ground surface, although, with the exception of iron, not as high as those in SMW-6a.

Big Flat Area - Concentrations of dissolved metals, with the exception of copper, are generally low in the Big Flat area groundwater, especially as compared to other portions of the ICP site. Dissolved arsenic concentrations range from <0.0001 to 0.0033 mg/L for all Big Flat area wells, and dissolved iron concentrations range from <0.03 mg/L to 0.85 mg/L (**Table 3-1**). These concentrations are believed to be representative of non-mineralized, relatively undisturbed portions of the site. Although the Big Flat area is not considered to contain an ore body, copper concentrations in groundwater are similar to other mineralized areas suggesting that mineralization is present in Big Flat.

Surface Water Resources

The ICP is situated in steep, mountainous terrain within the Panther Creek drainage, a tributary of the Salmon River. The ICP site ranges in elevation from 4200 feet to 8100 feet above mean sea level (msl) and is drained by several perennial and intermittent tributaries to Panther Creek. The major perennial tributaries to Panther Creek near the ICP include Bucktail, South Fork Big Deer, Big Deer, Big Flat, Little Deer and Blackbird Creeks and various unnamed tributaries to these creeks (**Figure 3-4**). In addition, the transportation route to the ICP lies in portions of the Williams Creek and Deep Creek drainages. Williams Creek is tributary to the Salmon River upstream of the city of Salmon. Deep Creek is tributary to Panther Creek between Blackbird Creek and Big Deer Creek.

Streamflows

Surface water flow in streams is sustained by snowmelt, stormwater runoff and bedrock aquifer discharges to alluvium and to streambeds. Lowest streamflows occur during the Fall/Winter period of approximately October through March. Diverse snowmelt patterns within the watershed cause significant runoff events in the spring through early summer. Summer thunderstorm precipitation events can cause infrequent high flow in isolated drainages.

Stream segments in the project area can be generally characterized as gaining streams in the upper portions (headwaters) and vary between locally gaining and losing segments in downstream reaches. Gaining and losing segments are dependent upon alluvial material connection with the stream channel and bedrock aquifer, potentiometric surface of the bedrock aquifer, topography, and preferential flow paths within the aquifer and streambed system. Surface flows in the lowest reach of Big Flat Creek and in unnamed tributaries to Big Deer Creek in the northern portion of the project area “disappear” into talus-filled sections of drainages. Flow has been documented both visually and via sound within these rock-filled portions of the stream channels.

No USGS gauging stations exist for streams in the ICP area. A summary of streamflow measurements recorded by FCC consultants (Shaw, 2005; Telesto, 2006f) during the baseline monitoring period (2001 through 2005) is provided in **Table 3-2**. Under average flow conditions, flow in Big Deer Creek comprises approximately half of the flow in Panther Creek. No streamflow measurements were made during the baseline period for streams along the transportation route, Deep Creek and Williams Creek.

TABLE 3-2. ICP Area Streamflow Measurement and Estimate Summary

	Flow Measurement Summary (1)				*Flow Estimate Summary (2)*		
Surface Water Sample Point	***# of Measurements***	***Minimum Instantaneous Stream Flow (cfs)***	***Maximum Instantaneous Stream Flow (cfs)***	***Mean Instantaneous Stream Flow (cfs)***	***Minimum Mean Monthly Flow - January (cfs)***	***Maximum Mean Monthly Flow - June (cfs)***	***Mean Annual Flow (cfs)***
Panther Creek WQ-25	*4*	*62.26*	*81*	*71.8*	*20*	*264*	*66*
Big Flat Creek WQ-7	*23*	*0.002*	*0.4*	*0.12*	*NA*	*NA*	*NA*
Little Deer Creek WQ-5	*8*	*0.63*	*5.5*	*1.86*	*0.9*	*11.1*	*2.76*
Ram Gulch WQ-10	*25*	*0.0004*	*0.075*	*0.028*	*NA*	*NA*	*NA*
Bucktail Creek WQ-21	*11*	*0.03*	*7*	*1.42*	*NA*	*NA*	*NA*
South Fork Big Deer Creek WQ-22	*12*	*0.047*	*35.51*	*10.1*	*NA*	*NA*	*NA*
Big Deer Creek WQ-24	*10*	*8.36*	*123.75*	*27.81*	*11*	*144*	*36*
Deep Creek	*NA*	*NA*	*NA*	*NA*	*6*	*80*	*20*
Williams Creek	*NA*	*NA*	*NA*	*NA*	*3*	*40*	*10*

(1) Data Source: Consolidated Baseline Hydrology Report (Shaw, 2004 and 2005; Telesto 2006f).

(2) Data Source: Middle Salmon River-Panther Creek Subbasin Assessment and TMDL (IDEQ, 2001).

cfs - cubic feet per second

Stream Water Quality - Water quality throughout the sub-basin is generally good with the exception of streams affected by historic mining. The Clean Water Act (CWA) requires that the states and tribes restore and maintain the chemical, physical and biological integrity of the nation's waters. As mandated by the CWA the State of Idaho is required to conduct a comprehensive analysis of Idaho's water bodies every two years to determine whether they meet state water quality standards and support beneficial uses or if additional pollution control measures are needed. This analysis is summarized in an "Integrated Water Quality Monitoring and Assessment Report" that is submitted to the U.S. Environmental Protection Agency (EPA) for approval. Idaho's 2002 Integrated Report was approved by EPA in December 2005 (IDEQ, 2003).

Table 3-3 summarizes the assessment units and streams within the Panther Creek watershed that are listed in the 2002 Integrated Report as not fully supporting beneficial uses. No TMDL has been prepared for the assessment units in the 2002 report. Assessment units added to the 2002 Report will be scheduled for TMDL development starting in 2008 (IDEQ, 2003).

Over the past decade, water chemistry data for streams in the ICP area have been collected by a variety of groups including government agencies and consultants for FCC and BMSG. Data from these efforts is included in the Consolidated Baseline Hydrology Report and subsequent annual monitoring reports (Shaw, 2005 and 2005a; Telesto, 2006f), data reports from BMSG (Golder, 2004, 2004a and 2005), the Blackbird Mine Site Remedial Investigation (Golder, 2001), Blackbird Mine Site ROD (USEPA, 2003), and the Water Resources Technical Report (Hydrometrics, 2006). The following description of ICP area surface water quality is based on data in these reports.

TABLE 3-3. Water Quality and TMDL Status of Streams in the Panther Creek Watershed

Assessment Unit	Streams Not Supporting Beneficial Uses	Pollutants	Beneficial Uses Not Fully Supported
ID17060203SL005 03 Big Deer Creek - South Fork Big Deer Creek to mouth	Big Deer Creek	Metals, pH and Siltation	Cold Water Aquatic Life
ID17060203SL009 02 Bucktail Creek – source to mouth	Bucktail Creek	Metals	Cold Water Aquatic Life
ID17060203SL010 05 Panther Creek – Napias Creek to Big Deer Creek	Panther Creek	Unknown	Cold Water Aquatic Life.
ID17060203SL011 02/04 Panther Creek- Blackbird Creek to Napias Creek	Fawn Creek, Spring Creek, Panther Creek	Metals, copper and unknown toxicity	Cold Water Aquatic Life; Salmonid Spawning.
ID17060203SL012a 02 Blackbird Creek-source to Blackbird Reservoir Dam	Blackbird Creek	None listed in 2002 report	Cold Water Aquatic Life
ID17060203SL012b 02 Blackbird Creek –Blackbird Reservoir to mouth	Blackbird Creek	Metals, pH and Siltation	Cold Water Aquatic Life
ID17060203SL027 02 Trail Creek-source to mouth	Trail Creek	Unknown Pollutants	Cold Water Aquatic Life; Salmonid Spawning

Assessment Units and 303(d) Listed Streams Within the Panther Creek Watershed in the 2002 Integrated Report for Idaho (IDEQ, 2003)

Big Flat Creek and Little Deer Creeks - Water quality in Big Flat Creek and Little Deer Creeks is generally good with near neutral pH and low metal concentrations. Water quality data collected by FCC consultants for these streams is summarized in **Table 3-4.**

Bucktail Creek/South Fork Big Deer Creek/Big Deer Creek - Water quality in the Bucktail Creek/South Fork/Big Deer Creek varies greatly depending on proximity to historic mining sources in upper Bucktail Creek, the effects of the release of soluble metals from mining-impacted sediments, and dilution of metals by clean water sources (both clean groundwater inflows and surface water from tributaries to Big Deer Creek). In addition, cleanup actions by BMSG have caused significant improvements in water quality throughout the drainage. Average water quality for selected stations in the drainage for the period of 1995 through 2005 are shown in **Table 3-5**. A comparison of data in **Table 3-5** illustrates the variation in water quality with high copper and other metal concentrations in Bucktail Creek that diminish downstream in the South Fork and Big Deer Creek.

The overall improvement in water quality in the drainage in recent years is illustrated by **Table 3-5**, which shows recent sulfate and metal concentrations in Bucktail Creek, Big Deer Creek and the South Fork of Big Deer Creek. In 1994/1995 copper concentrations in Bucktail Creek were on the order of 200 mg/L. By 2000, copper concentrations had declined approximately 100-fold. In 2002 Idaho DEQ concluded, and EPA agreed, that Bucktail Creek could not be remedied to the point of meeting water quality standards in the foreseeable future (IDEQ, 2002). Although this conclusion may hold true, it is apparent from the water quality data that a significant reduction in cobalt and copper concentrations in Bucktail Creek has been achieved.

The overall improvement in water quality in the South Fork of Big Deer Creek is shown by the plot of dissolved copper and cobalt concentrations (**Figure 3-7**). Although copper concentrations in the South Fork remain several times higher than the chronic aquatic life criterion of approximately 0.004 mg/L; copper concentrations have declined approximately 50 percent over the period of 2000 through 2005. Similar declines in metal concentrations have occurred throughout the drainage.

FIGURE 3-7. Water Quality Changes in South Fork Big Deer Creek

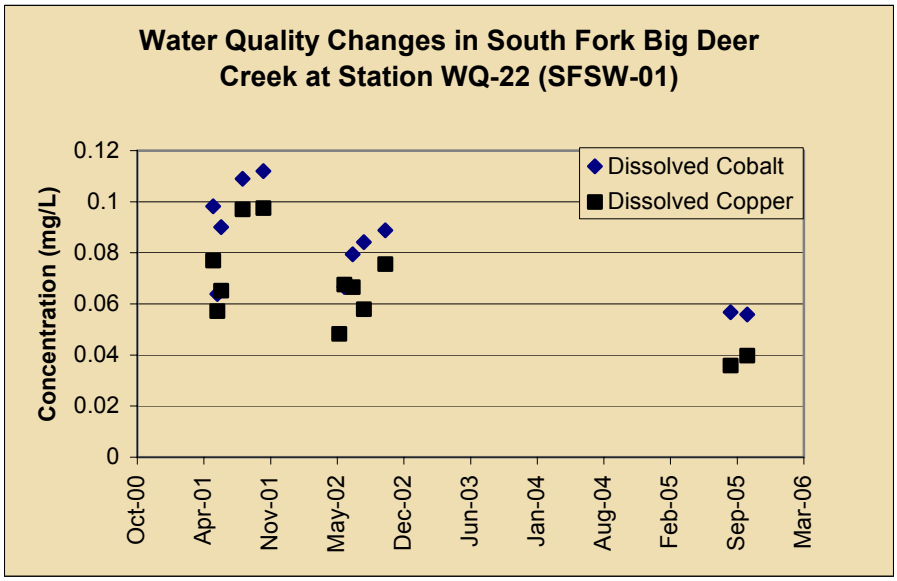


TABLE 3-4. Water Quality in Big Flat and Little Deer Creeks

Big Flat Creek and Little Deer Creek Sampling Results (2001 - 2005)																	
		Flows (cfs)		Dissolved Cobalt (mg/L)		Dissolved Copper (mg/L)		Total Sulfate (mg/L)		Dissolved Arsenic (mg/L)		Dissolved Iron (mg/L		Dissolved Nickel (mg/L)		Dissolved Zinc (mg/L)	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Big Flat Creek at mouth (WQ-2)		8.44	0.01	0.006	0.002	0.006	0.0015	6	3	0.0024	0.0016	0.07	0.03	<0.001	<0.001	0.008	0.006
Little Deer at mouth (WQ-5)		5.5	0.6	0.020	0.0089	0.015	0.0029	9	6	0.014	0.0081	0.16	0.03	0.001	<0.001	0.005	<0.005
Idaho Chronic Aquatic Life Criteria				None (1)		0.0033 (2)		None (3)		0.150		None		0.016		0.036	

Data Source: *2004 Water Quality Data Analysis Addendum to the Consolidated Baseline Hydrology Report* (Shaw, 2005a), *2005 Water Quality Data Summary* (Telesto, 2006f).

(1) For comparison, aquatic cleanup level for Blackbird CERCLA site is 0.086 mg/L cobalt (Allans, 2005).

(2) Criterion for copper is dependent on water hardness, value shown is for average hardness in Big Flat Creek of 24 mg/L.

(3) For comparison, federal secondary drinking water standard for sulfate is 250 mg/L.

TABLE 3-5. Water Quality in Bucktail, South Fork Big Deer, and Big Deer Creeks

Bucktail and Big Deer Creek Sampling Results (1995 to 2005)															
Site	**Date**	**Dissolved Cobalt (mg/L)**		**Dissolved Copper (mg/L)**		**Total Sulfate (mg/L)**		**Dissolved Arsenic (mg/L)**		**Dissolved Iron (mg/L)**		**Dissolved Nickel (mg/L)**		**Dissolved Zinc (mg/L)**	
		Max	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**
Bucktail at mouth BTSW-01 (WQ-21)	1995	50.4	9.39	272	40.9	344	-	-	-	-	-	-	-	-	-
	2000	1.54	1.2	1.16	0.492	148	134	<0.002	<0.002	<0.02	<0.02	-	-	-	-
	2005	0.44	0.285	0.264	0.212	75	44	0.0052	0.0037	0.04	<0.03	0.007	0.005	0.011	<0.005
SF Big Deer below Bucktail SFSW-01	1995	0.871	0.533	1.34	0.23	42.9	42.6	-	-	-	-	-	-	-	-
	2000	0.089	0.056	0.155	0.104	28.8	9.3	0.002	<0.002	0.03	<0.02	-	-	-	-
	2005	0.0568	0.0559	0.0398	0.0359	20	18	0.0014	0.0014	<0.03	<0.03	<0.001	<0.001	0.005	<0.005
Big Deer below SFK BDSW-03 (WQ-24)	1995	0.11	0.056	0.342	0.144	9.5	5.55	-	-	-	-	-	-	-	-
	2000	0.011	0.005	0.021	0.003	7.4	1.3	0.003	<0.002	0.09	<0.02	-	-	-	-
	2005	0.014	0.012	0.009	0.008	8	7	0.0006	0.0005	<0.03	<0.03	<0.001	<0.001	0.008	<0.005
Idaho Chronic Aquatic Life Criteria		None (1)		0.0037 (2)		None (3)		0.150		None		0.017		0.039	

Data Source: *Final Blackbird Mine Site Remedial Investigation Report* (Golder, 2001); *Blackbird Mine Site 2004 Data Summary* (Golder, 2005); *Consolidated Baseline Hydrology Report* (Shaw, 2005); *2005 Water Quality Data Summary* (Telesto, 2006f).

Notes: 1) For comparison, aquatic cleanup level for Blackbird CERCLA site is 0.086 mg/L cobalt (Allans, 2005).
2) Criterion for copper is dependent on water hardness, value shown is for average hardness in Big Deer Creek of 27 mg/L.
3) For comparison, federal secondary drinking water standard for sulfate is 250 mg/L.

Blackbird Creek and Panther Creek - Blackbird Creek has been and may continue to be heavily impacted by releases of acidity and dissolved heavy metals from the historic Blackbird Mine site. Recent (1995-2000) and current (2004/2005) water quality data for Blackbird Creek and Panther Creek is summarized in **Table 3-6**. In 1995, Blackbird Creek was heavily impacted by releases and discharges of dissolved copper and cobalt to the extent that in 1997 Idaho DEQ concluded that Blackbird Creek could not be remedied to the point of meeting water quality standards in the foreseeable future (IDEQ, 1997). Although this conclusion may hold true, it is apparent from the water quality data that a significant reduction in cobalt and copper concentrations in Blackbird Creek has been achieved.

Panther Creek receives metal loadings from historic mining sources in both Bucktail Creek/Big Deer Creek and Blackbird Creek. However, Panther Creek is a much larger stream than either Big Deer Creek or Blackbird Creek and metal concentrations in Panther Creek, both historically and currently, are much more dilute than these other streams. Monitoring station PASW-04 (WQ-25) on Panther Creek is downstream of both Blackbird Creek and Big Deer Creek and so represents the cumulative effects of historic mining on the Panther Creek system. As shown in **Table 3-6**, water quality has also improved significantly in Panther Creek over the last decade. In 2004/2005, water quality in Panther Creek downstream of Big Deer Creek met water quality criteria for copper most of the year with the exception of the spring high flow period of approximately March – June. In the 2002 303(d) report to EPA, IDEQ determined that lower Panther Creek (below Big Deer Creek) meets beneficial uses.

Springs, Seeps and Wetlands

Several detailed inventories of surface streams, springs, seeps, and hydraulic structures in the ICP area have been conducted. Spring and Seep inventory activities conducted to date include:

- *Spring and Seep Inventory by the BMSG – 1999;*
- *Stream Channel Transect Inventory by FCC – 1999;*
- *"Walk Down" Inventory by FCC - 2001/2002;*
- *Surface Water Monitoring from Stations Immediately Adjacent to Flow Springs by FCC - 2001/2002/2003/2004;*
- *Surficial Meteoric Water Occurrence Inventory by FCC – 2002;*
- *Comprehensive Spring and Seep Survey by FCC – 2004; and*
- *2000-2001 wetland delineation by Intermountain Resources.*

During these surveys, measurements of spring flows were made and water quality samples were collected from selected springs/seeps.

Numerous small seeps occur within the ICP, especially on the Big Flat. Locations of prominent springs in the ICP are shown on **Figure 3-8**. As shown on **Figure 3-8**, springs occur in the headwaters of area streams. These springs are an expression of groundwater discharge to surface water that occurs where the groundwater table intersects the ground surface. Overall, spring and seep water quality is good and similar to groundwater quality in the area. Exceptions are springs and seeps in the Bucktail drainage, where groundwater quality is impacted by historic mining and Ram Gulch spring (SS-11 and WQ-10) where water quality is naturally affected by proximity to the Ram ore body.

Wetlands are regulated under Section 404 of the Clean Water Act as a subset of waters of the United States. Wetlands are defined by the Army Corps of Engineers (COE) (Environmental Laboratory, 1987) as those areas that are inundated or saturated by surface water or groundwater at frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

TABLE 3-6. Blackbird Creek and Panther Creek Water Quality Data

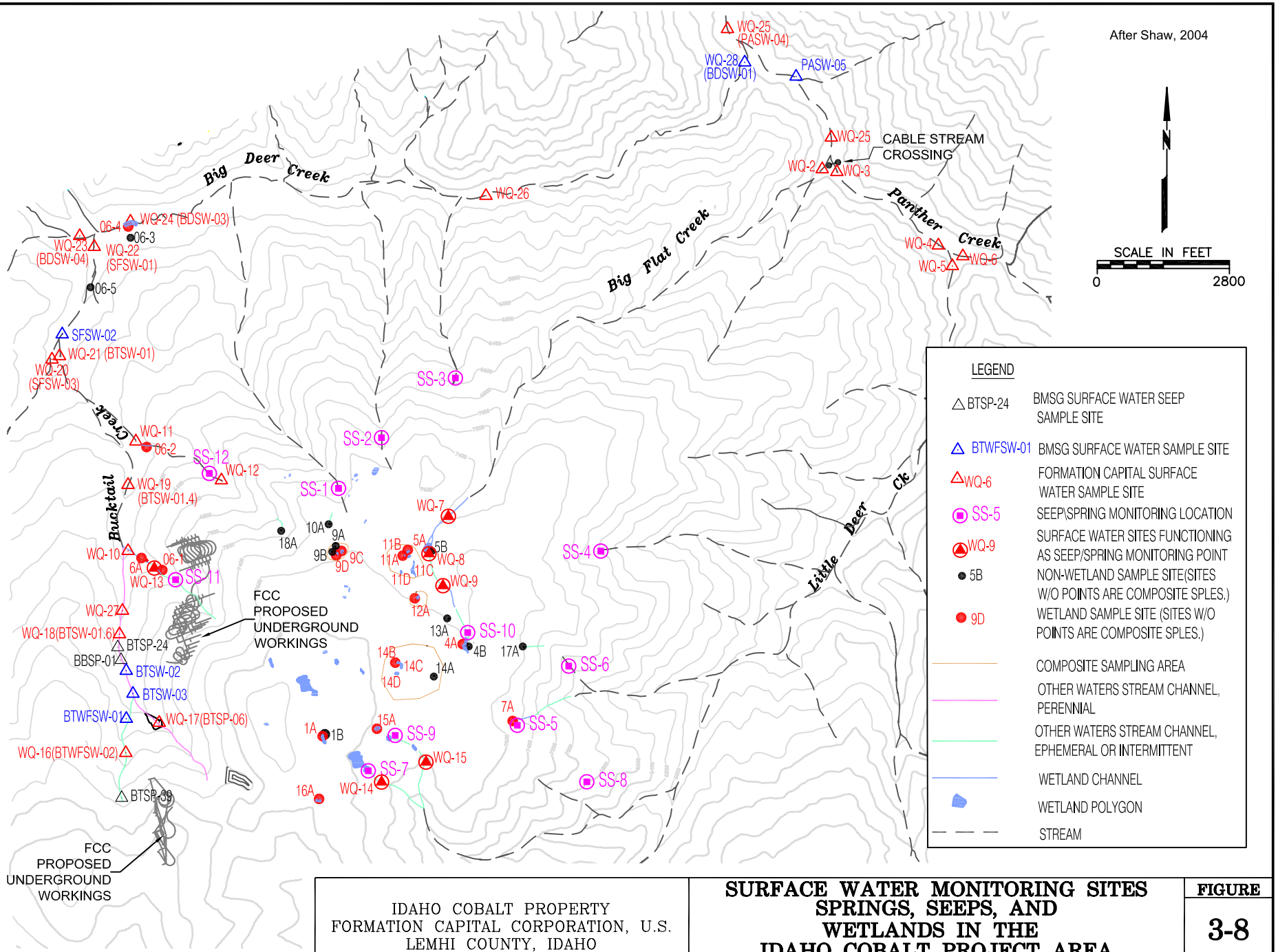
Blackbird Mine Site Sampling Results															
		Dissolved Cobalt (mg/L)		Dissolved Copper (mg/L)		Total Sulfate (mg/L)		Dissolved Arsenic (mg/L)		Dissolved Iron (mg/L)		Dissolved Nickel (mg/L)		Dissolved Zinc (mg/L)	
Site	**Date**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**
Blackbird below treatment plant BBSW-07	1995	5.81	0.475	13.2	0.782	679	3.34	-	-	-	-	-	-	-	-
	2000	0.782	0.193	0.26	0.183	312	16.5								
	2005	0.17	0.02	0.044	0.019	6	5	-	-	-	-	-	-	-	-
Blackbird at mouth BBSW-01 BBSW-01A	1995	1.85	0.299	1.69	0.213	102	25	-	-	-	-	-	-	-	-
	2000	0.8	0.117	0.063	0.008	112	30.3	0.054	<0.002	12	0.26	-	-	-	-
	2005	0.493	0.05	0.023	0.002	66.4	12	-	-	-	-	-	-	-	-
Panther Creek below Blackbird PASW-10	1995	0.269	0.05	0.218	0.0158 B	15.1	7.89	-	-	-	-	-	-	-	-
	2000	0.78	0.019	0.025	0.003	16.5	9.2	0.003	<0.002	0.17	<0.02	-	-	-	-
Panther Creek below Big Deer PASW-04 (WQ-25)	1995	0.077	0.0144	0.068	0.0214	8.78	3.94	-	-	-	-	-	-	-	-
	2000	0.031	0.005	0.015	0.003	11.6	3.3	0.003	<0.002	0.16	0.06	-	-	-	-
	2005	<0.01	.01	0.005	0.002	14	6		0.0084	-	0.03	-	<0.001	-	0.006
Idaho Chronic Aquatic Life Criteria		None (1)		0.0038 (2)		None (3)		0.150		None		0.018		0.040	

Data Source: *Final Blackbird Mine Site Remedial Investigation Report* (Golder, 2001) and *Blackbird Mine Site 2004 Data Summary* (Golder, 2005), *Blackbird Mine Site 2005 Data Summary* (Golder, 2006), *2005 Water Quality Data Summary* (Telesto, 2006f).

(1) For comparison, aquatic cleanup level for Blackbird CERCLA site is 0.086 mg/L cobalt (Allans, 2005).

(2) Criterion for copper is dependent on water hardness, value shown is for average hardness in Panther Creek of 28 mg/L.

(3) For comparison, federal secondary drinking water standard for sulfate is 250 mg/L.



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SURFACE WATER MONITORING SITES SPRINGS, SEEPS, AND WETLANDS IN THE IDAHO COBALT PROJECT AREA

FIGURE

3-8

Wetlands in the Project Area have been inventoried in accordance with COE procedures (Intermountain Resources, 2004 and 2004a; US Corps of Engineers, 2004). Both jurisdictional (connected to other waters of the U.S. and subject to COE 404 regulations) and non-jurisdictional (isolated and not subject to COE 404 regulation) wetlands have been identified and mapped in the Project Area.

Wetlands in the Project Area are associated with seeps and intermittent drainages that receive water from surface runoff and shallow groundwater discharge. They are small areas (less than 0.5 acres) on slopes and flats dominated by sedges, rushes, and other herbaceous vegetation. Common wetland species include aquatic sedge, arrow-leaf groundsel, smooth scouring-rush, five-stamened mitre-wort, small white violet, and dagger-leaf rush. There are about 3.6 acres of jurisdictional wetlands within the Project Area surveyed by Intermountain Resources (2004). The US Corps of Engineers (2004) indicated that FCC's original Plan of Operations did not require a 404 permit. However, changes to ICP's Plan resulted in a survey of areas outside of the 2004 inventory and identification of additional wetlands along a tributary to Bucktail Creek and in the riparian zone along Big Deer Creek where the water discharge pipeline is proposed. These additional lineal wetlands were found to be jurisdictional (Elliott, 2006; Intermountain Resources, 2006). Additionally, 1.3 acres of non-jurisdictional, isolated wetlands were identified in the original Project Area in the Big Flat (**Figure 3-8**).

Non-vegetated channels and ponds that originate in the Project Area and are interconnected with navigable waters downstream in the watershed are jurisdictional under the Clean Water Act as non-wetland waters of the United States. Non-wetland waters of the U.S. in the study area are ephemeral channels that have a defined bed and bank and transmit water, sediment, and litter during periods of high precipitation and runoff. Non-wetland waters of U.S. do not support wetland vegetation over their entire length but may have patches of wetland on sites that retain water for a sufficient period in the growing (usually one week or longer). Non-wetland waters of U.S. must be connected to navigable interstate waters to be jurisdictional under the Clean Water Act. Non-wetland waters of the U.S. comprise about 1.5 acres in the Project Area.

Sediment Yield and Quality

Sediment Yield – Sediment is produced from a number of natural and man-caused sources. Roads and other large scale land disturbances can be significant sources of sediment to streams. A broad scale sediment model was used to characterize erosion of sediment from area drainages, and to assess the cumulative effects of the proposed Idaho Cobalt Project. BOISED is an empirical model where erosion and sediment yield data from research are extrapolated to areas with similar characteristics to predict the effects of alternative watershed disturbances (USDA, 1978). The BOISED model is a local adaptation of the sediment yield model developed by the Northern and Intermountain Regions of the U.S. Forest Service for application to forested watersheds associated with the Idaho Batholith. The model provides an estimate of on-site erosion, sediment delivery to stream channels, and routing of sediment downstream to critical reaches where interpretation of sediment impacts can be made (USDA, 2006). It should be noted that BOISED model results were not calibrated to actual sediment sampling results discussed in the Fisheries section of this chapter. The modeling results are only intended to show theoretical differences in the behavior of the watershed to naturally and man-induced changes that influence the sediment production and delivery processes in the watershed. The reader is cautioned not to infer that there are immediate or lingering effects from sediment on a receiving stream if additional sediment delivery over natural conditions is indicated by the BOISED model.

The BOISED model is applied using landtypes to stratify the watersheds. Landtypes are units of land with similar landform, geologic, soil, and vegetative characteristics. Dominant erosion processes, including surface and mass erosion, are evaluated for each landtype in a watershed to provide estimates of natural sediment yields for undisturbed watersheds and sediment yields resulting from management activities (USDA, 2006). The BOISED Model was applied to the Big Flat and Bucktail drainages, as sediment production from these two drainages will be directly impacted by the ICP.

Big Flat Creek is a 1.65 square mile watershed that is a tributary to Panther Creek. Existing disturbances in this watershed include small exploration pits and mine exploration roads. In 2000 the Clear Creek fire burned the entire Big Flat Creek drainage, except for a few small areas (less than several acres). Fire severity was variable and ranged from low to high.

Bucktail Creek is a 1.59 square mile watershed. Bucktail Creek is a tributary to the South Fork of Big Deer Creek. Big Deer Creek is a tributary to Panther Creek. This watershed has been substantially impacted by activities at the Blackbird Mine. Existing mine facilities in this watershed include the Blacktail Pit, mine waste dumps, mine adits, mine roads, and water collection and transport facilities. Collection facilities include a dam at the 7000 foot elevation that routes contaminated water from the Bucktail drainage through underground workings to the Blackbird Creek drainage to a water treatment plant. In 2000 the Clear Creek fire burned the entire Bucktail Creek watershed with fire severity ranging from medium to high.

Sediment yields in tons per year were estimated for the undisturbed watershed (pre-mining) and the existing condition. The effects from the Clear Creek fire in 2000 and subsequent vegetation recovery are also captured by the sediment modeling. Additional sediment modeling was performed for the proposed "action" alternatives (see Chapter 4). The model provides an output for delivered sediment (tons/year) and total sediment delivered to a critical stream reach. This output is shown for sediment from natural erosion and sediment induced from disturbances (tons/year). **Table 3-7** summarizes the BOISED results for pre-ICP conditions.

TABLE 3-7. BOISED Model Results for Pre-ICP Conditions

Drainage	Natural Condition (tons/year)	1995-Pre Blackbird Reclamation (tons/year)	1999-post Blackbird Reclamation (tons/year)	2000-Following Clear Creek Fire (tons/year)	2004-post Fire (tons/year)	2006-Existing Condition (tons/year)
Big Flat	9.6	N/A	N/A	25	9.6	9.6
Bucktail	13	118	59	86	53	52

In the Big Flat watershed, BOISED estimated sediment delivered to the stream from the undisturbed watershed to be 10.5 tons/year. Sediment delivered to the stream is estimated to be 9.6 tons/year. Following the fire in 2000 the model estimated that an additional 15 tons per year of sediment were delivered to the stream. The total natural and fire related sediment delivery is estimated to be 25 tons/year following the fire. This is an increase of 162 percent over natural conditions. By 2004 the model indicated that fire effects diminished and the sediment levels were back to pre-fire conditions. For existing conditions (2006), the model results for Big Flat estimated that only 0.1 tons/year of sediment over natural levels was delivered to the stream. This is an increase of one percent over natural conditions (USDA, 2006).

In the Bucktail Creek watershed, BOISED estimated sediment yield from the undisturbed watershed to be 14 tons/year. Sediment delivered to the stream is estimated to be 13 tons/year. In 1995, one year prior to Blackbird Mine reclamation, the model estimates the sediment delivered to the stream to be 118 tons/year. In 1996 during the peak of the mine cleanup activities at the Blackbird Mine there was a substantial increase in sediment yield due to road construction and reconstruction, and construction of water collection and transport facilities. During this period the model indicates an increase in sediment delivered to the stream to be an additional 26 tons/year. The total natural and induced sediment in 1996 is estimated to be 158 tons/year, resulting in an increase of 1,125 percent over natural conditions. By 1999 BOISED estimates the total sediment delivered to the stream to be 59 tons/year resulting in a yield that is 355 percent over natural conditions. In 2000 the Clear Creek fire burned most of the Bucktail Creek watershed. Following the fire BOISED estimates that the sediment delivered to the stream increased to 86 tons/year resulting in a yield that is 566 percent over natural conditions. By 2004 the fire effects diminished and the sediment delivered to the stream

decreased to a total of 53 tons/year. This level is a 311 percent increase over natural conditions. The model results for Bucktail Creek in its existing condition (2006) shows the total sediment yield to be 52 tons/year. This shows an increase of 305 percent over natural conditions (USDA, 2006).

Sediment Quality - Sediment quality in the Panther Creek watershed is variable with concentrations depending on the local geology of the area, extent of natural mineralization, and historic mining impacts. Sediment quality is generally best in areas unaffected by natural mineralization and historic mining and generally worst downstream of historic mining (USEPA, 2003). In addition, to the direct effects of high sediment metal concentrations on aquatic biota and habitat, metal-bearing sediments have been shown to release significant amounts of dissolved metals to the water column in some stream reaches.

Streambed and overbank sediment quality in the Panther Creek watershed and the vicinity of the ICP was extensively characterized during the remedial investigation for the Blackbird CERCLA action and was not further characterized during baseline investigations for the ICP. Sediment descriptions in this section are based on the Final Blackbird RI (Golder, 2001), the Final Aquatic Ecological Risk Assessment (CH2MHill, 2001), and the Blackbird ROD (USEPA, 2003).

Geochemical modeling was used to determine the potential for significant releases of metals to the water column in area streams (USEPA, 2003). In Bucktail and South Fork Big Deer Creek most of the metals are in the form of copper carbonates which would be easily re-dissolved and re-mobilized if metal concentrations were reduced in the overlying water column.

In Big Deer and Panther Creek drainages the metals are mostly in the form of minerals, which have a strong adsorption to iron and manganese oxyhydroxides in the sediments. Desorption from iron and manganese oxyhydroxides in Big Deer and Panther Creeks may result in some trace metal loading if metal concentrations were reduced in the overlying water column.

There are metals in the stream sediments and adjacent overbank deposits (including debris flow deposits) along Bucktail Creek. Most of these metals are in the form of copper carbonates. These copper carbonates can be comparatively easily redissolved and re-mobilized under conditions of reduced metals concentrations in the overlying water column. If the copper concentrations in Bucktail Creek waters are substantially reduced, it is likely that the copper carbonates in the sediments will re-dissolve and be released to the surface waters. In addition, the copper carbonates in the overbank deposits are likely to be easily re-dissolved and flushed into Bucktail Creek during rainfall and/or snowmelt.

In South Fork Big Deer Creek, trace metal release from sediments is believed to be primarily responsible for the current observed increases in copper and sulfate concentrations between the confluence with Bucktail and Big Deer Creeks. Copper carbonate dissolution is likely to be the primary mechanism responsible for dissolved copper loading. Sulfate loading is likely the result of desorption or sulfate mineral dissolution.

Geochemistry

The most important issues pertaining to existing conditions and potential impacts of mining on water resources relate to acid rock drainage (ARD) generation and prediction; metals leaching from ore, waste rock, and tailings; and sulfur speciation. The baseline geochemical characterization program for the ICP was organized to address these issues. All of these issues are determined by the geochemical characteristics of ore, waste rock and tailings from the ICP and how these rocks are managed and stored as part of the mining operation. At the historic Blackbird Mine the combination of ore/waste rock/tailings geochemistry and improper management has resulted in widespread water resource impacts.

The baseline geochemistry program, results of which are described here, utilized a phased approach which began with identification and testing of a small number of samples, followed by selection of a

larger and more representative sample set for detailed testing. The phased geochemical testing program was designed to characterize whole-rock chemistry, mineralogy, acid-forming potential and metal mobility for the ICP ore and waste materials (Telesto, 2004). A more detailed discussion of ICP geochemistry and results of geochemical/water resource modeling efforts are outlined in more detail in the Water Resources Technical Report (Hydrometrics, 2006).

Geochemical Testing Program

An extensive geochemical testing program was conducted by the ICP in order to predict and understand the geo-environmental characteristics of mine waste rock, tailings, and underground mines. Representative samples of Ram and Sunshine ore, development rock, Ram and Sunshine tailings (with and without cement added), and grab samples of analogous rocks from the Blackbird mine were submitted for a wide spectrum of tests (**Table 3-8**). For a complete discussion of geochemical testing and test results, refer to Appendix B - Geochemistry And Environmental Risks Associated With The Proposed Idaho Cobalt Project of the Water Resources Technical Report (Hydrometrics, 2006).

TABLE 3-8. Summary of Geochemical Tests Conducted on Samples from the Ram and Sunshine Deposits.

Test Method / Description	Number of Samples	Sample Description
Static Tests	136	Ram drillhole samples
	101	Sunshine drillhole samples
	25	Blackbird waste rock grab samples
Net Acid Generation pH	94	Ram drillhole samples
	78	Sunshine drillhole samples
Water Extraction Tests (Soluble Metals)	10	Ram samples
	10	Sunshine samples
	7	Tailings (some with chemical amendments)
	1	Blackbird composite
	2	6,920 portal seep samples
Total Metals	136	Ram drillhole samples
	103	Sunshine drillhole samples
	3	Tailings
Kinetic columns	5	Development rock
	1	Tailings
Metallurgical tests	3	Tailings – locked cycle tests
Petrographic analysis	>200	Ore samples from core

Comparison to Blackbird Mine

The historic Blackbird Mine site is the source of extensive surface and groundwater contamination caused by release of metals, acidity and sediments from mining wastes and associated mine disturbances. The geo-environmental setting of the Blackbird deposits were described by Evans et al. (1995). Waters draining Blackbird waste rock had a wide range of pH from less than 3.0 to around 7.0, and dissolved metals 1 to over 1,000 milligrams per liter (1,000 to over 1,000,000 micrograms per liter) total metals.

Given the geoenvironmental risk posed by Blackbird mine waste, and the proximity of ICP to the Blackbird Mine, the potential similarity of ICP mine waste and Blackbird mine waste was carefully evaluated (Telesto, 2004). Twenty-five samples of mine waste were collected from surface deposits at the Blackbird mine by Hydrometrics in 2003. The clasts within the samples were geologically logged and samples that were lithologically similar to the ICP deposit were submitted for analysis of soluble metals, pH and acid base potential. The 15 samples that were representative of the ICP

development rocks had an average total sulfur of 0.013 percent, an average extract pH of 5.0, and variable levels of metals. Overall, the environmental risk of mine waste samples from the Blackbird site that were most representative of the ICP deposit were on the low end of the range observed at the Blackbird site.

The lower environmental risk associated with representative ICP samples is likely due to the relatively low pyrite levels contained in typical development rock (less than 1 percent pyrite in ICP vs. 3 to 10 percent in Blackbird: see Appendix H, Telesto, 2004). Pyrite (FeS_2) is typically the most abundant mineral contained in acid generating mine waste. In contrast, the suite of sulfides found in ICP development rock is relatively low in pyrite. The primary ore zone at the Blackbird Mine differs from ICP rocks in that pyrite, from secondary enrichment, was abundant. The pyrite accounts for the lower pH and higher metal levels found in Blackbird rocks.

The flotation process proposed at ICP is non-selective in that it removes a high percentage of the sulfide minerals from the tailings and yields a non-acid generating tailings. In contrast, the flotation process used at the Blackbird Mine was selective, meaning that copper and cobalt sulfides were removed but pyrite was left in the tailings yielding an acid-generating tailings. Therefore tailings material produced at the ICP, like development rock, would have a lower environmental risk than Blackbird tailings.

Acid Generation Risk

The geo-environmental risk of mine waste is related to the pH or acidity of the samples and the abundance of dissolved metals. The risk of acid generation in mine waste depends on the balance of minerals such as sulfides, which may form acidity during weathering, and acid neutralizing minerals such as calcite. Conventional test methods used to assess acid rock drainage (ARD) risk are based on the measured levels of sulfide sulfur and the acid consumption within a sample (Sobek et al., 1978). The amount of acidity that may be produced by sulfide oxidation depends on the kinds of sulfide minerals present. Pyrite, which is the most abundant sulfide mineral at most mines yields four units of acidity for each unit of sulfide sulfur. The ICP mineralogy is dominated by chalcopyrite and cobaltite, which produce one-half as much acidity as pyrite. Consequently, the net neutralization potential (NNP), a measure of ARD risk, was defined for ICP rocks as:

NNP=Acid Neutralization Potential (ANP) - Acid Generation Potential (AGP) [1]
AGP = pyritic sulfur percent times 15.6
ANP = kilograms per metric ton as CaCO3

A large proportion of samples tested had no detectable sulfide sulfur, and the median sulfide sulfur level was only 0.02 % in the Ram and 0.03 % in the Sunshine. Though ICP rocks are low sulfur, they are also low in neutralizing capacity. The median Acid Neutralizing Capacity (ANP) was only 2.4 to 2.9 kg/t in the Ram and Sunshine. The Sunshine rock samples had slightly higher average sulfide sulfur than Ram rocks, but in both deposits, the majority of samples were classified as non acid-generating. Overall about 17 percent of the 239 rock samples collected from the Ram and Sunshine deposits (**Figure 3-9**) were potentially acid generating (PAG), while the remaining samples were either weakly acid neutralizing (80 percent) or in an uncertain zone (3 percent).

Metallurgical tests designed to simulate the ore processing proposed by the ICP were conducted on several representative samples of Ram and Sunshine ore (Scales and King, 2002). The Ram and Sunshine deposits will generally not be mined and processed at the same time. Cobalt and copper will be removed by crushing and grinding the ore, then separating the sulfide grains from the remaining material (gangue) using a flotation process. When certain chemicals are added to a slurry of crushed ore and water, and then injected with air, the sulfide grains are trapped by the air and rise to the surface where they form a froth layer that can be physically separated. A “bulk flotation” process, which will be employed at ICP, removes all sulfides mineral types, and therefore leaves very low sulfide in tailings.

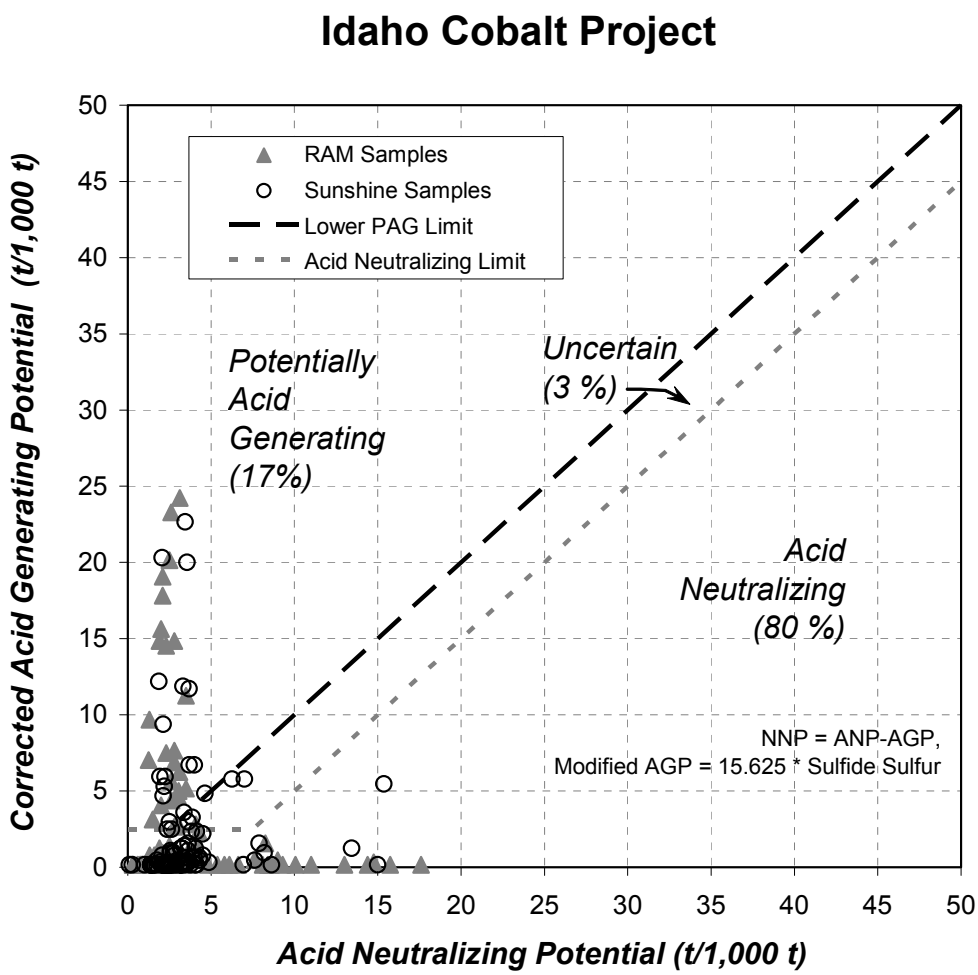


FIGURE 3-9. Acid generation potential and acid neutralizing potential of Ram and Sunshine development rock samples from the ICP.

The sulfide content of Ram and Sunshine ore samples ranged from 0.2 to 1.4 percent, while the corresponding tailings had only 0.02 to 0.05 percent sulfur content. In comparison, the flotation process used at the Blackbird Mine was selective, meaning that copper and cobalt sulfides were removed but pyrite was left in the tailings. Therefore, tailings material produced at the ICP, like development rock, would have a lower geoenvironmental risk than Blackbird tailings (also see Hydrometrics, 2006).

Metals Leaching Risk

The abundance of soluble metals dissolved in water that contacts mine waste is the second factor (in addition to pH) that determines geoenvironmental risk. Extensive geochemical testing was conducted to determine the rate and quantity of metals that may be accumulated in contact water.

In theory, fresh unweathered samples would tend to have fairly low levels of soluble metals because the sulfides have not weathered, and the metals contained in the sulfides are relatively insoluble. As

the sulfides weather, the metals are oxidized, meaning they are chemically converted into secondary minerals that are more soluble than the sulfides. Consequently, when water contacts weathered rock, metals may be released. The concentration of metals in water in contact with sulfide bearing rock depends on several factors including the sulfide abundance in the original rock, the pH of the system, and the amount of metal removal that has already occurred by rinsing.

Generally, as pH decreases, the concentration of metals that dissolves in contact water increases. While the inverse relationship of pH and metal solubility generally holds true for copper, cobalt, zinc, and many other metals, arsenic concentrations often increase as pH increases (at least in the pH range of 4 to 9). Column tests on development rock show that the "first flush" of weathered rock by contact water tends to have the greatest metal concentration, and the concentration gradually decreases as the sample is further rinsed (Telesto, 2004). Owing to the limited solubility of many secondary minerals, especially at near-neutral pH, weathered mine waste may continue to contribute metal loading to contact water for a long period of rinsing.

Numerous factors may affect metal concentration in contact water. As a result, predicting the concentration of metals that may develop at the proposed ICP is complex. Predictive tools must account for the variable quantity of sulfides in the rocks, the solubility control exerted by pH, the tendency for metal levels to diminish upon continued rinsing, and the potential for metals to be sorbed by soils or sediments if the contact water migrates.

The metals routinely observed at elevated concentrations in contact water from geochemical testing of ICP waste rock, ore, and tailings samples included principally **copper** and **cobalt**, while to a lesser degree **arsenic**, **nickel**, and **zinc** were sometimes found at elevated concentrations. Arsenic concentrations, though elevated, were much lower than was expected based on the relative abundance of arsenic in the ore (often several hundred milligrams per kilogram). Evans et al. (1995) also reported that arsenic levels in contact water at the Blackbird Mine were relatively low in comparison to their abundance in the ore, and attributed this to sorption of arsenic by iron oxyhydroxide precipitates. These five elements are considered the most likely to adversely impact receiving waters, and are considered the primary constituents of concern for evaluating potential impacts from the ICP.

Another important consideration when evaluating metals leaching risk is the time required for rocks to weather sufficiently to become acidic. In most systems, two factors determine the "lag period", which is the duration of the weathering period required to create acidic conditions (in PAG samples). Sulfide oxidation rate, the first factor influencing the lag period, is generally slow in ICP samples, favoring long lag periods. The amount of neutralization capacity is the second factor affecting lag period. The low ANP levels found in ICP rocks favor shorter lag periods. Overall, the lag period is expected to have a moderate duration meaning acidification, if it occurs, will likely be observed within one to five years after rock placement.

Soil Resources

Soils of the Salmon National Forest have been delineated by U.S. Forest Service Landtype mapping conducted at a third-order intensity (USDA, 1980). Landtypes are units of land with similar landform, geology, soils and vegetation characteristics. Landtype map units include descriptions of landforms, geology, and soils and a discussion of landtype management implications. A more intensive second order soil survey was conducted for the Project area.

Soils Study Area

In 2001, Project Area soils were delineated in a second-order level soil survey (Intermountain Resources, 2002). This survey identified a total of seven soil mapping units, including five mapping units in Mountain Slope Sites and two mapping units in the Big Flat area. Soils in the Big Flat area

were further evaluated as part of investigations into the design of FCC's water disposal land application system (CES, 2001 and 2005). Soils in the general Project Area are also covered by the Forest third order mapping (USDA, 1980).

Project Area Land Types and Soils

The general Project Area including the South Fork of Big Deer Creek, Bucktail Creek, and Big Flat Creek watersheds (**Figure 3-10**) contains a total of four general Landtypes with 11 Landtype Map Units. Landtype 109 (3 Map Units) at upper elevations and Mountain Slopeland Landtype 120 (6 Map Units) at lower elevations comprise the majority of the Landtype mapping in Idaho Cobalt area. Two other Landtypes (Landtype 111 and Landtype 124) are found within the study area.

109 - Cryic Uplands - This landtype is the broad, gently sloping ridgetops and mountain slopes that occur at the higher elevations, usually above 6,500 feet. The dominant slope forming process has been the action of freezing and thawing. Slope gradients generally range from 15 to 50 percent. These lands do not show evidence of glaciation, however the influence of glacial climates has been a very important element in their formation.

111 – Steep Glaciated Headlands - This landtype is found in steep drainage headlands at higher elevations, generally above 7,000 feet. Slopes are primarily concave on all aspects as weakly-developed cirques. Slope gradients are steep, typically ranging from 60 to 70 percent. Rock outcrops and talus slopes comprise less than 50 percent of the landtype area.

120 - Mountain Slopelands - This landtype is comprised of the moderately steep mountain slopes that have been formed primarily by stream cutting action. Slope gradients generally range between 40 and 65 percent. Slopes may be smooth or dissected by V-shaped drainages. This landtype is usually found between 4,000 and 6,500 feet.

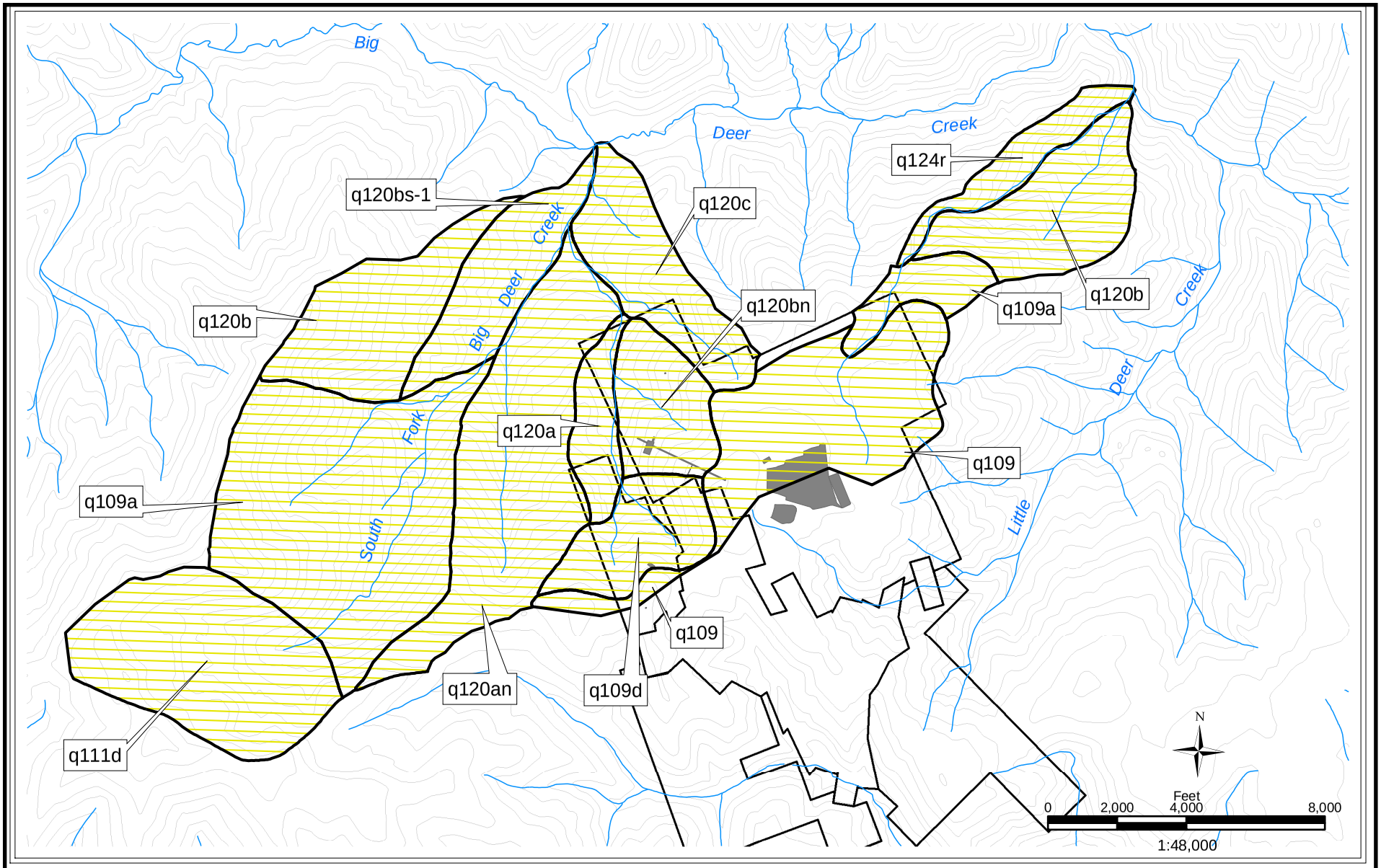
124 - Steep Canyonlands - This landtype includes the steep sideslopes of the deep canyons and the canyon bottoms that have been formed by stream cutting action. The sideslopes are very steep and generally range from 60 to 90 percent. The slopes are dissected by shallow, parallel drainages. Rock outcrops and talus slopes are frequent.

Project Area Soil Descriptions

Mountain Slope Sites

Five soil mapping units were identified in Mountain Slope Sites (Intermountain Resources, 2002) and include four Xeric Dystrochrept - Typic Cryorthent Complexes (Map Units 3D, 4CD, 5E, 6F) differentiated by slope class and a Disturbed Land - Xeric Dystrochrept Complex (Map Unit 7CF). These soil mapping units comprise 929 acres (57 percent) of the Soils Study Area. These landtypes are primarily found in the Bucktail drainage. Soils are well drained, moderately deep to deep (20 to 60 inches) on quartzite bedrock. Organic matter content is moderate in surface soils, decreasing to low levels with depth. Soil reaction (pH) ranges from neutral to slightly acid in surface soils to moderately to strongly acid with depth. Plant-available metal concentrations (zinc, iron, manganese, and copper) are generally low. Elevated concentrations of plant-available manganese (in all surface soils) and copper (through soil profiles at Map Units 6F and 7F) are noted, although relatively high soil pH limits metals mobility.

Surface soils have gravelly loam to sandy loam texture with low to moderate coarse fragment content (gravels, cobbles, stones, and boulders). Subsoils have very gravelly loam to sandy loam texture with high coarse fragment contents (gravels, cobbles, stones, and boulders). Depending on slope, these soils have erosion hazards ranging from low (less than 17 percent slope), to moderate (17 to 33 percent slope), to high (greater than 33 percent slope). Slope also limits the suitability of these soils for disturbance reclamation or cover soil salvage. Soils in low to moderate slope areas are suitable



Legend

Watershed/ Sediment Area of Potential Impact

Stream

FCC Claim Boundary

Alternative II Facillities

q111d Land Type

IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**IDAHO COBALT PROJECT LANDTYPE UNITS**	Figure 3-10

for reclamation or cover soil salvage (to a depth of 8 inches) with provisions for safe equipment operation and implementation of appropriate erosion control measures.

Big Flat Area

Two soil mapping units were identified in the Big Flat area during the 2001 second-order level soil survey (Intermountain Resources, 2002). These include Map Unit 1BC, a Xeric Haplocryalf - Xeric Dystrochrept Complex (637 acres / 39 percent of the Soils Study Area) and Map Unit 2B, an Oxyaquic Haplocryalf (59 acres / 4 percent of the Soils Study Area). Together, these soil mapping units comprise 696 acres (43 percent) of the Soils Study Area. Hematitic soils with little or no revegetation were identified in 2004 at three disturbed test pit locations on the Big Flat with the Project area. Further investigation in 2005 found that the hematitic soils are of a limited extent and do not present a significant risk of phytotoxicity.

Climate and Air Quality

Climate

Regional climate data is available from the USDA Natural Resources Conservation District (NRCS) Morgan Creek SnoTel station, located approximately 20 air miles south-southeast of the ICP and the Cobalt townsite weather station, located seven miles from the ICP. The Morgan Creek SnoTel station is located at an elevation of 7,600 feet above mean sea level, and has 23 years of data available.

The climate of central Idaho is characterized by a wet season in the winter (mostly snow), from November through March, and by a dry season in the summer, from July through September. The summer months are generally characterized by low relative humidity, less than 25 percent, and frequent sunshine. The mountainous terrain surrounding the proposed project area lessens the strength of winter storms in the vicinity and generally results in a mild winter season. Elevation, topography, vegetation and available moisture all influence the local climate of the proposed project area.

Temperature

Temperature data for the project area are available from the ICP meteorological station. Temperatures measured in the project area during 2000-2005 indicate wide seasonal variability, ranging from a low of -11 degrees Fahrenheit (^{o}F) to a high of 90°F (FCC, 2006). The temperature extremes typically occur during December/January/February and July/August/September. Average temperature over the period 2000-2003) was 42.8^{o}F.

Temperature data is also available from the Cobalt, Idaho weather station, located seven miles from the ICP site at elevation 5,010 feet. Based on 26 years of record, monthly average temperatures are as shown in **Table 3-9**.

Precipitation

The majority of the annual precipitation at the ICP occurs in the late fall through early spring. The predominant form of precipitation occurs as snow with thunderstorms in the summer months. The measured average annual precipitation ranges from 15 inches in the lower elevations (IDEQ, 2001), up to 24 inches at the Morgan Creek SnoTel station located at 7,600 feet elevation (Telesto, 2005a). Based on 23 years of data, average annual precipitation at the Morgan Creek station is 24.4 inches. Approximately 60 percent (14.7 inches) of precipitation at the site likely falls in the form of snow and 40 percent (9.7 inches) in the form of rain.

Total annual precipitation for the project site that was measured during the period of baseline study (July 2000 – August 2001) was 15.82 inches.

TABLE 3-9. Average Monthly Temperatures at Cobalt, Idaho		
Month	Mean Maximum Temperature (°F)	Mean Minimum Temperature (°F)
January	46	3
February	49	-8
March	52	4
April	62	10
May	74	15
June	77	28
July	86	41
August	83	39
September	77	24
October	68	7
November	52	3
December	47	1

2001 to 2003 data from Gelhaus (2004).

Wind

Wind speeds in the area of the proposed project are moderate and generally from the west. Wind speed and direction data were collected during the period of study (2000-03) at the ICP meteorological station. During that period, the predominant wind direction was from the southwest. Wind direction at the ICP site is influenced by local topography of Panther Creek and the surrounding mountains. The average wind speed during the study period was 5.7 miles per hour (mph). The resultant wind direction was from 232.1 degrees (southwesterly), and wind persistence averaged 53.1 percent. Wind patterns indicate slight variations of direction and speed associated with the time of year.

Evaporation

Pan evaporation measured at the ICP site is in the range of 25 to 30 inches per year (FCC, 2006). Free surface pond evaporation is assumed to be 70 percent of pan evaporation (Telesto, 2005a).

Air Quality

The project site is located in the Panther Creek air quality sub-basin, which is classified as an attainment area for air quality pollutants by the Idaho Department of Environmental Quality, therefore the Panther Creek sub-basin area would be designated a Class II area under the Prevention of Significant Deterioration (PSD) regulations. The nearby wilderness (Frank Church-River of No Return Wilderness) area would be considered as a Class II designation for PSD under the Federal rules and guidelines. The PSD Class II designation allows for moderate growth or degradation of air quality within certain limits above baseline air quality, while the PSD Class I designation allows little to no growth or degradation of air quality. Therefore special attention to any potential impacts from the proposed ICP site to the wilderness area must be assessed.

There are no major sources of air quality pollutant emissions in the proposed ICP area, however fugitive dust emissions from vehicular traffic on unpaved roads within the immediate area may contribute particulates to the ambient air in the area. Although no data are available on fugitive dust emissions for the surrounding area of the ICP site, particulate levels at the ICP site have been measured as part of

the baseline studies. Data generated from the baseline study included fugitive dust emissions from vehicular traffic within the immediate area of the ICP site and may be considered as "background" levels of particulates for the ICP site.

Particulates (PM_{10}) have been monitored in the project area from February 2001 – October 2002. State and federal 24-hour and annual PM_{10} standards are 150 micrograms per cubic meter (µg/m^3), and 50 µg/m^3, respectively. The annual PM_{10} standard is an arithmetic average of 24-hour PM_{10} measured concentrations at a monitoring location. Data collected on site indicate that existing conditions are in compliance with both the 24-hour and annual standards. The highest (i.e., maximum) 24-hour PM_{10} measurement observed during the study period was 39.0 µg/m^3, and this was measured on August 18, 2002. The annual arithmetic average of PM_{10} concentration for the study period was 6.2 µg/m^3 during the year of 2001 and 10.2 µg/m^3 during the year of 2002.

Noise Resources

Noise

Noise levels heard by humans and animals are dependent on several variables, including distance and ground cover between the source and receiver and atmospheric conditions. Human and animal perception of noise is affected by intensity, frequency, pitch and duration, as well as the auditory system and physiology of the animal. Noise can influence humans or wildlife by interfering with normal activities or diminishing the quality of the environment.

Noise-Sensitive Receptors

The ICP is 45 road miles west of Salmon, Idaho, and the site is accessed from US 93 via a series of Forest Service Roads along Williams, Deep, Panther, and Blackbird creeks. Residences and cabins are located in Cobalt, approximately 6.5 miles southeast of the ICP and along the first three miles of Williams Creek Road. People use the areas surrounding the ICP for recreational uses, including snowmobiling, cross-country skiing, hunting, fishing, hiking, and camping. Three potential noise-sensitive receptor areas of concern were identified by the USFS, including: 1) the Deep Creek Campground, located seven miles southeast of the ICP Area, 2) the confluence of South Fork Big Deer Creek and Big Deer Creek, located two miles north, and 3) the outfitter camp at Indian Point along the Gant Ridge Trail (Wilderness Boundary), located five miles to the northwest (**Figure 3-16**) (Big Sky Acoustics, 2005). The primary on-site human noise-sensitive receptors are ICP workers. Wildlife that live, forage, and pass through the ICP area are also primary noise-sensitive receptors in the immediate site area.

Ambient Noise Level Measurements

Two noise level measurements were completed in 2001 to determine the existing ambient noise levels representative of the ICP site and recreational noise-sensitive receptors (USFS, 2001). **Table 3-10** summarizes the measured ambient noise levels.

The higher noise levels measured at the Deep Creek Campground were due to the water flowing in Deep Creek, which also increases the estimated L_{dn} noise level (54 dBA). Therefore, the ambient noise levels on the Big Flat Plateau, where the ICP mill/processing and TWSF facilities will be located, are estimated to be similar to the measured noise levels at the Williams Creek Pass Summit (L_{eq} 34 dBA) (**Table 3-10**).

TABLE 3-10. ICP Area Ambient Noise Level Measurements						
9/12/01 Time (hours)	**Description**	**Approx. Distance and Direction from ICP**	**Measured L_{eq} (dBA)**	**Measured L_{90} (dBA)**	**Estimated L_{dn} (dBA)**	**Noise Sources During Measurements**
1439 to 1453	Deep Creek Campground	7 miles southeast	48 dBA	47 dBA	54 dBA	Water flowing in Deep Creek, birds, and insects. The campground was unoccupied. No vehicles passed by on roadway.
1518 to 1524	Williams Creek Pass Summit	13 miles east	34 dBA	28 dBA	32 dBA	Insects, birds, and wind in trees. No vehicles passed by on roadway.

Similar ambient noise levels have been quantified using measurements made at the north rim of the Grand Canyon (USEPA, 1971a). The study reported average 1-hour L_{eq} noise levels of approximately 40 dBA during the day and approximately 35 dBA at night, with natural sounds, such as insects, birds, and small animals as the typical dominant noise sources. However, instantaneous noise levels during the 24-hour measurement periods varied between a minimum of less than 15 dBA, when no identifiable noise sources were present, and a maximum level of approximately 68 dBA during an aircraft flyover. Based on additional EPA studies, L_{dn} levels for wilderness-type areas are typically between 30 and 40 dBA, comparable to the levels measured at the Williams Creek Pass Summit (L_{dn} 32 dBA) (**Table 3-10**). The noise levels measured near the ICP site, as well as wilderness-type noise levels documented in the EPA studies, are typical of isolated rural areas.

Vegetation Resources

Existing Vegetation

Vegetation in this EIS was evaluated for a large area surrounding and including the Project Area. Vegetation in the Project Area and area of potential impact varies with elevation, aspect, and history of disturbance (e.g. fires, insect infestations, and logging). Shrub and grassland communities, typically dominated by big sagebrush, mountain mahogany, bluebunch wheatgrass, Idaho fescue, and a diversity of forbs, occupy the driest sites, usually with south and west exposures. At mid and upper elevations conifer communities dominated by Douglas-fir, ponderosa pine, Engelmann spruce, subalpine fir, and lodgepole pine occupy the cooler and moister sites. Riparian vegetation composed of plants, adapted to wetter conditions along streams and intermittent drainages, is composed of water birch, alder, red-osier dogwood, cottonwood, and Engelmann spruce. **Table 3-11** presents a summary of Project Area habitat types.

Fire, insects, dwarf mistletoe, and logging are the primary factors affecting the ecology of vegetation in the project area and area of potential impact. Fire frequency and intensity has determined the structural stages, composition, and seral ecology of plant communities. Fire frequency and severity has had a dominant influence on plant community structure and composition, which substantially determines the character and quality of wildlife habitat, hydrology, sediment yield, water quality, and aquatic habitat.

Table 3-11. Vegetation Habitat Types in Idaho Cobalt Project Area		
Habitat Type	**Acres**	**Percent of Area**
Subalpine fir/Grouse Whortleberry	791	30.2
Subalpine fir/Sitka alder	378	14.4
Subalpine fir/Beargrass	145	5.6
Subalpine fir/Menziesia	59	2.2
Subalpine fir/Pinegrass	49	1.9
Subalpine fir/White spirea	35	1.4
Subalpine fir/Heartleaf arnica	29	1.1
Subalpine fir/Russet buffaloberry	27	1.0
Subalpine Fir/ Blue Huckleberry	18	0.7
Douglas-fir/Pinegrass	394	15.0
Douglas-fir/Blue Huckleberry	170	6.5
Douglas-fir/Ninebark	116	4.5
Douglas-fir/White Spirea	72	2.7
Douglas-fir/Bluebunch Wheatgrass	49	1.9
Douglas-fir/Mountain Snowberry	40	1.5
Douglas-fir/Common Juniper	20	0.8
Disturbed Land	226	8.6
Total	2620	100.0

Source: Vegetation and Wetland Technical Report (Elliot, 2005a).

Prior to the Clear Creek fires in 2000, vegetation in the area surrounding the ICP site consisted of forest plant communities dominated by an overstory of Douglas-fir, lodgepole pine, subalpine fir, and Engelmann spruce (Douglas-fir and subalpine fir climax habitat types). The Clear Creek fires burned 99 percent of the Area of Potential Impact with 60 percent of the area burning at high severity (80 to 90 percent crown or canopy removal), 30 percent burning at medium severity (20 to 80 percent crown removal), and 9 percent burning at low intensity (0-20 percent crown removal) (Intermountain Resources, 2004).

Post-fire vegetation consists mostly of standing and fallen dead trees with regrowth of trees and understory species being variable depending on slope, aspect and burn severity. Vegetation cover is lowest on south- and west-facing steep slopes where fire severity was high. Canopy cover ranges from 10 to 40 percent, with four to five lodgepole pine seedlings per acre. Dominant understory species include fireweed, pinegrass, elk sedge, grouse whortleberry, heartleaf arnica, and timothy.

On north-facing slopes and relatively flat areas there generally is good reproduction of young conifers, mostly lodgepole pine. Densities of tree seedlings on the cooler, moister sites range from 600 to 30,000 per acre. Common understory species are timothy and orchard grass, which were planted following the fire; heartleaf arnica; grouse whortleberry; pussytoes; pearly everlasting; and beargrass.

Plant communities in the area of potential impact are composed of species adapted to the relatively cool and dry conditions, ranging from mid to high-elevations (5,100-8,040 feet). Forest habitat types (i.e., potential climax vegetation) are dominated by Douglas-fir, lodgepole pine and subalpine fir.

Historically (i.e., pre-1900), dry Douglas-fir habitat types (Douglas-fir/Bluebunch Wheatgrass, Douglas-fir/Mountain Snowberry, Douglas-fir/Pinegrass, and Douglas-fir/Ninebark) typically burned at least once every 35 years, with low-severity, non-lethal fires (Crane and Fischer, 1986). Non-lethal fires in these habitat types killed less than 10 percent of the canopy cover.

Historically, subalpine fir habitat types burned at least once every 35-100 years with mixed severity. Mixed severity fires burn in a mosaic patterns with some areas being non-lethal and others experiencing stand-replacing fires. Based on tree-ring data, the last stand replacing fire in the project

area, prior to the Clear Creek fires in 2000, occurred in the 1880's (Hamilton, 2004). Fire return intervals in the cooler, higher elevation forest stands in the study area appear to be longer than the natural range of variability typical in these forest types, which is why the fires of 2000 were so severe. The longer interval between fires allowed fuel to build up to levels sufficient to sustain high-severity, stand replacing fires.

Sites within the Area of Potential Impact that burned with high severity, on steep south and west slopes, may not have sufficient numbers of seed trees to completely regenerate forest communities. Shrubs, forbs, and grasses may proliferate on burned areas where sufficient seed trees are not present. When vigorous stands of shrubs, forbs and grasses establish following fire, it is difficult for conifer seedlings to grow and dominate the site because of competition with dense ground cover (Crane and Fisher, 1986). Site visits in 2004 indicate that on most sites where conifer regeneration is poor, regrowth of shrubs and herbaceous species is patchy, with areas of rock and bare soil. In general, ecological succession on the project area, following fire, is typical of succession in central Idaho and Montana following fire (Crane and Fischer, 1986; Fischer and Bradley, 1987).

Potential climax plant communities on the study area are Douglas-fir and subalpine fir with successional stages that include lodgepole pine and Engelmann spruce (Intermountain Resources, 2004 and 2006). Over time, if fires do not set back ecological succession, plant communities burned by the Clear Creek fires will become dominated by an overstory of Douglas-fir, subalpine fir, lodgepole pine, and Engelmann spruce. The future character of plant communities in the study area will depend on future fire intervals as well as land management practices such as logging, grazing, and mining activity.

Fire Ecology

Scientific findings from the Interior Columbia Basin Ecosystem Management Project (ICBEMP) indicate that trends related to ecosystem structure and processes at the regional level are similar to ecosystem structure and processes in the Project Area and Area of Potential Impact. Broad-scale changes in the landscape that have occurred both regionally and locally include structural changes in mid-seral forest structures and increased density of some coniferous trees. The density of large, shade-intolerant trees (i.e., ponderosa pine and lodgepole pine) has decreased and density of smaller shade-tolerant trees (Douglas-fir, subalpine fir, and spruce) has increased. According to ICBEMP, prior to 1900, fire-regime severity in the watershed was mostly non-lethal (return interval 5 to 50 years). Prior to the Clear Creek fires, fire regimes in the watershed were mostly of mixed severity or lethal (return interval 30 to 300 years) in forest communities (ICBEMP, 2000).

Generally, the consensus among fire ecologists (Brown and Smith, 2000; Crane and Fisher, 1986; and Hardy and Arno, 1996) is that the structure and composition of most forest communities in the West have been altered by exclusion of natural cycles of fire. Fire suppression in the last century has reduced the frequency and spatial extent of fires in many forest communities. Fire suppression generally has lengthened intervals between fires, contributing to the creation of dense stands with high levels of fuel.

Old Growth

Prior to the Clear Creek fires of 2000, there were 998 acres of old growth stands dominated by Douglas-fir, lodgepole pine, and ponderosa pine in the area surrounding the ICP site (Intermountain Resources, 2004). The 2000 fires burned 668 acres of this old growth. Currently, there is no old growth forest in the area that would be directly affected by the proposed project.

Noxious Weeds

Noxious weeds are defined by Idaho Statutes (Title 22, Chapter 24 – Noxious Weeds) as any plant having the potential to cause injury to public health, crops, livestock, land, or other property; and which is designated by the Idaho Department of Agriculture. It is the duty of all landowners to control

noxious weeds on their land and property. Noxious weeds typically proliferate on sites where the native vegetation and soils have been disturbed (e.g. road margins, powerlines, and heavily grazed areas). There are 36 species of noxious weeds in Idaho. Three species of noxious weeds are present and abundant in the Project Area, spotted knapweed, bull thistle, and Canada thistle (Intermountain Resources, 2004). These weeds are common along roads, the Noranda powerline corridor, and along Big Deer Creek.

Special-Status Species

Special-status species are those plants listed under the Endangered Species Act of 1973 or designated by the Regional Forester as "sensitive" to comply with the National Forest Management Act, as provided in Section 2670 of the Forest Service Manual (FSM). As defined in FSM Section 2670, sensitive species are those identified by a Regional Forester for which population viability is a concern. Objectives for managing sensitive plants include:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions;
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands; and
- Develop and implement management objectives for populations and/or habitat of sensitive species (FSM 2670.22).

Eight species of special-status plants were identified by the Forest Service that may be present in the Project Area and Area of Potential Impact, including one plant listed as threatened under the Endangered Species Act (Ute Ladies' tresses). Field surveys in 2001, 2004, 2005 and 2006 of the Project Area and Area of Potential Impact did not find any of these plants (Intermountain Resources, 2004a and Elliott, 2006).

Wetlands

A total of 4.9 acres of wetlands have been identified in the Project Area. These wetlands are typically associated with seeps or intermittent drainages that receive water from surface runoff and shallow groundwater discharge. Common wetland species in the Project Area associated with seeps and drainages that receive water from surface runoff and shallow groundwater include aquatic sedge, arrow-leaf groundsel, smooth scouring-rush, five-stamened mitre-wort, small white violet, and dagger-leaf rush. Wetlands are described in more detail in the Water Resources section of this Chapter and are shown on **Figure 3-8**.

Wildlife Resources

National Forest lands on the Salmon-Challis National Forest are used by a variety of wildlife species.

Management Direction

The Forest Plan goal for wildlife management follows National Forest Management Act (NFMA) direction to "provide a variety and diversity of habitat throughout the Forest to support viable populations of all native vertebrate species." NFMA also directs National Forests to identify Management Indicator Species (MIS) which are defined as "plant and animal species, communities, or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent" (FSM 2620.5). MIS are generally presumed to be sensitive to habitat and population changes that are believed to indicate the effects of management activities. Forest plan direction to maintain MIS and their habitat includes

"sustain populations of MIS over the long term."

The Forest Plan reflects Endangered Species Act (ESA) requirements that specify all NEPA projects be coordinated with the Fish and Wildlife Service for effects to threatened, endangered, and candidate species. Forest Plan direction for these species includes "manage threatened and endangered species habitat consistent with recovery plan objectives." Currently there are three listed species; the gray wolf (experimental/non-essential population), Canada lynx (threatened), bald eagle (threatened) and one candidate species the yellow-billed cuckoo potentially present in the vicinity of the ICP Project Area.

Forest Service Sensitive Species direction (FSM 2672.4) requires the Forest Service to use a biological evaluation to review all programs and activities for possible impacts to sensitive species. The Regional Forester designates species as "sensitive" because their population or habitats are trending downward, or because little information is available on their population or habitat trends. Sensitive species that may occur in the analysis area are listed in **Table 3-12**.

Analysis Area

The Idaho Cobalt Mine, which includes the portals, roads, tram and processing facilities are all located in a high severity burn area that resulted from the 2000 Clear Creek fire. The intensity of the fire resulted in stand replacement conditions in all of these areas (**Figure 3-11**). The area that will be disturbed is entirely within the severely burned area. The footprint from the proposed project will be small (less than 340 acres under all alternatives) and the majority of disturbances will occur in a severely burned area on Big Flat and in the Bucktail Creek drainage. All primary access roads are in place and, except for a few modifications in alignment or grade, will not be changed.

The analysis of effects to wildlife and wildlife habitat focuses on threatened, endangered, Region 4 Sensitive, MIS, Idaho Species of Concern, neotropical birds, raptors, big game and other species that may occur in and adjacent to the Project Area. All are species that may be directly, indirectly or cumulatively affected by the proposed project activities. The degree to which any species may be affected will vary. The analysis of these species focuses on current habitat conditions, the amount of habitat that will be modified and to what degree and potential disturbance from human activities. The wildlife analysis area was determined based upon existing conditions, wildlife species under consideration and management direction for those species.

A review was completed for all species listed in **Table 3-12** to determine which species may occur in or adjacent to the project area. This review included the Idaho Conservation Data Center (CDC) database information, relevant publications, consultation with agency biologists and wildlife studies in the project area in 2001, 2002 and 2004. Based upon a review of listed species, four species have a low probability of occurrence, two species have a medium probability of occurrence and one species has a high probability of occurring in the project area. Eighteen species do not have any probability of occurring in or adjacent to the project area.

Affected Environment

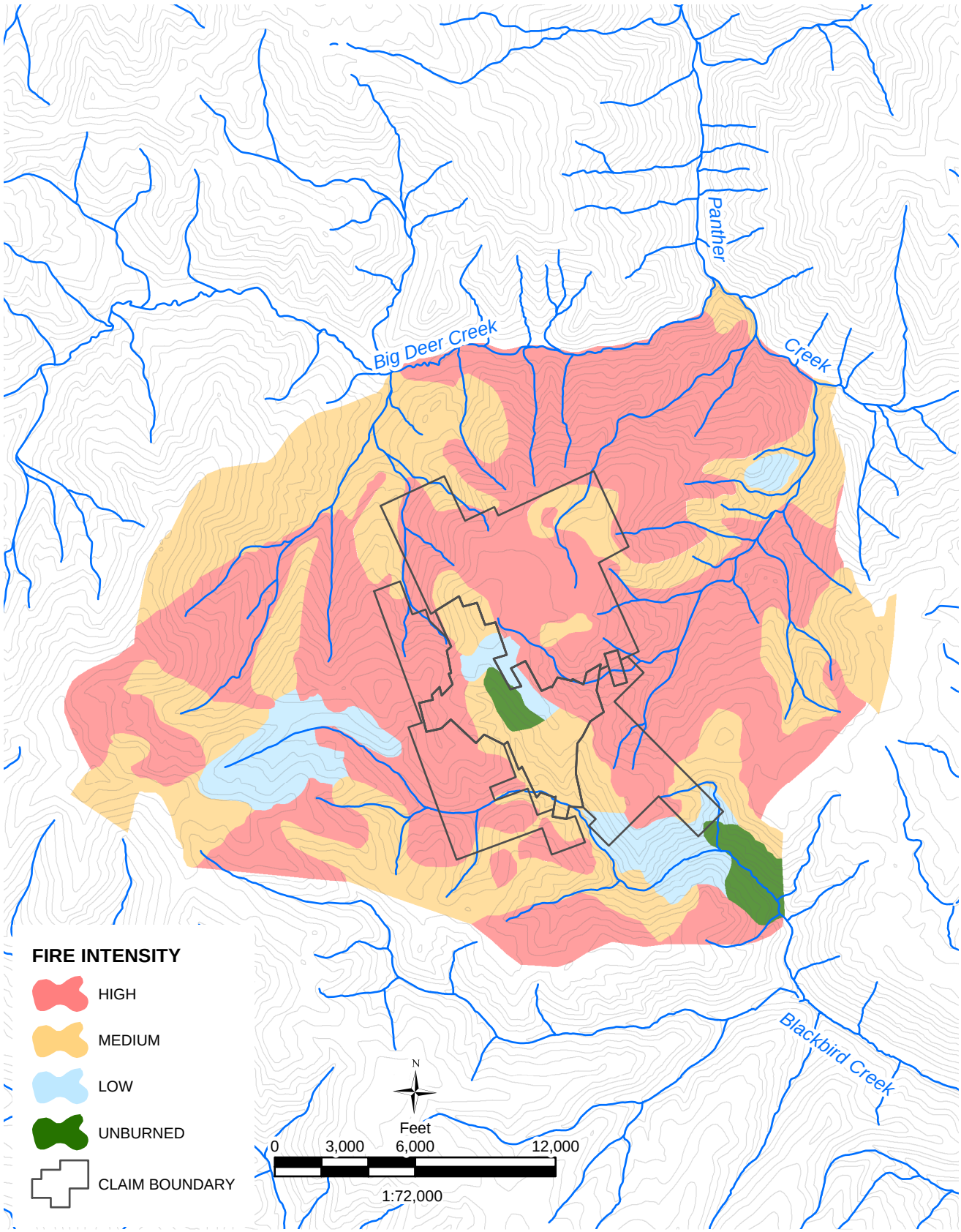
Past Events That Have Affected Current Conditions

Two factors, historic mining and a recent major forest fire in the project area have had significant effects on current habitat conditions and wildlife activities. From the late 1800's and into the 1980's the Blackbird Mine operated at varying levels of activity. Over those years of mining mine portals were established, large tailing areas created, access roads constructed and exploration activities conducted. The combination of these activities has resulted in considerable disturbance in the area. Regularly used and maintained roads are common and there are numerous exploration roads and pits in the area. These activities have had a considerable influence on habitat in the area.

TABLE 3-12. Probability of Occurrence of Threatened, Endangered, Region 4 Sensitive, MIS, and Idaho Species of Concern (Lemhi County) in and Adjacent to the Project Area (some species are found under more than one Category)

Species	Scientific Name	Probability of Occurrence	Habitat Suitability
Threatened Species			
Bald Eagle	Haliaeetus leucocephalus	Low	No Habitat
Canada lynx	Lynx canadensis	Low	Very limited
Endangered			
Gray wolf	Canis lupus irremotus	Moderate	Very limited
Region 4 Sensitive Species			
Wolverine	Gulo gulo	Low	Very limited
Fisher	Martes pennanti	Low	Very limited
Townsend's big-eared bat	Plecotus townsendii	None	No Habitat
Spotted bat	Euderma maculatum	None	No Habitat
Harlequin duck	Histionicus histrionicus	None	No Habitat
Peregrine falcon	Falco peregrinius	None	No Habitat
Northern goshawk	Accipiter gentillis	Low	Very limited
Great gray owl	Strix nebulosa	None	No Habitat
Boreal owl	Aegolius funereus	None	No Habitat
Flammulated owl	Otus flammeous	None	No Habitat
Three-toed woodpecker	Picoides tridactylus	Moderate	Suitable Habitat
Spotted frog	Rana luteiventris	High	Suitable Habitat
Sage grouse	Centrocercus urophasianus	None	No Habitat
Pygmy rabbit	Brachylagus idahoensis	None	No Habitat
Management Indicator Species			
Pileated woodpecker	Dryocopus pileatus	None	No Habitat
Sage grouse	Centrocercus urophasianus	None	No Habitat
Spotted frog	Rana luteiventris	High	Suitable Habitat
Idaho Species of Concern			
Western toad	Bufo boreas	None	No Habitat
California myotis	Myotis californicus	None	No Habitat
Western small-footed myotis	Myotis ciliolabrum	None	No Habitat
Long-eared myotis	Myotis evotis	None	No Habitat
Long-legged myotis	Myotis volans	None	No Habitat
Yuma myotis	Myotis yumanensis	None	No Habitat
Long-billed curlew	Numenius americanus	None	No Habitat

Source: Wildlife Resources Technical Report (Monarch and Associates, 2005).



IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**FIRE INTENSITY 2000 CLEAR CREEK BURN SALMON-CHALLIS NATIONAL FOREST**	Figure 3-11

The second and more dramatic influence was the 2000 Clear Creek fire. Habitat conditions and wildlife activities in the area are undoubtedly significantly different than what existed prior to the fire. As a result of the stand replacement fire on Big Flat and in the Bucktail drainage, habitat and associated wildlife activity in those areas where the facilities will be located were and still are affected. Currently, wildlife use in the immediate project area is low and will probably remain low until the various structural stages of vegetation that existed prior to the fire become reestablished.

Regional Level

Existing Condition - Habitat in a majority of the project area was significantly altered by the 2000 Clear Creek fire. The remainder of the project area if primarily forested with lodgepole pine with an understory of grasses, forbs and shrubs. Data collected during wildlife studies for the ICP indicate that wildlife activity in the immediate project area is low and will probably remain low for a number of years. As vegetation becomes reestablished around the proposed development wildlife use of the area will increase.

Threatened and Endangered Species

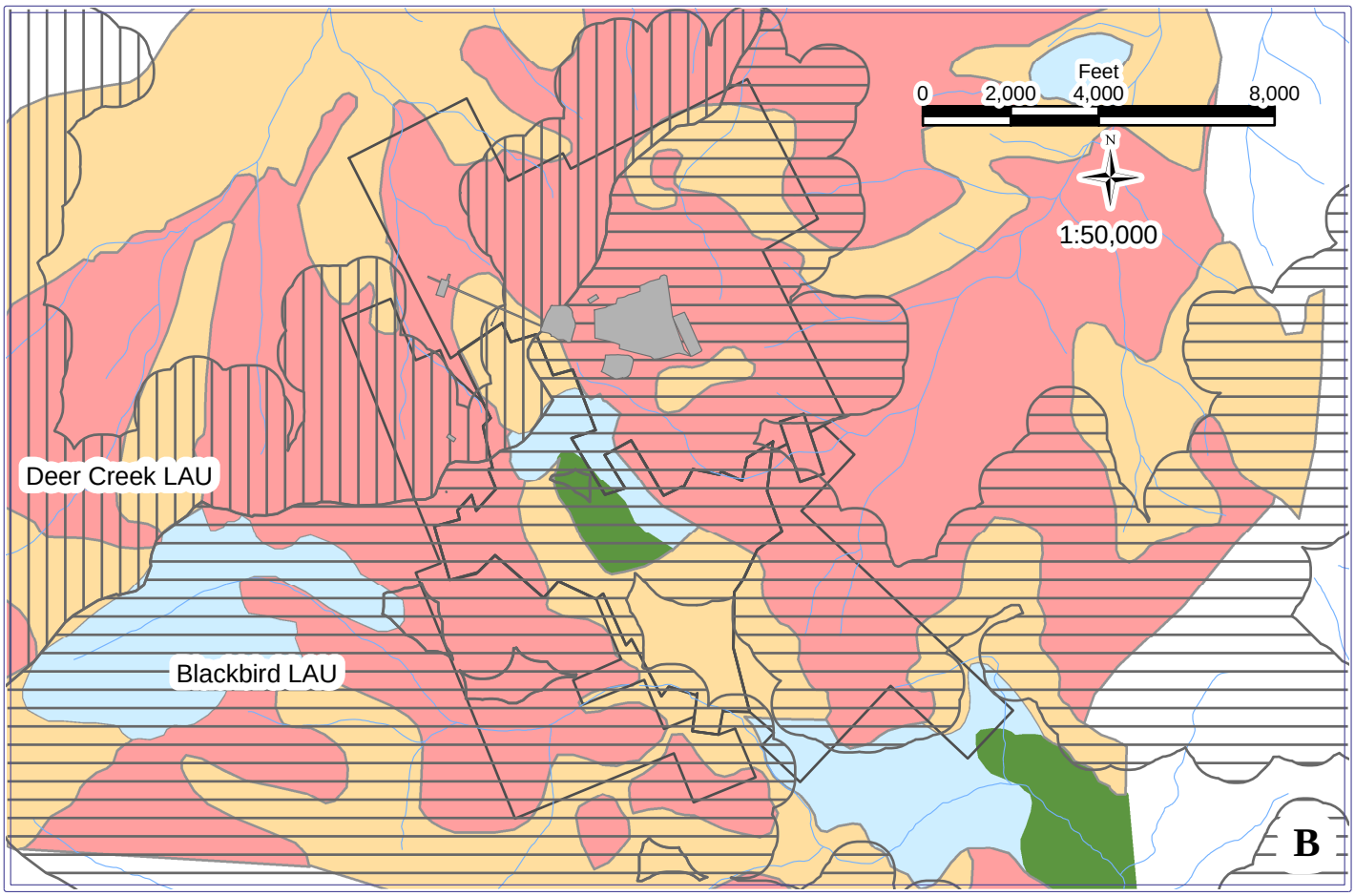
Two listed species are known to or may occur in the project area. These are the Canada lynx and gray wolf. A third, the bald eagle, is infrequently observed in the Panther Creek drainage several miles from the project area. During the wildlife studies in 2001, 2002 and 2004 potential suitable habitat conditions within the study area for these species were assessed. No evidence of these three species were observed during any of the fieldwork.

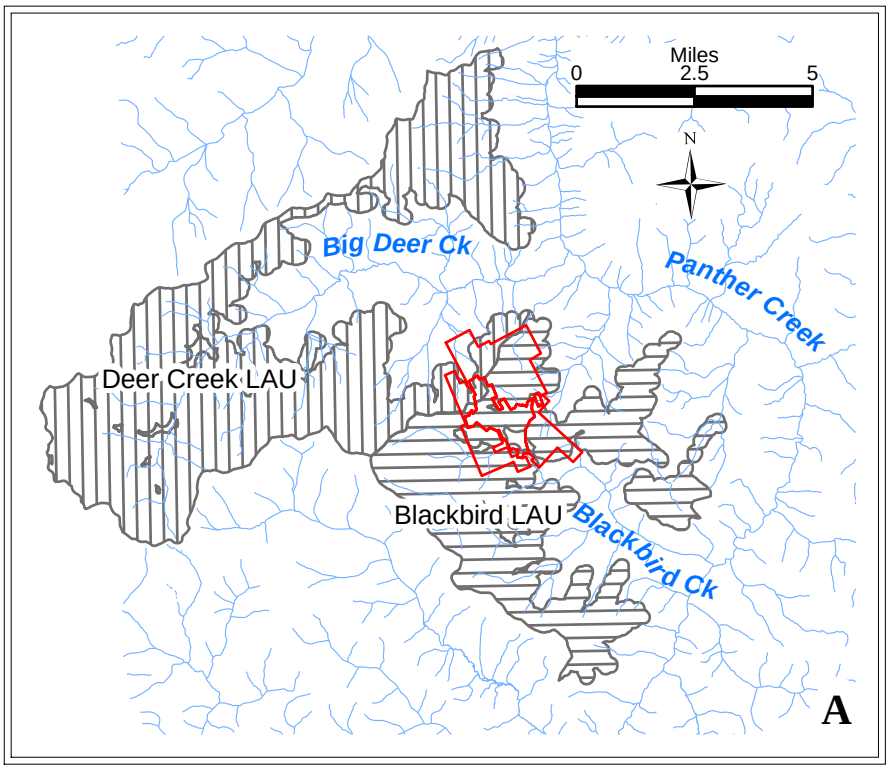
Canada lynx

The project area is located within the Blackbird and Deer Creek Lynx Analysis Units (LAU) (**Figure 3-12**). The LAUs encompass a total of 66,903 acres, of which approximately 36,000 acres (53 percent) was considered suitable lynx habitat prior to the Clear Creek fire in 2000. The Clear Creek fire burned approximately 85-90% of suitable habitat within the units. Even through the project is located in mapped suitable habitat, conditions are currently unsuitable for lynx. Lynx habitat was described using criteria in the Canada lynx Conservation Assessment and Strategy (Reudiger et al., 2000). Lynx habitat was significantly altered as a result of the Clear Creek fire in 2000. The USFS post-fire mapping shows the entire ICP Area as being burned at either moderate or high severity. The majority of the burned areas being classified as severely burned. In much of that area vegetation is just now becoming reestablished. There are some nearby stands that were not heavily burned, but these areas are dominated by lodgepole pine with little understory and lack components necessary for suitable lynx habitat. In addition, those areas where there is green timber are small, being less than 100 acres in size. Due to the fire, there is no green timber connectivity between these small areas and large unburned timbers stands a mile or more away.

Den sites are described as occurring in mature, often multi-storied, stands, particularly subalpine fir and Engelmann spruce stands, with a high degree of canopy closure, horizontal and vertical diversity, and down, woody material loadings (Ruediger et al., 2000). Prior to the Clear Creek fire these conditions were probably very limited in the area of the proposed project. As a result of the Clear Creek fire, none of these conditions exist in the Project Area and none are found in nearby areas.

Lynx foraging habitat is comprised of early successional forest stands with high densities of shrubs and seedlings for prey species primarily snowshoe hare. These conditions are currently lacking in the project area. During wildlife studies in 2004 a few snowshoe hares were observed within unburned portions of the proposed project area, but in very low numbers. Given the location and growing conditions, it will probably take two to three decades before conditions are suitable for Snowshoe hare recolonization of severely burned areas to the extent that hare numbers are high enough to support lynx in the area.





Blackbird LAU
Deer Creek LAU
ICP CLAIM BOUNDARY

FIRE INTENSITY

HIGH
MEDIUM
LOW
UNBURNED
STREAM

ALTERNATIVE II FACILITIES

Blackbird LAU
Deer Creek LAU
ICP CLAIM BOUDARY
STREAM

IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**LYNX ANALYSIS UNITS (LAU)**	Figure 3-12

No Canada lynx occurrence has been formally documented within the proposed Project Area. However, lynx or lynx tracks have been observed in the past few years in the upper reaches of the Panther Creek drainage (Wenger, 2001-2005). There is always the possibility that lynx could move through the project area, but the lack of suitable habitat as a result of the Clear Creek fire minimizes the chances of this happening.

Even though the ICP area and surrounding lands have been mapped as lynx habitat, conditions are currently unsuitable for lynx. Further disturbance will not add to the 30% disturbance level conservation measure established in the Lynx Conservation Assessment Strategy (Ruediger, et al. 2000). It will probably be two or more decades before conditions in and around the ICP area will be suitable as lynx denning or wintering habitat.

Gray wolf

All wolves in Central Idaho south of Interstate 90, whether re-introduced or naturally dispersing, have been designated as a “non-essential, experimental” population by the Secretary of the Interior to encourage experimental approaches to achieving recovery goals and provide more flexibility, especially in dealing with animals that may prey on domestic livestock (Mack and Laudon, 1998). Animals designated as part of a non-essential, experimental population are still provided protection under the Endangered Species Act of 1973.

The occurrence of wolves has been formally documented approximately two miles from the proposed project area. Dick Wenger (Wenger, 2005) provided information on activities of the Jureano and Moyer Basin packs. He indicated that the Jureano Pack ranges south to Blackbird Creek and the Moyer Basin Pack typically remains south of Blackbird Creek. Members of either pack could, however, potentially occur in the project area.

Because of habitat conditions resulting from the Clear Creek fire suitable reproductive, foraging, and migration/dispersal habitat for gray wolves does not exist within the Project Area. There are no known wolf secure reproduction habitat, dens, rendezvous sites or suitable summer and winter foraging habitat. Field observations during 2001, 2002 and 2004 showed that most elk and deer (the primary prey) are found in lightly to moderately burned areas well away from the project area.

Bald eagle

No bald eagle occurrence has been formally documented within or near the proposed project area. The nearest known bald eagle nest location is more than 20 air miles from the proposed Project Area, and reproductive habitat for bald eagle is not present in or near the proposed Project Area (Schuldt, 2004). Foraging habitat is not present in the project area or in close vicinity to the Project Area. Bald eagles do winter along the Salmon River and are known to make foraging flights into the Panther Creek drainage. Even if they come up the Panther Creek drainage as far as the confluence with Big Deer and Blackbird Creeks they would still be several miles from the proposed project area. Winter roost site habitat for bald eagle is not present within the project area. None were observed along Panther Creek during wildlife studies conducted from 2001, 2002 and 2004.

Yellow-billed Cuckoo

To date no yellow-billed cuckoos have been located during surveys across the Salmon-Challis National Forest. Currently, the only known populations of breeding Western yellow-billed cuckoos are in the southwestern U.S. However, a 2003-2004 study indicated it was likely some nested in five different areas of Idaho. During that same study, no nesting pairs were confirmed in central Idaho. The nearest to the project area any of these birds were observed was north of Salmon in 2003. What habitat they use for nesting and brood rearing depends on the geographic area. Data indicate they require rather extensive stands of lowland riparian forests. No suitable nesting and brood rearing habitat for the yellow-billed cuckoo is found in or near the Project Area.

Region 4 Sensitive Species

The USDA, Region Four lists 14 terrestrial vertebrates that occur, potentially occur, or habitat for which occurs on the northern portion of the Salmon-Challis National Forest. Key to the presence or absence of any sensitive species in the study area was whether the area was burned and how intensively. With the exception of a few acres, the entire project area is within a severely burned area. As a result suitable habitat for nesting, denning and foraging for most species is lacking. The lack of basic habitat requirements reduced or in some cases eliminated the chances that the area was being used by a given species. Region 4 Sensitive Species, which were observed in the area, included the northern goshawk, three-toed woodpecker and spotted frog.

Wolverine

The wolverine is a wide-ranging species throughout the mountains of Idaho. Potential wolverine habitat includes tundra and coniferous forest zones at higher altitudes in summer, and at mid to lower elevations in winter. On the Salmon-Challis National Forest, wolverines were found principally in mixed conifer habitat dominated by lodgepole pine. They use spruce-fir stands along stream bottoms and adjacent meadows (Bachman et al., 1990). The size and distribution of this population is unknown. Home ranges tend to be very large as the animals forage over large areas. As a result, individuals seldom remain in one place for a long period of time. There are limited records of wolverine in the Panther Creek watershed.

Accumulations of down, woody material may provide denning habit, but den sites for wolverine in Idaho have most often been linked to talus and boulder fields in remote areas at higher elevation (Ruggiero et al., 1994). None of this habitat exists in the proposed project area. Elk and deer, the primary prey species for wolverine, are currently reduced in numbers due to habitat changes following the Clear Creek fire. Field observations during 2001, 2002 and 2004 showed that most elk and deer (the primary prey) are found in lightly to moderately burned areas well away from the project area.

No wolverine occurrence has been formally documented within the proposed project area and no wolverine sign was found during the wildlife studies conducted in 2001, 2002 and 2004.

Fisher

Potential habitat for fisher include continuous-canopied mature to old-growth spruce-fir forests for denning, and areas with dense understories of young conifers, shrubs, and herbaceous cover for hunting and foraging. The 2000 Clear Creek fire resulted in stand replacement conditions in the project area. Habitat conditions suitable for the fisher are now lacking in the Project Area (Clark et al., 1989; Ruggerio et al., 1994). Rodents, snowshoe hares and other fisher prey species will recolonize nearby burned areas rather quickly (Smith, 2000). However, other habitat conditions necessary for fisher will take longer. No fisher occurrence has been formally documented within the proposed project area. No fisher or fisher sign was observed in the project area during wildlife studies conducted in 2001, 2002 and 2004.

Northern Goshawk

Northern goshawks are linked to mature forest with a high degree of canopy closure for nesting (although they will use more open forest habitat, meadows, and stream corridors for foraging). Preferred habitat includes mature to over-mature coniferous forest with a 75 to 80 percent intermediate -closed canopy, moderate (15-35 percent) slope, and northern aspect. Goshawk nests are normally found within stands of large trees with dense canopy and open understory (Squires and Ruggerio, 1996. Squires and Reynolds, 1997). Foraging activities are conducted within intermediate-closed canopy, open-understory forest, and within small forest openings.

No northern goshawk occurrence has been formally documented in the proposed project area, but a goshawk nest with young was located six miles to the southeast in the Quartz Gulch drainage by

Monarch & Associates in 2001. During June 2004 wildlife surveys, adult goshawks were observed on several occasions in that general area, but no nests were found. An adult with one young was observed in 2002 approximately one mile west of the project area in the South Fork of Big Deer Creek drainage.

As a result of the 2000 Clear Creek fire, suitable habitat for nesting and brood rearing in the Project Area is lacking. There is the possibility that goshawks could nest elsewhere and forage in the area. The amount of foraging activity would be very limited as there is a lack of prey species in the heavily burned areas that dominate the Project Area.

Three-toed Woodpecker

Three-toed woodpeckers are year around residents in the area. Three-toed woodpeckers are typically present at very low densities and persistence is linked primarily to the quantity and quality of snag habitat. Although three-toed woodpeckers also utilize green trees with heart rot and/or infested by insects and trees killed by insects or disease.

Three-toed woodpeckers are commonly observed for the first few years following a fire in burned areas, but over time numbers will decline in these areas. Potential three-toed woodpecker habitat is mixed-coniferous forest containing spruce, fir, tamarack, lodgepole pine, or aspen, with abundant dead and decayed trees, between 4000 and 9000 feet elevation. Three-toed woodpeckers are a snag-dependent species, which typically occurs at low endemic levels until abundant dead and decayed trees, in diseased and/or newly burned areas, become available. Because of the close association with fire-killed trees they are irruptive and often appear in greater number in larger burn areas one to several years after fire to take advantage of insect infestations in fire-killed or damage trees. Nest cavities are excavated in trees with heart rot, while snags with the most bark and limbs remaining on are used for foraging on wood-boring larvae of moths and beetles, caterpillars, and ants.

During the first year of wildlife studies in 2001, three-toed woodpeckers were commonly observed in the Idaho Cobalt project area within the area intensively burned during the 2000 Clear Creek fire. By 2004 numbers of these birds declined in the immediate project area as trees continued to die and fewer insects were available. Even though numbers have declined it is expected that a few birds will remain in the Project Area. They are still found in the moderately burned areas on Big Flat.

Spotted Frog

Spotted frog potential reproductive habitat is based around permanent water such as marshy edges of ponds or lakes, in algae-grown overflow pools of streams, near slow-moving water at streamside, or near springs with emergent vegetation. Spotted frogs are well distributed across the northern portion of the SCNF and may reliably be found wherever suitable riparian or wetland habitat is located. After breeding, spotted frogs may move considerable distances from water into mixed conifer and subalpine forest, grassland, or brushland of sage or rabbitbrush. The spotted frog is thought to hibernate in holes near springs or other areas where water remains unfrozen and is constantly renewed. Suitable reproductive and foraging habitat for the spotted frog occurs within the proposed Project Area.

Spotted frogs were observed at a constructed pond on Big Flat Creek during wildlife surveys conducted in June 2004.

Management Indicator Species (MIS)

The USDA Forest Service, Region Four, lists three terrestrial vertebrates, which occur, potentially, occur, or habitat for which occurs on the northern portion of the Salmon-Challis National Forest as Management Indicator Species. The purpose of this section of the report is to address these species

and determine if the proposed activities are likely to affect any of these species or their habitat within the project area.

Greater Sage Grouse

Sage grouse is an obligate species of sagebrush habitat. Sagebrush habitat does not occur within the proposed project area. No occurrence of sage grouse has been formally documented within the proposed project area.

Pileated Woodpecker

The pileated woodpecker is an uncommon year-around resident that is linked to mature Douglas-fir and mixed conifer forest, primarily at mid-elevations. Pileated woodpeckers require large diameter trees for nesting and roosting. Though they do well in a matrix of forest structural stages, the inclusion of some older forest with large trees in their territories appears to be necessary. The Clear Creek fire in 2000 totally removed any suitable nesting habitat within the vicinity of the proposed operation.

Pileated woodpeckers are not present in the immediate project area. However, they were observed and heard vocalizing and drumming during wildlife surveys in June 2004 in Blackbird, Quartz Gulch and South Fork of Deer Creek drainages. The nearest to any project related facilities that one of the birds was observed was approximately one mile northwest of the Ram portal in the South Fork of Big Deer Creek drainage. There are suitable Douglas fir nesting trees in this drainage that were not burned during the 2000 Clear Creek fire.

Spotted frog

This species is addressed in the Sensitive Species section of this document.

Idaho Species of Concern

Descriptions of Idaho Species of Concern that are known to or have a probability of occurring in or near the project area (goshawk, three-toed woodpecker, wolverine, boreal owl, wolverine and spotted frog) were addressed under Region 4 Sensitive Species. No other Idaho Species of Concern are known to occur in the project area.

Migratory Birds

In 2001, Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds, was signed. This order requires environmental analyses of federal action to evaluate the effects on migratory birds, with emphasis on species of concern. The Fish and Wildlife Service and Region 4 of the Forest Service agreed to use State Bird Conservation Plans as tools to identify relevant migratory birds species and habitat for project analysis.

In January 2000, the Idaho Partner in Flight program published the Idaho Bird Conservation Plan. The Idaho Bird Conservation Plan identified four high priority habitats in Idaho: riparian, non-riverine wetlands, sagebrush scrublands, and dry ponderosa pine/Douglas/grand fir forest. The riparian habitats identified are broad valley bottoms and narrow valley bottoms of low to mid elevations. Sagebrush scrublands and dry ponderosa pine/Douglas fir/grand fir forest do not exist in the Project Area. There is a minor amount of riparian and wetland habitat in the Project Area, but this was drastically altered during the 2000 Clear Creek fire. These areas are only now returning to pre-fire conditions. Data collected during migratory bird studies conducted in 2001, 2002 and 2004 did not show that these areas were being selectively used by any species. Listed species (Region 4 sensitive and MIS) that were observed in these areas were addressed previously in this document.

Big Game

Fire is generally beneficial to the summer range resource by reducing conifer regeneration that competes with important summer forage species, such as graminoids and forbs, in the understory of mature conifer stands in high elevation meadows. Forage species are now coming back in the burned areas and big game species such as elk and deer will continue to benefit.

Elk

None of the project area is classified as winter range for elk. There is a limited amount of use by elk moving through the area in early summer and again in the fall. There is no suitable calving habitat within the project area. Currently, elk are infrequently using heavily burned areas where the project is located. They are commonly observed in the lightly or unburned areas, all of which are found well away from those areas that will be disturbed by activities associated with the mining operations. The primary access route from the mine to Salmon does go through elk winter range in the Panther, Deep and Williams Creek drainages.

Deer

Like elk, none of the project area is classified as winter range for deer. The lack of suitable conditions in the immediate area of the proposed mining operations due to the Clear Creek fire has resulted in very limited use by deer from spring through fall. Lack of both cover and forage in the immediate project area will affect deer activity in the area until after cessation of mining activities. As habitat conditions improve in the area there will probably be an increase in deer use.

Moose

Moose infrequently occur in the project area. Very little suitable habitat for moose occurs in the Project Area and sign indicates they are moving through the area and do not stay. There is sufficient suitable habitat throughout the study area to support a limited number of moose.

Black Bear

Black bears are common in the general ICP area. Numbers and activity has increased over time following the Clear Creek fire. Bears and evidence of their presence were observed throughout the study area. There is considerable forage throughout the study area and within the Project Area.

Big Horn Sheep and Mountain Goats

Both species were observed in the study area. One big horn sheep was observed in the Bucktail Creek drainage near where the proposed pipeline will run. All mountain goat observations were made well away from the proposed operations. Suitable habitat for both these species is lacking in the immediate Project Area.

Other Species

Bats

Suitable habitat for bats is generally lacking in the study area. There is no suitable habitat in the project area. They may forage in the area, but suitable roosting sites are lacking.

Other Mammals

Other small mammals are common in the area. As habitat conditions improve in the burn area numbers will increase. Habitat for many of the small mammals is better in riparian and wetter areas.

Raptors

Several species of raptors occur in the Project Area. Species included northern goshawk, red-tailed hawk, Cooper's hawk, sharp-shinned hawk and great horned owl. These birds were most commonly observed in lightly burned or unburned areas. Observation of young of the year indicate that nesting by these species is occurring in the general area. Suitable nesting habitat for all of these species is found in unburned or lightly to moderately burned areas within remaining pockets of green trees. No suitable nesting habitat exists in the severely and moderately burned areas within the immediate project area. Raptors nesting nearby use the project area for foraging.

Amphibians and Reptiles

Habitat for amphibians does occur in and around the Project Area. Several species of amphibians, both pre-adult and adult, were observed in ponds and small springs indicating that adult survived the Clear Creek fire and breeding has occurred. Species observed included long-toed salamander and northern spotted frog. Tailed frogs were found in lower Little Deer Creek while conducting fisheries studies in 2001 and 2004. No reptiles were observed in the immediate Project Area, but western rattlesnakes bull snakes and western terrestrial garter snakes were observed in the study area.

Fisheries Resources

Background

The proposed Idaho Cobalt Mine Project development is located in the Panther Creek drainage, 40 miles west of Salmon, Idaho. Panther Creek flows into the Salmon River and is part of the Middle Salmon-Panther Watershed (4th order HUC, #17060203). Most of the baseline information describing current habitat conditions and status of fish populations potentially affected by the proposed ICP is described in the Fisheries Technical Report (Kuzis, 2004).

The analysis area includes streams within or immediately downstream of the ICP area and along the transportation route. Streams near the ICP site include: Bucktail, Big Flat, Little Deer, South Fork Big Deer, Big Deer, and Panther creeks (**Figures 3-4, 3-8**). The primary transportation route could directly affect portions of Panther, Deep, Moccasin, and Williams Creeks and indirectly affect downstream reaches of the main Salmon River (**Figure 3-13**).

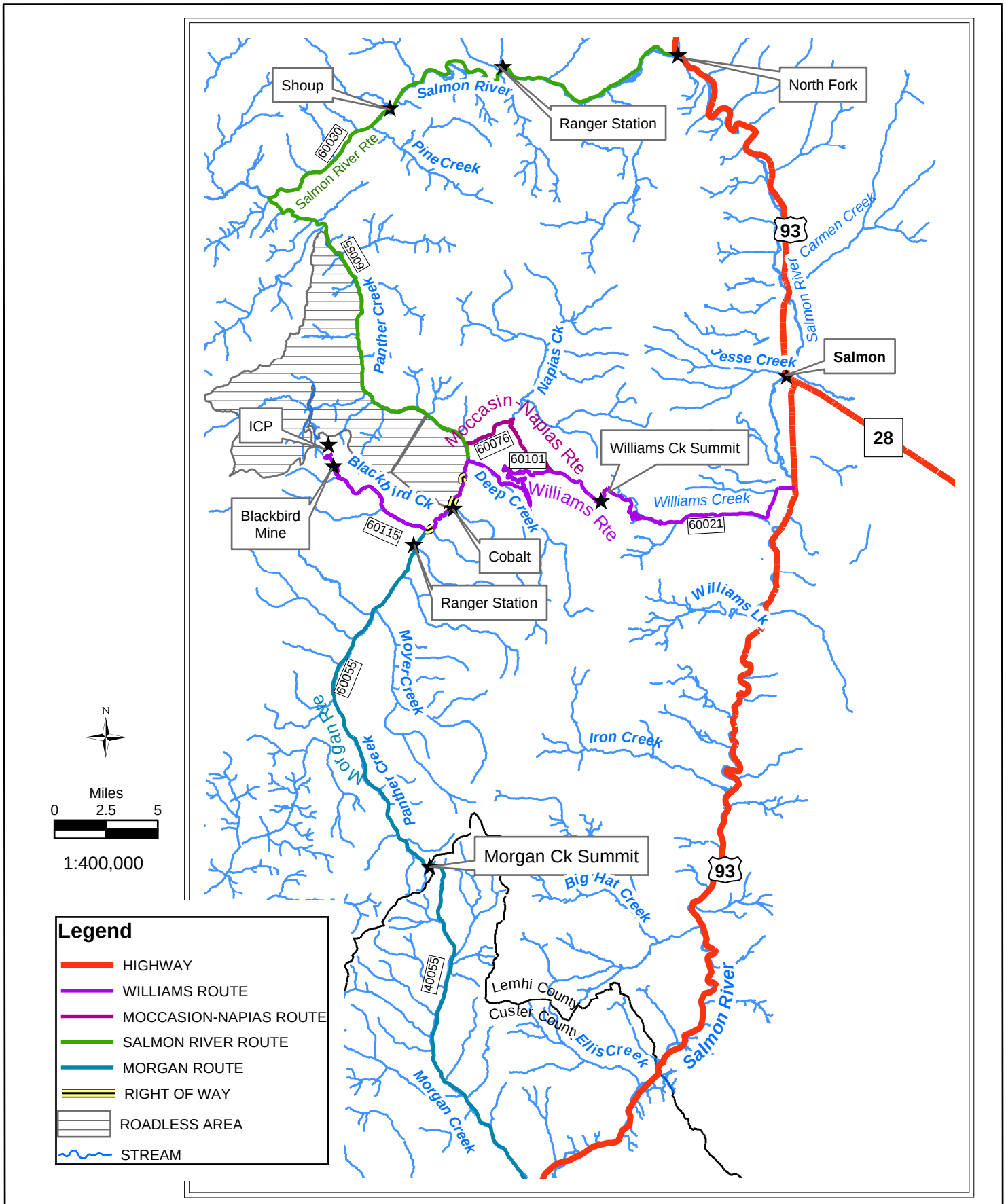
Streams in the analysis area directly or indirectly currently provide habitat for indigenous spring Chinook salmon (*Oncorhynchus tshawytscha*), summer steelhead and redband/rainbow trout (*O. mykiss*), bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*O. clarki lewisi*), mountain whitefish (*Prosopium williamsoni*), dace (*Rhinichthys* sp), sculpins (*Cottus* sp.), northern pikeminnow (*Ptychocheilus oregonensis*), and redside shiner (*Richardsonius balteatus*). Pacific lamprey (*Entosphenus tridentatus*) were historically found in the study area. Introduced non-native brook trout (*Salvelinus fontinalis*) are also found in some streams of the study area (**Figure 3-14**).

Management Direction

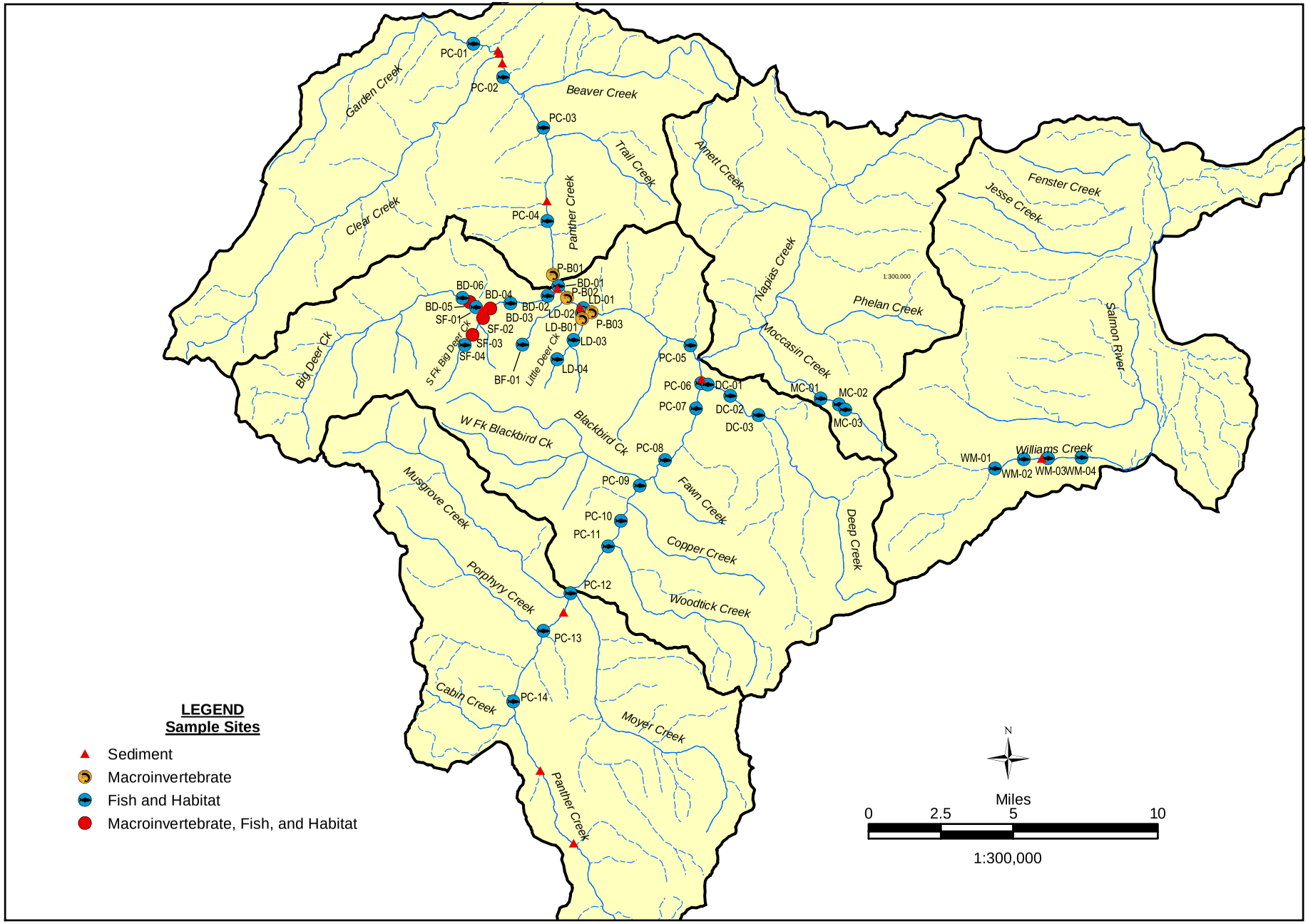
Salmon-Challis Forest Land Management Plan

The Land and Resource Management Plan for the Salmon National Forest (Forest Plan) (USFS, 1988) identifies the following Desired Future Condition for aquatic resources and habitats:

> "Aquatic habitats will be managed at a level sufficient to meet State water quality goals and maintain habitat capability to meet species production goals for both resident and anadromous species. … Habitat enhancement will have to be conducted on an annual basis to compensate for natural and man-caused habitat deficiencies. … Resident trout and anadromous species habitats will be improved in reproductive capacity over the plan period



IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**PROJECT ACCESS ROUTE ALTERNATIVES**	Figure 3-13



IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**AQUATIC SAMPLING SITES IDAHO COBALT PROJECT AREA**	Figure 3-14

through reduction in sedimentation, better riparian management, and habitat enhancement." (USFS, 1988, Pg IV-89)

Additional direction addressing maintenance, restoration and enhancement of both resident and anadromous Forest fisheries resources has been identified within the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon, Washington, Idaho, and Portions of California (PACFISH)(USDA and USDI, 1995) and the Inland Native Fish Strategy (INFISH) (USDA, 1995) aquatic and riparian management directives, which amended the Salmon National Forest Land and Resource Management Plan in 1995.

Special Status Fish Species

There are three Federally-listed salmonids in the study area: Snake River spring/summer Chinook salmon, Snake River Basin steelhead, and Upper Columbia River bull trout. Westslope cutthroat trout were designated as a sensitive species by the Intermountain (Region 4) Regional Forester in 1995 and bull trout are a Management Indicator Species (MIS) for the Salmon-Challis National Forest.

Chinook Salmon - Snake River spring/summer Chinook salmon were listed as threatened on April 22, 1992 by the National Marine Fisheries Service (NMFS) (57 FR 14653). Critical Habitat for Chinook salmon was established December 28, 1993 (58 FR 68543). Designated critical habitat for Snake River spring/summer Chinook salmon encompasses river reaches of the Columbia, Snake, and Salmon Rivers, and all tributaries of the Snake and Salmon Rivers (except for the Clearwater River) presently or historically accessible to Snake River spring/summer Chinook, except reaches above impassable natural falls and Hells Canyon Dam. With the exception of areas within the Napias Creek drainage above Napias Falls, the entire ICP analysis area lies within designated Chinook salmon Critical Habitat. The analysis area is also encompasses Essential Fish Habitat for Chinook salmon, as defined by the Magnuson-Stevens Fishery Conservation and Management Act

Steelhead - Snake River steelhead were listed as threatened August 18, 1997 by the NMFS (62 FR 43937). Critical habitat for steelhead was established February 16 2000 (65 FR 7764). On April 30, 2002, the U.S. District Court for the District of Columbia approved a NMFS consent decree withdrawing critical habitat designations for steelhead. The move was in response to litigation challenging the process by which NMFS established critical habitat. Under the ESA, NMFS was required to analyze the economic impacts. On December 14, 2004 NMFS re-issued a proposed critical habitat designation for Snake River basin steelhead (69 FR 74752). The Service issued a final designation of critical habitat September 2, 2005 (70 FR 52630). Designated Snake River Basin steelhead habitat within the ICP analysis area encompasses Panther Creek, Deep Creek, Williams Creek and the lowermost reaches of Big Deer and Little Deer Creeks.

Bull Trout - Columbia River bull trout were listed as threatened June 10, 1998 by the United States Fish and Wildlife Service (63 FR 31647). The entire Salmon River Basin Unit (including the Panther Creek drainage) has been excluded from the final critical habitat designation under provisions of Section 4(b)(2) of the ESA because of cooperative efforts being undertaken as part of the Snake River Basin adjudication (69 FR 59996). Numbers of bull trout in the Panther Creek drainage are low and connectivity and interactions between resident populations in Napias and upper Deep creeks have been reduced or eliminated by migration barriers (USFWS, 1999). Connectivity among resident populations is unobstructed in other portions of the Panther Creek drainage (USFWS, 1999).

Westslope Cutthroat Trout - On June 6, 1997 the USFWS received a petition to list westslope cutthroat trout as threatened throughout its range. Pursuant to a Court order the USFWS reconsidered an amended petition to list the westslope cutthroat trout. On August 7, 2003, the USFWS found that listing the westslope cutthroat trout as either threatened or endangered was not warranted (68 FR 46989).

Affected Environment

Actions that have Affected Current Conditions

Historic to recent mining activity, livestock grazing, roads, timber harvest, surface water withdrawals and wildfires have all had an effect on surface water resources and fishery habitats within the ICP analysis area. Detailed discussion of regional and local effects of these factors on fish habitat are provided in the Aquatic Baseline Condition Technical Report (Kuzis, 2005) as well as in the Biological Assessment.

Existing Condition

Assessment of current habitat conditions for project area streams was conducted and summarized by Kuzis (2004), based on existing reports, agency files, and data collected in 2001, 2002, and 2004. The information included assessment of riparian conditions, substrate, large woody debris, frequency and quality, off-channel habitat, channel width-to depth ratios, streambank stability and floodplain condition. Additional assessments were made for fish and macroinvertebrate populations.

Data were collected and compiled and compared to the NMFS (1996) indicators of Properly Functioning Condition (PFC) and standards for future desired conditions on the National Forests. The framework of the NMFS matrix formed the basis to assess current conditions and potential impacts associated with the proposed Idaho Cobalt Project alternatives. The pathways and associated indicators of the matrix are provided in Fisheries Technical Report (Kuzis, 2005). Habitat conditions are summarized in the following sections for each of the streams in the analysis area followed by information on fish and macroinvertebrate communities. More specific information can be obtained in the Fisheries Technical Report (Kuzis, 2004) and the Biological Assessment (Roberts and Baer, 2004).

Panther Creek

Panther Creek is a fifth order stream draining approximately 529 square miles of the forested Salmon River Mountains in east-central Idaho. The stream enters the Salmon River downstream from the town of Shoup. Mean annual flow, measured near the mouth of Panther Creek over a 33 year period of record (1945-1978), was approximately 258 cubic feet per second (cfs), and ranged from 22 to 2,850 cfs. Water quality in Panther Creek has been impacted by past heavy metals introductions from Blackbird Creek and Big Deer Creek, and large portions of the lower drainage were encompassed by the 2000 Clear Creek fire.

Kuzis (2004) sampled 14 sites in Panther Creek to document fish and habitat condition. Poor habitat conditions were documented for most measured habitat elements. Panther Creek tends to be wide and shallow and the lack of large woody debris contributes to infrequent pools and poor pool quality.

Riparian habitat provides poor shade conditions throughout the stream. Maximum stream temperatures over an eleven year period (1993-2003) at five stations have varied from 16.1 to 24.7°C with slightly lower ranges reported for maximum seven-day average temperatures (14.7 to 23.6°C) (Kuzis, 2004). Natural valley bottom confinement and a road along lower Panther Creek contribute to a lack of off-channel habitat. By contrast, streambanks are mostly stable along Panther Creek, with 86 percent of the survey sites meeting or exceeding the PACFISH/INFISH Riparian Management Objective level of 80 percent stability.

The Forest Service has monitored six long-term sites along Panther Creek for fine sediment. Study sites in lower Panther Creek (below Blackbird Creek) sampling are located in confined and moderately confined valley bottom types with stream gradients that varied from 1 to 8 percent. Sites in upper Panther Creek (above Blackbird Creek) are located in unconfined valley bottom sites with stream gradients of one to two percent. Fine sediment levels at the three lower Panther Creek sites ranged from 16.4 to 48.9 percent between 1993 and 2006, with most samples exceeding the Salmon

National Forest anadromous habitat sediment goal of 20 percent fines at depth. Highest levels of fines at the two lowermost Panther Creek sampling sites occurred after the Clear Creek fire of 2000. Recent sampling has indicated that substrate conditions at these sites have recovered to pre-fire conditions. Fine sediment levels at the three upper Panther Creek monitoring stations ranged from 7.1 to 30.3 percent with most samples meeting the Forest anadromous habitat sediment goal level. These sites are located outside the area of effect of the 2000 Clear Creek fire and showed no measurable post-fire changes to their natural range of variability during the 1993-2006 period of record.

Big Deer Creek

Big Deer Creek is a third order tributary to Panther Creek with a drainage area of approximately 44 square miles. A natural cascade approximately 0.7 miles above the mouth of the creek is believed to block fish migration to the upper reaches of the stream. Streamflow, measured at water quality monitoring station WQ-24, near the confluence of South Fork Big Deer Creek, varied from 4.4 to 343.5 cfs with a mean annual flow of approximately 88.6 cfs. The lower reaches of the stream have been impacted by past copper introductions from the South Fork, and most of the drainage was encompassed by the 2000 Clear Creek fire.

Six sites were established in the Big Deer Creek watershed to describe baseline fish and aquatic habitat conditions. Properly functioning habitat was noted for large woody debris, substrate, off-channel habitat and floodplain connectivity (Table 3-12). Poor habitat conditions were documented for pools and width/depth ratios. There were few pools and pool quality was poor throughout most sampled areas. The lack of pools in Big Deer Creek is also reflected in high (>12) width to depth ratios. Five of six survey reaches displayed streambank stability in excess of the PACFISH/INFISH Riparian Management Objective level of 80 percent. Riparian habitat provided poor shade (<40 percent) in the high gradient confined sites and mostly good to fair shade in lower gradient areas. Maximum stream temperatures for seven years (1996-2003) varied from 14.8 to 19.0 °C with a slightly lower range reported for maximum seven-day average temperatures (14.0 to 18.2 °C).

The Forest Service established two sampling sites in upper Big Deer Creek in 2001 to monitor fine sediment levels above and below the South Fork. A monitoring site in lower Big Deer Creek has been sampled infrequently since 1993 dependent upon the varying occurrence of spawning gravels at the mouth of the stream from year to year. Substrate fines at the lower Big Deer Creek site have ranged from 9.7 to 29.4 percent, meeting the Salmon National Forest anadromous production goal level of 20 percent fines during approximately half of the sampling periods. Elevated levels of fines were observed in the year immediately after the Clear Creek fire. Fine sediment levels at the monitoring site below the confluence of the South Fork have ranged from 14.8 to 30.7 percent fines, meeting the Forest's resident fish production goal level of 28.7 percent fines during the last five of seven sampling periods. The 2001 to 2006 trend at this site has been a reduction in levels of fine sediment at depth since the Clear Creek fire. Levels of fines at the monitoring site above the confluence of the South Fork have ranged from 23.5 to 29.6 percent fines, meeting the Forest's resident fish production goal in three of four samplings, and displaying a generally stable trend in fines between 2001 and 2004.

South Fork Big Deer Creek

South Fork Big Deer Creek is a second order tributary to Big Deer Creek which drains the north side of Blackbird Mountain. Streamflow, measured at water quality monitoring station WQ-22 near the mouth of the stream, varied from 1.2 to 56.6 cfs with a mean stream flow of 11.2 cfs. The lower reach of the stream, below the confluence of Bucktail Creek has been impacted by past copper introductions from the Blackbird Mine. Most of the drainage was encompassed by the 2000 Clear Creek fire.

Four sites were established in South Fork Big Deer Creek to document baseline conditions for fish and aquatic habitats. All sampling sites in the South Fork Big Deer Creek were located in confined

valley bottoms with stream gradients that varying from 6-15 percent. Poor habitat conditions were noted for pool frequency, pool quality, off-channel habitat, and width/depth ratios. Properly functioning habitat conditions were noted for substrate, large woody debris, and streambank condition. Riparian habitat consisted of coniferous trees, shrubs and some grasses that provided generally good shading (<60-80 percent) to the stream.

Bucktail Creek

Bucktail Creek is a small first order stream which drains the north side of Blackbird Mountain and flows through two sediment control dams before entering South Fork Big Deer Creek. The stream has a drainage area of 1.59 square miles and an extremely steep gradient of 32 percent. Measured flows near the mouth (WQ-21) have ranged from 0.03 to 14.01 cfs with a mean stream flow of 4.14 cfs. No fish and very few macroinvertebrates have been found in this stream (Mebane, 2002).

Little Deer Creek

Little Deer Creek drains the eastern ridge lines and slopes of Blackbird Mountain. The stream is contained within a relatively small and steep 6.2 square mile watershed that drains directly into Panther Creek. Measured streamflow near the mouth of Little Deer Creek (WQ-05) varies from 0.10 to 17.70 cfs, with a mean annual flow of 2.94 cfs.

Baseline conditions were described at four fish and habitat sampling sites in a variety of valley confinements and bottom types. Stream gradients varied from 4-10 percent. Riparian habitat was characterized by burnt trees, shrubs, and grasses that provided mostly poor stream shade. Maximum stream temperatures at 10 sites in 2002 varied from 16.4 to 20.1°C with a slightly lower range reported for maximum seven-day average temperatures (15.7 to 18.9°C). Debris flows through Little Deer Creek after the Clear Creek fire probably contributed to poor habitat conditions documented for pool frequency, pool quality, off-channel habitat, width-depth ratios and streambank condition. By contrast large woody debris was considered to be Properly Functioning at half of the study sites.

A sediment monitoring site was established in lower Big Deer Creek by the Forest Service in 2001 to track effects of the Clear Creek fire. Substrate fines a depth were found to be meet Forest Plan goal levels during all samplings between 2001 and 2004, ranging between 10.1 and 13.8 percent. It is believed that the low levels of fines observed were associated with post fire channel scouring, which flushed smaller materials from the channel bed.

Big Flat Creek

Big Flat Creek drains the eastern ridge lines and slopes of Blackbird Mountain. Big Flat Creek is contained within small watershed that has a drainage area of about 1.6 square miles. Stream flow in most of Big Flat Creek between the project area and Panther Creek is subsurface and inaccessible under the large talus that fills the drainage. Flows measured in accessible areas near the mouth (WQ-02) and in the upper drainage (WQ-07) have varied from 0.006 to 0.347 cfs. No sites were established in Big Flat Creek because habitat conditions could not be measured and no fish were found in the accessible area of upper Big Flat Creek that is nearest the ICP area.

Blackbird Creek

Blackbird Creek is a second order tributary to Panther Creek which flows southeast for about nine miles to its confluence with Panther Creek. Mean annual flow in Blackbird Creek is 12 cfs, with mean monthly flows ranging from 4 cfs to 48 cfs (IDEQ, 2001). Recent sampling in Blackbird Creek, as part of the Blackbird Mine Site Group (BMSG), has been used to describe current conditions (Stantec, 2004). Mebane (1997) provides a summary of other fisheries related work that has occurred in Blackbird Creek. Blackbird Creek has been impacted by dissolved heavy metals loading from acid mine drainage originating from exposed sulfide containing ore and waste rock at the Blackbird Mine site, as well as historic mine waste disposal directly into the creek (Mebane, 1997). Habitat surveys in lower Blackbird Creek noted impaired physical habitat quality associated with grading and

channelizing of the stream (Stantec, 2004). These habitat surveys indicated poor conditions for pool frequency, riparian vegetation, large woody debris, and stream width/depth ratios.

Williams Creek

Williams Creek is tributary to the Salmon River upstream from the town of Salmon, Idaho. The stream has a mean annual flow of about 10 cfs and mean monthly flows range from 3 to 40 cfs. At times the lower portion of the stream may be dewatered by irrigation, but may contain sufficient flow for fish passage in some years (IDEQ, 2001). The drainage was not impacted by the 2000 Clear Creek fire.

Four habitat sampling sites were established to measure baseline habitat conditions). Sampling occurred in confined and moderately-confined valley bottom types with stream gradients that varied from two to four percent. Riparian habitat along Williams Creek provided good shade for the stream. Maximum stream temperatures for eleven years (1993-2003) have varied from 11.3 to 14.8°C with a slightly lower range reported for maximum seven-day average temperatures (11.1 to 14.2°C) (Kuzis, 2004). Poor habitat conditions were noted for stream width/depth ratios, pool frequency, and pool quality. Better habitat conditions were documented for streambanks, floodplain connectivity, and substrate dominance. Half of the sample sites documented properly functioning condition for large woody debris and off-channel habitat.

The Forest Service has conducted sediment monitoring operations on Williams Creek since 1993. With few exceptions, the stream has consistently met Salmon National Forest sediment goal levels for both resident and anadromous fish species production capability, displaying levels of fines between 6.6 and 34.1 percent. Overall sediment trends in the drainage have been a reduction in levels of fines at depth.

Moccasin Creek

Moccasin Creek is a small tributary to Napias Creek, which is a tributary to Panther Creek. A natural falls located in Napias Creek about 0.5 miles from the mouth limits upstream fish passage into Moccasin Creek, and the stream displays a short seasonally intermittent reach through talus slopes in the lower third of its length. A small portion of lower drainage was encompassed by the Clear Creek fire.

Three fish and habitat sites were established on Moccasin. Sampling in Moccasin Creek occurred in variety of different valley bottom types with stream gradients that varied from four to six percent. Extensive beaver dam complexes exist in the middle reaches of the steam course. Riparian habitat along Moccasin Creek provided mostly fair shade for the stream. Maximum stream temperatures for nine years (1993-2003) have varied from 13.6 to 18.6°C with a slightly lower range reported for maximum seven-day average temperatures (12.7 to 17.9°C) (Kuzis, 2004). Poor habitat conditions were noted for stream width/depth ratios, pool frequency, pool quality, and substrate dominance. Better habitat conditions were documented for streambanks, floodplain connectivity, off-channel habitat, and large woody debris.

A single sampling of fine sediment conditions in Moccasin Creek by the Forest Service in early 2000 indicated that the stream met the Salmon National Forest sediment goal level for resident fish species.

Deep Creek

Deep Creek is a third order tributary to Panther Creek with a mean annual flow of 20 cfs. Mean monthly flows can vary from 6 cfs to 80 cfs (IDEQ 2001). Three fish and aquatic habitat sites were established on the stream to document baseline conditions. Sampling in Deep Creek was conducted in confined and unconfined valley bottoms with stream gradients that varied from two to eight percent. Poor habitat conditions were noted for pool frequency, pool quality, stream width/depth ratios, and off-

channel habitat. Better habitat conditions were indicated for substrate dominance, large woody debris, and streambank condition. Floodplain connectivity was limited by natural valley confinement in most sites. Riparian habitat provided good shade throughout most of the areas sampled. Maximum stream temperatures for eleven years (1993-2003) have varied from 11.6 to 16.0 °C with a slightly lower range reported for maximum seven-day average temperatures (11.1 to 15.5 °C) (Kuzis, 2004).

The Forest Service has conducted sediment monitoring operations in lower Deep Creek since 1993. With one exception over a twelve-year period of record, the stream has consistently met Salmon National Forest sediment goal levels for both resident and anadromous fish species production capability. Overall sediment trends in the drainage have been generally stable.

Fish Populations

The Idaho Cobalt Project analysis area contains Federally-threatened, Forest Service-sensitive, and SCNF management indicator species. In the analysis area, adult Chinook salmon have been observed in Panther Creek. Juvenile Chinook salmon have been observed in Panther Creek, lower Blackbird Creek, and Little Deep Creek. For convenience, steelhead and rainbow trout have been combined in this discussion. Steelhead/rainbow trout have been found in Deep, Moccasin, Little Deer, Big Deer, and lower Blackbird creeks. Bull trout are known to occur in Moccasin, Deep, and upper Panther creeks, and have recently been observed in lower Blackbird Creek. (Beak and Golder, 2002). Westslope cutthroat trout were found in Deep, Panther, Big Deer, and Williams creeks. Whitefish, dace, Northern pikeminnow, and redside shiners were found only in Panther Creek, while sculpins were found in Panther, Deep, and Williams creeks. Non-native brook trout were found only in upper Panther and Little Deer creeks. No fish were found in South Fork Deer, Bucktail, and Big Flat Creeks and most of lower Blackbird Creek (Kuzis, 2004; Mebane, 1997; Mebane, 2002).

In the analysis area, potential spawning areas for anadromous salmon may include Panther Creek, Williams Creek, and the lower portions of Deep and Big Deer creeks. The status (abundance) of steelhead and Chinook in streams of the Panther Creek drainage is generally not well understood. Chinook are absent from many of the streams because of past mining activity and the distinction between rainbow trout and anadromous steelhead in most streams is unknown. A few hatchery steelhead have been observed in the lower Panther Creek Watershed. No adult Chinook were observed spawning in lower Panther Creek following Idaho Fish and Game outplants in 2001. However, Chinook spawning was noted in Panther Creek upstream from Napias Creek in 2001, and when progeny from this the 2001 outplant returned as adults in 2005 and 2006.

Natural barriers in Napias and Big Deer creeks limit the use of these streams by anadromous fish. Because there is limited information on spawning of resident fish, such as rainbow and cutthroat trout, it is assumed that watersheds in which they occurred may also provide spawning habitat.

Bull trout populations are present but depressed in much of the Panther Creek drainage (Roberts and Baer, 2004). Bull trout spawning areas have been surveyed since about 1999 in the Panther Creek headwaters, Little Deep Creek, and Napias drainage. Bull trout redd counts show a slight downward trend in the Napias Creek drainage and a more noticeable decline in the headwaters of Panther Creek. Numbers of bull trout redds counted in Little Deep Creek are increasing (Salmon-Challis National Forest, 2004a).

Macroinvertebrate Populations

Macroinvertebrate populations are often monitored to describe the health of stream ecosystems. Macroinvertebrates were sampled in Panther, Little Deer, Big Deer, and South Fork Big Deer creeks (Kuzis, 2004). The Idaho Department of Environmental Quality has used a multi-metric index called macroinvertebrate biotic index (MBI) to indicate if streams support their beneficial uses. MBI scores that range from 3.5 to 6.0 are fully supported. When the value ranges from 2.5 to 3.5 beneficial uses are partially supported and when the values range from 0.0-2.5 beneficial uses are not supported.

IDEQ MBI scores, abundance and species richness values for Ephemotera, Plecoptera, and Trichoptera (EPT) indicate that water quality from Bucktail and Blackbird Creeks have had an adverse effect on benthic fauna downstream (**Table 3-13**). For example in Panther Creek, MBI scores generally increase downstream from Blackbird Creek. The two sites (P-B01 and P-B02) furthest downstream from Blackbird Creek were in full support of beneficial uses while the most upstream site closest to Blackbird Creek (PBO-3) was only partially supportive of beneficial uses.

TABLE 3-13. IDEQ MBI Scores Along with Total and EPT Species Abundance and Richness in ICP Area Streams (from Kuzis, 2004). Numbers in parenthesis indicate the range in values for that site.

Stream	Site	IDEQ MBI	Abundance		Richness	
			Total	EPT	Total	EPT
Panther Creek	P-B01	4.4	3,398	1,208	54	17
	P-B02	3.9	1,768	1,011	44	12
	P-B03	(2.6 - 3.2)	(9,087 - 11,352)	(1,344 - 2,515)	(23 – 31)	(5 – 11)
Big Deer Creek	BD-05	5.1	3,474	1,260	60	27
	BD-04	3.1	1,042	98	32	12
S. F. Deer Creek	SF-03	4.2	613	215	43	21
	SF-02	2.1	91	15	12	4
Little Deer Creek	L-B01	(4.4 - 5.1)	(402 - 1,172)	(224 – 758)	(38 – 58)	(16 – 25)

In the Big Deer Creek watershed macroinvertebrate samples collected downstream from Bucktail Creek in Big Deer Creek (BD-04) and South Fork Big Deer Creek (SF-02) had lower MBI scores, abundance and richness values than their reference sites upstream from the influence from Bucktail Creek (Kuzis, 2004). MBI scores, abundance and richness values in Little Deer Creek (L-B01) suggest that beneficial uses in this stream are fully supported.

Road and Access Management

Access to the Idaho Cobalt Project is by unpaved Forest Service roads from either US Highway 93 or Idaho Highway 28. U.S. Highway 93 and Idaho State Highway 28 are administered by the Idaho Department of Transportation. Both Highways are paved, all-season, two-lane highways and major transportation routes for Lemhi and Custer Counties. U.S. 93 connects Salmon with Missoula, Montana to the north and Challis, Idaho to the south. Idaho State Highway 28 connects Salmon to Interstate 15 near Idaho Falls, Idaho.

Forest road routes (see **Figure 3-13**) that provide access to the Idaho Cobalt site include:

- **Moccasin-Napias Route,** taking Williams Creek Road (FS#60021) to Phelan Road (FS#60098) to Moccasin-Napias Road (FS#60076) to Morgan Creek-Panther Creek Road (FS#60055) to Blackbird Road (FS#60115) to project site;
- **Salmon River Route,** taking Salmon River Road (FS#60030) to Morgan Creek-Panther Creek Road (FS#60055) to Blackbird Road (FS#60115) to project site;
- **Williams Route,** taking Williams Creek Road (FS#60021) to Deep Creek Road (FS#60101) to Morgan Creek-Panther Creek Road (FS#60055) to Blackbird Road (FS#60115) to project site; and
- **Morgan Route,** taking Morgan Creek-Panther Creek Road (FS#40055/60055) to Blackbird Road (FS#60115) to project site.

These roads are used to access recreation, hunting, and resource management activity. The first 5.5 miles of the Williams Creek Road (FS#60021) from Highway 93 is owned and administered by Lemhi

County. The first 8.88 miles of Morgan Creek-Panther Creek Road (FS#40055) is owned and administered by Custer County. The Salmon-Challis National Forest has easements through private property at two locations on the Morgan Creek – Panther Creek Road. Negotiations for a third easement are ongoing. All remaining existing Project Access Route roads considered are owned and administered by the Salmon-Challis National Forest with the exception of a portion of the Blackbird Road, which is on private land (Blackbird Mining Company). The Williams Creek Road to Morgan Creek – Panther Creek Road to Blackbird Road Route (Williams Route) is used to access ongoing cleanup operations at the Blackbird Mine site and the Cobalt Ranger Station. The Project currently uses and proposes to continue using the Williams Route for access. Available average daily traffic data for Project Access Routes considered in the study are provided in **Table 3-14**.

TABLE 3-14. Project Access Route Average Daily Traffic (ADT) Data

Road	Period of Record	Maximum Daily Traffic	Minimum Daily Traffic	Average Daily Traffic for Period of Record
Williams Ck.[1]	6/23/97 to 12/14/97	318	63	159
Panther Ck.[2]	9/10/02 to 10/03/02	131	44	75
Panther Ck.[3]	7/02/03 to 7/20/04	93	33	66

[1] ADT data at mile post 7 on Williams Creek Road - 1997, 1998, 1999
[2] ADT data near Cobalt Ranger Station
[3] ADT data at Forest Service Boundary – 2003, 2004
Source: Salmon-Challis National Forest, 1997 - 2004.

The Forest Project Access bridges are generally adequate for current and projected future uses. Forest Service roads that access the Project Area are also generally in adequate condition for current uses. However, much of the access road would be significantly impacted by a substantial increase in traffic (Parker, 2006) and a section of sharp switch backs at milepost eight on the Williams Creek Road has a history of accidents and difficulty with the steep grade, particularly during winter conditions. Portions of the Morgan Creek-Panther Creek road (FS#40055) and the Blackbird road (#60115) experience flooding during high stream flows. Blackbird road between Mile Post (M.P.) 35.7 and 37.4 constricts Blackbird Creek channel width.

Site roads are currently being used for FCC's exploration and baseline study activities. These roads are also used to access Blackbird Mine monitoring and cleanup operations. Existing site roads are generally narrower and steeper than the secondary Forest access roads and are maintained by FCC or the Blackbird Mine Site Group for local seasonal access. Currently the Blackbird road is gated and closed to public use below West Fork Blackbird Creek. There are currently a total of approximately 26 miles of roads within FCC's block of unpatented mineral claims. Approximately five miles of these existing roads will be upgraded for mine use under the Project's proposal.

The nearest commercial airports are Missoula, MT and Idaho Falls, ID. Salmon and Challis, ID have airports for general aviation. There are railheads at Dubois, ID approximately 136 miles from Salmon and at Missoula, MT approximately 140 miles from Salmon.

Land Use and Recreation Resources

Land Use

The Salmon-Challis National Forest Land and Resource Management Plan (Forest Plan) (USFS, 1988) provides for "coordinated multiple-use management of outdoor recreation, range, timber, watershed, wildlife and fish, minerals, and wilderness resulting in sustained yields of goods and services for the benefit of the American people." The Record of Decision (ROD) on the Final Environmental Impact Statement (FEIS) identified the preferred Plan from a list of twelve alternatives.

The Forest Plan was developed under implementing regulations of the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ), Title 40, Code of Federal Regulations, Parts 1500-1508 (40 CFR 1500-1508); and the National Forest Management Act (NFMA), Title 36, Code of Federal Regulations, Part 209 (36 CFR 219).

The FEIS ROD states that "…the Plan sets forth a strategy for managing the Forest; this is not a plan for day-to-day internal operations. It does not address administrative matters such as personnel, fleet equipment, internal organizational changes, and does not emphasize all site-specific design decisions or all specific resource outputs. Rather, the Plan prescribes general management practices for the Salmon National Forest. The intention is to achieve multiple-use goals and objectives with optimum economic efficiency."

The Salmon National Forest Land and Resource Management Plan defines Management Areas (MAs) with prescriptions for visual resource management, dispersed recreation management, wildlife habitat improvement and maintenance, range improvement and maintenance, and silviculture. The MA prescriptions address issues, concerns, and opportunities (ICOs) and areas of significant public interest identified in the planning and EIS process. Issues addressed in the MA prescriptions include: management of undeveloped areas; wildlife and fish habitat management; timber economics and "below cost" timber sales; timber management-allowable sale quantity; transportation system management; watershed management; range resource; and community stability.

The Forest Plan FEIS inventoried thirty RARE II roadless areas. The FEIS evaluated impacts from resource development and road construction to the roadless areas since the 1978 RARE II inventory. Alternatives evaluated in the FEIS prescribed whether or not a roadless area, or part of a roadless area, was to be considered for wilderness designation. The roadless areas adjacent to the Project were not recommended for wilderness consideration in the ROD on the Plan.

FCC holds mineral rights on 145 unpatented mineral claims comprising 2,524 acres (**Figure 3-3**). These claims are made under the 1872 Mining Law and in accordance with mineral staking regulations in the State of Idaho. Project mineral claims surround patented mining claims related to the Blackbird Mine and owned by Blackbird Mining Company.

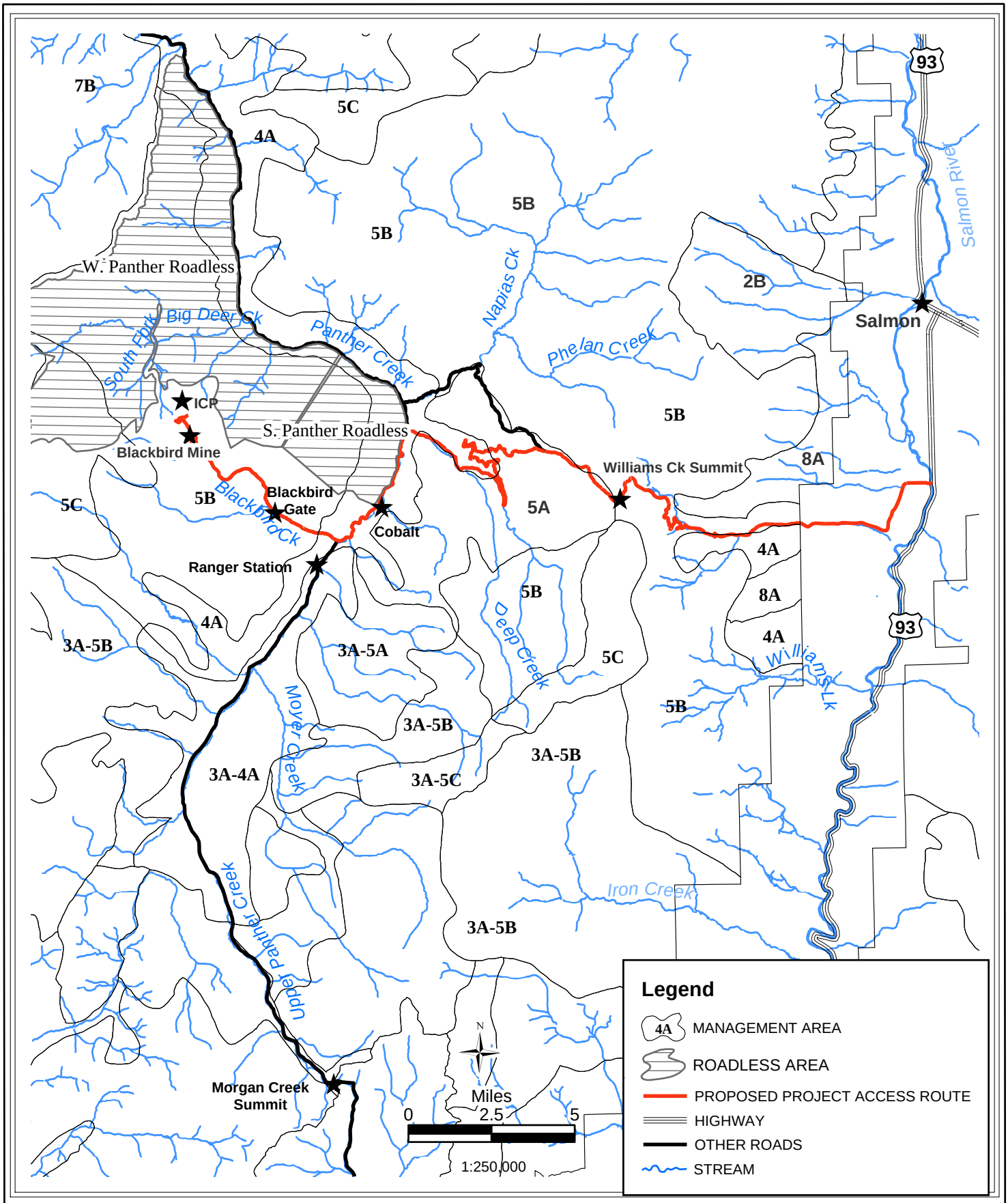
The ICP would consist of two mines, a mill, a waste disposal facility, roads and ancillary facilities. Management Areas (MAs) affected by actions proposed by the Idaho Cobalt Project (Project) are shown on **Figure 3-15**. The Project and proposed Project Access Route (Williams Creek – Deep Creek – Panther Creek – Blackbird Creek Roads) are located in three MA prescriptions:

- 4A – Emphasis is on managing key big game winter range to insure required forage and cover conditions exist to meet big game needs.
- 5A – Emphasis is on producing long-term timber outputs through a high level of investment in regeneration and thinning.
- 5B – Emphasis is on producing long-term timber outputs through a moderate level of investment in regeneration and thinning.

Two roadless areas, West Panther Creek and South Panther Creek (**Figure 3-15**), are located to the north, west and east of the Project. These roadless areas in the project area are within MAs 4A, and 5B.

Recreation

There are numerous recreational resources in the Project Area, primarily involving areas adjacent to the proposed Project transportation route. The Project site, however, offers no recreational opportunities or access for the public. The proposed Project is located on FCC's mining claims and public access to the Project site is restricted. The Project's existing site access road, and proposed operational access route above Blackbird Creek, utilizes an existing access road that passes through the adjacent Blackbird Mine site and CERCLA remediation area. Open public access on this road is



IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**LAND USE MANAGEMENT AREAS**	Figure 3-15

not permitted to or through the proposed Project site. The proposed Project transportation route, however, is open to year-round public access.

The Salmon-Challis National Forest completed a National Visitor Use Monitoring Results report (NVUM) in June 2004 based on data gathered during fiscal year 2003 (October 2002 through September 2003). The NVUM was implemented as a response to the need to better understand the use and importance of and satisfaction with national forest system recreation opportunities. Recreation use on the forest for fiscal year 2003 was 466,835 national forest visits.

The average length of stay on the forest for a national forest visit was 43.2 hrs. Over 23 percent of visitors stayed overnight on the forest. During their visit to the forest, the top five recreation activities of the visitors were viewing natural features, viewing wildlife, hiking/walking, relaxing, and driving for pleasure. The three most used facilities/areas were forest roads, forest trails and scenic byways (USDA, 2004).

Recreation Opportunity Spectrum

The Forest Service's Recreation Opportunity Spectrum (ROS) classification contains six classes, each of which is defined by its setting and the possible recreational experiences and activities it affords. The proposed Project site and adjacent areas involves three of the six classes (**Figure 3-16**). They are: Semi-primitive Motorized, Semi-primitive Non-motorized, and Roaded Natural.

The proposed Project site, including the adjacent Blackbird Mine CERCLA site and large areas south of this area, as well as the Panther Creek road corridor are classified Roaded Natural class of ROS. Areas in this class are characterized as a predominantly natural environment with evidence of moderate permanent alternative resources and resource utilization. Evidence of the sights and sounds of man is moderate, but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from the sights and sounds of man. It must be noted, however, that public vehicle access is not available to the proposed Project site above the Blackbird Mine Gate, and adjacent Blackbird Mine CERCLA area for recreational opportunities.

Large areas east and north of the proposed Project site are encompassed by the Semi-primitive Motorized ROS class. Areas in this class are characterized by a predominantly natural or natural-appearing landscape. The size of these areas gives a strong feeling of remoteness compared to areas that are more heavily used and developed. Opportunities exist to practice woodsman and outdoor skills. Also, recreationists using areas in this class experience a moderate probability of isolation from the sights and sounds of humans, independence, closeness to nature, and feelings of self-reliance.

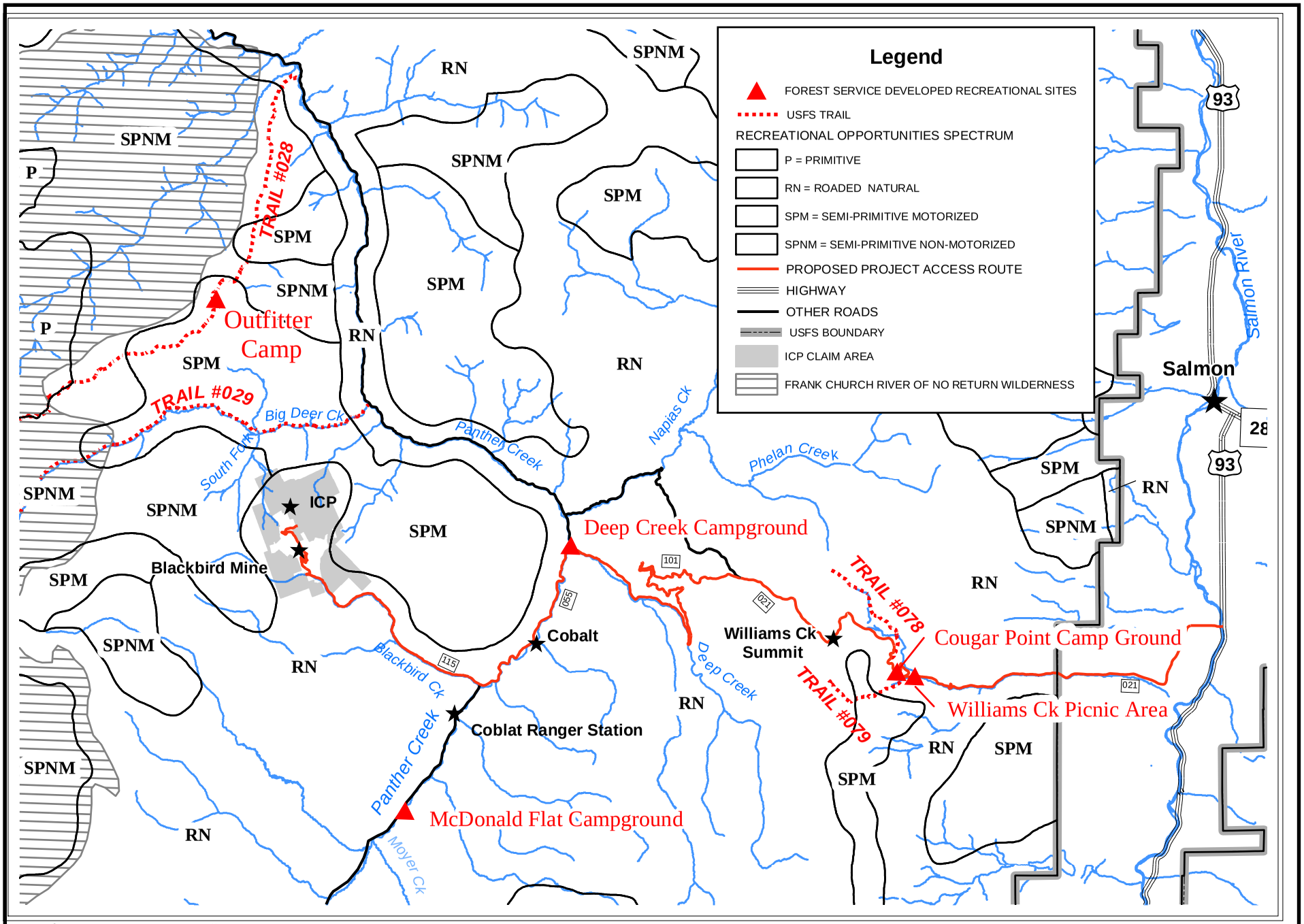
A large area located immediately west of the proposed Project site, including portions of the South Fork of Big Deer Creek drainage is encompassed by the Semi-primitive Non-Motorized ROS class. These areas are characteristically similar to Semi-primitive Motorized areas. The primary difference between the two is the presence or absence of vehicles. Recreationists using areas in this class experience a high probability of isolation from the sights and sounds of humans, independence, closeness to nature, and feelings of self-reliance.

Developed Federal Sites

Three developed recreational facilities administered by the Forest Service are present along the transportation route proposed for the Idaho Cobalt Project (see **Figure 3-16**):

Site Name	Site Capacity*	Utilization (%)*
Williams Creek Picnic Area	40	30
Cougar Point Campground	90	23
Deep Creek Campground	15	29

*Source: USDA June 1991.



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LEMHI COUNTY, IDAHO

RECREATIONAL OPPORTUNITIES SPECTRUM
TRAILS & RECREATION SITES

Figure
3-16

The predominant public use of these developed facilities is associated with the big game hunting season. Summer use of these facilities is typically low and intermittent (Stauffer, 2005).

Trails

The site of the proposed Project provides no public access for trail use or recreational activities. However, Forest trails in the general area of the proposed Project and along the proposed Project transportation route, provide an important recreational resource. Hiking, horseback riding, off-road vehicle travel, snowmobiling and cross country skiing are popular forms of trail-related recreation in this area.

Primary hiking and horseback trails in the general area of the proposed Project and along the proposed project transportation route include the following (**Figure 3-16**):

FS Trail No. 029 (Big Deer Creek Trail): This trail follows Big Deer Creek from its trailhead on the Panther Creek Road north of the proposed Project site to the Crags Campground area located southwest of the proposed Project area and adjacent to the Frank Church River of No Return Wilderness Area. The trail is popular for use by hikers during the summer months and hunters during the fall hunting season.

FS Trail No. 028 (Gant Ridge Trail): From its trailhead located on the Panther Creek Road north of the proposed Project site, this trail follows the eastern boundary of the Frank Church River of No Return Wilderness Area before entering the wilderness area west of the proposed Project site. The trail is used by hikers during the summer months and hunters during the fall hunting season.

FS Trails No. 079 and 078: These trails are located in the Williams Creek Picnic Area and Cougar Point Campground area and are lightly used.

Fish and Wildlife

Big game hunting is a popular activity in the areas adjacent to and in the general vicinity of the proposed Project site. Opportunities exist for hunting elk, mule deer, bighorn sheep, black bear, and mountain lion.

Opportunities for fishing in some of the streams in the general vicinity of the proposed project site are very limited as a result of the adverse effects of historic mine drainage on water quality. The nearest public fishing access site is the Deep Creek Campground, located at the confluence of Deep Creek and Panther Creek (**Figure 3-16**).

Wild and Scenic Rivers

The Wild and Scenic Rivers Act was signed into law as Public Law 90-542 on October 2, 1968 and Congress established a National Wild and Scenic Rivers System (National System). To qualify, a river or river segment must be in a free-flowing condition and must be deemed to have one or more "outstanding remarkable" scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values. Every river in the National System must be administered in such a way as to protect and enhance the values that made it eligible for the National System, but not to limit other uses that do not substantially interfere with public use and enjoyment of these values.

In March 2004, the Forest Service prepared the "Salmon-Challis National Forest Wild and Scenic River Study in Forest Plan Revision" to guide assessment of wild and scenic rivers in the Salmon - Challis National Forest Resource Management Plan revision process. The document included information regarding the eligibility, classification and suitability evaluation processes (USDA, 2004a).

Based on the results of the eligibility evaluation process, Panther Creek from its headwaters to the Salmon River (45.6 miles) was determined to meet the qualifications for the following Outstandingly Remarkable Values: Free Flowing, Scenery, Recreation, Geology, Fish, and Wildlife. As a result of the Classification/Suitability evaluation, the report concluded that Panther Creek from its headwaters to the Salmon River is eligible for a recommendation for inclusion in the National System with a classification as a Recreational River area. Recreational River areas are defined as follows:

> *"Recreational River areas: Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or division in the past."*

A short segment of the proposed Project transportation route is located along Panther Creek.

Winter Sports

There are approximately 15 miles of groomed cross-country ski trails in the Williams Creek Summit, Cougar Point and Ridge Road areas that are adjacent to the Project's proposed transportation route. There are three major trailheads for the cross-country ski trails; the Big Fir Trailhead located above the Cougar Point Campground, Meadow trailhead located below Williams Creek Summit, and Williams Creek Summit. The use of these areas is primarily local. In additional to cross-country ski trails, there are several groomed snowmobile routes for which the major trailhead is located at Williams Creek Summit.

Social and Economic Resources

Socioeconomic Resources

The socioeconomic study area encompasses Lemhi and Custer Counties and the city of Salmon, the closest major community to the proposed mine site.

Social Life

The original inhabitants of the Salmon Valley were the Lemhi Shoshones; however, except for the newly constructed Sacajawea Interpretive, Cultural, and Education Center just east of Salmon, little influence of Native Americans is reflected in the area today. In 1907, the federal government forced the Shoshones from their Salmon area homeland and moved them to the Fort Hall Reservation. Lemhi Shoshoni tribal members were subsequently enrolled in the Shoshone-Bannock Tribes after the 1936 Indian Reorganization Act (Mann, 2004).

Salmon, the county seat and the most populated community in Lemhi County, lies at the confluence of the Salmon and Lemhi rivers in the Salmon Valley. The city is surrounded by open space areas and natural landforms that are mostly managed by the federal government. The Salmon area offers both summer and winter outdoor activities, oftentimes causing the population to swell with part-time residents, recreationists, and tourists. In spite of this influx of temporary residents primarily in the summer, local residents appear to have retained their small-town character and friendly attitude.

Area residents are not immune from the social problems that affect youth in larger cities nationally. Local programs are available to help families dealing with these situations. Many social, civic, and support groups in the study area actively work and interact to provide an improved human and natural environment in the county. Local residents and businesses also appear willing to "lend-a-hand" to families who have suffered hardships or need assistance with odd jobs such as home repairs.

The social processes of the area often are influenced by factors and interests outside of the study area. The national or world market price of commodities such as agricultural products, timber, and minerals as well as decisions concerning the nearby national forests, mining in the area, and resort

developments are often made by individuals, corporations, or regulatory agencies with little or no affinity with the communities.

Residents of the area have social and commercial ties with Lemhi County, primarily because it is their place of residence. But, people often travel outside the community to shop for major purchases, especially to Montana where there is no sales tax. In addition, many youth leave the area in pursuit of jobs, training, a permanent vocation, or other opportunities.

Salmon has survived past cycles of "boom and bust" caused by the opening and closing of mining developments in the area. Property values were negatively affected during the bust cycles and employment in the area declined. However, in spite of closure of the Beartrack Mine in 1999, the unemployment rate has remained fairly stable, indicating that the economy may not be as dependent on the mining industry as it once was. The hiring of the county development director in 2002 and support of state and local officials have helped to diversify and decrease the dependency on one main industry.

Population Trends and Demographic Characteristics

The State of Idaho has continued to increase in population, climbing to an estimated population of 1,393,262 in 2004, or 5.4 percent over the 2001 population estimate. Lemhi County's population grew at a slower pace than the state between 2001 and 2004, increasing by 2.2 percent from 7,655 in 2001 to 7,820 in 2004. Unlike the slight population rises in the state and the county, the city of Salmon remained fairly stable during the four-year period, increasing by <1 percent (**Table 3-15**). Population in Custer County and Challis has fallen slightly since 2000.

Table 3-15. Population Trends - State of Idaho, Lemhi County, Salmon, Custer County, and Challis

Year	State of Idaho	Lemhi County	Salmon	Custer County	Challis
Census					
1980	944,127	7,460	3,308	3,385	758
1990	1,006,734	6,899	2,941	4,133	1,073
2000	1,293,953	7,806	3,122	4,342	909
Percent Change (1980-2000)	+37.1%	+4.6%	-5.6%	+28.3%	+19.9%
Estimates					
2001	1,321,309	7,655	3,042	4,270	892
2002	1,343,124	7,757	3,064	4,166	866
2003	1,366,332	7,731	3,038	4,118	851
2004	1,393,262	7,820	3,056	4,114	853
Percent Change (2001-2004)	+5.4%	+2.2%	+0.5%	-3.7%	-4.4%

Source: U.S. Bureau of the Census, Population Division. 2004 and 2005.

In general, the 2000 demographic characteristics of Lemhi County, the city of Salmon, Custer County, and the city of Challis were fairly similar. The population was almost evenly divided between males and females and the majority of the population (>98 percent) were Caucasian. About two-thirds of the living quarters were family households, with a range of 2.21 (Challis) to 2.41 persons (Custer County) per household. Approximately one-quarter of the population residing in the two counties, Salmon, and Challis were under 18 years of age, while only 7.5 percent of the state population fell within this age category. Median age was somewhat lower in Salmon (39.9 years) than the two counties and Challis, but slightly higher than the statewide median age of 37 years.

Community Service Providers

Education

The proposed ICP is located in Salmon School District #291, which includes: Salmon Pioneer Primary School (pre-kindergarten through grade 3), Brooklyn Intermediate School (grades 4 and 5), Salmon Middle School (grades 6, 7, and 8), Salmon High School (grades 9, 10, 11, and 12), Salmon Alternative School (grades 9, 10, 11, and 12), and Salmon Juvenile Detention Center School (grades 9, 10, 11, and 12). Classes are held in antiquated buildings, which need to be renovated or replaced, most likely through construction of a new facility on school district-owned property near the existing high school (Grabowska, 2004).

The Challis Joint School District in Custer County operates five schools (three elementary in Challis, Clayton, and May; one high school in Challis; and one combined elementary-junior high school in Stanley). Challis Elementary School provides education to students in pre-kindergarten through grade 6, while Challis Senior High School serves grades 7 through 12. Of the 509 students in the Challis Joint School District, approximately 182 go to the elementary school and 266 attend the high school.

Salmon School District enrollment decreased within the past five years by about 100 students due to the shutdown of a nearby mining development; however, within the next two years, enrollment is expected to increase due to upcoming large class sizes. Between the 2001-02 and 2003-04 school years, Salmon High School showed the highest decrease in enrollment (12.4 percent), while Salmon Middle School had the smallest decrease (1.1 percent). During the 2003-04 school year, the school district enrollment was at 1,077 students, including students enrolled in the alternative school and the juvenile detention center. Currently, there is an average student/teacher ratio of 22 students/teacher (Grabowska, 2004).

Law Enforcement

The Idaho Highway Patrol, Lemhi County Sheriff's Department, Custer County Sheriff's Department, Salmon Police Department, and Challis Police Department provide law enforcement services to community residents. The Highway Patrol is responsible for enforcing traffic laws, investigating traffic collisions, assisting motorists, and conducting criminal investigation on Idaho's interstate highways, state highways, and secondary highways. The Sheriff's Departments are accountable for law enforcement activities in Lemhi and Custer Counties, including the unincorporated towns, while the Salmon and Challis City Police activities are primarily restricted to their respective city limits. Law enforcement agencies provide assistance, when requested, in performing law enforcement duties in nearby areas.

Fire Protection

The Salmon Volunteer Fire Department (VFD), with a membership of about 31, provides fire services for the city and Lemhi County Fire Protection District #1. District #1 covers a 5-mile fire service area around the city limits (City of Salmon, 2005). Insurance Services Office (ISO) Commercial Risk Services Inc. inspects the adequacy of fire departments nationwide to determine ratings for property covered by insurance agencies. On an ISO Commercial Risk Services Inc. scale of 1 to 10, with class 1 being the highest rating and 10 being virtually unprotected, the Salmon VFD has an ISO rating of 5 and Fire District #1 has an ISO rating of 8-10 (Nygaard Promotions, 2004).

Ambulance Service

Lemhi County has two ambulance services--Salmon Advanced Emergency Medical Technicians (EMTs) and Leadore EMTs. The Salmon EMTs has a team of 13 members and provide Intermediate Life Support, while the Leadore EMTs are trained in Basic Life Support with a team of 24 (Idaho Department of Health and Welfare, 2005). Three Quick Response Units (QRUs) also are located in

Lemhi County--Salmon Search & Rescue, Elk Bend QRU, and Gibbonsville QRU. Emergency responders of the three QRUs are trained in Basic Life Support, as well as being certified in the various emergency response areas (Idaho Department of Health and Welfare, 2005). One Community Emergency Response Team (CERT) operates out of the Elk Band area and is comprised of 13 CERT team members. About 50 Salmon citizens are also CERT trained (Nelson, 2005).

Health Care

Steele Memorial Hospital, the only licensed hospital in Lemhi County, is a fully accredited 25-bed critical access healthcare facility. Associated with the hospital is the federally designated Certified Rural Health Clinic that provides a wide range of primary care, ancillary services, and specialty services, such as immunizations, patient health education, acute and chronic illness management, routine physical examinations, well-child/development examinations, minor procedures, diagnostic laboratory procedures, mental health counseling, orthopedic services, and x-ray services. The hospital and clinic employ over 125 workers, including the medical staff a team of nurses and ancillary staff.

Construction of the new Steele Memorial Hospital in downtown Salmon was completed in 2004. The new facility is an indication of the ever-expanding medical service area of Lemhi and Custer counties. The healthcare facility offers outpatient and inpatient care, therapy department, laboratory services, medical imaging services (CT Scan, ultrasound, mammography, radiology, MRI), and surgical services (general, orthopedic, gynecological, and endoscopy procedures). Healthcare professionals also in residence include optometrists, dentists, physical therapists, chiropractors, and home-health care agencies (Nygaard Promotions, 2004).

Public Assistance

Public assistance in Lemhi County is provided through Region 7 of the Idaho Department of Health and Welfare, with its regional office located in Idaho Falls and field office in Salmon. The Department of Health and Welfare offers medical and financial assistance, child protection services, and mental health services for residents who are eligible.

Water Supply

The primary water source for the city of Salmon is surface water, serving an estimated population of 3,080. Upgrade of the Salmon city water treatment plant started in the spring of 2005. Several other community water systems use ground water as the primary water source (USEPA, 2005), while residents outside of the community water systems rely on wells for potable water.

Wastewater Treatment

The Salmon wastewater treatment facility serves about 3,122 people and has a designed capacity of 5,300. The existing flow is 1.570 millions of gallons per day (mgd) which is below the designed flow capacity of 2.500 mgd (USEPA, 2004). Housing units outside the city service area utilize septic tanks for wastewater disposal.

Solid Waste

The Lemhi County Landfill was certified as a Class D landfill and opened for waste disposal in 1995. It was originally estimated that the landfill had a life span of 16 years. With the addition of landfill space savers (e.g. cardboard and aluminum can baler, scrap metal removal, and vehicle battery and oil recycling), the landfill may increase that life span to 20 years. The landfill accepts waste from Lemhi and Custer counties (Searle Hart & Associates, PLLC 2005).

Economy

Employment and Income

Employment in Lemhi County is highly seasonal. Agriculture (primarily cattle ranching) is a primary industry, with most ranches being family owned and operated. Logging also is one of the main non-agricultural industries along with tourism and mining. Custer County is known as one of the richest mineral belts in North America and is the economic center of mines, ranches, farms, government, and tourism. Mineral resources of the area include molybdenum (a hardening agent for steel), gold, and silver along with 40 other minerals worthy of being mined commercially.

Major employers in Lemhi County include Discovery Care Center, Lemhi County, Q.B. Corporation, Salmon Public School District #291, Saveway Market, Steele Memorial Hospital, and the federal government (Nygaard Promotions, 2004). Number of business establishments in Lemhi County increased by 2.3 percent between 2001 and 2002 (301 businesses in 2001 and 308 businesses in 2002). Eighty-eight percent of the county businesses (266 establishments) were located in Salmon. Seventy-one percent of the Salmon businesses employed one-to-four workers, while, at the other end of the spectrum, only one establishment employed between 100 and 249 workers (U.S. Bureau of the Census EPCD, 2005). In a recent inventory of local businesses, 269 businesses had registered with the City of Salmon and it was expected that at least 25 had not yet licensed their businesses. The 269 local businesses employed an estimated 1,250 workers (City of Salmon, 2005).

Major employers of Custer County include Challis Joint School District, Custer County, L&W Stone Corporation, Redfish Lake Lodge, The Industrial Company (TIC), Thompson Creek Mining, U.S. Forest Service, and Village Inn/Challis Lodge/Village Square (Nygaard Promotions, 2004).

During 2003, approximately one-third of the jobs in Lemhi County were in government (federal, state, or local), followed by retail trade (14.2 percent) and the accommodation and food service industries (10.4 percent). The transportation and warehousing sector was the fastest growing industry in the county, rising by 80.6 percent between 2000 and 2003. The utilities sector showed the largest decline in employment (50 percent); however, the decline was from only four to two employees. The largest decline in actual number of employees was in the manufacturing sector, which lost 33 employees between 2000 and 2003.

Over the past five years (2000-04), the unemployment rate in Idaho peaked to 5.4 percent in 2002, then decreased to the 2000 average of 4.7 percent in 2004. Lemhi County fluctuated from its highest unemployment rate (7.8 percent) in 2000 to its lowest rate (6.8 percent) in 2004 during the five-year study period. Similar to the state, the Custer County unemployment rate was at its peak of 6.8 percent in 2002 and declined to 5.4 percent in 2000 (Idaho Department of Labor, Research & Analysis and Public Affairs, 2005).

Mining jobs were the highest paying jobs in Lemhi County in 2003, paying workers an annual average wage of $57,558. The next top paying jobs were in the Management of companies and enterprises sector ($51,872) and the Federal Government sector ($42,761). The accommodation and food service industry was at the lower end of the spectrum ($8,639). Average annual wage for all industries in 2003 was $21,899 in Lemhi County, lower than the statewide average of $28,667.

Lemhi County ranked 25th among the 44 Idaho counties, but lagged below the state average per capita income between 2000 and 2002. In 2002, per capita income in Lemhi County was $21,645 compared to the state ($25,476) and the United States ($30,906).

Housing

Housing stock in Salmon ranges from 1800-vintage mining shacks to elegant Victorian-style homes. During the past century, housing has developed in and around Salmon, primarily on land with views of the valley and the Bitterroot Range. Other housing developments are occurring in outlying areas to

the north and south of Salmon; however, water and sewer limitations may eventually curb this residential growth (City of Salmon, 2004).

Over the past couple of years, housing has become very limited in the Salmon and Challis area. Realtors reported that once listed an average home is sold in about two weeks (Gilliam, 2005). The expansion of the nearby Thompson Creek Mine with the hiring of approximately 40 new employees, has also added to the limited amount of housing. Many of the newly hired workers were former employees who had moved from the area, but needed housing when returning to work at the mining operation (Gilliam, 2005).

During 2000, the U.S. Bureau of Census recorded 4,154 housing units in Lemhi County, comprised of 82.7 percent 1-unit structures, 0.6 percent 2 to 4 unit structures, and 16.7 percent mobile homes or "other" housing units. Approximately 21 percent of the housing units were vacant and, of the 936 vacant units, 52.2 percent were classified by the U.S. Bureau of the Census as seasonal, recreational, or occasional use housing units. Similarly, 47.2 percent of the vacant units in the state were identified as seasonal, recreational, or occasional use units.

In Custer County, there were 2,983 housing units of which 78 percent were occupied units and the remaining 31 percent were vacant units. The majority of the occupied units (69.3 percent) were owner occupied, while most of the 115 vacant units were classified as seasonal, recreation, and occasional use units (30.4 percent), followed by rental units (26.1 percent).

Temporary housing in the area includes approximately 235 motel and bed-and-breakfast accommodations in Salmon and 172 rooms in Challis. Private/public campgrounds and recreational vehicle (RV) courts also provide short-term housing in both of the areas (IDOC/Idaho Division of Tourism Development, 2004).

Heritage Resources

Heritage Resources are defined as Historic Properties, under the National Historic Preservation Act. Section 106 of the National Historic Preservation Act requires federal agencies to identify any Historic Properties that might be affected by a federally licensed, permitted or assisted undertaking. An undertaking refers to any federal action, activity, or program, or the approval, assistance, or support of any action, activity, or program, including those involving a federal lease, permit, license, or other entitlement for use. Consultations to identify, evaluate and address potential impacts to Heritage Resources/Historic Properties, can involve the applicants for federal licenses, permits or assistance; the federal agencies issuing such licenses, permits or assistance; the State Historic Preservation Officer (SHPO); interested Indian tribes, and members of the public in general. Once identified, Potential Historic Properties are evaluated by the federal agency in consultation with the State Historic Preservation Officer, and other interested parties, to determine whether or not the property is eligible for listing on the National Register of Historic Places (NRHP). If it is determined to be eligible, the federal agency must determine whether or not the property will be adversely affected by the activity. If the proposed activity would affect any property either listed on the NRHP or eligible for such listing; the agency must address the effects of the action, through such means as avoidance by project redesign, or mitigation of effects by archaeological data recovery, the recording of historic architectural-engineering resources and so forth. Heritage Resource Management plans are prepared by the federal agency and are reviewed by the SHPO, interested Indian tribes, and other consulting parties, which may include the Advisory Council on Historic Preservation. The federal agency is required to take into consideration the comments of these parties in making a decision on the proposed action.

Federal responsibilities to consult with Indian tribes are included in the National Historic Preservation Act, Native American Graves Protection and Repatriation Act, and the American Indian Religious Freedom Act. Also, Presidential Executive Orders 12875 and 13007 call for consultation with Tribal governments.

Public disclosure of the location of certain types of Historic Properties is exempted under 16 USC 470 Sec. 9(a)(1)(2). The purpose of this exemption is to protect Historic Properties from potential vandalism and to retain as confidential, the location and nature of Historic Properties, including those that are of cultural significance to Indian peoples.

Cultural Resource Inventories

Twenty-two cultural resource inventory projects have been conducted within the general ICP area. Most previous inventory projects have been small in scale and associated with Blackbird Mine exploration or cleanup. Several recent inventories, however, have been conducted specifically for the Idaho Cobalt project (Rossillon, 2001, 2006; Dickerson, 2005). These inventories include intensive surface field studies for proposed activities such as roads, exploration drill sites and environmental cleanup associated with the Blackbird Mine as well as an intensive cultural resource inventory within the boundary of the proposed project area.

The inventories have identified 12 historic and two prehistoric properties in or immediately adjacent to the ICP Project Area that are eligible or are likely eligible for nomination to the NRHP. The historic properties range in function from trails to mining camp ruins dating primarily to the first half of the 20th century. None of these resources will be directly impacted, as the project is currently designed. Those historic properties closest to impact areas (a portion of the Thunder Mountain Trail, a dump at an early 20th century mining camp ruin, and a log hoist house) have been carefully mapped to insure avoidance.

The two prehistoric archaeological properties within the ICP Project Area are located adjacent to planned support facilities outside the FCC claim boundary. The first, initially recorded in 1991, is a lithic tool-making debris scatter containing a single projectile point fragment and multiple pieces of toolstone debitage. The second was a temporary camp, also containing a significant amount of toolstone debitage. Both appear to contain elements of significance to archaeological research for the general area. Project design at each location is now such that the project will avoid the important portions of both properties and so will pose no adverse effect.

Consultations With American Indian Peoples

American Indian Tribes are afforded rights under various federal statutes that include the National Historic Preservation Act (NHPA)(16 U.S.C. 470, et. seq.), the *Native American Graves Protection and Repatriation Act* (NAGPRA) (25 U.S.C. 3001 et seq.), and the *American Indian Religious Freedom Act* (AIRFA) (42 U.S.C. 1996). Federal guidelines direct federal agencies to consult with modern American Indian Tribal representatives who may have concerns about federal actions that may affect religious practices, other traditional cultural uses, as well as cultural properties and remains associated with American Indian ancestors. Any tribe whose aboriginal territory occurs within a Project area is afforded the opportunity to voice concerns for issues governed by NHPA, NAGPRA, or AIRFA. Federal responsibilities to consult with Indian tribes are included in Executive Orders 12875 and 13007. Executive Order 12875 calls for regular consultation with Tribal governments; and Executive Order 13007 requires consultation with Indian tribes and religious representatives on the access, use, and protection of Indian sacred sites.

SCNF consulted with the Shoshone/Bannock and Nez Perce tribes throughout the process of project evaluation from 2001 through 2005 , including informational presentations to the Shoshone/Bannock Tribal Council and staff, periodic project update letters, and other meetings, and on-site tours involving representatives of the Shoshone/Bannock Tribe and the Nez Perce Tribe. This included providing all documents requested by the tribes on Heritage Resources identification on the project, as well as other documents related to the total scope of environmental analysis of the proposed project. Site inventory work has identified no Traditional Cultural Properties in the Project Area or in consultations with tribal representatives conducted by SCNF.

Roadless/Wilderness and Visual Resources

Roadless and Wilderness Resources

The boundary of the Frank Church River of No Return Wilderness (FCRNRW), at its nearest, is approximately four miles to the west of the proposed ICP Project and facilities (**Figure 3-17**). The wilderness area was established in 1980 when congress passed the Central Idaho Wilderness Act, and covers over two million acres in Central Idaho. The Frank Church River of No Return Wilderness is the largest contiguous wilderness in the lower 48 states, and the largest in the National Forest System.

The majority of wilderness recreation users are river floaters on the Salmon and Middle Fork Rivers. Both rivers manage recreation use with a permit system during the summer season. During the summer seasons, noncommercial float boating permits are randomly assigned by a lottery system, and the commercial operators are assigned a set number of launches for each river in their special use permits. Over 17,000 people float these two rivers each year.

The Forest Service designated West Panther Roadless Area lies to the north and northwest of the ICP and the South Panther Roadless Area lies to the southeast (**Figure 3-15**). The roadless areas, although in generally rough terrain and difficult to access, provide wildlife habitat and dispersed recreational opportunities for backpackers and hunters.

Visual Resources

Management Direction

The Salmon National Forest Resource Management Plan directs the Forest to apply the Forest Service's Visual Management System to all lands administered by the Forest. The Forest Service implements its Visual Management System through the use of Visual Quality Objectives (VQOs). The proposed Project site and adjacent areas are located in Management Prescription Area 5B.

Management direction for this prescription area directs the Forest to meet the VQOs established in the Salmon National Forest Resource Management Plan (USFS, 1988).

Visual Quality Objectives

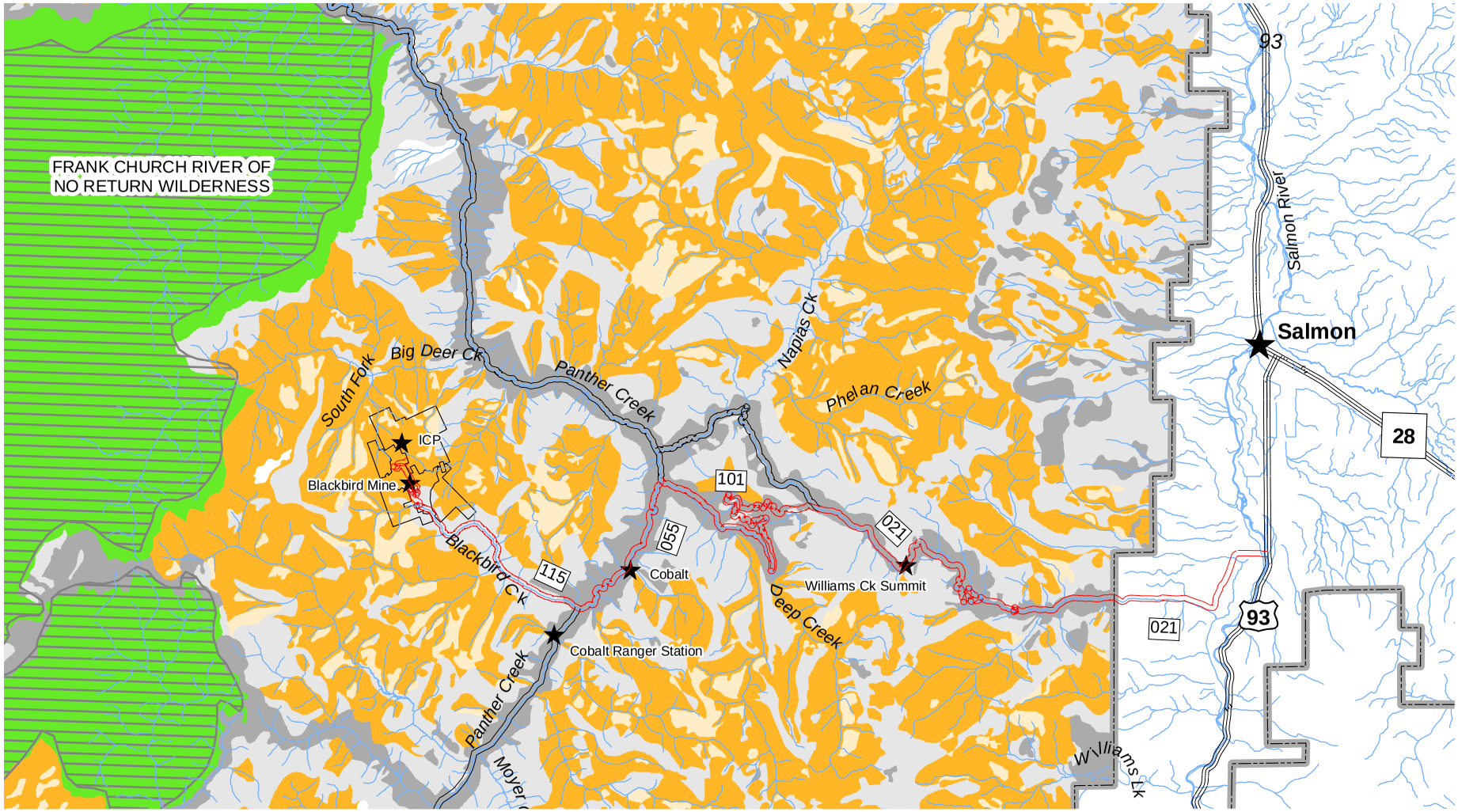
Visual Quality Objectives are designed to establish measurable standards or objectives for the visual management of forest lands. They are represented by five terms, which can be defined as visual resource management goals. The objectives are:

P	Preservation;
R	Retention;
PR	Partial Retention;
M	Modification; and
MM	Maximum Modification.

VOQs for the area of the proposed Project and adjacent areas are shown on **Figure 3-17**.

The majority of the areas near the proposed Project site, including the proposed Project site, have a VQO of Modification (M).

> *"Under the modification VQO, management activities may visually dominate the original characteristic landscape."* (USDA, 1974)
> Several smaller areas with a VQO of Partial Retention (PR) are located in the general Project Area, including a larger area located east and northeast of the proposed Project site and extending to the Panther Creek Road corridor.



Legend

VISUAL QUALITY OBJECTIVES

- Preservation
- Retention
- Partial Retention
- Modification
- Maximum Modification

- FRANK CHURCH RIVER OF NO RETURN WILDERNESS
- USFS BOUNDARY
- IDAHO COBALT PROJECT CLAIMS
- PROPOSED PROJECT ACCESS ROUTE
- HIGHWAY
- OTHER ROADS

- 021 Williams Creel Road
- 101 Deep Creek Road
- 055 Morgan-Panther Road
- 115 Blackbird Road

N

Miles

2.5 1.25 0 2.5

1:250,000

IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**VISUAL QUALITY OBJECTIVES**	Figure 3-17

"Management activities remain visually subordinate to the characteristic landscape when managed according to the partial retention visual quality objective." (USDA, 1974)

The Panther Creek Road corridor has a VQO of Retention (R) and a Sensitivity Level designation of Level 1. A VQO of Retention (R), and a Sensitivity Level 1 is described as follows:

"This visual quality objective provides for management activities which are not visually evident." (USDA, 1974)

"Sensitivity Level 1 includes all seen areas from primary travel routes, use areas, and water bodies where, as a minimum, at least one-fourth of the Forest visitors have a major concern for the scenic qualities." (USDA, 1974)

The FCRNRW area, located west of the proposed Project site and adjacent areas, has a VQO classification of Preservation (P).

"This visual quality objective allows ecological changes only. Management activities, except for very low visual impact recreation facilities are prohibited." (USDA, 1974)

Hiking trails in the Salmon-Challis National Forest in the general area of the proposed Project site are located in, and provide foreground, middle ground, and background views of areas with VQO's of Partial Retention, Modification, and Preservation. Ridge-top trails, as a result of the local mountainous topography and terrain, offer a limited opportunity for long distance views of the proposed ICP project area. No established public vista areas are located along the roads of the proposed ICP project area, including the proposed transportation route.

Blackbird Mine Site Activities

Blackbird Mine Site History

The Blackbird Mine is an inactive mine located in Lemhi County, Idaho approximately 13 miles south of the Salmon River and 25 miles west of Salmon, Idaho and adjacent to the ICP (see **Figure 1-1**). The Blackbird Mine CERCLA Site includes approximately 830 acres of private patented mining claims and adjacent unpatented mining claims within the Salmon-Challis National Forest on which hazardous substances were released and/or came to be located as a result of historic mining activities at the Blackbird Mine.

Mining activities at the Blackbird Mine began in the late 1800s and continued until 1982. Mining created about 14 miles of underground workings, a 12-acre open pit, 4.8 million tons of waste rock deposited in numerous piles, and two million tons of tailings disposed of at a tailings impoundment. Mining and surface disturbances at the Blackbird Mine site span two drainages: Bucktail Creek and Meadow/Blackbird Creeks. These drainages flow into Panther Creek, which flows into the main stem of the Salmon River. Acid rock drainage from waste rock piles, underground workings, the tailings impoundment, and tailings deposited along area creeks have resulted in the release of elevated levels of hazardous substances to the environment (groundwater, surface water, soils), including but not limited to copper, cobalt and arsenic. These releases have contributed to elevated levels of dissolved copper and cobalt in Panther Creek and its tributaries. Contaminated soil, sediment, waste rock and tailings were also released from the Blackbird Mine site during high water flows from thunderstorms and snowmelt and deposited in soil along the banks of downstream creeks (referred to as overbank deposits/soil) including Panther Creek and its tributaries. Investigations show that irrigation also spread contaminated material along Panther Creek in the overbank soil as well as in pastures. The fisheries and aquatic resources downstream of the Blackbird Mine have been impacted by arsenic, copper and cobalt releases. Dissolved copper concentrations in area creeks

downstream from the mine frequently exceed the State of Idaho water quality standard (WQS) for protection of aquatic life regarding this metal.

Mining History – Minerals in the Blackbird area were discovered and first began to be developed in 1893, when the Blackbird Copper-Gold Mining Company consolidated several small prospects and conducted the first significant mining activities from 1893 until 1907. Mining continued until 1982 as follows:

- From about 1917 until 1920, the Haynes-Stellite Company mined and milled approximately 4,000 tons of ore from a site located along the east side of Blackbird Creek approximately 1.2 miles downstream of the present Blackbird Mine.
- In 1938 the Uncle Sam Mining Company reopened two old adits and built a 75-ton/day flotation mill at the present Blackbird Mine site.
- The Calera Mining Company (a subsidiary of Howe Sound, which was also actively involved in the mining operations) purchased the Blackbird Mine property in 1943. Full-scale mining activity was initiated in 1949 and was expanded during the 1950s and included the construction of a 1000 ton/day mill.
- In 1954, Calera initiated open pit activities in the Blacktail Pit. Excavation of the open pit resulted in the deposition of approximately 3.8 million tons of waste rock in the headwaters of Blackbird and Bucktail Creeks.
- Prior to full-scale mining, tailings from the mining operation were deposited directly in Blackbird Creek. After 1950, tailings were deposited behind the West Fork Tailings Impoundment, but some tailings "spills" are known to have occurred. It is estimated that 20,000 cubic yards of tailings were deposited or spilled along Blackbird Creek, and an estimated two million cubic yards of tailings are impounded behind the West Fork Tailings Impoundment. Underground mining operations during this period also resulted in the formation of a number of waste piles outside mine adits, totaling approximately one million tons. Subsequent to mining operations, debris flows, erosion, and acid rock drainage (ARD) have resulted in the spreading of arsenic, cobalt, and copper from the original mining waste disposal areas to downstream locations.
- The Calera Mining Company suspended mining operations and sold its interest in the Blackbird Mine to Machinery Center Company in 1963. Between 1963 and 1967, Machinery Center produced copper from the mine primarily through leasing operations. Machinery Center sold controlling interest to the Idaho Mining Company, a subsidiary of the Hanna Mining Company, in 1967. For the next few years, the Idaho Mining Company engaged in an exploration program on the property and initiated meetings with state and federal agencies to obtain authorizations to re-open the mine.
- The Calera Mining Company was a wholly-owned subsidiary of the Howe Sound Company, which later changed its name to Howmet Corporation and was acquired by Pechiney.
- In 1977, Noranda Exploration entered into an option agreement with the Idaho Mining Company, allowing Noranda to explore and acquire interest in the mine property. In December 1979, Noranda Mining, Inc. and Hanna Services Company created the Blackbird Mining Company, a limited partnership, wherein Noranda Mining became the general partner responsible for re-opening the mine. During this same time period, Idaho Mining Company sold all its real and personal property to Hanna Services Company.
- Noranda Exploration and then the Blackbird Mining Company conducted exploration activities from 1978 to 1982. Exploratory drilling activity included increases to the main Haynes-Stellite Adit openings in order to allow exploration equipment to access the interior of the adit. The Blackbird Mining Company conducted pilot activities at the mine from 1980 to 1982 to determine the feasibility of full-scale operation of the mine.
- A wastewater treatment plant was constructed in 1981 to treat mine drainage from the 6,850-foot level of the mine. The Blackbird Mining Company also diverted mine drainage from the 7,400, 7,200, and 7,100-foot levels to the 6,850-foot level for treatment by the wastewater treatment plant.

- In 1981, the Blackbird Mining Company suspended all pilot operations at the Blackbird Mine and in 1982 ceased all underground activities upon completion of the pilot program. Poor market conditions were identified as the reason that full-scale re-opening of the mine was not pursued by the Blackbird Mining Company.

Summary of CERCLA Actions – In 1983 the State of Idaho initiated a natural resource damage assessment (NRDA) for the Blackbird Mine and clean up pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In 1992, the State of Idaho filed an action pursuant to CERCLA and various Idaho laws for cleanup, cost recovery and natural resource damage action pursuant to CERCLA. Subsequently, the United States joined the suit, bringing claims for cleanup, cost recovery, and natural resource damages under CERCLA and the Clean Water Act, and alleging violations of the Endangered Species Act. In 1995, a Consent Decree (No. 83-4179 *State of Idaho, et al. v. The M.S. Hanna Company et al.*) was lodged committing the defendants (the BMSG) to implementing a restoration plan; meeting water quality standards; restoring water quality in Panther Creek and Big Deer Creeks to levels capable of supporting anadromous and local fisheries by a specified date; and implementing the CERCLA remedy and other response actions selected by EPA through separate consent decrees or administrative orders. EPA has negotiated or required the BMSG to conduct emergency response actions to address imminent releases from the West Fork Tailings Impoundment; non time-critical removal actions (the Early Actions) conducted in the Bucktail Creek basin and in the Meadow/Blackbird Creek basin to address water quality and along Panther Creek to address human health concerns; and investigations and studies to complete a Remedial Investigation/Feasibility Study (RI/FS). EPA issued the Record of Decision (ROD) for the Site in 2003**.**

Emergency Response Actions were conducted in 1993 at the West Fork Tailings Impoundment to minimize the potential for release of tailings into Blackbird and Panther Creeks. These actions were conducted pursuant to an Administrative Order on Consent (AOC) issued by EPA to the Blackbird Mine Site Group (BMSG – a consortium of companies with environmental liability at the Blackbird site) in July 1993 (EPA Docket No. 1093-07-04-106). Prior to these actions, West Fork Blackbird Creek flowed through a buried concrete culvert beneath the tailings pile and there was concern that mass failure of the tailings storage facility was possible if the culvert became plugged. The Emergency Response Actions included construction of a new lined channel and spillway for the West Fork of Blackbird Creek over the tailings.

From 1995 to 2002 additional non time-critical removal actions (Early Actions) were conducted pursuant to an AOC issued by EPA to the BMSG in June 1995 (EPA Docket No. 10-95-0083). From 1995 through 1998 Early Actions were focused on controlling sources of acid rock drainage that were impacting water quality. From 1999 to 2001 Early Action activities consisted of sediment removal along Panther Creek and Blackbird Creek to mitigate potential risk to human health associated with elevated levels of arsenic present in mine related deposits. These actions have also reduced potential risk to terrestrial and aquatic ecological receptors. During the fall of 2002 additional collection and diversion of waters, and waste rock isolation in the Bucktail Creek and Meadow Creek drainage basins that were not intercepted during previous actions, was completed to reduce contact of clean surface water with metal bearing sediment. The water treatment plant that treats water from the Blackbird mine and is located approximately 1,200 feet downstream from the confluence of Meadow Creek and Blackbird Creek was also upgraded and expanded. The upgraded treatment plant has a capacity of 800 gpm and discharges treated water to Blackbird Creek.

Early Actions activities in the Bucktail Creek drainage immediately adjacent to the ICP included:

- Construction of an earth fill clay-core dam (7,000 level dam) and pipeline and open-channel spillway to collect, store, and divert contaminated water to the water treatment plant via the 6,930 level adit to the underground mine workings. The 7,000 level dam is approximately 70 feet high and impounds a reservoir with a maximum surface area of 0.52 acre and a maximum storage capacity of 5.85 acre-feet.

- Construction of a new adit at elevation 6,930 to connect to the 6,850 level of the old mine workings. The 6,930 level adit extends approximately 1,300 feet into the mountain and is used to transport the contaminated water from the Bucktail Creek basin into the mine, where it can be conveyed to the water treatment plant.
- Construction of a pump station and pipeline located downstream of the 7,000 level dam. The pump station and pipeline is used to collect and convey springs and dam seepage and pump it to the 6,930 adit for transport through the mine to the water treatment plant.
- Relocation of waste rock piles, with disposal in the Blacktail Pit.
- Creation of a waste rock repository (Blacktail Pit), including a foundation drainage system to drain water entering the former pit into the old mine workings and to the water treatment plant.
- A series of clean water ditches and pipelines to divert clean water around the waste rock dumps and the 7,000 level dam reservoir, and transport the clean water to Bucktail Creek downstream of the 7,000 level dam.
- The 7,200 level collection ditch to collect contaminated water from the remainder of the West Lobe waste rock dump and direct the contaminated water toward upper Bucktail Creek upstream of the 7,000 level dam.
- A series of sediment control ditches within the waste rock to remain in place.
- Debris traps located in the Bucktail Creek channel to reduce the risk of debris flows.
- Two temporary sediment control dams to settle out sediment generated during construction activities and sediments from residual debris flow materials along Bucktail Creek. The upper sediment control dam located just upstream of the upper access road crossing of Bucktail Creek and downstream of the pump back station was removed in 2005. The lower sediment control dam is located just upstream from the lower access road crossing of Bucktail Creek.
- Relocation of a portion of the debris flow material along Bucktail Creek between the upper and lower sediment dams. This debris flow material was disposed of in the Blacktail Pit.
- Rehabilitation of the 6,850 level to allow for the transport of contaminated water from the Bucktail drainage to the water treatment plant and allow for ingress/egress of men and materials to the 6,850 bulkhead.
- Construction of a cutoff wall in Bucktail alluvium, seepage collection and pipeline to pump captured water to water treatment.

Remedial Investigation/Feasibility Study (RI/FS) – EPA RI/FS activities have been conducted pursuant to an AOC issued by EPA to the BMSG in November 1994 (U.S. EPA Docket No. 10-94-0222). The RI was initiated in 1995; however, much of the data collection (especially water quality data) concentrated on the period after Phases I through III of the Early Actions were completed in 1998. The Early Actions improved water quality in the area creeks downstream from the mine, and the focus of the RI was to address contamination remaining after completion of the Early Actions. The RI was completed in November 2001. The FS evaluated alternatives to address the contamination remaining after the Early Actions were completed. The FS was completed in June 2002.

Remedial investigations were conducted from 1995 through 2001 and are described in detail in the Final Blackbird Mine Site Remedial Investigation Report and in the Remedial Investigation Addendum - 2001 Sample Results. Remedial investigations included studies to determine the nature and extent of contamination in waste rock deposits, tailings deposits, surface waters, in-stream sediments, overbank soils, and groundwater at the Blackbird Mine site and surrounding area. These investigations included an evaluation of the quantity and concentrations of metals (mass loading) released from known or potential sources during various hydrologic conditions. The Early Actions have resulted in a reduction in dissolved metals transported in surface water from the mine area. A major focus of the investigations was to determine the mass loading of metals from residual and remaining sources following implementation of the Early Actions. The RI investigations conducted during 1995 included comprehensive investigations to evaluate the nature and extent of contamination prior to implementing Early Actions. Post-Early Action investigations to evaluate improvements to water quality began in the Spring of 1998 for the portion of the Site that includes

Meadow and Blackbird Creeks, and in the Fall of 1998 for the portion of the Site that includes Bucktail, South Fork Big Deer, and Big Deer Creeks. Information developed during the RI was also used to complete both human health and ecological risk assessments.

Remedial Actions – Additional collection of Bucktail Creek groundwater using wells and seep collection and construction of the lower Bucktail pumpback system have been initiated to increase capture of metal load in Bucktail drainage. The ROD contemplates construction of a diversion utilizing a buried pipeline (BT-5 diversion) that would divert remaining Bucktail drainage water around South Fork Big Deer to Big Deer Creek. This diversion is scheduled for construction in about 2009. Additional metal load reductions in Bucktail and South Fork Big Deer by removal of sediments along these drainages is also anticipated in the ROD and would likely occur in two to three years following completion of the Bucktail diversion.

Contingent Actions – Contingent Actions are activities described in the ROD that might be initiated if cleanup standards are not being met by the previous and remedial actions. The range of Contingent Actions in the Bucktail/South Fork Big Deer drainages includes additional sediment removal, additional water/seep collection, installation of passive or semi-passive treatment systems and additional measures as necessary to meet water quality cleanup levels. The need for or timing of any Contingent Actions is not known and would be determined based on long-term monitoring of South Fork Big Deer, Big Deer and Panther Creeks.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter contains the Agencies' analysis of probable impacts to the natural and human environment that would result from construction and operation of the proposed Idaho Cobalt Project and its associated facilities (ICP or the Project). It also contains the analysis of probable cumulative impacts that would result from adding the proposed project to other existing and reasonably foreseeable activities in the project area.

Some effects are quantified, such as acres disturbed, elevated levels of sedimentation, and expected human population increases. Others are described qualitatively, such as visual resources and quality of life. This section of the environmental analysis describes the consequences of each alternative for the significant issues, concerns, and opportunities (ICOs) identified during the public involvement effort documented in Chapter 1.

For each discipline or issue the effects are quantified or qualified in the following categories:

1. ***Direct effects*** occur at the same time and place as the activity being considered.

2. ***Indirect effects*** occur at a different place or time than the project activities, but can be traced to the original activity or disturbance.

3. ***Cumulative effects*** are defined as collective impacts for the project when considered in conjunction with other past, present, and reasonably foreseeable activities. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. *Cumulative impacts are summarized at the end of this Chapter.*

These categories may be further qualified as follows:

- ***Unavoidable:*** Some adverse effects, which could occur from the ICP, can be eliminated or minimized by management requirements and mitigation measures. Not all effects of the Project can be avoided however, and these are identified as ***unavoidable***.

- ***Irreversible and Irretrievable:*** An irreversible or irretrievable commitment of resources would occur when resources were either consumed, committed, or lost as a result of the Project. The commitment of a resource would be ***"irreversible"*** if the Project resulted in a "process" (chemical, biological, and/or physical) that could not be stopped or reversed. As a result, the resource, its productivity, and/or its utility would be consumed, committed, or lost forever. Commitment of a resource would be considered ***"irretrievable"*** when the Project would directly eliminate the resource, its productivity, and/or its utility for the life of the Project or longer. *These impacts are discussed at the end of this chapter when they are expected to occur to a given resource.*

- ***Potential vs. predicted:*** In the DEIS the agencies have tried to distinguish between a predicted effect and a potential effect or risk. Predicted effects are specifically identified as such, and described in terms of magnitude, duration, and significance. These effects are those that are reasonably certain to occur. Where appropriate they are described by the terms short-term, long-term, irreversible, unavoidable and irretrievable. Effects or risks that are not predicted, but which have a potential to occur, are identified along with some estimate of the likelihood or probability of their occurrence. These potential effects are recognized and described to ensure full disclosure of risks, and to ensure that reasonable steps are taken to minimize them. Potential effects or risks are not predicted to occur, however they are described in the EIS to illustrate the potential range of impacts if the analysis is not correct or if mitigation measures are not applied.

- ***Short-term*** vs. **Long-Term**: **Short-term** impacts or effects of the project are those that would occur during the life of the project. ***Long-term*** impacts from the project are those that would persist beyond final closure and reclamation. Impacts can be both short and long-term and should be considered to be both unless otherwise specified. *The relationship between short-term uses of the environment and long-term productivity is discussed at the end of this chapter.*

Qualitative terms describe anticipated magnitude of impacts and anticipated importance of an impact. ***"Significant," "potential to become significant,"*** and ***"insignificant"*** describe importance (as defined in NEPA 40 CFR **§** 1508.27). "Significant" used in NEPA analysis requires considerations of both context and intensity. This means that the significance of an action must be analyzed in several contexts such as society as a whole, regional or local. Intensity refers to the severity of impact and includes consideration of impacts to other laws, regulations or federally protected resources. Impacts are considered to be insignificant unless identified otherwise.

Assumptions for the Action Alternatives

Assumptions made as part of the agencies' analyses are listed below.

Assumptions for Alternatives II through V include:

- Cobalt supply/demand, labor, equipment, and market conditions are beyond the scope of this EIS; however it is assumed that any changes in these factors would not materially change projected level of development.

- Mine production would last about 10 to 12 years as described in FCC's Plan. Significant addition to the ore reserves and expansion of the mine are outside the scope of the current analysis. Mining and reclamation technology would not change substantially throughout mine life.

- It is anticipated that the majority of reclamation would be completed within two to three years following mine closure. Monitoring or mitigation would continue for a number of years after reclamation is complete depending on which alternative was selected, results of operational monitoring and regulatory requirements.

Methodology

Methods used to gather data and conduct the impact analysis and more detailed technical reports for all resource areas are on file at the Salmon-Challis National Forest (SCNF) where they may be reviewed by appointment during regular business hours. Appendix A contains a listing of technical reports submitted by FCC and developed by the EIS team that were utilized in evaluation of the ICP.

Direct, Indirect and Cumulative Impacts of Alternatives Considered

Geology and Geotechnical Characteristics

Summary

Construction of the project facilities for all action alternatives would alter the existing topography in the tailings and waste rock storage facility (TWSF) area. The TWSF would result in a minor alteration of existing topography. Mining would result in total production of an estimated 43 million pounds of

cobalt, 50 million pounds of copper and 55,000 troy ounces of gold. This would increase domestic production of these metals and would have a positive effect on the U.S. gross national product and reduce the need to import cobalt from foreign producers.

Project facilities constructed on the Big Flat area would have suitable foundation materials for the proposed design and if constructed in accordance with proposed design standards would be geotechnically stable in the long-term. Facilities planned for the north-facing slope of the Bucktail drainage, including the adit and tram system, would be on steep slopes and require special design requirements to ensure long-term stability. Existing and proposed new roads occur on a variety of slopes and foundation materials.

Data that pertain to acid rock drainage (ARD) and metal leaching (ML) potential have been analyzed and indicate a low total acid production potential and a possibility of near neutral pH metal mobility. Geochemical impacts are discussed in more detail in the Water Resources Technical Report (Hydrometrics, 2006).

Alternative I – No Action Alternative

If the ICP is not developed, there would be no impacts to the geological or geotechnical resources of the area resulting from the no action alternative. Current impacts to these resources associated with historic mining and cleanup activities at the Blackbird Mine would continue to be the significant geological and geochemical effects in the general area. The Idaho cobalt belt would continue to be the focus of exploration and development interest as one of the only identified primary cobalt resources within the United States. Future development of one or more mines in the Idaho cobalt belt would continue to be a possibility; however, such development is too speculative to be considered a reasonably foreseeable activity.

Alternative II - Company's Proposal

Geology and Ore Reserves - Current mineral resources of the ICP deposit are estimated by the applicant to be about 3.78 million tons at an average grade of 0.62 percent cobalt, 0.67 percent copper and 0.016 troy ounces of gold per ton. Mining would result in a total production of about 43 million pounds of cobalt, 50 million pounds of copper and 55,000 troy ounces of gold. The ICP could supply approximately 16 percent of the annual U.S. demand for cobalt, which is currently mostly imported.

Topography - Construction of the surface facilities, tailings impoundment, and deposition of adit waste rock for the ICP would alter the existing topography and surface drainage system. The TWSF would remain as a permanent landform feature following mining operations.

Geotechnical – FCC's TWSF would be constructed at the "Big Flat," within the ICP Project Area where ground slopes are generally around 6 or 7 percent. There are no significant direct or indirect projected geotechnical impacts from the applicant's proposal.

Tailings and Waste Rock Facility - FCC proposes to place approximately 2.5 million cubic-yards of tailings and waste rock in a 55-acre facility located on the Big Flat. The site proposed by FCC is on some of the flattest natural ground available on the mine site. In addition, FCC has ensured the stability of the TWSF by using relatively gentle slopes of 4 horizontal to 1 vertical (4H:1V) and by providing 100-foot wide benches at heights of 50 and 100 feet. FCC has demonstrated that the factors of safety for stability which would be achieved by their design for the TWSF exceed the minimum standards for structures of this type. There are various standards for stability that provide guidance to the project. Idaho's Mine Tailings Impoundment Structures Rules (IDAPA 37.03.05) lists a standard for static stability of 1.5, as does Department of Interior (30 CFR Sec. 816.73).

Water Management Ponds - FCC proposes to construct a lined pond on the Big Flat with a volume of 10-million gallons. This pond presents no impact to the existing geotechnical environment as long

as the liners prevent underlying soils from saturating. FCC has proposed to use a double-liner design that would provide a significant amount of protection against leakage.

Roads - FCC proposes to construct roads some of which would be on very steep slopes. New roads would be constructed in compliance with Forest Service standards and in accordance with Mine Safety and Health Administration (MSHA) regulations (safety berms) and would have storm water ditches and sediment control measures in accordance with Best Management Practices (BMP's) for Mining in Idaho guidelines (IDL, 1992) to control storm water runoff. Although these standards do not directly address geotechnical concerns, roads built to Forest Service standards in this area have shown little evidence of stability problems.

Ram Portal - The pad constructed at the adit portal facility in Ram Gulch would be on a steep slope and would require specialized construction techniques to ensure stability. To construct a suitably large level surface on a very steep hillside at the Ram Portal, FCC proposes to use a reinforced earth construction technique. In a reinforced earth structure, layers of geosynthetics are used to add the required shear and tensile strength to a soil embankment to give it an adequate factor of safety for stability. Although this type of construction is sensitive to surface runoff drainage considerations, it is a well established construction method that should not impact the existing stability of the hillside as long as it is designed and constructed properly.

Subsidence - Surface subsidence associated with subsurface mining is typically limited in extent to the area above the portal tunnels and mine workings. In rock formations, this subsidence is mostly realized by frictional sliding on pre-existing faults and joints and occasionally by fracture propagation. For the proposed 13-foot wide portal tunnels, once the overburden depth reaches 65 feet, the amount of surface subsidence resulting from a total collapse of the tunnel is unlikely to exceed 1.3 feet. This suggests that if the portal tunnels were to someday collapse, subsidence on the surface above the mine workings could be evident over a maximum horizontal distance of about 90 feet.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Geology and Ore Reserves - There would be no substantive differences between effects of Alternative II and III with respect to geology and ore reserves.

Topography - Construction of the surface facilities, tailings impoundment, and deposition of adit waste rock for the ICP would alter the existing topography and surface drainage system. The TWSF would remain as a permanent landform feature following mining operations.

Geotechnical – In Alternative III, the Tailings and Waste Rock Facility would be relocated to the north of the mill site on the "Big Flat," where ground slopes are slightly steeper than for Alternative II. In addition, Alternative III proposes minor changes to the road cuts and the reinforced earth structures at the Ram Portal that may reduce the impacts of these structures on the existing geotechnical environment.

TWSF - Under Alternative III the TWSF would have a similar footprint and have the same basic design as in Alternative II, but be located to the northeast of the mill site where the land has an existing slope of 12 percent to 16 percent, which is steeper than for Alternatives II, IV and V (8 percent). This steeper slope would affect the potential geotechnical stability of the TWSF. However, the configuration for the TWSF proposed for Alternative III would be stable and exceeds the minimum standards for structures of this type; even though it provides a slightly lower factor of safety than the TWSF as located in Alternatives II, IV and V.

Roads - Alternative III would include a number of mitigation measures to improve access roads. Some of these mitigation items would improve drainage, reduce sediment yield, address traffic safety issues or reduce risk of flood damage.

Ram Portal - Under Alternative III the Forest Service would require facilities placed on the adit patio fill to include a 5 foot setback from the edge of the fill (both cut and fill slope edges). Additionally, any non-bedrock portions of the uphill cut above the portal pad would need to either be reinforced or reduced in slope to a range of ¾H:1V to 1.5H:1V, depending on the soil conditions.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Geology and Ore Reserves – There would be no substantive differences between effects of Alternative II, III and IV with respect to geology and ore reserves.

Topography – The only difference in effects of Alternative III and IV would be that the TWSF would be increased in size and because it would be constructed on a steeper slope, it would be higher (about 175 feet versus 150 feet).

Geotechnical – In Alternative IV, the Tailings and Waste Rock Facility would be constructed at the same location on the "Big Flat," as for Alternative II; however, the size of the TWSF facility would be reduced to more closely match the existing ore reserves. Alternative IV proposes minor changes to the reinforced earth structure at the Ram Portal that would reduce risk of geotechnical problems as described in Alternative III.

TWSF - Under Alternative IV the TWSF would have a smaller initial footprint than Alternative II (36 acres vs. 55 acres), otherwise geotechnical characteristics would be similar.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Geology and Ore Reserves - There would be no substantive differences between effects of Alternative II, III, IV and V with respect to geology and ore reserves.

Topography – Mine facility construction would be the same for Alternative V as for Alternative IV.

Geotechnical – Mine facility construction and potential effects to the geotechnical environment would be the same for Alternative V as for Alternative IV.

Water Resources

Summary

Water resource conditions in the project area would be modified from existing conditions under all alternatives. In all alternatives, surface water quality improvements would occur from the ongoing Blackbird Mine cleanup. All action Alternatives (II, III, IV, and V) would result in:

- Short-term increase (during construction) and long-term improvements (reduction) in the sediment yield to Bucktail Creek due to road reclamation;
- Short-term to long-term changes in groundwater quantity and quality in the vicinity of the underground mines;
- Short-term to long-term changes in flow and water quality in area streams, seeps, and springs; and
- Long-term commingling of Sunshine Mine and Blackbird Mine waters with subsequent capture and treatment of water (with the exception of Alternative III).

All action alternatives would require FCC to obtain NPDES discharge permits prior to mining for discharge of treated mine water to Big Deer Creek (Alternatives II and IV), Big Flat Creek (Alternative III), or Blackbird Creek (Alternative V). All mining alternatives may also require an NPDES discharge

permit during closure for release of water from the flooded Ram mine to Ram Spring, a tributary to Bucktail Creek. All action alternatives will require NPDES permits for authorization of stormwater discharges during construction and operations.

The terms ***"significant," "potential to become significant,"*** and ***"insignificant"*** describe the importance of the impacts to water resources. "significant" used in NEPA analysis requires considerations of both context and intensity. The significance of the anticipated water resource effects was considered in the context of regional (Panther Creek watershed) and local (e.g, Bucktail Creek watershed) water resource conditions, Idaho water quality standards, the Blackbird Mine cleanup, and the probability of occurrence of an impact. Intensity refers to the magnitude or severity of impact. In particular, the determination of the significance of impacts to water resources considered the magnitude of the change in water quality or water quantity relative to current water resource conditions, Idaho water quality standards, Blackbird Mine cleanup goals, and limitations and uncertainties of the analysis methods.

Effects to water resources are considered to be significant impacts if:

1. The effect is expected or is likely to occur;
2. The magnitude of the effect is large relative to current or anticipated future water resource conditions;
3. The magnitude of the effect is large relative to the uncertainty in the method of analysis of impacts;
4. The effect results in a change in the status of compliance with drinking water standards in areas of domestic use, aquatic life criteria, or Blackbird cleanup goals; and
5. Mitigation of the adverse effect is not provided or is not anticipate to be effective.

The significance of some predicted effects is strongly dependent on future conditions, the amount of uncertainty that is ascribed to effects estimates, and the probability of occurrence that is selected to represent the expected effect. Some predicted water resource effects that fell short of significance when judged by these five criteria above, would become significant if certain future conditions were to occur. Such impacts are described as having the "potential to become significant" and the conditions that would lead to significant impacts are described.

Most predicted water resource changes and impacts from the alternatives are insignificant. Changes that are considered to be significant or have the potential to become significant are:

1. In all alternatives, short-term and long-term significant improvements in surface water quality would occur from the ongoing Blackbird Mine cleanup. Streams that do not currently meet water quality standards and have impaired aquatic life conditions (Big Deer Creek, South Fork Big Deer Creek, Panther Creek) will be improved and EPA and the State of Idaho project that water quality standards in these streams will consistently be met during the life of the ICP.
2. In all alternatives, the ongoing Blackbird Mine cleanup would cause significant short-term and long-term decreases in surface water flows in lower Bucktail Creek and South Fork Big Deer Creek due to the planned BT-5 pipeline that would divert Bucktail Creek around South Fork Big Deer Creek to Big Deer Creek.
3. Alternative II may cause changes in surface water quality in Big Deer Creek that have the potential to become significant after closure. If actual conditions were to be worse than expected (but within the range of possible outcomes), the changes in water quality caused by Alternative II might not be fully mitigated by the proposed groundwater capture and treatment system and exceedance of the copper aquatic life criterion in the streams could occur.
4. All action alternatives that allow mine flooding during and after closure (Alternatives II, IV, and V) would cause water quality changes in Ram Spring that have the potential to become significant. Ram Spring is a tributary to Bucktail Creek. Currently, copper concentrations in Ram Spring are much lower than Bucktail Creek but higher (worse) than the surface water quality standard. Alternatives II, IV, and V would cause copper concentrations in Ram Spring to increase. This increase in copper concentration in Ram Spring is not considered to be

significant because Bucktail Creek is not expected to be cleaned up to meet water quality standards (IDEQ, 2002) and the copper mass load from Ram Spring is very small and would have a negligible effect on Big Deer Creek. The changes in Ram Spring have the potential to become significant only if the changes preclude attainment of water quality standards in Bucktail Creek or downstream waters. Concentrations of metals other than copper and zinc are not predicted to exceed water quality standards.

Noteworthy changes to water resources that are considered to not be significant and are not considered to have the potential to become significant include:

1. Expected (most likely case) changes in water quality and quantity in South Fork Big Deer Creek, Big Deer Creek, Panther Creek or Blackbird Creek occurring in Alternatives II (with post-closure mitigation of groundwater capture and treatment), III, IV, and V during and after mine operations are not expected to be significant. In the expected case with post-mining groundwater capture and treatment, all action alternatives adequately mitigate post-mining water quality effects from the underground mines.
2. Surface water quality effects of Alternatives III, IV, and V are considered to not have the potential to become significant. Unlike Alternative II, these Alternatives include additional mitigation measures (amendment of waste rock slash and additional groundwater capture and treatment provisions) that reduce the risk that impacts to surface water quality in Big Deer Creek would become worse than expected after closure. Thus, in contrast to Alternative II, the impacts to Big Deer Creek predicted for Alternatives III, IV, and V are not considered to have the potential to become significant, even if worst case conditions were to occur.
3. Alternative II is predicted to cause an increase in copper concentration in groundwater near the Sunshine Mine during and after closure that may exceed the Idaho groundwater quality standard. The environmental impact of the elevated copper concentrations is not considered to be significant as there is no beneficial use of groundwater currently in the area. However, there may be regulatory ramifications if copper concentrations were to exceed groundwater quality standards or violate the anti-degradation provisions of the Idaho Groundwater Quality Rule.
4. Alternatives II, IV, and V are predicted to cause increases in metal concentrations in groundwater near the Ram Mine that may constitute a lowering of water quality even though no water quality standards are predicted to be exceeded. The environmental impact of the elevated metal concentrations is not considered to be significant as there is no domestic use of groundwater currently in the area. However, there may be regulatory ramifications if the increase in metal concentrations constitutes degradation under the Idaho Groundwater Quality Rule.
5. All action alternatives are predicted to cause sulfate concentrations in groundwater to increase above existing conditions or exceed Idaho groundwater quality standards in the vicinity of the mines (Alternatives II, IV, and V), the TWSF (all alternatives) and the LAT (Alternative III) during and after mine closure. The environmental impact of elevated sulfate concentrations is not considered to be significant as there is no domestic use of groundwater currently in the area. However, there may be regulatory ramifications if sulfate concentrations were to exceed groundwater quality standards.
6. All action alternatives that allow mine flooding during and after closure (Alternatives II, IV, and V) would likely result in co-mingling of ICP mine waters and chemical mass loads with waters that are captured and treated by BMSG. From the perspective of environmental impact, this co-mingling is not considered to be significant as: 1) the quantity of ICP water and chemical mass loads potentially intercepted by BMSG is expected to be very small; 2) water captured by BMSG would be treated prior to release to the environment; and 3) ICP alternatives for groundwater capture/treatment systems would likewise intercept and handle water and chemical mass loads from BMSG sources in Bucktail Creek drainage. Co-mingling of waters has possible ramifications if commingling were to interfere with the Blackbird cleanup.
7. All action alternatives are predicted by the DSM to cause slight increases in cobalt and copper concentrations in South Fork Big Deer Creek in the early years of the project, prior to completion of the Blackbird cleanup. These model-predicted increases are not considered to be significant because it is unlikely that the changes would significantly worsen stream quality

or interfere with the Blackbird cleanup; cobalt and copper chemical mass loads to the stream from the ICP are actually decreased during this period; and the ICP is predicted to result in decreases in cobalt and copper concentrations in Big Deer Creek during this same period. Upon completion of the cleanup, the ICP is not predicted to cause changes in cobalt or copper concentrations in South Fork Big Deer Creek.

Cumulative effects of the ICP include short-term and long-term beneficial effects to surface water quality in all alternatives with implementation of the Project due to ongoing and proposed activities of the Blackbird Mine Cleanup. Other cumulative effects would include reduced flows in the Bucktail drainage from Blackbird remediation and ICP activities, continued but improving metals loads to area streams and continued poor groundwater quality in the Bucktail drainage.

Water Resource Effects Evaluation - The foundation of the water resource effects evaluation is the environmental data collected by field and laboratory testing and measurement of water resource media (groundwater, surface water, climate, soils, geochemistry of mining-related rock) summarized in Chapter 3 and described in detail in the Water Resources Technical Report (Hydrometrics, 2006). The water resource characterization data was used to develop conceptual and quantitative models to describe potential water resource effects under existing and future possible water resource conditions and the mine water management systems provided by the various alternatives. The goal of describing potential water resource effects with the models is to provide a means for comparison of the relative performances of the alternatives and to provide estimates of potential effects to site waters from the alternatives. Because all models fall short of being exact representations of the physical world, some level of professional judgment is required in interpretation of model results.

The water resource characterization data was initially used to develop conceptual and quantitative deterministic models for: 1) hydrologic and geochemical processes related to surface water and groundwater flows and quality, 2) climatic processes (i.e., rain and snowfall, evaporation, temperature, etc.), 3) mine facility performance, and 4) geochemical properties of mining-related rock. Many of the water resource effects were predicted wholly or in part using these media-specific deterministic models as described in the Water Resources Technical Report (Hydrometrics, 2006). These models are deterministic, meaning that single values were used as input parameters to the models and the models then provide a single unique set of model results, such as a single predicted copper concentration for a particular day and location.

Dynamic Systems Model (DSM) - In addition to the media-specific models, the conceptual models of the hydrologic, climatic, geochemical and mine facility processes were incorporated into a single, stochastic dynamic systems model (DSM) that was used to evaluate the storage and process pond capacities and the cumulative effects of mining on water flows and water chemistry within the Panther Creek watershed. The DSM model is a representation of the climatic, hydrologic and geochemical processes that occur within the proposed mine and in potentially affected receiving waters. The DSM was originally developed for Alternatives I and II by Telesto (Telesto, 2005), a contractor to FCC, in coordination with the EIS team. The EIS team then conducted an independent evaluation of the model, verifying, validating, and modifying (in coordination with Telesto) the model to represent all Alternatives (Hydrometrics, 2006). Results of the Telesto DSM may be found in Telesto (2005 and 2006b). Unless otherwise stated, all results presented in this Section of the EIS are based on the EIS team DSM as described in Appendix A of the Water Resources Technical Report (Hydrometrics, 2006). Tables summarizing DSM-predicted changes in surface water flow and groundwater and surface water concentrations of arsenic, cobalt, copper, nickel, zinc, sulfate, and nitrate for all alternatives and all project periods are provided in Appendix B.

The DSM is a stochastic or probabilistic model in the sense that a range of input values (e.g. a probability distribution) rather than single values are used as input parameters to the model and numerous separate model runs (called iterations or realizations) are performed using statistically derived combinations of input values. The DSM then provides a range of predicted results such as a range of copper concentrations for a particular day and location. To make sense of the results of the DSM, statistical analyses were performed to summarize the range of predicted results. For each

model output, such as daily copper concentration in mine water, the results are ranked from highest to lowest. The model result for which one-half of the predicted values are lower and one-half are higher is the median (50th percentile). The median result from a model simulation is called the "most probable" or "expected case" result. The result that corresponds to the lowest 10th percentile (e.g. 90 percent of values are higher) is called the "best case" or 10th percentile case. Finally, the result that corresponds to the highest 10th percentile (e.g. 90 percent of values are lower) is called the "worst case" or 90th percentile case.

The terms "best case" and "worst case" can be misleading because these terms have historically been used to represent highly unlikely, to impossible, scenarios. A better way of understanding the "best" or 10th percentile case as used in this analysis is that this case or better is possible (with about a 1 in 10 likelihood of occurrence). The best case would occur if actual conditions during mining were better than expected (e.g. mine water pH is at the higher end of the predicted range, groundwater capture efficiency is better than expected, etc.). Similarly, the "worst" or 90th percentile case is the case or worse is possible (with about a 1 in 10 likelihood of occurrence). The worst case would occur if actual conditions during mining were worse than expected (e.g. mine water pH is at the low end of the predicted range, etc.).

The water resource effects analysis was conducted for the entire duration of mining and mine closure and the DSM provides daily values for the entire 50-year model period. However, for ease of discussion and comparison of effects between mining phases, mining alternatives, and Blackbird cleanup changes, the following project periods were defined for the effects evaluation:

- Ram Operations pre-BT-5: The period from the beginning of mining through Ram operations before construction of the BT-5 Bucktail bypass system and before Blackbird cleanup goals are met (years 0 through 5).
- Ram Operations: During Ram operations after BT-5 is operational and Blackbird cleanup goals are assumed to be met (years 5 through 12).
- Sunshine Operations: Final mining period when both the Ram and Sunshine are actively mined (years 12 through 14).
- Closure Year 5: This represents the period soon after the mine is re-filled (Alternatives II, IV, and V) when mine water quality and groundwater and surface water effects are likely to be the worst.
- Closure Year 23: This represents the period after post mine-filling (Alternatives II, IV, and V) when mine water quality is likely to have attained, or be close to attaining, long-term conditions.

The Ram and Sunshine operations periods are defined as the period of active mining. The mine filling (flooding) period occurs between the Sunshine Operations and Closure Year 5 periods. During this filling period water is contained within the mine because groundwater inflow is stored within mine voids. During the post-filling period groundwater would flow both into, and out of, the underground mines. Consequently, environmental impacts are more likely to occur during the post-filling period and so the effects analysis focuses on the operations and closure periods rather than the mine filling period.

Constituents of Concern - The constituents of concern (COCs) for the ICP were identified based on comparison of results of geochemical testing and baseline water quality results for area waters with potentially applicable water quality standards. Constituents of concern for the ICP were identified as: aluminum, arsenic, cadmium, copper, iron, lead, mercury, nickel, nitrate, selenium, sulfate and zinc by Telesto (2004). Geochemical evaluation conducted by the EIS team indicated that arsenic, cobalt, copper, nickel, zinc, nitrate and sulfate were the COC's of primary importance. Therefore, DSM results from only this subset of constituents are the focus of the alternatives analysis. Of this subset, the most significant differences between alternatives and between mining periods occurs for copper and cobalt, the parameters that are of greatest concern in the Blackbird, and sulfate. Accordingly, the emphasis is placed on discussion of predicted concentrations of cobalt, copper, and sulfate.

Limitations of the DSM - The DSM is a comprehensive water balance and chemical mass load model of the ICP facilities and surrounding surface water bodies, which provides extensive

information about the internal mechanics of the mine and its interaction with groundwater and surface water. However, the DSM, like any model, contains limitations that must be heeded when interpreting model results.

With two exceptions, the model does not simulate the actual processes that may occur during transport of water or chemical mass from the mine through the soil/groundwater system. The exceptions are the land application system (Alternative III) where chemical adsorption and attenuation are simulated and the TWSF where the time lag in water movement through the piles is modeled. Because groundwater transport processes are not fully simulated, the timing of effects may be improperly calculated in the model if actual transit times are significant. Additionally, DSM results may overestimate impacts to receiving water if significant hydrodynamic dispersion or chemical attenuation occurs in the groundwater system. In particular, the DSM likely overestimates dissolved arsenic concentrations since arsenic attenuation is not modeled in the groundwater system.

With the exception of the underground mines and the TWSF, the DSM is a mass-balance model rather than an equilibrium geochemical model meaning that when two waters such as contact water from the Ram and surface water at WQ-24 are mixed, all constituents are assumed to remain in solution. Observations in Bucktail Creek and South Fork Big Deer Creek indicate that chemical precipitates have historically formed in the streams and not all constituents may remain in solution. Within impacted waters such as Bucktail Creek, a mass balance model will likely overestimate concentrations in receiving water.

Within the underground mines and in TWSF interstitial water, an equilibrium geochemical model is used for predicting metal concentrations. The mine water pH determines the metal levels in mine water based on empirical equations developed from geochemical tests for predicting copper, cobalt, arsenic, nickel and zinc concentrations. This equilibrium modeling approach may over or underestimate metal levels if chemical conditions in the mine water differ from the conditions of the sample tests. Examples of chemical conditions that may not be properly simulated in the DSM include development of anoxic conditions in mine water (e.g. all tests were conducted under oxidized conditions), or accumulation of soluble weathering products over many years of weathering. The equilibrium model presumes that we know or can predict mine water pH after closure. While the EIS team used their best professional judgment to predict long-term pH trends based on acid rock drainage risk and presence of alkaline amendments such as Portland cement, actual pH trends may differ from estimates. The stochastic model input considered pH variations of $\pm$1.0 pH units in the DSM. However, the sensitivity of DSM results to mine water pH suggests that long-term pH trends are critical to potential impacts. As such, reviewers should pay particular attention to predicted pH trends in mine water, and monitoring programs should assess actual pH trends during mine operation and in post-closure.

Some surface water locations, especially Big Deer Creek and South Fork of Big Deer Creek have shown decreasing metal concentrations between the late 1990's and present. Consequently, data used for DSM calibration were collected in 2001 or later with most data obtained in 2004-2005. Although data from 2005 is considered most representative of current conditions, inclusion of data from earlier years was necessary to provide sufficient data to develop statistically significant flow versus metal concentration relationships as needed for the DSM. Although necessary, inclusion of pre-2005 data causes the model to over predict existing metal concentrations prior to 2012. After 2012 this overestimation no longer occurs as ambient concentrations are based on Blackbird cleanup assumptions.

Metals occur and may be transported in water in both dissolved and particulate forms. The DSM considers all metals in all waters (groundwater, mine water, process water, surface water) to be dissolved and does not simulate interactions between dissolved and particulate forms of metals. In interpretation of DSM-predicted groundwater results it should be noted that Idaho groundwater quality standards are based on total metal concentrations (dissolved plus particulate) and that total metal concentrations might be somewhat higher than the predicted dissolved concentrations.

The final limitation of the DSM is that the model is unable to simulate the more complex decision processes that site managers may employ when the mine is operated. If routine monitoring programs detect adverse effects from the mine, site managers or regulatory staff may change the management of the facility to reduce environmental effects. For example, the water treatment system may be modified to increase the removal efficiency for targeted compounds, if they are problematic. This adaptive management process that is commonly employed at mines is not included in the DSM.

Alternative I - No Action Alternative

Geochemistry - Under Alternative I, the ICP mines would not be developed and the mineralized rock would continue to slowly release mildly acidic water containing low to moderate concentrations of metals including arsenic, cobalt, copper, nickel, and zinc to groundwater and ultimately to surface water in the Bucktail Creek drainage.

Groundwater Resources - In Alternative I, groundwater changes occurring as the result of the Blackbird Cleanup would include dewatering of shallow bedrock and alluvial groundwater systems along Bucktail Creek by a system of groundwater capture wells installed by BMSG. Groundwater quality in the Big Flat area would continue to be of high quality while groundwater in the Bucktail Creek drainage would continue to be of poor quality with metal concentrations that exceed federal drinking water standards and Blackbird groundwater cleanup levels in some areas.

Under Alternative I, long-term adverse effects to groundwater in Bucktail Creek would continue from the historic Blackbird Mine disturbances. Concentrations of copper and cobalt in groundwater in portions of the Bucktail Creek drainage currently exceed EPA's acceptable-risk range and human health risk-based cleanup levels for copper and cobalt (USEPA, 2003). In EPA's selected remedy for Bucktail Creek (BT-5), no groundwater controls beyond what is necessary to meet surface water goals in South Fork Big Deer and Big Deer Creeks are proposed. Therefore, high concentrations of copper and cobalt will likely remain in groundwater in Bucktail Creek drainage following completion of the cleanup.

Surface Water Resources - In Alternative I, surface water quality and quantity would be affected by ongoing remedial cleanup activities being conducted by BMSG under the Blackbird Mine cleanup. These actions are predicted by BMSG and EPA (USEPA, 2003) to result in significant long-term improvements in water quality (decrease in metal concentrations) in South Fork Big Deer Creek, Big Deer Creek and Panther Creek. However, EPA and IDEQ have determined that it is unlikely that Bucktail Creek and Blackbird Creek would ever attain aquatic life standards or support fisheries (IDEQ, 1997 and 2002).

These cleanup actions will also result in long-term decreases in streamflow in Bucktail Creek and South Fork of Big Deer Creek due to the continued pumping and transport of groundwater and surface water from Bucktail Creek to the BMSG water treatment plant in the Blackbird Creek drainage. The BT-5 diversion is projected to be installed in 2009 and would divert streamflows in Bucktail Creek around lower Bucktail Creek and South Fork Big Deer Creek to Big Deer Creek. The Bucktail Creek surface water diversion would cause continuous (year-round) reductions in flows in South Fork Big Deer Creek of about 11 percent and in lower Bucktail Creek of nearly 100 percent.

Sediment Yield - Alternative I would maintain existing conditions in regards to sediment production and capture and sediment yields in Bucktail Creek and Big Flat Creek will remain the same as the existing condition displayed in **Table 3-7**. Alternative I causes no changes to physical conditions that influence sediment production and capture. No significant man-influenced changes to sediment production are expected to occur with this alternative, excepting those potential, insignificant changes that result from reclamation of certain roads within the FCC project area as part of FCC's existing exploration plan. Naturally-occurring influences that lessen sediment production and increase sediment capture would continue as the areas burned in the Clear Creek fire continue to re-vegetate.

Sediment Quality – In Alternative I, sediments in area streams would continue to improve as the result of the Blackbird cleanup. Objectives of the Blackbird cleanup remedial actions (USEPA, 2003) are:

- Reduce direct contact with in-stream sediments containing contaminants of concern in excess of the cleanup levels.
- Reduce migration of in-stream sediments to downstream areas so that the cleanup levels for the contaminants of concern established for in-stream sediments at those downstream areas are not exceeded.
- Restore and maintain sediment quality and aquatic biota conditions capable of supporting all life stages of resident salmonids and other fishes in South Fork of Big Deer Creek and Big Deer Creek.
- Restore and maintain sediment quality and aquatic biota conditions capable of supporting all life stages of resident and anadromous salmonids and other fishes in Panther Creek.
- Reduce concentrations of contaminants of concern in Blackbird Creek to improve sediment quality such that cleanup levels are not exceeded in Panther Creek and to support some aquatic life in Blackbird Creek.
- Reduce concentrations of contaminants of concern in Bucktail Creek to improve sediment quality such that cleanup levels are not exceeded in South Fork of Big Deer and Big Deer Creeks.

Fairly extensive removal of contaminated sediments from Bucktail Creek, Blackbird Creek and Panther Creek was conducted during cleanup actions prior to EPA's Record of Decision (2003). The ROD specifies that future remedial actions to address sediment would consist of natural recovery of sediments in Bucktail Creek, South Fork Big Deer Creek, Big Deer Creek, and Panther Creek, and Blackbird Creek with additional contaminated sediment removal in limited areas of Blackbird Creek, near Panther Creek Inn. In Alternative I, sediment quality in Bucktail Creek, South Fork Big Deer Creek, Big Deer Creek, Panther Creek, and Blackbird Creek would be expected to improve through natural recovery such that sediment cleanup levels would eventually be achieved.

Alternative II - Company's Proposal

In Alternative II, mining would follow FCC's proposed plan. The effects of the mine operation on water resources differ depending on the stage of operation. During mine operation, the mines are de-watered, mine water is used in the mill to extract cobalt and copper from ore and then is used to pump cemented tailings paste back to the Ram mine for backfill. Water in excess of what is needed for mining and milling would be treated by reverse osmosis and discharged via a pipeline to Big Deer Creek. Discharge of treated water would be subject to monitoring and limitations of an NPDES permit. If the volume of mine water encountered is not adequate for mining and milling operations, additional make-up water would be obtained from two water supply wells to be drilled near the mill. DSM predictions suggest that approximately two million gallons of supplemental water would be needed during the initial years of mining but that an average of approximately 60 gpm of excess water would need to be discharged during latter years of mining.

During the closure period, which was simulated in the DSM to occur for 30 years, mining and milling would cease and the Ram and Sunshine mines would be allowed to refill or flood. For Alternative II, the model assumes that after closure no groundwater capture or water treatment is employed. This assumption was made in part to evaluate FCC's contention that closure water treatment is not expected to be needed. Therefore, DSM results provide an indication of the need for post-filling water treatment, and also assess the degree to which water collection and treatment protects receiving waters. Actual need for and duration of post-filling water collection and treatment would depend on the actual quantity and quality of the mine water that flows from the mine workings during the closure period.

Summary tables in Appendix B and in the following sections detail the predicted groundwater quality, surface water quality, and stream flow conditions expected in Alternative II and the other alternatives. The following Sections provide additional detail regarding conditions resulting from Alternative II.

Geochemistry - The geochemistry of the ICP is important to water resources because geochemical reactions that occur in the mined and milled rock determine the water quality of groundwater and other waters that contact the rock. The quality of these mining-affected waters ultimately determines the effects of mining operations on groundwater and surface water resources.

The DSM used data derived from the geochemical characterization program to assess the amount of chemical load that would be rinsed from mined rock and to predict the concentrations of chemical constituents in mine water. For the five key metals (arsenic, cobalt, copper, nickel, and zinc), the concentration in mine water was determined by an empirically-derived numerical relationship between metal solubility and the pH of the mine water. The pH in the underground mine and in the TWSF was simulated to vary through time and was based on geochemical test results and professional judgment. The relationship between mine water pH and metal concentration was based on baseline geochemical testing as described in the Water Resources Technical Report (Hydrometrics, 2006).

During mine operation, tailings backfill zones are expected to have an alkaline pH of about 10.5 owing to the pH control exerted by the process solution chemistry and the cement added to the tailings paste. When the mine refills with water, removal of process solution, curing of the cement, and release of stored acidity within the backfill is expected to cause pH to decline to around 8.2. After filling is complete, the pH in the tailings zones are expected to gradually rise over a 25 year period to around 9.2, the value observed in long-term cement curing/leaching tests of tailings. Both potentially acid-generating (PAG) and non-PAG waste rock occur in the Ram and Sunshine deposits and no segregation or special handling of PAG rock is proposed. In waste rock slash zones, pH is expected to be 6.0 during operations, decreasing to 5.8 during filling, then again slowly rising to 6.3 about 25 years after filling.

Ram Mine - During operations, the Ram mine contributes the majority of flow and chemical mass load to the overall mine water balance. During and after closure, the flow through the Ram system is the major potential source of water and chemical load to the upper Bucktail watershed. For the Ram mine the expected concentrations of sulfate in contact solutions (i.e., groundwater) were predicted to increase during the mine operation period as sulfide minerals in the tailings and slash are weathered and soluble oxidation products (sulfate and metals) accumulate. Sulfate concentrations peak at approximately 500 mg/L immediately after mining as the mine refills with water, and then gradually decreases through time as the accumulated sulfate is rinsed out and as sulfate generation ceases to accumulate after slash and backfilled tailings are re-saturated.

For metals, the concentrations were more strongly controlled by mine water pH, which differed for areas of the mine backfilled with tailings as compared to areas with waste rock slash. Expected copper and cobalt concentrations are predicted to be approximately 0.04 mg/L during operations, increasing to around 0.09 mg/L for copper and 0.07 mg/L for cobalt during Closure Year 5, and dropping back to around 0.06 mg/L for copper and 0.05 mg/L for cobalt during Closure Year 23. Arsenic concentrations ranged from 0.003 mg/L during operations to over 0.10 mg/L during closure. Nickel and zinc concentrations in mine water are predicted to remain near ambient pre-mining concentrations throughout operations and closure.

Nitrate is expected to occur in mine water when residual blasting agents are dissolved. The nitrate is contributed solely by the explosives used for mining and is virtually absent from the mined rock and the background groundwater. The DSM used cumulative distribution functions to represent the potential range of residual blasting agent remaining in the waste rock (2 to 8 percent) and the portion of the residual nitrogen that is immediately soluble (65 to 95 percent). Nitrate concentration in mine water is predicted to peak at around 100 mg/L during the early years of mining (when groundwater inflows are low), decline to around 20 mg/L at the end of operations, decline further to around 5 mg/L by Closure Year 5, and return to pre-mining conditions by Closure Year 23.

Sunshine Mine - For the Sunshine mine the expected concentrations of constituents during operations are similar to those described for the Ram mine. During closure, sulfate and nitrate concentrations are expected to continue to remain similar to those described for the Ram mine. Metals concentrations in

the Sunshine are expected to be higher than in the Ram mine due to the lower pH that is expected to occur in the Sunshine. Lower pH is expected due primarily to the lack of tailings backfill and associated alkalinity in the Sunshine. Expected copper and cobalt concentrations are predicted to be approximately 0.04 mg/L during operations, increasing to around 1.5 mg/L for copper and 1.6 mg/L for cobalt during Closure Year 5, and dropping back to around 0.08 mg/L for copper and 0.30 mg/L for cobalt Closure Year 23. Arsenic concentrations ranged from 0.003 mg/L during operations to over 0.100 mg/L during closure. Nickel and zinc concentrations in mine water are predicted to remain near ambient pre-mining concentrations throughout operations and closure.

Tailings and Waste Rock Storage Facility - In Alternative II, the TWSF would consists of two adjacent, mostly separate, piles of tailings and waste rock. Runoff and seepage from both tailings and waste rock would be collected and stored in the water management pond.

Sulfate concentrations in TWSF pore water are predicted to peak at around 1,200 mg/L during operations and decline to about 1,000 mg/L during closure. Nitrate increases to a maximum of about 20 mg/L during operations and gradually decreases during closure. Copper and cobalt concentrations are approximately 0.02 and 0.01 mg/L respectively throughout operations and closure.

Despite the elevated concentrations of sulfate that occurs in the TWSF, the facility contributes little chemical mass load to the watershed during or after closure owing to the small amount of leakage (less than 0.01 gpm) that permeates through the bottom liner of the TWSF.

Mill and Water Treatment System - Water treatment would be conducted in a separate building adjacent to the mill. The Alternative II wastewater treatment plant (WTP) is designed to remove trace metals and dissolved ions such as sulfate and nitrate from the mine and process water for the purpose of controlling the trace metal levels in both the mill process water and the discharge water. Treatment would include pH adjustment by lime addition, precipitation and clarification, followed by filtration. The filtered water would be polished using a three-stage reverse osmosis (RO) utilizing vibratory separation (VSEP) in the second stage to reduce the amount of brine concentrate needing disposal. The solids sludge formed during the precipitation and clarification process would be routed to the mill during operations. The brine concentrate formed during the RO processes would be mixed with bentonite and cement to form a solid, which would be disposed in the TWSF (FCC, 2006).

Table 4-1 illustrates the nominal amount of chemical constituent removal predicted for the Alternative II water treatment system. Predicted influent and effluent concentrations are based on DSM modeling and RO model simulations, respectively as described in *Technical Memorandum – ICP Mine Water RO Conceptual Process Recommendation (*Telesto, 2006h). As shown, reverse osmosis treatment is expected to be very effective in removing metals including copper and cobalt from excess water. The amount of constituent removal presented in **Table 4-1**, would likely be achievable on a relatively continuous basis except for short-term (hours) interruptions due to upsets and variations in treatment effectiveness that would occur. **Table 4-2** describes the variability in predicted water treatment effluent (daily average and daily maximum concentrations) that would likely occur.

Discharge of treated water would be restricted based on effluent limitations and other conditions in the NPDES permit. The draft effluent limits are shown in **Table 4-5**. The Fact Sheet for the draft permit describes in detail how the effluent limits and other permit conditions were developed (EPA 2006 – ref. to fact sheet). Effluent limits are established based on the more stringent of applicable technology-based limits and water quality-based limits. Technology-based effluent limits are imposed to require a minimum level of treatment for industrial point sources based on available treatment technologies. The technology-based limits that apply to the ICP discharge are shown in **Table 4-3**.

Water quality-based effluent limits are calculated based upon meeting state water quality criteria protective of the beneficial uses of the water. State water quality criteria applicable to Big Deer Creek are shown in **Table 4-4**. Where the state authorizes a mixing zone (a defined zone where exceedences of water quality criteria are allowed), dilution can be factored into the calculation of water quality-based limits. No mixing zone was included in calculating the water quality-based effluent limits

TABLE 4-1. Alternative II Water Treatment Predictions (Nominal Concentrations)

Parameter	Pre-Treatment Feed	Ro Feed (Influent)	Ro Concentrate (*Vsep Concentrate*)	Ro Permeate (Effluent)
		mg/L		
Calcium	38-60	58-80	1,500 (*25,000*)	1-2
Magnesium	6-77	6-77	100-8,000 (*150,000*)	0.5-1.5
Potassium	10-208	10-208	150-3,000 (*60,000*)	1-15
Sodium	5-145	5-145	90-2,500 (*60,000*)	<1
Chloride	0.13-25	15.13-40	300-1,000 (*20,000*)	2.5
Sulfate	200-790	200-790	4,000-12,000 (*200,000*)	10
Alkalinity	10	10	150 (*3,000*)	0.5
Fluoride	0.1-0.2	0.1-0.2	<2	<0.02
Nitrate-N	10-54	10-54	150-750 (*12,000*)	3-8
Silica	5-30	5-30	100-600 (*4,000*)	1
Thiosulfate	<1-40	<1-40	<800	<1
Xanthate	<1-30	<1-30	<600	<1
		mg/L		
Aluminum (Al)	56-150	10-50	200-1,000	<2.5
Silver (Ag)	<0.1	<0.1	<2	<0.05
Arsenic (As)	6-200	10-50	200-1,000	<2.5
Boron (B)	42-54	42-54	840-1,080	<2.7
Barium (Ba)	2-5	2-5	40-100	<0.25
Beryllium (Be)	<5	<5	<100	<0.25
Bismuth (Bi)	<0.3	<0.3	<6	<0.015
Cadmium (Cd)	<0.1	<0.1	<2	<0.05
Cobalt (Co)	1-594	<50	<1,000	<2.5
Copper (Cu)	1.3-35	<10	<200	<0.5
Iron (Fe)	<1-1,750	<20	<400	<1
Mercury (Hg)	---	---	---	---
Lithium (Li)	<5	<5	<100	<0.25
Manganese (Mn)	20-6,000	5-50	100-1,000	<2.5
Molybdenum (Mo)	18-25	<20	<400	<1
Nickel (Ni)	2-5	<5	<100	<0.25
Lead (Pb)	<0.2-0.3	<0.3	<6	<0.015
Antimony (Sb)	0.7-1	<1	<20	<0.05
Selenium (Se)	8-16	8-16	160-320	<0.8
Tin (Sn)	<1	<1	<20	<0.05
Strontium (Sr)	27-42	27-42	540-8400	<2.1
Titanium (Ti)	<3	<3	<60	<0.15
Thallium (Tl)	<0.2	<0.2	<4	<0.01
Vanadium (V)	<0.9-1.0	<1	<20	<0.05
Zinc	2-53	1-10	20-200	<0.5

Telesto, 2006h

1. Values shown are the nominal amount of chemical constituent removal predicted for the Alternative II water treatment system and are shown only to illustrate the relative effectiveness of the treatment. Predicted influent and effluent concentrations are based on DSM modeling and RO model simulations, respectively as described in *Technical Memorandum – ICP Mine Water RO Conceptual Process Recommendation (*Telesto, 2006h).
2. Metals concentrations are for total constituents.

TABLE 4-2. Estimates of Pollutant Discharge Through Outfall 001 (Average and Daily Values)

Pollutant	Maximum Daily Value		Average Daily Value	
	Concentration	Mass	Concentration	Mass
Biological Oxygen Demand	1 mg/l	0.818 kg	1 mg/l	0.610 kg
Chemical Oxygen Demand	1 mg/l	0.818 kg	1 mg/l	0.610 kg
Total Organic Carbon	1 mg/l	0.818 kg	1 mg/l	0.610 kg
Total Suspended Solids	30 mg/l	24.5 kg	15 mg/l	9.2 kg
Flow	150 gpm	---	112 gpm	---
Ammonia (as N)	1 mg/l	0.818 kg	1 mg/l	0.6104 kg
Temperature (Winter)	55° F	---	35° F	---
Temperature (Summer)	55° F	---	40° F	---
pH	9 s.u.	---	7.5 s.u.	---
Nitrate + Nitrite as N	10 mg/l	8.18 kg	6 mg/l	3.66 kg
Sulfate	250 mg/l	204 kg	50 mg/l	31 kg
Aluminum	200 µg/l	164 g	20 µg/l	12 g
Cobalt	38 µg/l	31.1 g	10 µg/l	6.1 g
Iron	300 µg/l	245 g	30 µg/l	18 g
Magnesium	100 mg/l	81.8 kg	10 mg/l	6.1 kg
Manganese	50 µg/l	40.9 g	5 µg/l	3.1 g
Nickel	39 µg/l	31.9 g	5 µg/l	3.1 g
Zinc	26 µg/l	21.3 g	5 µg/l	3.1 g
Arsenic	8 µg/l	6.54 g	5 µg/l	3.05 g
Cadmium	0.09 µg/l	0.074 g	0.05 µg/l	0.031 g
Copper	2.8 µg/l	2.29 g	1.5 µg/l	0.92 g
Lead	0.39 µg/l	0.319 g	0.3 µg/l	0.183 g
Mercury	0.0018 µg/l	0.001 g	0.001 µg/l	0.001 g
Selenium	4 µg/l	3.27 g	2 µg/l	1.22 g
Thallium	2 µg/l	1.6351 g	1 µg/l	0.6104 g

Notes:

- Information presented as reported on Section V. of NPDES Application Form 2D (FCC, 2006a)
- Maximum daily values based on design flow of 150 gpm, average daily values based on estimated discharge
- This table describes the variability in predicted water treatment effluent (daily average and daily maximum concentrations) that would likely occur.
- Metal concentrations are as total metals.

TABLE 4-3. Technology-Based Effluent Limits

Pollutant	Daily Maximum	Monthly Average
Cadmium (µg/L)	100	50
Copper (µg/L)	300	150
Lead (µg/L)	600	300
Mercury (µg/L)	2	1
Zinc (µg/L)	1,500	750
TSS (mg/L)	30	20
pH (s.u.)	Between 6.0 and 9.0	

Note: Table B-1 represents NSPS from 40 CFR § 440.104(a)

TABLE 4-4. Water Quality Criteria Applicable to the Idaho Cobalt Project and Big Deer Creek

Pollutant (µg/l unless otherwise noted)	Cold Water Aquatic Life Criteria		Human Health Criteria [1]	Agriculture Water Supply [2]
	Acute Criteria	Chronic Criteria		
Arsenic	340	150	50	
Cadmium [3]	0.52	0.37		50
Cobalt [4]		86		1,000
Copper [3]	4.6	3.5		500
Iron				5,000 [9]
Lead [3]	13.88	0.54		100
Mercury		0.012		10
Nickel [3]	145	16.1		
Selenium	20	5	4,200	50
Silver [3]	0.32			
Thallium			0.47	
Zinc [3]	36.2	36.5		25,000
Ammonia (mg/l) [6]	5.6	2.34		
Nitrate + Nitrite (mg/l)				100
Sulfate (mg/l)				250 [10]
Sulfide		2		
pH (s.u.)	Within the range of 6.5 – 9.5 [5]			
Temperature (°C) [7]	Maximum daily ≤ 19			
WET (TU_C)	Surface waters shall be free from toxic substances in concentrations that impair designated beneficial uses. [8]			

Notes

1. Human health criteria are for the consumption of organisms only. Values are presented in column C2 for Criteria for Toxic Substances, and apply to all waters designated for recreational use [IDAPA 58.01.02.210.01(b)].
2. Numeric criteria for agriculture water supply are presented for livestock watering (except for iron), and were obtained from the document *Water Quality Criteria 1972* (Blue Book) per IDAPA 58.01.02.252.02.
3. Aquatic life criteria are hardness dependent. The hardness value used in calculating metals criteria was 25 mg/l. Aquatic life criteria expressed as dissolved concentrations.
4. Cobalt criteria was calculated as a site specific value for streams impacted by the Blackbird Mine Superfund cleanup site. This numeric value is based on chronic criteria for the protection of cold water aquatic life (Allans, 2005), and is being incorporated into the draft permit under the hazardous materials narrative criteria at IDAPA 58.01.02.200.01 and 40 CFR § 122.44(d)(1)(vi)(A).
5. General Criteria applicable to all aquatic life use designations (IDAPA58.01.02.250.01)
6. Ammonia criteria were calculated as a function of temperature and pH of the receiving water per IDAPA 58.01.02250.02.(d). Input parameters represent 95th percentile of temperature and pH values measured at ambient monitoring station WQ-24.
7. As per IDAPA 58.01.02250.02(b) [19°C = 66°F]. If natural background temperatures in the receiving water are above these limits, then the discharge may not raise water temperatures more than 0.3°C above the natural condition on a cumulative basis considering all anthropogenic sources [IDAPA 58.01.02.401.03(a)(v).
8. As per IDAPA 58.01.02.200.02. EPA's recommended magnitude for this narrative criteria at 1 TU_C for chronic toxicity based on a whole effluent toxicity (WET) test (USEPA, 1991). TU_C are chronic toxicity units and are equal to the reciprocal of the effluent concentration that causes no observable effect in chronic toxicity tests.
9. Numeric criteria for agriculture water supply are presented for irrigation water, and was obtained from the document *Water Quality Criteria 1972* (Blue Book) per IDAPA 58.01.02.252..02.
10. The 250 mg/l criteria is a secondary drinking water criteria based on taste and odor thresholds, and is being adopted into the permit based upon narrative water quality standards prohibiting deleterious materials in concentrations that may impair designated beneficial uses (IDAPA 58.01.02.200.03).
11. Metals criteria expressed as dissolved concentrations.

TABLE 4-5. Draft NPDES Permit Proposed Effluent Limits and Monitoring Requirements

Parameter	Units	Effluent Limits and Monitoring Requirements			
		Maximum Daily Limit	Average Monthly Limit	Monitoring Frequency	Sample Type
Arsenic [2]	µg/l	100	50	Weekly	Grab
Cadmium [2]	µg/l	0.52	0.26	Weekly	Grab
Cobalt [2]	µg/l	141	70.4	Weekly	Grab
Copper [2]	µg/l	4.80	2.40	Weekly	Grab
Lead [2]	µg/l	0.90	0.45	Weekly	Grab
Mercury [2]	µg/l	0.12	0.01	Weekly	Grab
Nickel	µg/l	26.52	13.22	Weekly	Grab
Thallium	µg/l	0.95	0.47	Weekly	Grab
Zinc	µg/l	37.02	18.45	Weekly	Grab
Ammonia (total as N)	mg/l	5.62	2.80	2/Month	Grab
Nitrate + Nitrite	mg/l	100	---	2/Month	Grab
Sulfate	mg/l	250	---	2/Month	Grab
Sulfide	µg/l	2	---	2/Month	Grab
TSS	mg/l	30	20	Weekly	Grab
pH	s.u.	Between 6.5 and 9.0 at all times		Weekly	Grab
Dissolved Oxygen	mg/l	Must exceed 6.0 at all times		2/Month	Grab
Temperature	C°	19	---	2/Month	Grab
Iron	µg/l	---	---	Monthly	Grab
Aluminum	µg/l	---	---	Monthly	Grab
Hardness	mg/l	---	---	Monthly	Grab
Chloride	mg/l	---	---	Monthly	Grab
Conductivity	mS/m	---	---	Monthly	Grab
TDS	mg/l	---	---	Monthly	Grab
Whole Effluent Toxicity (WET)	TU_C	---	---	1x/6 months	Grab
Expanded Effluent Testing [1]	---	---	---	3x/5 years	Grab

Notes:

1. Metals limits expressed as total recoverable except for mercury which is expressed as total.
2. Expanded effluent testing includes the 126 chemicals listed in 40 CFR § 131.36. This testing shall occur in years 2, 3 and 4 of the permit cycle, and should occur coincident with WET testing and other routine monitoring.
3. Reporting is required within 24 hours of a maximum daily limit violation.
4. Sulfate limit based on narrative standard and may be modified in final permit.

for the ICP discharge, therefore the water quality-based limits are based on meeting Idaho water quality criteria at the discharge point.

For the most part, the water quality-based limits were more stringent than the technology-based limits; therefore, most of the effluent limits in the draft permit are water quality-based. The exception to this is the TSS limit, the upper pH limit, and the flow limits are technology-based.

The NPDES regulations have special requirements for new sources that prohibit the discharge of process wastewater from mills that use the froth flotation process alone or in conjunction with other processes for the beneficiation of certain ores, including copper ores. This prohibition on the discharge of process water is meant to encourage recycling and reuse of the water. The exception to this no discharge provision is that in the event that annual precipitation falling on the treatment facility and the drainage area contributing surface runoff to the treatment facility exceed the annual evaporation, then a volume of water equal to the difference between annual precipitation falling on the treatment facility and the drainage area contributing surface runoff to the treatment facility and annual evaporation may be discharged.

Wastewater associated with tailings, seepage from the TWSF, and drainage from the ore stockpile is considered process water. In their NPDES application supplement, Formation identified the net precipitation applicable to the NSPS to be 20.2 million gallons/year (38 gpm) based on a non-exceedance probability of 0.2 percent (Formation, 2006a).

To ensure that only the net precipitation volume of process water is discharged, the draft permit includes an effluent limit that prohibits the discharge of wastewater from the TWSF and the ore stockpile in combined flows exceeding 38 gpm (54,720 gpd). FCC will be required to establish an internal monitoring point to continuously measure the combined flow from the TWSF and the ore stockpile. Ambient surface water monitoring requirements for the discharge are listed in **Table 4-6**.

Water Treatment Waste Disposal - Solid sludge formed during the precipitation and clarification process of the WTP would be routed to the mill during operations. The brine concentrate formed during the RO processes would be mixed with bentonite and cement to form a solid, which would be disposed in the TWSF (FCC, 2006). FCC estimates that approximately 500 to 3,000 pounds per day (dry weight basis) and 350 to 1,100 gallons per day of RO waste brine would be generated that would yield 7 to 26 cubic yards per day of stabilized waste for disposal in the TWSF. The range in estimated waste reflects variations in the amount and constituent concentrations of the water treatment feed water. The EIS team independently reviewed FCC's projections of RO waste brine generation and concluded that, although within the range of potential brine generation rates, FCC's brine projections were optimistic given the lack of actual pilot-scale water treatment testing. Therefore, the EIS team more conservatively estimates that actual brine volumes could be approximately four to ten times higher than FCC's projections (Crown Solutions, 2006) and recommends additional pilot-scale water treatment testing prior to final selection and design of the proposed WTP. Generation of higher than projected volumes of brine during operations would result in higher than projected cost of water treatment due to greater amounts of bentonite and cement to stabilize the brine for disposal. Disposal of stabilized brine in the TWSF is not expected to significantly effect the water chemistry of TWSF drainage and leakage. Addition of greater than projected volumes of stabilized brine to the TWSF is not expected to have adverse water resource consequences.

If water treatment is needed during closure, stabilized brine would be disposed in the TWSF. At FCC projected brine generation rates, the TWSF is estimated to have the capacity for disposal of seventeen years of WTP waste. Generation of higher than projected volumes of brine during closure would result in higher than projected cost of water treatment, shortening of the usable duration of the TWSF for brine disposal, and the need for a replacement disposal system, most likely off-site disposal. As for the operational period, addition of greater than projected volumes of stabilized brine to the TWSF is not expected to have adverse water resource consequences from the TWSF. The need for offsite disposal would increase transportation risks of spills.

TABLE 4-6. Ambient Surface Water Monitoring Requirements at WQ-24 and Downstream Station				
Parameter	**Units**	**Monitoring Frequency**	**Sample Type**	**Maximum ML**
Flow	gpm	Quarterly	Grab	---
Arsenic	µg/l	1x/6 months	Grab	5.0
Cadmium	µg/l	1x/6 months	Grab	0.2
Cobalt	µg/l	1x/6 months	Grab	5.0
Copper	µg/l	1x/6 months	Grab	1.0
Lead	µg/l	1x/6 months	Grab	0.4
Mercury	µg/l	1x/6 months	Grab	0.01
Nickel	µg/l	1x/6 months	Grab	5.0
Silver	µg/l	1x/6 months	Grab	2.0
Thallium	µg/l	1x/6 months	Grab	0.3
Zinc	µg/l	1x/6 months	Grab	5.0
Ammonia (total as N)	mg/l	1x/6 months	Grab	1.0
Nitrate + Nitrite	mg/l	1x/6 months	Grab	10
Sulfate	mg/l	1x/6 months	Grab	10
Sulfite	µg/l	1x/6 months	Grab	2.0
TSS	mg/l	1x/6 months	Grab	5
PH	s.u.	1x/6 months	Grab	---
Dissolved Oxygen	mg/l	1x/6 months	Grab	---
Temperature	C°	1x/6 months	Grab	---
Iron	µg/l	1x/6 months	Grab	20
Aluminum	µg/l	1x/6 months	Grab	20
Hardness	mg/l	Quarterly	Grab	---
Chloride	mg/l	1x/6 months	Grab	1.0
Conductivity	mS/m	1x/6 months	Grab	---
TDS	mg/l	1x/6 months	Grab	---

Stormwater Management and Permits - FCC has proposed a Stormwater Management Plan (SWMP) as described in Chapter 2 with the goals of: 1) preventing storm water run-on to proposed facilities, 2) minimizing erosion, and 3) reducing sediment transport to downstream receiving waters. FCC would be required to obtain a Storm Water Permit or Permits from EPA prior to beginning construction. Facilities to be covered under the Permit for the proposed Project are as follows:

- Topsoil and borrow material stockpiles;
- Haul and access roads;
- Parking lots;
- Office buildings; and
- Ancillary disturbance areas not associated with milling process.

A construction storm water permit would be required to address construction activities proposed for the site.

A computerized soil erosion model was used to estimate sediment generation under existing and proposed developed conditions, and to compare erosion from existing road surfaces versus those that would be upgraded or modified (Telesto, 2006). The effectiveness of proposed sediment management, using constructed Best Management Practices (BMP) sediment control structures, has been evaluated for the developed condition to assess the resulting changes in sediment loading to area drainages and is described in the section on “Sediment Yield.”

Groundwater Resources - Alternative II causes direct effects to groundwater due to:

- Pumping groundwater for mine dewatering during mine operations;
- Groundwater capture (if needed) downgradient of the mine workings during the closure water management period;

- Release of metals and sulfate to groundwater from the mine workings during closure and post-closure;
- Seepage from the TWSF during operations and closure; and
- Release of drainage water from the TWSF after closure.

FCC (2006) predicts that post-operational mine water chemistry under Alternative II would be suitable for discharge to downgradient groundwater and ultimately to surface water, so post-operational groundwater management would not be necessary. However, as proposed by FCC, if water quality conditions warrant, groundwater pumpback wells would be installed downgradient of the Ram and Sunshine mines to capture a portion of the contaminants derived from the mines for treatment.

Groundwater Quantity/Flow - During the mine operational periods, the predominant impact on groundwater quantity/flow would result from dewatering of the Ram and Sunshine mine workings in the Bucktail Creek drainage. The volume of groundwater captured in the mine workings and removed from the Bucktail drainage would vary from an average of 0 to 50 gpm during the first three years of mining (as the Ram mine is being developed) to approximately 58 gpm during the three year period when both the Ram and Sunshine mines are dewatered. At its peak, mine dewatering would reduce the total estimated bedrock groundwater flux within Bucktail Creek drainage by about 43 percent. Reduction in the groundwater flux would cause indirect effects to spring, seep and stream flows in Bucktail Creek. During operations, reduced recharge to the Big Flat area groundwater system due to capture and diversion of incident precipitation on the tailings and waste rock storage facility (TWSF) and the water management pond would reduce groundwater recharge and flows in Big Flat Creek drainage by about 14 percent.

If the volume of mine water encountered is not adequate for mining and milling operations, additional make-up water would be obtained from two water supply wells to be drilled near the mill. Based on DSM results, approximately two million gallons of supplemental make-up water would be required during the initial two years of mining, or an average of 2.0 gpm. This equates to about 3.5% of the total flux of 54 gpm estimated for the Big Flat bedrock groundwater system. Based on the relatively small percentage of total flow, and relatively short duration that make-up water would be required, pumping of the two make-up water wells is not expected to have detrimental effects on local or downgradient water resources.

Groundwater quantity effects during the closure period would depend on whether groundwater capture is needed to mitigate water quality effects from mine water. If groundwater capture is instituted, groundwater flow effects would be about 50 percent higher than the operational period (i.e., about 60 percent reduction in total bedrock groundwater flux) due to capture and diversion of bedrock groundwater downgradient of the two mines. Effects to Big Flat area groundwater would continue due to continued operation of the TWSF to accommodate water treatment wastes. If groundwater capture is not needed, groundwater flow rates and patterns would be similar to pre-mining conditions.

If groundwater capture is not needed during closure, there would be no mine dewatering or groundwater capture from the Ram and Sunshine mines and the TWSF and water management pond would be fully reclaimed, allowing runoff water to infiltrate near the facility toe. Thus, post-closure groundwater flow rates and patterns would approximate those that would occur at that time under the No Action scenario, Alternative I.

Potential Connection to Blackbird Mine Site Groundwater - Of particular interest in all mining alternatives is the possible hydrologic connection between ICP and Blackbird Mine area groundwater and the potential for dewatering of the Ram and Sunshine mine workings to draw contaminated groundwater from the Blackbird Mine site into the dewatered workings. Capture of contaminated groundwater in the Ram or Sunshine dewatering systems could negatively affect mine water chemistry. The potential for a hydrologic connection was evaluated in the Water Resources Technical Report (Hydrometrics, 2006) based on the elevations and locations of the Blackbird and proposed ICP mine workings, known geologic structures in the area that might act as conduits for groundwater flow, and the predicted extent of ICP mine dewatering effects. Current information

indicates that dewatering of the Ram and Sunshine mines is not likely to induce groundwater inflow from the Blackbird mine site. However, groundwater monitoring to verify and confirm this conclusion would be necessary under all ICP mining alternatives.

Groundwater Quality - Changes to groundwater quality under Alternative II would occur from the interaction of bedrock groundwater with mine backfill material and waste rock slash, potential leakage from the tailings and waste rock storage facility (TWSF) and water management pond, and post-reclamation drainage from the TWSF. Other potential sources of groundwater quality impacts include leakage/spills of hazardous materials. Groundwater quality impacts from the ICP were evaluated through multiple methods and tools, including the DSM, numerical and analytical groundwater flow modeling, baseline groundwater hydrology and chemistry characterization, and a watershed hydrology model (Hydrometrics, 2006). Concentrations of metals, sulfate, and nitrate predicted to occur for Alternative II and the other alternatives are tabulated in Appendix B and are further described in the following sections. **Table 4-7** presents best case (10th percentile), expected case (50th percentile) and worst case (90th percentile) groundwater copper concentrations for all alternatives.

***Bucktail Drainage* -** The primary potential source of adverse impacts to groundwater quality in Bucktail Creek drainage from the ICP is the interaction of bedrock groundwater with the waste rock and tailings backfill material to be placed in the Ram and Sunshine mine workings during mine development. Mine stopes within the Ram Mine would be backfilled with tailings and access ramps would be backfilled with waste rock (PAG and non-PAG) during mining operations. Groundwater would interact with the backfill material as the mine workings refill with groundwater after mine closure. Mine water/groundwater quality within the flooded workings would be as described above under Geochemistry.

During the mine operational period, groundwater inflow to the Ram and Sunshine workings would be captured and diverted to the mine process circuit for treatment and discharge to Big Deer Creek under an NPDES permit. Chemistry of groundwater inflow to the Ram and Sunshine mines during the mine operational period was predicted through the DSM, based on ambient groundwater quality in the vicinity of the proposed mines. Ambient groundwater chemistry in the vicinity of the mines shows elevated concentrations of some metals presumably due to natural leaching of metals from mineralized bedrock and/or existing man-caused sources.

After cessation of mining, the mines would be allowed to refill with groundwater, and an equilibrium groundwater flow-through condition would be attained in the mines approximately one year after cessation of dewatering. Some metals, nitrate and sulfate would be leached from the mine backfill material and migrate with groundwater downgradient of the mines towards Bucktail Creek. Based on the DSM stochastic analysis for Alternative II, potential groundwater metal, nitrate and sulfate concentrations that would occur downgradient of the Ram and Sunshine mine workings during the closure period were predicted (see Appendix B and **Table 4-7**). At the Ram Mine, metals concentrations in downgradient groundwater are predicted to increase approximately two-fold (or less) over ambient concentrations but remain less than groundwater quality standards for the expected case (50th percentile). Groundwater sulfate concentration downgradient of the Ram Mine was predicted to be 315 mg/L in closure Year 5, decreasing to 51 mg/L in Closure Year 23. For comparison, ambient groundwater sulfate concentration is about 27 mg/L and the Idaho groundwater quality standard is 250 mg/L.

At the Sunshine Mine, expected copper, cobalt, nickel and zinc concentrations in groundwater during the mine closure/water management period would exceed ambient concentrations by an order of magnitude or more but only copper is predicted to exceed the State of Idaho groundwater standard (1.3 mg/L) for the expected case. As for the Ram mine, groundwater sulfate concentration downgradient of the Sunshine Mine was predicted to be 315 mg/L in closure Year 5, decreasing to 51 mg/L in Closure Year 23.

ICP Groundwater Capture System and Effects to Upper Bucktail Alluvium and BMSG Capture System – If water quality conditions warrant, FCC proposes to install and operate groundwater capture wells downgradient of the Ram and Sunshine mines to capture contaminants derived from

Table 4-7. Predicted Dissolved Copper Concentrations in Groundwater
Idaho Cobalt DEIS

Alternative / Project Phase*	Bucktail Drainage																		Big Flat Drainage					
	Immediate Ram Mine Vicinity						Immediate Sunshine Mine Vicinity						Upper Bucktail Alluvium***						TWSF Area					
	Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?		
	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case
Alt I - No Action																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.500	7.500	7.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Alt II - FCC Proposal																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.052	0.089	0.372	Yes	Yes	Yes	1.083	1.534	2.333	Yes	No	No	2.07	2.31	2.73	No	No	No	0.0027	0.0027	0.0028	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.050	0.065	0.196	Yes	Yes	Yes	0.024	0.077	0.480	Yes	Yes	Yes	1.50	1.53	1.75	No	No	No	0.0029	0.0029	0.0030	Yes	Yes	Yes
Alt III - Perpetual Dewatering & LAT																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.500	7.500	7.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.500	7.500	7.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.041	0.043	0.046	Yes	Yes	Yes	0.041**	0.043**	0.046**	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0026	0.0026	0.0027	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.041	0.044	0.048	Yes	Yes	Yes	0.041**	0.044**	0.048**	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0028	0.0028	0.003	Yes	Yes	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.500	7.500	7.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.041	0.043	0.046	Yes	Yes	Yes	0.041**	0.043**	0.046**	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0026	0.0026	0.0027	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.041	0.044	0.048	Yes	Yes	Yes	0.041**	0.044**	0.048**	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0028	0.0028	0.003	Yes	Yes	Yes

Relative Impacts from ICP-Derived Dissolved Copper

green =	decrease or negligible increase that is nonmeasurable (NM)
yellow =	concentration increase; does not contribute to WQ standards exceedance
orange =	substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
** Concentrations predicted to be similar to Ram Mine concentrations based on similar pH.
*** Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity.
Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase I
Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).
Idaho Groundwater Quality Standard for Copper=1.30 mg/L.

the mines for treatment. Operation of the Alternative II bedrock groundwater capture wells would not affect bedrock groundwater concentrations immediately downgradient of the mines since the pumpback systems would be located some distance from the mine workings. However, the capture system would reduce impacts to alluvial groundwater (and also to surface water as described in the following section).

The bedrock capture well system for the Ram mine would consist of a series of pumpback wells located downgradient of the Ram mine in close proximity to Bucktail Creek. The conceptual basis for the capture wells is that a reverse hydraulic gradient would be created between the creek and the wells (i.e., the groundwater level at the wells would be lower than near the creek), thus preventing groundwater flow towards the creek. Discharge from the groundwater capture system would be piped to Big Flat for water treatment and discharge to Big Deer Creek under an NPDES permit. Alternative II capture wells at the Ram Mine are expected to achieve about 90 percent capture of Ram mine water and associated chemical mass loads. The capture system could achieve higher capture rates if conditions were highly favorable for capture.

The capture system efficiencies are based primarily on best professional judgment, in conjunction with knowledge of the localized hydrogeology. The 90 percent capture efficiency for the Ram Mine wells is based on:

- The proposed well field location near the drainage bottom;
- the potential to create a reversed hydraulic gradient between Bucktail Creek and the well field;
- the stipulation that FCC conduct a detailed field characterization program, including well drilling and aquifer testing, to determine feasibility and optimum design for the capture well field; and
- the requirement that FCC install as many wells as necessary to achieve the target capture efficiency.

Relocating the Ram Mine capture wells near the drainage bottom as opposed to the original midslope location should increase the potential capture efficiency due to the lower horizontal hydraulic gradient (≈0.2 ft/ft or less) near the drainage bottom as compared to the midslope gradient (≈0.33 ft/ft). The lower hydraulic gradient increases the potential for lowering the phreatic surface near the capture wells below the phreatic level between the wells and Bucktail Creek. This “reversed gradient” greatly reduces, but does not eliminate, the potential for groundwater contaminants to bypass the capture well system. Therefore, a 90 percent capture efficiency for the Ram area wells is considered reasonable for the ICP impacts analysis given the level of field testing and final design requirements dictated for the project. Additional detail on the capture system performance, including the individual capture well zone of contribution, is provided in the 12/06 Water Resources Technical Report.

The effects of the ICP project on alluvial groundwater quality in the Upper Bucktail drainage are of interest due to the potential for ICP-generated contaminants entering the Upper Bucktail drainage alluvial groundwater system where the BMSG Phase I and Phase II capture systems are located (**Figure 2-1**). In particular, contaminants leached from the Sunshine Mine slash backfill or wallrock following mine reflooding could migrate through bedrock groundwater to the Upper Bucktail alluvium and the BMSG capture system. The BMSG Phase II capture system consists of a series of spring/seepage collection systems and alluvial pumpback wells in Upper Bucktail drainage bottom. Seepage water and alluvial groundwater captured through the system would be pumped back to the Blackbird mine workings for treatment at the BMSG water treatment plant and discharge to Blackbird Creek.

Potential impacts from the Sunshine Mine contaminant loads on Upper Bucktail alluvium (Appendix B) were evaluated based on ambient concentrations in alluvial groundwater, groundwater flow rates through the alluvium, and mine chemical mass loads as determined from the DSM (Hydrometrics, 2006). Chemical mass load of copper from the flooded Sunshine mine is estimated to be 0.15 lb/day. Without operation of the Alternative II groundwater capture system, groundwater flow from the mine

workings is predicted to cause a 10 to 50 percent increase in copper concentrations in the alluvial groundwater. The groundwater capture system for the Sunshine mine consists of four bedrock capture wells located downgradient of the Sunshine mine. In contrast to the Ram mine capture system, the Sunshine system is not expected to cause a reversal of hydraulic gradient and therefore the Sunshine system is expected to achieve a lower capture efficiency than the Ram system. Operation of the Alternative II groundwater capture system for the Sunshine mine could reduce (by an estimated 75 percent), but not eliminate, effects to Upper Bucktail alluvial groundwater.

The lower (75 percent) capture efficiency used in the analyses for the Sunshine Mine groundwater capture wells is based on the steeper hydraulic gradient (≈0.30 ft/ft) and the potentially more complex groundwater flow field at this location as compared to the Ram area. Acceptance of the relatively high capture efficiency for evaluation purposes is based on the assumption that FCC would install and operate as many pumpback wells as necessary to achieve 75 percent capture of the Sunshine Mine contaminant load, and the opportunity to locate primary groundwater flow structures during development of the mine workings.

Adoption of the 90 percent and 75 percent capture efficiencies assume that FCC would conduct detailed field investigations, including well drilling and aquifer testing, to confirm the bedrock hydrologic characteristics in the vicinity of the proposed capture systems and design, install and test the capture systems prior to mine shutdown to verify their effectiveness. However, the physical characteristics of the fractured bedrock system and logistical considerations of working on a steep hillside result in the conclusion that higher capture efficiencies are unlikely to be achieved.

Big Flat Area - Groundwater quality changes in the Big Flat Area would stem from leakage from the TWSF during operations and drainage from the TWSF following closure and reclamation of the TWSF. Groundwater impacts from the TWSF would be limited to the bedrock groundwater system due to the lack of a shallow interflow system in the vicinity of the proposed TWSF (as documented during baseline investigations, (Shaw, 2005) and the very low seepage rates anticipated from the lined TWSF.

Metals and sulfate chemical mass loading rates from the TWSF seepage to the bedrock groundwater system during the mine operational period would be very low due to the very low seepage rate through the low permeability TWSF under liner. During operations, groundwater concentrations of metals and sulfate would remain similar to ambient concentrations. After mine closure and TWSF reclamation, TWSF drainage (from 1 to 3 gpm) would be released to groundwater and chemical mass loading rates to underlying groundwater would decrease gradually over time. During Year 5 of closure, metals concentrations in downgradient metal concentrations would remain virtually the same as ambient while sulfate concentrations would increase from 1.0 mg/L to about 120 mg/L. During closure year 23, the sulfate concentration would decrease to about 90 mg/L, still above ambient conditions but below the 250 mg/L secondary standard. Metals concentrations in closure year 23 would remain close to ambient.

Springs and Seeps - Springs and seeps represent groundwater discharge zones where the groundwater system intersects the ground surface. For the most part, springs and seeps at the ICP site are recharged by both the bedrock groundwater system and the interflow system, with the interflow system contributing to spring/seep flows primarily during the spring snowmelt/runoff period or after significant precipitation events, and the bedrock groundwater system providing year-round flows to perennial springs. Effects to spring/seep flows would result from dewatering of the mine workings (Ram and Sunshine) during the operational period, closure period groundwater capture in Bucktail drainage, and capture and diversion of incident precipitation on mine facilities in the Big Flat area during operational, mine closure/water management, and post-closure phases.

Operational Period - A series of springs occurs downgradient of the proposed Ram mine workings in Ram Gulch. Flow rates for these springs and seeps would be reduced during the mine operational period due to dewatering of the mine workings. Spring SS-11 (Ram Spring) in Ram Gulch is located directly downgradient of the Ram workings, and represents the uppermost elevation of surface flow in

Ram Gulch. Based on its close proximity to the Ram workings (approximately 200 feet downgradient or west of the workings), flow from the spring would essentially cease. No other springs or seeps are expected to be affected by dewatering of the Ram and Sunshine mine workings.

Big Flat area springs/seeps generally occur in the upper reaches of the drainages located along the north and east margins of Big Flat. Interception and diversion of precipitation recharge by the TWSF and the water management pond would result in decreased spring/seep flow rates downgradient of the facilities (36 percent at spring/seep site SS10 and associated wetlands located downgradient of the TWSF in the headwaters of Big Flat Creek and 25 percent at SS9 located in Little Deer Creek drainage (**Figure 3-8**)).

Mine Closure/Water Management Period - After mine closure and reflooding of the mine, groundwater levels and flowpaths would return to near pre-mining conditions in the Bucktail Creek drainage. As a result, spring flows in Bucktail drainage would also return to pre-mining conditions. This would be true even if groundwater capture were enacted, since the proposed Alternative II groundwater capture wells would be located downgradient of the springs. Mine groundwater would be allowed to flow freely to spring SS11 in Ram Gulch and the spring would have similar water chemistry as the Ram Mine groundwater outflow (see **Table 4-7** and Appendix B). Currently, copper concentrations in Ram Spring are much lower than Bucktail Creek but higher (worse) than the surface water quality standard. Alternative II would cause copper concentrations in Ram Spring to increase two- to three-fold. As for the Ram mine water, sulfate concentration in Ram Spring was predicted to be 315 mg/L in closure Year 5, decreasing to 51 mg/L in Closure Year 23. An NPDES permit would be required for discharge of mining affected groundwater to surface water at Ram Spring after mine flooding.

Effects to spring/seep flows in the Big Flat area would be similar to the operational period if groundwater capture near the Ram and Sunshine mines is conducted. If groundwater capture is not enacted, conditions would return to pre-mining conditions after reclamation as runoff from the TWSF would no longer be captured and diverted for treatment, but instead would be allowed to infiltrate peripheral to the TWSF, thus re-establishing recharge to downgradient springs and seeps.

Wetlands - Wetlands in the project area are associated with seeps and intermittent drainages that receive recharge from surface runoff and shallow groundwater discharge. Wetlands identified within the Bucktail Creek drainage and downgradient of the proposed mine workings are limited to riparian wetlands along drainage bottoms. Hydrologic effects to these wetlands during the project operational phase would be similar to those described above for springs and seeps, with dewatering of the mine workings reducing the level of recharge to the downgradient wetlands. Effects to wetlands would be minimal during closure if no groundwater capture is enacted. If closure period groundwater capture is enacted, flow would continue to be reduced to the downgradient wetlands along Bucktail Creek by approximately 90 percent during baseflow periods and approximately 45 percent during spring runoff periods.

The occurrence and hydrologic effects to wetlands in the Big Flat area would be similar to those described for Big Flat area springs and seeps resulting from alterations in magnitude and timing of precipitation recharge rates from mine facilities. Potentially affected wetlands are located adjacent to upper Big Flat Creek. Recharge to these wetlands would be reduced during the operational phase due to interception and diversion of incident precipitation on the TWSF and process/storage ponds. Recharge would be restored after reclamation of the TWSF.

Surface Water Resources – Mine development under Alternative II would result in potential impacts to surface water in the Bucktail, South Fork Big Deer and Big Deer Creek drainages.

Hydrology - Alternative II causes direct effects to surface water hydrology due to:

- Pumping groundwater from the Bucktail drainage and treating then releasing it to Big Deer Creek;

- Placing facilities in the Big Flat drainage which intercept precipitation within the process water circuit then treating and releasing it to Big Deer Creek; and
- Effects of the BT-5 diversion, part of the Blackbird cleanup, on South Fork Big Deer Creek as described for the no-action alternative.

Streamflow Effects - Predicted changes to streamflows caused by Alternative II and the other action alternatives are summarized in Appendix B and the Water Resources Technical Report (Hydrometrics, 2006). During Ram operations, but before BT-5 is employed, mining of the ICP in Alternative II would reduce surface water flows during baseflow conditions in Bucktail Creek (44 percent), South Fork of Big Deer Creek (11 percent), Big Deer Creek (one percent), and Big Flat Creek (three percent). During Ram operations after BT-5 is employed, surface water flows would be reduced further by BMSG cleanup resulting in cumulative flow reductions during baseflow conditions in lower Bucktail Creek below the BT-5 pipeline (up to 100 percent) and South Fork of Big Deer Creek (25 percent). Flows in Big Deer Creek and Big Flat Creek would continue to be reduced slightly similar to the Ram Operations pre-BT-5 period. Following closure, surface water flows would return to no-action conditions as soon as groundwater capture and treatment is ceased.

Surface Water Quality – Surface water quality impacts from the ICP were evaluated through multiple methods and tools, including the DSM, baseline surface water hydrology and chemistry characterization, and a watershed hydrology model (Hydrometrics, 2006). Concentrations of metals, sulfate, and nitrate predicted to occur for Alternative II and the other alternatives are tabulated in Appendix B and are further described in the following sections. **Tables 4-8** and **4-9** present expected (50th percentile) and worst case (90th percentile) surface water copper concentrations for all alternatives.

The constituents of concern (COCs) for the ICP were identified based on comparison of results of geochemical testing and baseline water quality results for area waters with potentially applicable water quality standards. Constituents of concern for the ICP were identified as: aluminum, arsenic, cadmium, copper, iron, lead, mercury, nickel, nitrate, selenium, sulfate and zinc by Telesto (2004). Geochemical evaluation conducted by the EIS team indicated that arsenic, cobalt, copper, nickel, zinc, nitrate and sulfate were the COC's of primary importance. Therefore, DSM results from only this subset of constituents are the focus of the alternatives analysis. Of this subset, the most significant differences between alternatives and between mining periods occurs for copper and cobalt, the parameters that are of greatest concern in the Blackbird drainage, and sulfate. Accordingly, the most emphasis is placed on discussion of predicted concentrations of cobalt, copper, and sulfate.

Bucktail/Big Deer Drainage - Alternative II would cause direct effects to surface water quality due primarily to:

- Discharge of treated mine water to Big Deer Creek during operations; and
- Release of groundwater from mine workings to Bucktail drainage during closure.

Three surface water stations were used in the DSM to evaluate the potential effects of the ICP on receiving waters downstream of the Ram and Sunshine mines and Bucktail Creek. These include the South Fork of Big Deer Creek below the confluence with Bucktail Creek (WQ-22), Big Deer Creek below the confluence with the South Fork (WQ-24), and Panther Creek below Big Deer Creek (WQ-25).

Water quality conditions in the South Fork Big Deer Creek are primarily controlled by the effects of the Blackbird cleanup and the BT-5 diversion. During Ram operations before BT-5, metal concentrations in South Fork would remain similar to current conditions and likely would remain poorer than water quality standards and cleanup goals. Water quality is not predicted to be significantly affected by mining the ICP, as no release of mine water to the stream would occur during operations. Although the DSM predicts a slight increase in copper concentration in the South Fork during this period due to removal of mine area groundwater, it is unlikely that this increase would actually occur or be measurable if it were to occur. Presently, water quality in South Fork is dominated by flows of poor

Table 4-8.

Idaho Cobalt PDEIS - DSM Predicted Copper Concentrations in Streams

Most Probable or Expected Case (50th percentile, 50 % probability that actual value will be higher than value shown)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	No	0.065	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.03	No	0.068	No	0.0112	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0025	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0025	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.089	No	0.06	No	0.002	Yes	0.0044	Partial	0.0016	Yes	0.0034	Yes
	Closure Year 23	0.065	No	0.04	No	0.002	Yes	0.0037	Partial	0.0016	Yes	0.0033	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.011	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.043	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.044	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.043	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.044	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
Water Quality Standard - Aquatic Life Criterion		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
	Hardness	25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

Table 4-9.

Idaho Cobalt PDEIS - DSM Predicted Copper Concentrations in Streams

90th percentile Case (90 % probability that actual value will be lower than value shown).

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	No	0.065	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.03	No	0.068	No	0.0113	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0026	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0026	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.372	No	0.18	No	0.002	Yes	0.0087	No	0.0016	Yes	0.0039	Yes
	Closure Year 23	0.196	No	0.10	No	0.002	Yes	0.0057	No	0.0016	Yes	0.0036	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.011	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.046	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.048	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.043	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.044	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
Water Quality Standard - Aquatic Life Criterion		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
	Hardness	25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

quality water from Bucktail Creek and the presence of metal-contaminated sediments in the stream. It is therefore likely that pumping of relatively clean groundwater from the watershed will have a negligible effect on stream water quality.

After BT-5 is installed, flow in Bucktail Creek would be diverted around the South Fork and the South Fork water quality is predicted by EPA (Allans, 2005) and IDEQ to improve to meet cleanup goals and water quality standards for the duration of the ICP operations and closure period.

Water quality conditions in Big Deer Creek are primarily controlled by the discharge of treated mine water from the ICP and the effects of the Blackbird cleanup. As described in the Geochemistry section (above) and in the draft NPDES permit (USEPA, 2006 and **Table 4-5**), ICP water discharges to Big Deer Creek would contain low metal concentrations and would be required to meet or be better than water quality standards prior to mixing with the stream (i.e., at end-of-pipe). Because of the anticipated very low effluent limits for treated water, Big Deer Creek is not expected to be adversely affected by mine discharges during the operations period. However, during Ram operations before BT-5 and completion of the Blackbird cleanup, metal concentrations in Big Deer Creek would remain similar to current conditions and likely would continue to not meet water quality standards and cleanup goals.

After BT-5 is installed and the Blackbird cleanup is completed, it is predicted by EPA and IDEQ that cleanup goals and water quality standards for metals would be met in Big Deer Creek for the duration of the ICP operations. ICP water discharges to Big Deer Creek would meet or be better than water quality standards prior to mixing with the stream (i.e., at end-of-pipe) so no increases in metal concentrations and no adverse effects are expected. However, some slight changes in concentrations of non-metal constituents might occur. For sulfate in Big Deer Creek, a very slight increase in concentration of 2 mg/L (from 5 to 7 mg/L) is predicted during operations. For comparison, ambient sulfate concentration in Panther Creek is approximately 10 mg/L. For nitrate, concentrations are predicted to increase from 0.07 to 0.11 mg/L. Neither the sulfate or nitrate changes would cause adverse effects.

During the closure period, the Ram and Sunshine mines would be allowed to refill with groundwater and release of mine water to streams via groundwater would occur. Without groundwater capture and treatment, it is expected (50th percentile or median case) that changes in metal concentrations would be negligible, with the possible exception of copper. Copper concentrations in Big Deer Creek would increase slightly in comparison to the no-action Alternative I by approximately 0.001 mg/L soon after mine refilling (Closure Year 5). Copper concentrations would then decline throughout the post-mine filling period and are predicted to be about 0.0006 mg/L (less than 1 ppb) higher than the no-action Alternative I during Closure Year 23. It is unlikely that increases of these magnitudes would be measurable or would cause exceedance of the water quality standard or BMSG cleanup goal if it were to occur. Moreover, increases of these magnitudes likely could be mitigated by groundwater capture and water treatment as proposed in Alternative II. Therefore, no significant adverse effects are expected during closure.

The 90th percentile case (worst case) DSM results differ from the expected case in predicted metal concentrations, potential impacts, and potential effectiveness of Alternative II groundwater capture systems in controlling adverse impacts during closure. In the 90th percentile case without groundwater capture and treatment, it is predicted that copper concentrations in Big Deer Creek would increase relative to the no-action Alternative I by approximately 0.006 mg/L soon after mine refilling (Closure Year 5). Copper concentration would then decline throughout the post-mine filling period and is predicted to remain about 0.003 mg/L higher than the no-action Alternative I. Although the 90th percentile case has a lower probability of occurrence than the 50th percentile case, it is still considered to have a sufficiently high probability of occurrence (about 1 in 10) so that planning and mitigation for such an occurrence is reasonable and necessary. If copper concentrations of this magnitude were to occur, the increase in copper likely would be measurable and likely would cause an exceedance of the water quality standard (approximately 0.004 mg/L) and would impact the attainment of cleanup goals in Big Deer Creek. An increase of this magnitude might be mitigated by

groundwater capture and water treatment as proposed in Alternative II if the capture system were to have a very high efficiency so that nearly all of the chemical mass load emanating from the flooded mines were captured and removed by treatment. Achievement of a sufficiently high groundwater capture efficiency to mitigate the 90th percentile case in the fractured bedrock groundwater system as proposed in Alternative II would be difficult and can not be assumed with a high degree of certainty. Therefore, surface water quality impacts to Big Deer Creek in Alternative II are considered to have the potential to become significant, since mitigation is not certain, and if they occurred, potential impacts would likely result in exceedance of water quality standards and cleanup goals.

Big Flat Creek Drainage - Alternative II causes direct effects to surface water quality due to seepage and release of water from the TWSF and water management pond. Predicted effects of the TWSF and pond are negligible as demonstrated by the imperceptible predicted changes in chemical concentrations (see **Tables 4-8** and **4-9** and Appendix B).

Panther Creek - All of the effects to surface water quality described for Bucktail, Big Deer and Big Flat Creeks would be manifest in Panther Creek in diminished magnitude due to the larger stream flows and greater dilution available in Panther Creek. Water quality conditions in Panther Creek would be influenced by the discharge of treated mine water from the ICP and the effects of the Blackbird cleanup in Bucktail Creek. During Ram operations before BT-5, metal concentrations in Panther Creek would remain similar to current conditions and likely would continue to meet water quality standards and cleanup goals at most times with some excursions above standards/cleanup goals. Because of the anticipated very low effluent limits for treated water, Panther Creek is not expected to be adversely affected by mine discharges during the operations period. After the Blackbird cleanup is completed, it is expected that cleanup goals and water quality standards for metals would be met in Panther Creek for the duration of the ICP operations. For sulfate, a very slight increase in concentration from 10.1 to 10.7 mg/L is calculated during operations.

During the closure period, the Ram and Sunshine mines would be allowed to refill with groundwater and release of mine water to streams via groundwater would occur. Without groundwater capture and treatment, it is expected (50th percentile case) that negligible changes in metal concentrations in Panther Creek would occur. For example, copper concentrations in Panther Creek are calculated to increase from 0.0033 in the no-action case to 0.0034 mg/L in Alternative II soon after mine-filling (closure year 5). Copper concentration would then decline throughout the post-mine filling period and in closure year 23 are predicted to be equivalent to the no-action Alternative I. It is not likely that the model-calculated increase in copper would be measurable or would cause an exceedance of the water quality standard or cleanup goals in Panther Creek if it were to occur. If it were considered necessary to mitigate an increase of this magnitude it likely could be accomplished by continued groundwater capture and water treatment as proposed in Alternative II.

The 90th percentile case DSM results differ only slightly from the expected case both in predicted metal concentrations and overall conclusions of impacts and mitigations during closure. In the 90th percentile case without groundwater capture and treatment, it is predicted that copper concentrations in Panther Creek would increase from 0.0033 in the no-action case to 0.0039 mg/L in Alternative II soon after mine-filling (closure year 5). Copper concentration would then decline throughout the post-mine filling period and in closure year 23 are calculated to remain approximately 0.0003 mg/L higher than the no-action Alternative I. If copper concentrations of this magnitude were to occur, the increase in copper likely would not be measurable but could contribute to an exceedance of the water quality standard or cleanup goals in Panther Creek. An increase of this magnitude might be mitigated by groundwater capture and water treatment as proposed in Alternative II if the capture system were to have a very high efficiency so that nearly all of the chemical mass load emanating from the flooded mines were captured and removed by treatment.

Effects of Spills of Hazardous or Deleterious Materials – Alternative II would require transportation of hazardous or deleterious materials near or adjacent to streams where an accidental spill could affect surface water quality. The risk of transporting potentially hazardous materials is common to all the action alternatives (II-V). The potential for a hazardous spill to cause significant

adverse effects to surface water quality and fisheries resources was evaluated in the Transportation Technical Report (Hydrometrics and Smith, 2006) based on the types and amounts of hazardous materials transported and the likelihood and effects if a spill were to occur. The spill evaluation concludes that although adverse affects would occur if significant quantities of many of the hazardous or deleterious materials were to be spilled and released to streams, greatest potential risk to surface water resources would occur from transport of petroleum (diesel fuel) and copper sulfate. Spills of diesel fuel and copper sulfate would be estimated to occur approximately once every forty years and once every 300 years, respectively. If spills of diesel or copper sulfate were to reach streams in significant quantities, severe short-term adverse affects including violation of water quality standards and impacts to beneficial uses would likely occur and continue until the spill is cleaned up and/or diluted by stream flows. Long-term effects would depend to a large degree on the success of cleanup activities in removing residual contamination from stream sediments and to some degree on the characteristics of the spilled material. Long-term effects from spills of highly soluble materials (e.g. copper sulfate) would likely be slight, whereas long-term effects from insoluble (e.g. bulk sulfide concentrate) or immiscible materials (e.g. diesel) could cause continued water quality effects.

Sediment Yield – Effects of the ICP on sediment production and capture were evaluated using two sediment models (Hydrometrics, 2006). The BOISED model was used to compare theoretical sediment production in the Bucktail and Big Flat drainages on a watershed scale (USDA, 2006) and to evaluate cumulative effects of the ICP and other ongoing and proposed projects. The Water Erosion Prediction Project (WEPP) (Flanagan and Livingston, 1995) model was used to evaluate sediment effects for the existing condition and the operational period from project hill slopes and site roads in the Bucktail and Big Flat drainages, and from the access road between Williams Creek and Blackbird Creek. The WEPP model incorporates two modeling interfaces that were used to model sediment impacts from the ICP. These include the Disturbed WEPP and WEPP:Road interfaces.

Results of the WEPP model were used by the ICP to develop sediment control best management practices (BMPs) for the project site and access roads. BMPs include road surfacing with gravel, rock sediment basins, biofilter strips, silt fences and slash barriers (Telesto, 2006a). The BMPs developed for the project using the WEPP model were also incorporated into the BOISED model to look at sediment effects on a watershed scale.

Construction Period – The BOISED model predicts that sediment yield in the project area during the construction period would increase over background conditions (a potential short-term effect). This increase is due to facilities and road construction and reclamation of existing unused roads in both the Bucktail and Big Flat Creek watersheds.

In the Big Flat Creek watershed the BOISED model predicts that there would be an additional 0.1 ton of sediment yield based on the proposed disturbances, resulting in a total sediment yield of 9.7 tons/year in 2007, a one percent increase over baseline levels. In Bucktail Creek the model estimates that the disturbances would generate an additional 17.5 tons of sediment, resulting in a total sediment yield of 69.6 tons/year in 2007 and an increase of 34 percent over baseline levels. In both Big Flat and Bucktail Creeks the BOISED model predicts that sediment levels would return to the 2006 baseline level within one to two years.

Road improvements proposed by FCC along the access route are predicted to reduce sediment delivery to the streams adjacent to the road (Williams Creek, Deep Creek and Panther Creek) by approximately 50 percent based on WEPP model results (TTE, 2006). This reduction in sediment yield is a result of adding a gravel surface to 10.9 miles of the access route that is adjacent to the streams.

Mine Operation, Closure and Post-Closure Period - Following cessation of mining activities FCC proposes to reclaim an additional 1.76 miles of road in the Big Flat watershed and two miles in the Bucktail watershed. The BOISED model predicts that the road and facilities reclamation would reduce long-term sediment yield in Bucktail Creek by 12 percent below the baseline level. No

additional reduction is predicted for Big Flat Creek as the sediment yield in this watershed returned to natural levels in 2008.

Sediment Quality - In Alternative II, sediments in area streams would continue to improve as the result of the Blackbird cleanup as described for Alternative I. Sediment quality in Bucktail Creek, South Fork Big Deer Creek, Big Deer Creek, Panther Creek, and Blackbird Creek would be expected to improve through natural recovery such that Blackbird sediment cleanup levels would eventually be achieved.

Discharges and releases of water from mine facilities are not expected to significantly affect sediment quality or interfere with attainment of Blackbird sediment cleanup levels as the water discharged from the project would be required to meet aquatic life criteria and thus would have very low metal concentrations. Because of the low metal concentrations in discharge water, no significant precipitation or adsorption of metals from the water column to sediments is expected.

Adverse effects to sediment quality potentially could occur in Alternatives II, III, IV, and V from spills of hazardous or deleterious materials to streams similar to the effects described for surface water quality. The risk of transporting potentially hazardous materials is common to all the action Alternatives (II-V). If spills of diesel, copper sulfate or other materials were to reach streams in significant quantities, severe short-term adverse affects including exceedance of sediment cleanup levels and impacts to beneficial uses would likely occur and continue until the spill is cleaned up and/or diluted by stream flows. Long-term effects would depend to a large degree on the success of cleanup activities in removing residual contamination from stream sediments and to some degree on the characteristics of the spilled material. Long-term effects from spills of highly soluble materials (e.g. copper sulfate) would likely be slight, whereas long-term effects from insoluble (e.g. bulk sulfide concentrate) or immiscible materials (e.g. diesel) could cause continued sediment quality effects.

Alternative III – Relocation of TWSF, Perpetual Mine Dewatering, and Land Application Water Discharge

Alternative III differs in many ways from the company's proposed plan (Alternative II) and the resultant estimated geochemical and water resource effects reflect many of these differences. Key differences between Alternative II and Alternative III include:

- Addition of chemical amendments to waste rock slash to maintain alkaline pH levels in the Ram and Sunshine mines;
- Continued pumping from the mine workings after mine closure to provide more efficient capture of groundwater and reduce post-operational water treatment requirements;
- Use of a second water storage pond with a substantial increase in overall pond capacity;
- Seasonal land application treatment (LAT) of excess water in portions of Big Flat and Little Deer Creek drainages; and
- Co-mingling of tailings and waste rock in the TWSF.

Tables 4-7, 4-8, and additional tables in Appendix B summarize water quality conditions under Alternative III. The following Sections provide additional detail regarding conditions resulting from Alternative III.

Geochemistry - Alternative III effects from the mines during operations are assumed to be equivalent to the other alternatives as described above for Alternative II. In Alternative III, mine dewatering would continue during the closure period and effects from mines would remain similar to the operations period. The amendment of waste rock slash in the mines in Alternative III would reduce the risk of mobilization of high concentrations of metals from the slash (similar to Alternatives IV and V) thereby reducing the risk of exceeding the metal attenuation capacity of the LAT and increasing the probability that LAT could continue post-operations without the need for supplemental water treatment of waters to be land applied.

Land Application Treatment - In Alternative III, excess water is treated and discharged to the land application area for disposal and further treatment by soils. The Alternative III LAT system would provide excellent metals and nitrate removal and no metal or nitrate effects to groundwater and surface water are expected. Sulfate would not be strongly attenuated in land application area soils. Consequently, water percolating through the soils is expected to have sulfate concentrations that are higher (owing to evapo-concentration) than sulfate levels in applied solutions (approximately 400 mg/L).

An NPDES permit would likely be required for the LAT discharge because of shallow groundwater – surface water interconnection in the Big Flat drainage. Effluent limits for such a permit would likely be similar to those proposed for the Alternative II and IV discharge to Big Deer Creek (**Table 4-5**). LAT is predicted to be able to meet the effluent limits proposed for Big Deer Creek, with the exception of sulfate.

Tailings and Waste Rock Storage Facility - In Alternative III, IV, and V, the tailings and waste rock storage facility consists of commingled waste rock and tailings rather than separate disposal areas for waste rock and tailings as in Alternative II. Tailings have much lower hydraulic conductivity and sulfide content and higher alkalinity (from residual processing reagents) than waste rock. The EIS team identified co-disposal of tailings and waste rock as an option to consider since encapsulating waste rock in tailings is likely to greatly reduce the rate of oxidation of waste rock, decreasing ARD and metal leaching risk, and potentially improving the quality of water draining from the facility. Potential disadvantage of co-disposal is the inability to segregate water if one portion of the facility were to develop poor water quality (e.g. the waste rock). During operations runoff and seepage from the facility would be collected and stored in two large water management ponds.

Groundwater Resources – The primary differences between Alternative II and Alternative III relative to groundwater effects result from the addition of amendments to the backfill slash underground and the continued pumping and dewatering of the mine following closure.

Groundwater Quantity/Flow - In Alternative III, mine dewatering effects would be identical to operational phase effects in Alternative II and would continue through operations and closure periods.

Impacts on groundwater quantity/flow in Big Flat/Little Deer drainages would result from the land application of wastewater (seasonally, during operations and closure) and reduced recharge to the Big Flat area groundwater system due to capture and diversion of incident precipitation on the tailings and waste rock storage facility (TWSF) and water management ponds during operations and during closure prior to TWSF reclamation. These effects are discussed further in the section entitled "Springs and Seeps" below.

Groundwater Quality - Similar to Alternative II, groundwater quality effects under Alternative III would result from the interaction of bedrock groundwater with mine backfill material and leakage and drainage from the tailings and waste rock storage facility (TWSF) and process/storage ponds. Alternative III would also affect groundwater quality by recharge of metals and sulfate-bearing water from the LAT system.

***Bucktail Drainage* -** In Alternative III, the majority of the Ram Mine workings would be backfilled with mine tailings and waste rock during development to facilitate mining activities. During operations, impacts to groundwater quality in Alternative III would be identical to those described for Alternative II.

During the mine closure/water management period, the mines would continue to be dewatered to prevent interaction of groundwater with the backfill material, with the mine water treated and disposed of through the LAT system. Groundwater capture within the Ram and Sunshine Mines is expected to approach 100 percent during the mine closure/water management period. Therefore, as with the mine operational period, the Ram and Sunshine Mines are expected to have negligible effects on groundwater quality during the closure period.

***Big Flat Area* -** Groundwater quality impacts in the Big Flat Area under Alternative III would result from the land application treatment system (LAT), and the tailings and waste rock storage facility

(TWSF). No negative effects to groundwater are anticipated from the LAT system for metals and nitrogen based on extensive testing and modeling performed for the LAT system design (CES, 2005).

Expected case sulfate concentrations in groundwater beneath and downgradient of the LAT would range from about 283 mg/L to 76 mg/L during the operational period. All of these values exceed the ambient sulfate concentration of 1.5 mg/L and the 283 mg/L value exceeds the secondary drinking water standard of 250 mg/L. Peak concentrations, occurring on a localized basis in areas of little upgradient groundwater recharge, would be greater than these average values, and would approximate the LAT feed water concentrations, which approach 400 mg/L. For the post-operational period (mine closure), expected case sulfate concentrations are expected to average about 76 mg/L throughout the LAT area throughout the closure period (Years 5 and 23).

Similar to Alternative II, metals and sulfate chemical mass loading rates from the TWSF seepage and drainage to the bedrock groundwater system during the mine operational period would be very low and groundwater concentrations of metals and sulfate would remain similar to ambient concentrations.

Springs and Seeps - Similar to Alternative II, impacts to springs and seeps in Alternative III would occur primarily from dewatering of the Ram and Sunshine mine workings and interception and diversion of incident precipitation on mine facilities. In addition, effects would occur from operation of the land application (LAT) system.

During the mine operational period, impacts to spring and seep flows in Bucktail Creek drainage would be identical to those expected and discussed for Alternative II. In Alternative III, dewatering of the Ram and Sunshine mine workings would continue after the mine operational period and throughout the mine closure water management period. As a consequence, impacts to springs/seeps downgradient of the mine workings under Alternative III would be similar after mine closure as described above for the mine operational period. Specifically, flows at spring SS11 in Ram Gulch could be reduced by close to 100 percent. This condition would persist for as long as groundwater capture and treatment is required.

Springs and seep flow rates in Big Flat Creek drainage would be affected by interception and diversion of precipitation runoff from the TWSF and the process/storage ponds similar to Alternative II with the exception that the increased recharge from the Alternative III Land Application Treatment (LAT) system to springs in Big Flat Creek and Little Deer Creek would largely offset the impacts to springs during the LAT season of June through September.

Surface Water Flow - During Ram operations but before BT-5 is employed, Alternative III would reduce surface water flows during baseflow conditions in Bucktail Creek (44 percent), South Fork of Big Deer Creek (11 percent), and Big Deer Creek (one percent). Flows in Big Flat Creek would be increased by three percent due to land application treatment of excess mine water.

During Ram operations after BT-5 is employed and during closure surface water flows during baseflow conditions in Bucktail Creek below the BT-5 diversion would be reduced by capture and diversion (100 percent), South Fork of Big Deer Creek (25 percent), Big Deer Creek (one percent). Flows in Big Flat Creek would be increased by three percent due to land application treatment of excess mine water.

Water Quality - Tables in Appendix B summarize water quality conditions under Alternative III. No significant effects to surface water quality are predicted to occur from Alternative III during any mine periods with the exception of an increase in sulfate in Big Flat Creek. Sulfate concentrations in Big Flat Creek are predicted to increase from approximately 2 mg/L (baseline condition) to a peak of approximately 190 mg/L during operations then decrease to about 50 mg/l during closure. Although elevated sulfate concentrations in Big Flat Creek would remain better than federal Secondary Drinking Water Standard of 250 mg/L at all times.

Effects of Spills of Hazardous or Deleterious Materials – Alternative III would require transportation of hazardous or deleterious materials near or adjacent to streams where an accidental spill could affect surface water quality. The risk of transporting potentially hazardous materials is common to all the action alternatives (II-V). The potential for a hazardous spill to cause significant adverse effects to surface water quality and fisheries resources was evaluated in the Transportation Technical Report (Hydrometrics and Smith, 2006) based on the types and amounts of hazardous materials transported and the likelihood and effects if a spill were to occur. The risk and effects of a spill on surface water quality in Alternative III would be similar to that described for Alternatives II, IV and V with one exception. In Alternative III there would be significantly less transport of water treatment reagents to the project and no transport of water treatment wastes off-site for disposal. Thus, risk of a spill of water treatment reagents and wastes is less in Alternative III than alternatives II, IV, and V.

Sediment Yield - Sediment yield in Alternative III is different than Alternative II due to the negative effects of the soil disturbance associated with the LAT and the beneficial effects of additional road reclamation and long-term road improvements.

Construction Period - The BOISED model predicts that sediment yield in the project area during the construction period would increase over background conditions (a potential short-term effect). This increase is due to facilities and road construction and reclamation of existing unused roads in both the Bucktail and Big Flat Creek watersheds.

Alternative III will have an increased sediment yield in Big Flat Creek due to additional soil disturbance associated with construction of the LAT. The BOISED model predicts that there will be an additional 0.7 ton of sediment yield resulting in a total sediment yield of 10.3 tons/year in 2007 and a seven percent increase over baseline levels. In Bucktail Creek sediment yields are predicted to be slightly reduced in Alternative III compared to Alternative II due to additional road reclamation (1.7 miles) during the construction period. The BOISED model predicts that the proposed disturbances will generate an additional 16 tons of sediment, resulting in a total sediment yield of 68.1 tons/year in 2007 and an increase of 31 percent over baseline levels. As in Alternative II sediment yields are predicted to return to baseline levels within one to two years in both drainages.

Surfacing of segments of the access road will reduce sediment delivery to the streams adjacent to the road by an estimated 50 percent (TTE, 2006). Other road improvements in Alternative III, including relocation of a segment of the Williams Creek Road away from the stream, will provide for additional reduction in sediment delivery.

Mine Operation, Closure and Post-Closure Period – In addition to the access road improvements discussed above during the construction period, Alternative III includes other road improvements that will be phased in during the life of the mine. The additional road improvements are listed in Chapter 2, Monitoring and Mitigation Measures Included in Agency Alternatives. These improvements will further reduce sediment delivery to streams along the access route.

Alternative III will reclaim 5.2 miles of road in the Big Flat drainage after mining ceases and sediment levels will return to baseline levels. These reclaimed roads will include roads constructed to access the LAT area. In Bucktail Creek an additional 2.2 miles of road will be reclaimed after mining. The BOISED model predicts that the road and facilities reclamation would reduce long-term sediment yield in Bucktail Creek by 15 percent below baseline levels.

Sediment Quality - In Alternative III, sediments in area streams would continue to improve as the result of the Blackbird cleanup as described for Alternative I. Sediment quality in Bucktail Creek, South Fork Big Deer Creek, Big Deer Creek, Panther Creek, and Blackbird Creek would be expected to improve through natural recovery such that Blackbird sediment cleanup levels would eventually be achieved.

Discharges and releases of water from mine facilities are not expected to significantly affect sediment quality or interfere with attainment of Blackbird sediment cleanup levels. However, adverse effects to sediment quality potentially could occur in Alternatives II, III, IV, and V from spills of hazardous or deleterious materials to streams similar to the effects described for surface water quality. The risk of transporting potentially hazardous materials is common to all the action Alternatives (II-V). The risk and effects of a spill on sediment quality in Alternative III would be similar to that described for Alternatives II, IV and V with one exception. In Alternative III there would be significantly less transport of water treatment reagents to the project and no transport of water treatment wastes off-site for disposal. Thus, risk of a spill of water treatment reagents and wastes is less in Alternative III than Alternatives II, IV, and V.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Alternative IV is similar to Alternative II with the following exceptions:

- Alternative advanced treatment technology would be employed to achieve NPDES effluent limits in discharge water;
- Chemical amendments would be added to waste rock slash to maintain alkaline pH levels in the Ram and Sunshine mines;
- Tailings and waste rock would be commingled in the TWSF;
- The TWSF would be reduced in size;
- The Alternative II groundwater capture system would be augmented as necessary with a surface water/alluvial groundwater capture system in lower Bucktail Creek drainage; and
- At mine closure, cessation of mine dewatering would be contingent on monitoring results and projections indicating no adverse effects to water quality objectives or cleanup goals.

Tables 4-7 through **4-9** and Appendix B summarize water quality conditions under Alternative IV and the other alternatives.

Geochemistry - In Alternative IV, as in Alternative II, the cement tailings paste backfill to the Ram mine is expected to provide an abundance of alkalinity such that pH of backfill contact water is expected to remain alkaline in perpetuity. These alkaline waters are predicted to contain relatively low metal concentrations and have negligible environmental effects.

Unlike Alternative II, Alternative IV further reduces the risk of acid contact waters from waste rock slash by the addition of alkaline amendments to slash in the Ram and Sunshine mines. In Alternative II waste rock slash remaining in the Ram and Sunshine mines is predicted to generate slightly acidic contact waters of approximately pH 5.8 in the expected case, and lower pH in the worst case. In contrast, Alternative IV waste rock slash contact water is expected to remain neutral to slightly alkaline in all cases, both expected and worst cases. The more neutral pH of the slash in Alternative IV is predicted to result in lower metal concentrations in mine water during closure for Alternative IV in comparison to Alternative II. These differences are relatively slight for the expected case (50th percentile DSM predictions) but become potentially significant for the worst case (90th percentile DSM predictions). For comparison, predicted Ram mine water copper concentrations for 50th percentile and 90th percentile cases in Closure Year 5 are 0.043 and 0.046 mg/L, respectively for Alternative IV and 0.089 and 0.372 mg/L, respectively for Alternative II.

An NPDES permit would be required for the discharge of treated water into Big Deer Creek. The draft effluent limits for such a discharge are the same as described for Alternative II (see **Table 4-5**). The metals treatment process for Alternative IV should result in the discharge meeting the effluent limits. This is based on an analysis of the Kensington Mine water treatment system which utilizes a similar metals treatment system to treat remove metals and solids from mine water to meet end-of-pipe metals limits. Alternative IV requires that treatability testing be performed before the treatment system is constructed to verify that the system will be able to meet the limits. If the metals treatment system alone is unable to meet the limits, then this alternative requires that more advanced treatment

including reverse osmosis or ion exchange be added on in order to meet the limits. As described in **Table 4-2**, reverse osmosis will be effective in meeting the draft effluent limits.

The water balance and wastewater flows for Alterative IV are the same as analyzed for Alternative II. The discharge, therefore, would be based on best available demonstrated technology and comply with the New Source Performance Standard prohibition on the discharge of process water except for net precipitation as described under Alternative II. Under this alternative, FCC would have to amend their NPDES permit application to reflect differences between water management and treatment for Alternative IV.

Water treatment feedwater for Alternative IV would be as described for Alternative II in **Table 4-1**. However, this Alternative assumes that effluent metal concentrations would be similar to those projected for Alternative II (**Table 4-2**) and would be lower than proposed effluent limits in EPA's Draft NPDES permit (**Table 4-5**) in order to avoid the need for RO treatment. Maximum sulfate concentrations in effluent could be 600 mg/L or more if a mixing zone is granted and water treatment for sulfate removal is not required. Upon full mixing with the stream, instream sulfate concentrations would be approximately 10 mg/L.

In Alternative III, IV, and V, the tailings and waste rock storage facility consists of commingled waste rock and tailings rather than separation of waste rock and tailings in two distinct areas as in Alternative II. Tailings have much lower hydraulic conductivity and sulfide content and higher alkalinity (from residual processing reagents) than waste rock. The EIS team identified co-disposal of tailings and waste rock as an option to consider since encapsulating waste rock in tailings is likely to greatly reduce the rate of oxidation of waste rock and consequently, should decrease ARD and metal leaching risk, and should improve the quality of interstitial water that may drain from the facility relative to Alternative II. Potential disadvantage of co-disposal is the inability to segregate water if one portion of the facility develops poor water quality (e.g. the waste rock pile). Runoff and seepage from the facility is collected and stored in the water management pond as in Alternative II.

Groundwater Resources - In Alternative IV, groundwater would be affected by mine dewatering during operations, interaction of groundwater with mine backfill during the closure/water management and post-closure phases, decreased recharge from interception of incident precipitation on the TWSF and water management pond, and leakage and drainage from the TWSF. At mine closure, cessation of mine dewatering would be contingent on monitoring results and projections indicating no unacceptable effects to water quality objectives or cleanup goals. If appropriate, the Ram and Sunshine mines would be allowed to flood resulting in groundwater flow through the mine workings toward Bucktail Creek. Groundwater outflow from both the Ram and Sunshine mines would be partially intercepted by bedrock groundwater capture wells located between the mines and Bucktail Creek (as in Alternative II), if needed to meet water quality goals. Additional groundwater control would be provided by a surface water/alluvial groundwater capture system in Lower Bucktail Creek drainage, if the bedrock capture well systems cannot adequately control the mine-generated contaminants.

Groundwater Quantity and Flow - Effects of operational mine dewatering in Alternative IV would be identical to Alternative II. If needed, operation of the bedrock groundwater capture system during closure for Alternative IV would cause identical effects as described for the Alternative II bedrock system. If needed, the Lower Bucktail capture system would potentially reduce alluvial groundwater/surface water flows in the lower Bucktail Creek drainage up to an additional estimated 60 to 90 gpm during the mine closure period. This alluvial/surface water capture could reduce the amount of water captured and diverted by BMSG's BT-5 pipeline diversion which is downstream of the proposed capture location.

During the mine operational phase, reduced recharge to the Big Flat area groundwater system due to capture and diversion of incident precipitation on the TWSF and water management pond would also have a small effect on groundwater flow in the vicinity of the facilities. Based on the reduced initial TWSF surface area (36 acres compared to 55 acres for Alternatives II and III), these effects would be smaller than Alternatives II and III. In Alternative IV, the TWSF could be expanded to 55 acres if

additional new ore reserves are identified during the operational period and additional TWSF space is required to allow processing of the additional ore. If expanded to the maximum size of 55 acres, Alternative IV effects from the TWSF would be identical to Alternatives II and III.

Impacts to groundwater quantity and flow patterns would be negligible during the post-closure phase of the project as precipitation on the TWSF and water management pond would be released to the watershed.

Groundwater Quality - Similar to Alternatives II and III, groundwater quality effects under Alternative IV would result from the interaction of bedrock groundwater with mine backfill material and leakage and drainage from the tailings and waste rock storage facility (TWSF) and water management pond.

Bucktail Drainage - During the operational period under Alternative IV, groundwater inflow to the Ram and Sunshine mines would be captured and diverted to the mine process circuit for treatment and disposal similar to Alternatives II, III and V and as described for Alternative II, no adverse effects are expected.

After mine closure in Alternative IV, the mines would be allowed to refill with groundwater and mine water/groundwater would flow towards Bucktail Creek as in Alternatives II and V. The chemical mass loads of copper and other metals exiting the mines under Alternative IV would be less than that estimated for Alternative II due to the amendment of the waste rock slash. Groundwater concentrations of sulfate, copper and other metals in Alternative IV and the other alternatives are tabulated in Appendix B and **Table 4-7** (copper only). Similar to Alternative II, metal concentrations are expected to be better than groundwater quality standards but slightly higher than ambient conditions. Sulfate concentrations in groundwater in Alternative IV would be similar to Alternative II, and may exceed the groundwater standard of 250 mg/L during the initial years of mine closure.

Big Flat Area - Sources of groundwater quality impacts in the Big Flat area include seepage and drainage from the tailings and waste rock storage facility (TWSF) as in Alternative II. Groundwater quality impacts from the tailings (TWSF) under Alternative IV are expected to be virtually identical to those described for Alternative II. Metals concentrations in downgradient metal concentrations would remain virtually the same as ambient while sulfate concentrations would increase from 1.0 mg/L to about 120 mg/L. During closure year 23, the sulfate concentration would decrease to about 90 mg/L, still above ambient conditions but below the 250 mg/L secondary standard. Metals concentrations in closure year 23 would remain close to ambient.

Springs and Seeps - Operational period effects to springs and seeps in Bucktail Creek drainage under Alternative IV would be identical to those described above for Alternatives II and III. Flows to Ram Gulch spring SS11 would be reduced by up to 100 percent, while effects to other Bucktail drainage springs and seeps are considered to be minimal.

In Alternative IV, as in Alternative II and V, flows to Ram Spring would be restored during closure after the mines are allowed to flood and groundwater flow through the mines is restored. Water quality in Ram Spring would approximate mine water quality as described above in the Groundwater Quality and Geochemistry sections and below in the Surface Water section. Metal concentrations in Ram Spring water would be similar to ambient conditions and remain better than groundwater quality standards but worse than surface water quality standards. In Alternative IV, copper concentrations in Ram Spring are predicted to be approximately two to ten times lower than for Alternative II due to amendment of the waste rock slash in the Ram mine.

Impacts to spring and seep flows in Big Flat Creek under Alternative IV would be identical to those described for Alternative II if the TWSF is expanded to its ultimate size (55 acres) in Alternative IV. If the TWSF were to remain at its initial size of 36 acres, the flows in spring SS10 in Big Flat Creek would be reduced by 22 percent in Alternative IV as compared to approximately 40 percent in Alternative II.

Surface Water Flow Effects - Surface water flow effects predicted for all Alternatives are tabulated in Appendix B. Effects to flows from Alternative IV are nearly identical to Alternative II with very minor exceptions in Big Flat and Big Deer Creeks. Because the TWSF in Alternative IV is initially smaller and captures less rain and snowmelt from the Big Flat Creek drainage, the model predicts flow reductions in Big Flat Creek to be slightly lower in Alternative IV than Alternative II. However, this difference would disappear if the Alternative IV TWSF were expanded to the full size as provided by Alternative IV.

Surface Water Quality Effects - Tables 4-8 and **4-9** and Appendix B summarize water quality conditions under Alternative IV and the other alternatives. No significant effects to surface water quality are predicted to occur from Alternative IV during any mine periods with the possible exception of sulfate in Big Deer Creek during mining and copper, sulfate and nitrate in Ram Spring during closure and post-closure periods.

Sulfate concentrations in Big Deer Creek are predicted to increase from approximately 5 mg/L (baseline condition) to a peak of approximately 10 mg/L (after full mixing) during operations then decrease to about 5 mg/l during closure. Predicted peak sulfate concentration in Alternative IV (10 mg/L) is higher than peak sulfate concentration for Alternative II (7 mg/L) due to the assumed lack of water treatment processes for sulfate removal in Alternative IV. Sulfate concentration in mine discharge (effluent) could be up to 600 mg/L and would be diluted by Big Deer Creek. Sulfate concentrations within the discharge mixing zone would be intermediate between the effluent concentration and 10 mg/L. The size and shape of the mixing zone depends on the nature of the discharge device used and the mixing zone granted by IDEQ. Alternative IV provides for discharge through an infiltration gallery adjacent to Big Deer Creek. This device was selected to minimize disturbance to the stream and adjacent riparian wetlands. The mixing zone associated with the infiltration system discharge is estimated to extend for several hundred feet downstream of the discharge location.

Ambient copper concentration in Ram Spring is about 0.036 mg/L and is predicted to increase to about 0.043 mg/L during closure. Both ambient and predicted concentrations exceed the aquatic life criterion for copper of approximately 0.004 mg/L. Sulfate in Ram Spring is predicted to increase to over 300 mg/L during the initial years of closure and decline to about 50 mg/L in closure year 23. Ambient sulfate concentration in Ram Spring is approximately 20 mg/L. Nitrate is predicted to increase to about 4 mg/l during the initial years of closure and decline to ambient baseline conditions (0.5 mg/L) within a few more years.

Alternative Discharge Locations - Under Alternative IV, the surface water discharge could be relocated at any phase of the project to other streams in the vicinity of Big Deer Creek, if desired. The EIS team chose Big Deer Creek for the discharge location in Alternative IV primarily due to concerns regarding the existing sediment contamination in South Fork Big Deer Creek. Studies (Golder, 2001) have shown that sediments in South Fork Big Deer Creek are contaminated with copper from the Blackbird Mine Site and that the sediments readily release copper to clean water (i.e., water with low copper concentrations) that contacts the sediments. Currently, the South Fork receives flows of contaminated water from Bucktail Creek, which prevents the sediment in the South Fork from being flushed of copper and becoming clean. Thus, the EIS team predicted that if treated mine water were discharged to South Fork Big Deer Creek, the water would likely become re-contaminated before it would reach Big Deer Creek, thus nullifying the environmental benefit of providing water treatment. However, since EPA's selected remedy for sediments in South Fork Big Deer Creek is natural cleanup by flushing, discharge to the stream could accelerate the cleanup.

Discharge of treated water to Big Flat Creek was also considered by FCC and dismissed primarily due to hydrologic limitations of the stream and effects associated with the additional road and pipeline disturbance with required for discharge to Big Flat Creek (Telesto, 2006d). Because ambient flows in Big Flat Creek are low, discharge of the predicted volume of treated water into upper Big Flat Creek could cause some channel modification and erosion. Discharge to middle Big Flat Creek would minimize hydrologic modification of the stream but would require road building in a roadless area.

Effects of Spills of Hazardous or Deleterious Materials – Alternative IV would require transportation of hazardous or deleterious materials near or adjacent to streams where an accidental spill could affect surface water quality. The risk of transporting potentially hazardous materials is common to all the action alternatives (II-V). The potential for a hazardous spill to cause significant adverse effects to surface water quality and fisheries resources was evaluated in the Transportation Technical Report (Hydrometrics and Smith, 2006) based on the types and amounts of hazardous materials transported and the likelihood and effects if a spill were to occur. The risk and effects of a spill on surface water quality in Alternative IV would be similar to that described for Alternative II with one possible exception. In Alternative IV there would be slightly less transport of water treatment reagents to the project and significantly less transport of water treatment wastes off-site for disposal, if reverse osmosis water treatment is not employed. In addition, Alternative IV includes upgrades and relocation of portions of the road along Williams Creek that will increase safety and reduce the risks of accidents and spills. Thus, risk of a spill of water treatment reagents and wastes is potentially less in Alternative IV than Alternative II.

Sediment Yield - Alternative IV has less sediment yield than Alternatives II or III. This alternative has less mining disturbance than Alternative III (because of elimination of the LAT for water treatment) and more road reclamation and road improvements than Alternative II (same as Alternative III).

Construction Period - The BOISED model predicts that sediment yield in the project area during the construction period would increase over background conditions (a potential short-term effect). This increase is due to facilities and road construction and reclamation of existing unused roads in both the Bucktail and Big Flat Creek watersheds.

In the Big Flat Creek watershed Alternative IV would have the same sediment yield as Alternative II. The sediment yield would be a one percent increase over the baseline level with sediment delivery returning to baseline levels within one year.

In the Bucktail Creek watershed Alternative IV would have the same sediment yield as Alternative III. The sediment yield would be an increase of 31 percent over the baseline level. As in Alternatives II and III sediment yield is predicted to return to the baseline level within two years.

Mine Operation, Closure and Post-Closure Period – Alternative IV would have the same additional access road improvements as Alternative III resulting in additional reductions in sediment delivery along the access route. In the project area long-term sediment yield in Big Flat Creek would be the same as described in Alternative II. The BOISED model predicts that Alternative IV would reduce long-term sediment yield in Bucktail Creek by 15 percent below baseline levels.

In Alternative IV, sediments in area streams would continue to improve as the result of the Blackbird cleanup as described for Alternative I. Sediment quality in Bucktail Creek, South Fork Big Deer Creek, Big Deer Creek, Panther Creek, and Blackbird Creek would be expected to improve through natural recovery such that Blackbird sediment cleanup levels would eventually be achieved.

Discharges and releases of water from mine facilities are not expected to significantly affect sediment quality or interfere with attainment of Blackbird sediment cleanup levels. However, adverse effects to sediment quality potentially could occur in Alternatives II, III, IV, and V from spills of hazardous or deleterious materials to streams similar to the effects described for surface water quality. The risk of transporting potentially hazardous materials is common to all the action Alternatives (II-V). The risk and effects of a spill on sediment quality in Alternative IV would be similar to that described for Alternative II with one possible exception. In Alternative IV there would be slightly less transport of water treatment reagents to the project and significantly less transport of water treatment wastes off-site for disposal, if reverse osmosis water treatment is not employed. In addition, Alternative IV includes upgrades and relocation of portions of the road along Williams Creek that will increase safety and reduce the risks of accidents and spills. Thus, risk of a spill of water treatment reagents and wastes is potentially less in Alternative IV than Alternative II.

Alternative V – Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Mine operation is virtually identical for Alternative IV and V, except that in Alternative V water would be pumped to Blackbird Creek where it would be treated and discharged. The mine hydrology, groundwater, and geochemistry in Alternative V are the same as described for Alternative IV. Only the potential flow and water quality effects in Big Deer and Blackbird Creek differ because of the different discharge location.

Geochemistry - Geochemistry of Alternative V would be the same as Alternative IV with the exception of potential differences in the water treatment system. In Alternative V, water from ICP that requires treatment (excess water during operations and captured groundwater (if needed) during closure) would be piped to a water treatment plant at the current location of the BMSG treatment plant in Blackbird Creek. Water treatment feedwater from the ICP for alternative v would be as described for Alternative II in **Table 4-1**. Projections of treated water (effluent) quality for Alternative V have not been made. However, this alternative assumes that effluent metal concentrations would be similar to those projected for Alternative II (**Table 4-2**) and the proposed effluent limits in EPA's draft NPSES permit (**Table 4-5**) for discharge to Big Deer Creek.

Groundwater Resources - Effects to groundwater resources would be identical to Alternative IV.

Surface Water Flow Effects - During Ram operations but before BT-5 is employed, Alternative V would reduce surface water flows during baseflow conditions in Bucktail Creek (44 percent), South Fork of Big Deer Creek (11 percent), Big Deer Creek (three percent), and Big Flat Creek (three percent). During Ram operations after BT-5 is employed and during closure, Alternative V would reduce surface water flows during baseflow conditions in Bucktail Creek (100 percent), South Fork of Big Deer Creek (25 percent), Big Deer Creek (three percent), and Big Flat Creek (3 percent).

Flows to Blackbird Creek during operations and closure would be increased by approximately 60 to 80 gpm (approximately 10 percent) on an annual basis, however, actual timing of the flow modification would depend on how the Blackbird water treatment system is operated. Currently, the Blackbird treatment plant is not operated during the winter and no discharge occurs when the plant is shut down. During post-closure, surface water flows would return to near pre-mining conditions.

Surface Water Quality Effects - Tables in Appendix B summarize water quality conditions under Alternative V and the other alternatives. No significant effects to surface water quality are predicted to occur from Alternative V during any mine periods with the possible exception of copper, sulfate and nitrate in Ram Spring during closure. Effects to Ram Spring would be as described for Alternative IV. Effects to Blackbird Creek have not been estimated quantitatively since the type of water treatment and NPDES effluent limits for this discharge are not known. However, the effects of this discharge would likely be beneficial as the stream currently experiences high metal concentrations and it is likely that an NPDES permit would require discharge of cleaner water that would dilute the instream metal concentrations.

Effects of Spills of Hazardous or Deleterious Materials – Alternative V would require transportation of hazardous or deleterious materials near or adjacent to streams where an accidental spill could affect surface water quality. The risk of transporting potentially hazardous materials is common to all the action alternatives (II-V). The risk and effects of a spill on surface water quality in Alternative V would be similar to that described for Alternative IV.

Sediment Yield - Alternative V has the lowest sediment yield of all the action alternatives. This alternative has less mining disturbance than Alternative III because of the elimination of the LAT for water treatment. Alternative V has the same additional site road reclamation and access road improvements as Alternatives III and IV. Alternative V has less new road construction and soil disturbance than Alternatives II and IV because the water treatment plant discharge pipeline to Big Deer Creek has been eliminated.

Construction Period - The BOISED model predicts that sediment yield in the project area during the construction period would increase over background conditions (a potential short-term effect). This increase is due to facilities and road construction and reclamation of existing unused roads in both the Bucktail and Big Flat Creek watersheds. However Alternative V has slightly less construction impacts due to elimination of the discharge pipeline to Big Deer Creek. The new road construction along the lower end of the pipeline is located outside of the Bucktail Creek drainage in the South Fork of Big Deer and Big Deer Creek drainages.

In the Big Flat Creek watershed Alternative V would have the same sediment yield as Alternatives II and IV. The sediment yield would be a one percent increase over the baseline level with sediment delivery returning to baseline levels within one year. In the Bucktail Creek watershed Alternative V would have the same sediment yield as Alternatives III and IV. As in the other action alternatives sediment yield is predicted to return to the baseline level within two years.

Mine Operation, Closure and Post-Closure Period – Alternative V would have the same additional access road improvements as Alternatives III and IV, resulting in additional reductions in sediment delivery along the access route during the mining period. In the project area long-term sediment yield in the Big Flat Creek watershed would be the same as described in Alternative IV. The BOISED model predicts that Alternative V would reduce long-term sediment yield in Bucktail Creek by 15 percent below baseline levels the same as Alternatives III and IV.

Sediment Quality - Alternative V would have a similar effect on sediment quality as Alternative IV.

Soil Resources

Summary

Construction, operation and reclamation of the ICP under all alternatives would result in similar impacts to soils, including loss of soil development and reduced productivity during operations and following reclamation. Soil salvage operations to maximize quality and quantity of salvaged soil would contribute to the success of site reclamation. Isolated areas of native soils may contain elemental concentrations of metals that could affect plant growth, but upon mixing with other soils no significant adverse affects are expected.

The area analyzed for soil impacts is the ICP Project Area centered on the Big Flat and areas near the Ram and Sunshine mines, and does not include the access roads.

Projected impacts to soil resources from construction and mine operations include:

- Destruction of soil associations and soil horizons;
- Changes in soil physical properties;
- Changes in soil fertility; and
- Changes in soil biology.

Impacts to soil development and productivity would be long-term in the area of the tailings and waste rock storage facility because of reduced soil thickness. Modification and mitigation measures developed by the agencies would reduce these impacts. Soil impacts under Alternatives IV and V would be less than Alternatives II and III.

Alternative I – No Action

Under the No Action Alternative soil impacts would be limited. Existing exploration related disturbance would be reclaimed. Erosion and sedimentation would continue at reduced rates as natural vegetation becomes established. Sediment loading from forest and existing FCC and BMSG site mine roads would continue to impact surface waters.

Alternative II - Company's Proposal

This alternative would disturb 129 acres (see **Table 2-3**), including seven acres for soil stockpile. Soils would be salvaged and stockpiled from sites disturbed by ICP activities. At reclamation, stockpiled soils would be spread across disturbed areas and revegetated. The overhead tram system, portals and utilities and would be removed and reclaimed at project closure. The applicant proposes to reclaim approximately 23,000 feet of sub-standard and non-essential pre-existing roads in the vicinity during initial project construction. Soil salvage would destroy soil profiles, alter soil structure, and reduce organic matter content, affecting aeration, pore space and bulk density, which affect soil-plant relations. Grading, scarification, disking and ripping would reduce compaction during reclamation. Establishment of vegetation, rodent activity, and freezing and thawing would contribute to the soil building process.

Long-term storage of soil would reduce populations of soil microorganisms essential in soil nutrient cycling, plant establishment and productivity. Biological components (e.g. native plant seeds, rhizomes and other plant parts) would be lost. It would likely take decades for volunteer establishment of native trees in the reclaimed areas due to limited seed source and competition with introduced grasses.

Isolated areas of existing native soils in the Project Area are naturally high in metals (up to 56 ppm cobalt and 605 ppm copper). Metals-affected soils, associated with soil parent materials derived from mineralized bedrock, would be mixed with other salvaged soils and would not have a significant effect on reclamation success.

Impacts from soil salvage would be short-term and minor.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

The increased disturbed area under Alternative III (324 acres including 176 acres of LAT area) would result in a proportionally greater impact to soils. LAT area soils would be tilled and planted, but not physically removed; otherwise impacts to soils would be similar to Alternative II. Plowing, tree removal and management for grass production on the LAT area will cause mixing of surface horizons and potential changes to soil characteristics. Application of treated water to the LAT would slightly increase metals over the period of LAT water application (estimated increase of 1 ppm copper and about 3 ppm arsenic), but this increase would be insignificant compared to naturally high levels in some area soils due to natural mineralization. Proposed road reclamation and improvements would locally reduce sediment yield to surface waters. The soil disturbance associated with Alternative IV would be in compliance with Forest Plan directives.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Alternative IV would have 112 acres of soil disturbance. Impacts to soils would be similar to those identified under Alternative II except that areas of disturbance would vary and impacts would be in proportion to amount of disturbed area. The soil disturbance associated with Alternative IV would be in compliance with Forest Plan directives.

Alternative V – Lower Bucktail Groundwater Capture, Water Treatment At Site Of Blackbird Treatment Plant And Surface Discharge To Blackbird Creek

Alternative V would have 111 acres of new soil disturbance. Impacts to soils would be similar to those identified under Alternative II except that areas of disturbance would vary and impacts would be in proportion to amount of disturbed area. The soil disturbance associated with Alternative V would be in compliance with Forest Plan directives.

Climate and Air Quality

Summary

Mining of the ICP under all alternatives would not result in changes to the climate of the Project Area or surrounding area. Mining, ore-processing, and construction activities at the Formation Capital Corporation Idaho Cobalt Project would be sources of suspended particulates and various hydrocarbons from gasoline and diesel-powered vehicles and equipment. FCC would be required to obtain an air quality permit from the Idaho Department of Environmental Quality. Overall, air quality in the Project Area would remain at or near present levels.

Alternative I - No Action Alternative

If ICP were not developed there would be no associated impacts to the air quality of the area. Current impacts to air quality associated with construction activities for the Blackbird mine cleanup and periodic forest fires would continue.

Alternative II - Company's Proposal

Air quality in the ICP site area would be affected by fugitive dust emissions from vehicular traffic on unpaved roads. The mining, ore-processing, and construction activities of the ICP site would be a source of both total suspended particulates (TSP or PT) and particulates that are 10-micron-or-smaller in diameter (PM_{10}). Ore-processing operations and gasoline and diesel-powered vehicles and equipment would be primary sources of gaseous pollutants such as sulfur dioxide, oxides of nitrogen, carbon monoxide, and volatile organic compounds.

Particulates - Particulate emissions from mining and construction would be caused by drilling, blasting, excavation, loading, hauling, and dumping of waste rock and ore. Particulate emissions from ore processing would result from crushing, handling, and storage of ore. Control or mitigation measures may be included in the air permit issued by IDEQ. In addition to particulates resulting from construction, mining, and ore-processing, ambient particulates from wind erosion, traffic on unpaved roads, and other sources exist within the ICP site area.

Gaseous Emissions - Background levels for gaseous criteria pollutants in the Project Area are low with no significant sources. The major emission source for gaseous criteria pollutants for the ICP site would be the vehicles. This would include sulfur dioxide, oxides of nitrogen, carbon monoxide, and volatile organic compounds.

Air Toxics (Metals Concentration) - Ore and waste rock at the ICP site contain minor amounts of metals. These air toxics (metals) are released through mining and construction activities, and are associated with the TSP and PM_{10} particulate emissions. Measures used to reduce particulate emissions are also effective in reducing air toxic (metals concentration) potential.

Air Quality Model - As a part of a comprehensive air quality permitting package for the ICP site proposed action, an air quality model was used to evaluate impacts of FCC's proposal using the current allowable PM_{10} emission rates, as well as fugitive emissions which occur at the ICP site. This model addressed all air quality parameters, their proposed emission rates, and utilized the on-site meteorological data collected by ICP for the years of 2000-2003. According to the summary for this modeling, the predicted concentration of PM_{10} particulates, when added to the representative background PM_{10} concentrations (**Table 4-10**), are within the limits set by the applicable Idaho, and Federal, ambient air quality standards. The modeling results indicate that operation of the ICP site does not cause exceedances of applicable ambient air quality standards, nor would it appear to have any significant effect on the nearby Frank Church-River of No Return Wilderness area (PSD Class II) airshed for air quality or visibility.

TABLE 4-10. Comparison of Maximum Modeled PM_{10} Concentrations With Idaho and Federal Ambient Air Quality Standards ICP Site				
Time Interval	**Maximum Contribution ($\mu g/m^3$)**	**Background Concentration ($\mu g/m^3$)**	**Contribution Plus Background ($\mu g/m^3$)**	**Idaho and Federal Ambient Standard ($\mu g/m^3$)**
24-Hour[(a)]	39.0	30.0	69.0	150
Annual[(b)]	7.0	7.5	14.5	50

Note: (a) = 24-hour concentration expressed as high, second-high values
(b) = Annual modeled contribution expressed as arithmetic mean
$\mu g/m^3$ = micrograms per cubic meter

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Impacts on air resources resulting from the agencies modifications to the company's proposal described under Alternative II would be the same as those discussed under the proposed action. Ambient air standards would not be expected to be exceeded. Elevated TSP and PM_{10} levels may result from short-term construction activities.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Impacts on air resources resulting from the agencies modifications to the company's proposal under Alternative IV would be the essentially the same as those discussed under the proposed action. Location of particulate sources associated with the tailings impoundment would be moved approximately one quarter of a mile to the north. Ambient air standards would not be expected to be exceeded. Elevated TSP and PM_{10} levels may result from short-term construction activities.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Impacts on air resources resulting from the agencies modifications to the company's proposal under Alternative V would be essentially the same as those discussed under the proposed action. Location of particulate sources associated with the tailings facility would be moved approximately one quarter of a mile to the north. Post closure access to the water treatment facility would not require access to the Big Flat or Bucktail drainage areas and there would be a slight decrease in the traffic mileage required to service the post closure water treatment facility. Ambient air standards would not be expected to be exceeded. Elevated TSP and PM_{10} levels may result from short-term construction activities.

Noise Resources

Summary

Mining of the ICP under all alternatives would result in increased noise levels. Noise generated by the ICP under the Action Alternatives II, III, or IV would vary in frequency and intensity during construction, operation, and reclamation activities. Although no cabins or residences are located within a 6.5-mile radius, the surrounding area is used for recreational activities and home to many wildlife species, and therefore, the EPA L_{dn} 55 dBA criteria (USEPA, 1979) was used to evaluate the ICP noise levels.

On-site workers and wildlife present in the ICP area would be exposed to various noise sources during the construction, operation, and reclamation phases of the ICP. Except the brief period that blasting occurs at or near the surface, noise sources associated with construction and operation

would typically be attenuated to near-ambient background levels within approximately one mile of the mine (Big Sky Acoustics, 2005).

Alternative I – No Action

Under the No Action Alternative there would be no changes to ambient noise conditions in the Project Area.

Alternative II - Company's Proposal

Noise Sources - ICP noise sources include: heavy diesel equipment; haul trucks; backup alarms; underground blasting; ore and waste rock loading/unloading; the tram air compressor; indoor mill processing and water treatment equipment; and water pumping and discharge.

Estimated Noise Levels - Table 4-11 indicates the estimated noise levels for various mining related activities at varying distances from the source. The values in the table conservatively assume that a direct line of sight exists between the noise source(s) and a receptor location at the distance shown. Because of the steep mountainous terrain in the project area, noise levels could be between 10 and 20 dBA less than those shown in **Table 4-11**, due to shielding by the natural terrain if the line of sight between a noise source and receptor is blocked. Although not predicted to be significant beyond one mile from the mine, noise sources (except blasting) associated with the project may be audible up to 2 miles from the sources depending on the location of the receptor relative to the sources, the background noise level at the receptor location, and atmospheric conditions.

Potential Noise Effects - On-site workers and wildlife present in the ICP would be exposed to various noise sources during the construction, operation, and reclamation phases of the ICP. Noise-induced hearing loss is the primary effect of exposure to excessive noise, which would only affect workers at the mine. Federal workplace standards for protection from hearing loss allow time-average level of 90 dBA over an 8-hour period, 85 dBA averaged over a 16-hour period and 70 dBA over a 24-hour period. Recreationists and others within several miles of the mine may perceive mine noise as an annoyance.

Numerous studies have been conducted documenting the effects on noise and wildlife. Wildlife response to noise is a function of many variables, including: characteristics of the noise and its duration; life history characteristics of the species; habitat type; season and activity of the animal; sex, age, previous noise exposure; and other physical stressors such as drought (CST, 1996). General wildlife responses to human-made noise include attraction, tolerance and aversion (CST, 1996; USEPA, 1971b: Knight, 1995).

On-site mammal and bird species studies were completed in 2004 concurrently with ICP drilling activities (Monarch and Associates, 2005a). Based on site observations, the wildlife functioned normally and did not startle due to the presence of the drill rig noise, including the constant hum of the equipment and the pounding noises. The noise levels were loud enough at some locations that birds could not be heard, so they were recorded by visual detection (Monarch and Associates, 2005a). Therefore, on-site habituation of wildlife receptors to the ICP noise sources is suggested, although some species and some individuals may react by avoidance or altering movement patterns.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Noise impacts of Alternative III would not differ significantly from those described under Alternative II. The differences in location of particular facilities would change the location of noise sources during construction, operation and reclamation. The greater area of disturbance associated with the LAT would result in a longer period of construction noise as well as the long-term operation of the LAT including sprinkling.

TABLE 4-11. Estimated Noise Levels at Various Distances from Source(s)				
Proposed Action	**Examples of Typical Mining Equipment / Noise Sources**	**Noise Level at Receptor**		
		½ mile	**1 mile**	**2 miles**
Construction — • Site preparation • Haul and access roads	Three pieces of earth moving equipment operating simultaneously, such as end-dump trucks, bulldozers, scrapers, front-end loaders, graders, etc., between 0700 and 1900 hours.	L_{dn} 39 dBA	L_{dn} 31 dBA	L_{dn} 23 dBA
Operation — • Mill facility • TWSF areas • Water treatment & discharge	Mill building encloses crushing and grinding operations, the water treatment system and operates 24 hours per day. One dozer and one heavy truck operate at TWSF site between 0700 and 1900 hours.	L_{dn} 45 dBA	L_{dn} 37 dBA	L_{dn} 29 dBA
Operation— • Tram operation	One diesel engine driving tram at the Ram portal 24 hours per day.	L_{dn} 43 dBA	L_{dn} 35 dBA	L_{dn} 27 dBA
Operations — • Cleaning tram buckets	Instantaneous blast of compressed air at tram takeoff.	35 dBA	27 dBA	19 dBA
Operation — • Mine blasting	Blasting – 10 charges of 375 lb explosives detonated simultaneously in holes approximately 25-30 feet deep below the ground surface.	106 dBC (peak)	100 dBC (peak)	94 dBC[1] (peak)
Operation— • Tram loading/unloading • 20-ton haul truck loading/unloading	Instantaneous noise due to impact of aggregate on bare metal of tram bucket or haul-truck bed.	35 dBA	27 dBA	19 dBA
Operation — • Road traffic	Fourteen vans or pickup trucks and three concentrate or supply trucks traveling the same road during the same hour.	L_{eq}(h) 33 dBA	L_{eq}(h) 29 dBA	L_{eq}(h) 26 dBA
Reclamation — • All areas	Three pieces of earth moving equipment operating simultaneously, such as end-dump trucks, bulldozers, scrapers, front-end loaders, graders, etc., between 0700 and 1900 hours.	L_{dn} 39 dBA	L_{dn} 31 dBA	L_{dn} 23 dBA

Note: (1) Blast noise would be potentially audible for several miles.
Sources: Big Sky Acoustics (2005).

Alternative IV - Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Noise impacts of Alternative IV would not differ significantly from those described under Alternative II. The differences in location of particular facilities would change the location of noise sources during construction, operation and reclamation.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Noise impacts of Alternative V would not differ significantly from those described under Alternative II. The differences in location of particular facilities would change the location of noise sources during construction, operation and reclamation.

Vegetation and Wetland Resources

Summary

Mining of the ICP under all alternatives would result in removal of vegetation in early stages of ecological succession following the Clear Creek fires. Depending on the alternative, 96 to 270 acres of vegetation would be removed for construction of mining facilities. Following mining, most of this acreage would be reclaimed and revegetated with native or agronomic species of grasses and forbs. Like current conditions, lodgepole pine would become the dominant tree species.

Alternative II (the company's proposal) would result in the filling of 0.1 acres of jurisdictional wetlands, 0.22 acres of isolated non-jurisdictional wetlands and reduction in recharge water to 1.02 acres of wetlands. These losses would be offset by construction of 0.25 acres of new wetlands. The other action alternatives would not result in the filling of 0.22 acres of isolated wetlands.

Alternative I - No Action Alternative

This alternative would maintain existing vegetation conditions in the Project Area. Plant communities would continue to undergo post-fire ecological succession. Non-native species seeded following the Clear Creek fires (e.g. timothy, smooth brome, and orchard grass) would remain a dominant component in the understory vegetation. Roads and other disturbances from exploration activities would be reclaimed.

Without the proposed project, plant communities would continue to mature, with lodgepole pine and subalpine fir becoming the dominant overstory species. As an overstory canopy of trees develops, the understory composition of grasses and other herbaceous species would decrease as a result of shading and competition for moisture. Non-native grass species would likely decline in abundance as the forest canopy matures. The development of even-aged lodgepole pine stands would be typical of ecological succession following a stand-replacing fire.

Taking no action would not affect wetlands or non-wetland waters of the United States. As a result of the Clear Creek fires, most of the forest overstory of the project area burned, which reduced evapotranspiration rates. With reduced evapotranspiration rates, surface runoff, and shallow groundwater was retained in shallow soil horizons and surfaced in downslope seeps, forming small isolated wetlands. As the forest overstory develops, rates of evapotranspiration would increase and some seeps and associated wetlands would become drier, perhaps losing a dominant component of hydrophytic vegetation. Small isolated wetlands, which currently are dominated by pioneer wetland species, may undergo conversion to upland sites; however, wetlands associated with perennial and ephemeral drainages would likely be unaffected by increased rates of evapotranspiration associated with a developing forest overstory.

Alternative II - Company's Proposal

This alternative would result in the disturbance or removal of 226 acres of vegetation. Plant communities that would be removed or altered are dominated by lodgepole pine communities in early stages of ecological succession. Of this disturbed acreage, 183 acres burned with high severity, 43 acres burned with medium severity. Additionally, 2.6 miles of new road would be constructed and 3.2 miles of existing roads would be upgraded, resulting in the removal of additional vegetation. Approximately 4.5 miles of substandard and non-essential roads would be reclaimed under this Alternative.

Construction of facilities on steep slopes (e.g. the tram corridor) would increase the risk that slopes would erode, removing vegetation and topsoil. Currently, steep slopes on which the tram corridor would be located are sparsely vegetated. Construction of the tram on these steep slopes would set back natural development of plant communities in immediate areas of construction disturbance and

increase amounts of unvegetated soil vulnerable to erosion. Erosion control measures may be necessary to prevent unacceptable levels of soil erosion and associated loss of vegetation resulting from construction disturbance on steep slopes.

Removal of forest vegetation for construction of project facilities would eliminate the potential of the land to provide forest products such as timber and fire wood for the duration of the project. This effect would be minor as most of the disturbed area currently is mostly dominated by seedlings and saplings and is not available for public access. At least 30 years would be required for burned communities to develop sufficiently to have economic value.

No threatened, endangered, or sensitive plants have been identified in the project area and therefore none would be affected by this alternative. Searches conducted of habitats likely to harbor threatened, endangered, and sensitive plants did not find any special-status plants.

Vegetation removed by project facilities would be lost for the duration of mining. Following mining, project facilities would be removed and topsoil would be replaced, recontoured, and revegetated. Within 3 to 5 years, plant communities in early stages of ecological succession would become established. These early seral communities would be dominated by herbaceous species, with trees becoming prominent within 5 to 10 years. During early stages of reclamation, soils would be vulnerable to wind and water erosion until vegetation cover becomes sufficiently well established to form root systems that bind and stabilize soil. Reclamation monitoring and implementation of remedial measures (e.g. reseeding, replanting, placement of geotextile and straw bales, and installation of silt fences) would help ensure successful revegetation and soil stabilization.

This alternative would result in the filling and permanent removal of 0.1 acres of jurisdictional wetlands from discharge pipeline and infiltration gallery construction, 0.22 acres of isolated, nonjurisdictional wetland vegetation by the tailings and waste rock storage facility, and the possible reduction in the water source to an additional 1.02 acres of wetland vegetation (0.22 acres in Ram Gulch and 0.80 acres in the headwaters of Big Flat Creek) (**Figure 3-9**). Reductions in groundwater recharge could alter the species composition and/or spatial extent of wetland plant communities. Following mining, recharge to these plant communities would be restored. Mitigation plans to compensate for losses to wetland vegetation have been prepared by FCC. ICP's plans specify onsite creation of 0.25 acres of wetland, which would act as direct replacement of the wetlands eliminated by the TWSF. No mitigation is proposed for potential secondary impacts to 1.02 acres of wetlands from loss of recharge or to the direct impacts to the 0.1 acres of wetlands affected by the pipeline.

Disturbance of soil resulting from mine-related activities would increase the potential that noxious weeds would spread to areas currently not infested. New roads would provide potential corridors for invasion of weeds into areas not currently infested. Monitoring and control of noxious weeds during all phases of the project would help reduce the risk that the proposed project would lead to the proliferation of noxious weeds into area not currently infested.

The natural progression of ecological succession following fire would be interrupted on sites where vegetation has been removed for mine-related activities; consequently, plant communities unaffected by mining would continue to mature, with tree species becoming predominant. Reclamation following mining would initiate early cycles of ecological succession, which would result in plant communities with different species composition and structure from unaffected plant communities. Newly reclaimed communities would have a higher composition of forbs and grasses; whereas plant communities undisturbed by mining would be tree-dominated with less foliar cover of herbaceous species in the understory vegetation.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

This alternative would result in the direct disturbance of 129 acres of vegetation from mine-related facilities. Additionally, about 4.5 acres of vegetation along the Williams Creek Road would be altered with the upgrading road to improve safety and structural characteristics of the road.

Plant communities that would be removed or altered on the mine site are dominated by lodgepole pine saplings and seedlings. Of this disturbed acreage, 195 acres burned with high severity and 71 acres burned with medium severity.

On the mine site, 5.6 miles of new road would be constructed and 3.1 miles of road would be upgraded resulting in the removal of additional vegetation. Upgrading of the Williams Creek Road would remove vegetation from approximately one mile of road that would be re-aligned, disturbing approximately 4.5 acres of sagebrush-grassland vegetation and talus on steep south-facing slopes. Additional Douglas-fir and lodgepole pine communities (less than one acre) would be removed through construction of elevated turnouts and other minor improvements.

Upgrading the Williams Creek Road would not affect any sensitive species. Although one sensitive species, Salmon twin bladderpod, is known to occur in lower Williams Creek on dry, sparsely vegetated slopes, field searches of areas of proposed disturbance in May of 2005 did not find any occurrences of this species (Elliott, 2005). It appears that habitat that would be disturbed by upgrading the Williams Creek Road is not suitable for this species. Most of the habitat that would be affected is above the elevational occurrence of this species in the Williams Creek drainage. Also, the substrate where this species occurs is steep dry, unstable gravel on steep slopes. Sites that would be disturbed have different substrate characteristics, with substantial amounts of large angular talus that does not support plant growth.

This alternative differs from Alternative II in that the LAT would convert 175 acres of early successional lodgepole pine forest to non-native agronomic species such as timothy, smooth brome, orchard grass, and fescue species. Application of water to this stand of cultivated grasses would result in production of substantial amounts of biomass that would be harvested and to a small extent accumulate as litter. Harvesting or burning biomass that accumulates during the growing season as proposed would be necessary to maintain optimal functioning of the LAT.

Following mine closure, non-native vegetation on the LAT would need to be removed to allow for establishment of native vegetation. Most species of native vegetation, especially lodgepole pine, subalpine fir, and Engelmann spruce, are not able to naturally establish where there is a high density of competing vegetation. Removal of the agronomic species from the LAT would require treatment to kill the vegetation, followed by cultivation to break up the sod and root systems.

Plants in the LAT would likely produce seed that would spread to adjacent areas, increasing the component of non-native grasses in areas surrounding the LAT site. This effect would be minor as non-native species (e.g. timothy, smooth brome, and orchard grass) were extensively seeded following the Clear Creek fires and have subsequently become well established on many burned areas.

The tailings and waste rock storage facility would be decreased from 55 acres to 36 acres. Unlike Alternative II, this alternative would not directly destroy 0.22 acres of wetland vegetation through construction of tailings and waste rock storage facility. This alternative would also have less potential to reduce groundwater recharge to 0.08 acres of wetland vegetation in Big Flat drainage because the tailings and waste rock storage facility would cover less area and the LAT would provide additional recharge.

This alternative differs from Alternative II in that approximately one mile of road along Panther Creek would be raised to improve drainage and elevate the roadbed above the floodplain; and

improvements to the Williams Creek Road would include modification of 10 turnouts, one corner modification, and approximately one mile of road alignment.

Effects on vegetation resulting from construction would be similar to that described for Alternative II, but the land area affected would be substantially larger as a result of the LAT with Alternative III. Impacts to forest production and noxious weeds would otherwise be similar to Alternative II. Like Alternative II, plant communities would be removed for the life the mine, but would be reclaimed following mining. Unlike Alternative II, reclamation with this alternative would revegetate with native species.

This alternative would not result in the filling of 0.22 acres of isolated, non-jurisdictional wetlands that would be affected by FCC's proposal in Big Flat but would permanently reduce recharge to wetlands below the Ram mine. This alternative would relocate the tailings and waste rock storage facility, which would eliminate direct impacts to wetlands and in the headwaters of Big Flat Creek.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

This alternative differs from Alternative III in that the tailings and waste rock disposal facility would be located to the east of the mill site, the water storage pond would be eliminated, and the Alternative III LAT would be replaced with advanced water treatment and discharged to surface water (Big Deer Creek). The water treatment system for Alternative IV differs from Alternative II in that reverse osmosis would not be included as a primary treatment step and would only be utilized as a polishing step if required to meet effluent limits. The pipeline to conduct water to be discharged would be placed primarily in existing roads and would have minimal effects on vegetation. As a result of these modifications, 112 acres (versus 129 for Alternative II and 324 acres for Alternative III) would be disturbed. This alternative would result in the disturbance of 97 acres of post-fire vegetation.

Elimination of the LAT would substantially reduce effects to vegetation as compared with Alternative III (175 acres for land application). Vegetation removed by the initial tailings and waste rock storage facility (36 acres) would be less than for Alternatives II or III.

This alternative would have a similar effect on wetlands as Alternative II. The water discharge pipeline and infiltration gallery would directly impact 0.1 acres of jurisdictional wetlands in the Bucktail and Big Deer drainages. Wetlands would also be impacted where there would be potential for reduced surface runoff and shallow groundwater to charge downslope wetlands in the headwaters of Ram Gulch and Big Flat Creek. Affected wetlands could become smaller or contain less surface water, which could affect the nature and extent of wetland vegetation. This alternative is projected to affect wetlands or waters of the U.S. where the pipeline to conduct excess surface water to Big Deer Creek crosses drainages that flow under roads that would contain the pipeline. At points where the pipeline would cross drainages that pass under the road, culverts or bridges would have to be placed which could result in discharge of sediment or fill to surface waters and associated wetlands. The riparian wetlands adjacent to Big Deer Creek would be directly impacted by construction of the infiltration gallery to discharge water to Big Deer alluvium.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Construction of mine facilities with this alternative would have similar effects on vegetation as Alternative IV. Unlike Alternative III and Alternative IV, construction of mine facilities would not directly affect jurisdictional wetlands in the Bucktail and Big Deer Creek drainages.

Wildlife Resources

Summary

Mining would result in a small loss of habitat, but would not result in significant local or regional impacts to wildlife. Minor impacts to wildlife would result from additional noise, lights, human activity and traffic. Increased traffic could result in minor increases in mortality. There is currently little wildlife activity in the project area, but it would increase as the forest regenerates following the 2000 Clear Creek fires. The project, under any alternative, would have no effect on federally listed threatened or endangered species of wildlife. Population viability of Forest Service sensitive species, would not be affected and would not result in a trend toward federal listing**.** No Management Indicator species would be affected by any of the action alternatives.

Alternative I – No Action

Under the No Action alternative, wildlife and wildlife habitat would be unaffected by the proposed project. Ecological succession would continue in the absence of fire and forest habitats would provide habitat for a diversity of wildlife species.

Alternative II - Company's Proposal

Under Alternative II there would be a direct loss of 129 acres of habitat. These losses would be temporary, lasting for the life of the project. Following operations, all areas would be reclaimed. Assuming a ten-year life of operations and time for vegetation to become established, it would be 5 to 10 or more years or more following mining before conditions are suitable for most species of wildlife**.**

Sounds and sights of mining would have varying effects on wildlife depending on sensitivity of species and individuals and the magnitude of disturbance. Loss of habitat would reduce local availability of forage, security, and breeding cover for wildlife inhabiting the area. Species that utilize these disturbed sites would be displaced from portions of their existing range. Displaced animals may be incorporated into adjacent populations, depending on variables such as species behavior, density, and habitat quality. Adjacent populations may experience increased mortality, decreased reproductive rates, or other compensatory or additive responses.

With the loss of habitat, the capacity of the project area to support current levels of wildlife would be reduced. Additionally, unaltered habitat adjacent to the project area may have reduced habitat values because some species and individuals could avoid using habitat close to high levels of human activity. Many species and individuals would habituate to activities associated with mining operations and would resume or continue use of habitat in or near the Project Area.

Threatened And Endangered Species: Canada Lynx - Although the area has been mapped as suitable lynx habitat, it is currently unsuitable as a result of the 2000 Clear Creek fires. The Blackbird and Deer Creek Lynx Analysis Units, which includes the project area, currently has 85–90 percent unsuitable habitat. The Lynx Conservation Assessment Strategy (Ruediger, et al., 2000) specifies that developments that remove lynx foraging and denning habitat would not be approved in lynx habitat when 30 percent or more of and LAU is unsuitable. The proposed project would not increase unsuitable habitat in the LAU, as all habitat in the Project Area proposed for disturbance is currently unsuitable.

There would be no direct or indirect effects to lynx or lynx habitat as a result of proposed mine construction and operations under Alternative II. Due to habitat alterations, as a result of the Clear Creek fires and presence of a well-developed road system, lynx likely would not utilize habitat in the Project Area except as transients. It would probably be 10 to 20 years following cessation of mining operations before suitable lynx habitat exists in areas of the ICP Project Area.

Threatened And Endangered Species: Gray Wolf - Gray wolf populations are stable to increasing in central and southern Idaho (Wenger, 2005). Wolf management, regulatory direction and adequate big game populations are likely to be the dominant factors in continued wolf recovery. The limited scale of the proposed action is not expected to have measurable impacts to gray wolf reproductive, foraging and travel/migration habitat, prey base, or population viability.

The gray wolf is covered by recovery plans; however, the Idaho population is a nonessential experimental population not subject to complete protection under the Endangered Species Act of 1973.

The proposed action would not adversely affect gray wolves and would not jeopardize the continued existence of the gray wolf. Wolf habitat would not be affected by the proposed alternative. There is no known use of the project area by gray wolves with all known wolf activity being well away from the project site. In addition, habitat for primary prey is sub-optimal in the burned area around the project site, which further reduces the chances of wolves coming into the area.

Threatened And Endangered Species: Bald Eagle - No occurrence of bald eagles has been documented within the proposed project area and none are known to nest within 20 miles of the project. There would be no direct, indirect or cumulative effects to the bald eagle as the result of proposed mine construction and operations under Alternative II.

The limited scale of the proposed action is not expected to affect bald eagle reproduction, foraging or roosting habitat or population viability.

Candidate Species: Yellow-billed Cuckoo - No yellow-billed cuckoos have been observed during surveys on the Salmon-Challis National Forest. There is no suitable habitat for this species within the area. All action alternatives would have no effect on the yellow-billed cuckoo because of the limited scope and scale of the proposed action and lack of suitable habitat.

Region 4 Sensitive Species: Wolverine - Due to conditions following the Clear Creek fires there is little likelihood that wolverines would occur in the area. There would be little chance of affecting individuals and habitat. Alternative II is not likely to contribute to a trend toward federal listing or loss of viability to the population, species or its habitat.

Region 4 Sensitive Species: Fishery - There would be no direct, indirect or cumulative effects to fisher as a result of Alternative II. Mining disturbances would delay the recovery of forested habitat for a period of 10 to 15 years beyond what would occur in the absence of the proposed project. No fishers have been documented within the proposed project area and there is little likelihood that they would occur in the area.

None of the alternatives are likely to contribute to a trend toward federal listing or loss of viability to the population, species, or its habitat. Fisher habitat would not be affected by any of the alternatives.

Region 4 Sensitive Species: Northern Goshawk - There would be no direct or indirect effects to northern goshawk as a result of Alternative II. As a result of the Clear Creek fires no suitable habitat for this species is present in the project area.

None of the alternatives would contribute to a trend toward federal listing or loss of viability to the population or species. Goshawks nest and occupy territories in the general area, but well away from the project area. The proposed mining operations would not affect suitable nesting habitat in the project area.

Region 4 Sensitive Species: Three-toed Woodpecker - Foraging and nesting habitat for the three-toed woodpecker would be removed by mining facilities; however, as a result of the Clear Creek fires, considerable foraging and nesting habitat was created. With the large expanses of burned trees and

associated high insect populations, foraging and nesting opportunities for the three-toed woodpecker would continue to be abundant locally and regionally for several years.

None of the alternatives would contribute to a trend toward federal listing or loss of viability to the population or species. Three-toed woodpeckers move into areas where there have been forest fires. Considering the small area that would be disturbed for mine facilities, the large expanses of suitable habitat nearby, effects on this species would be negligible.

Region 4 Sensitive Species: Northern Spotted Frog - Direct and indirect impacts to potential Spotted Frog habitat are predicted as a result of Alternative II. Alternative II would result in removal of 0.22 acres of wetland vegetation by tailings and waste rock storage facility, and the possible reduction in the water source to an additional 1.02 acres of wetland vegetation. Although the northern spotted frog has not been observed at these wetlands, they provide potential habitat.

Proposed activities may impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species

Management Indicator Species: Pileated Woodpecker - The pileated woodpecker requires old and mature forest with snags and downed logs for nesting and foraging. As a result of the Clear Creek fires, suitable mature or old-growth Douglas-fir in the area of the proposed operations is lacking. Under Alternative II there would be no direct or indirect effects on pileated woodpecker habitat or the species.

Management Indicator Species: Greater Sage Grouse - There would be no direct or indirect effects to greater sage grouse as a result of Alternative II. The greater sage grouse is a sagebrush-obligate species. Sagebrush habitat does not occur within or near the proposed project area. No greater sage grouse habitat would be affected.

Management Indicator Species: Northern Spotted Frog - This species is addressed above as a Region 4 Sensitive Species.

Other Species: Elk, Mule Deer And Other Big Game Species - Major big game species would not be directly affected through implementation of Alternative II. The project footprint is small compared to the regional habitat available. Suitable foraging habitat is becoming established following the Clear Creek fires and there would be a small amount of new roads constructed in the area. Public access to the area would continue to be controlled by the locked gate on Blackbird Creek.

There is a slight possibility for increased big game mortality as a result of more traffic on roads; however, rates of vehicle-animal collisions on forest roads are low because speeds are usually low and drivers are aware of wildlife along roads.

There is the possibility of increased hunting pressure in the Project Area due to increased site use; however, access is controlled by the Blackbird Mine Group and employees would not be allowed to carry firearms on the Blackbird or ICP properties.

Other Species: Birds - Proposed mining activities would remove habitat for birds for the life of mining until reclamation is successful. Forest species would not inhabit disturbed areas until trees become established. The continued regeneration of the forest following the Clear Creek fires will result in an increase in suitable habitat in the area around mining developments.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Under Alternative III there would be a direct loss of habitat (approximately 149 acres) and changes to habitat in 175 acres associated with the LAT. Alternative III would reduce the size of the TWSF to eliminate direct impacts to 0.22 acres of isolated wetlands and would include the area of the LAT

irrigation site (175 acres). Alternative III, direct habitat loss from total project disturbance including the TWSF (149 acres) would be for the life of the operation. Following cessation of operations the TWSF would be capped and revegetated with native grasses, forbs, shrubs and trees.

By eliminating the direct loss of 0.22 acres of isolated wetlands Alternative III would reduce the risk of impacts to wildlife that rely on wetland habitat for security, foraging or breeding. The species that may be most affected by the retention of these wetlands are the northern spotted frog and migratory birds that could use the wetlands and adjacent riparian habitat. There may be minor indirect effects from displacement of wildlife due to the proximity of ICP activities.

The increase in disturbance associated with the LAT disposal area of approximately 175 acres would result in an increase in the area cleared of burned trees and some living trees (approximately 20 acres) and would be planted to non-native grasses to enhance evapotranspiration during operations. Removal of tree and shrub regeneration from this area would delay use of this area by wildlife species that require trees and canopy cover for the life of the mine and until trees become established following final reclamation (several decades).

The exposure of wildlife to heavy metals and nitrates due to uptake by vegetation in the LAT or movement of water from the LAT into ground or surface water in the Big Flat drainage has been identified as a potential concern. Fencing of the LAT would limit big game access to LAT vegetation. Because water would be treated prior to application to the LAT, metals concentrations would not be elevated in vegetation or surface water and groundwater.

The possibility that nitrates may adversely affect herbivores foraging on grasses irrigated on the LAT system was evaluated because nitrogen compounds would end up in mine water as a result of compounds used in blasting (30 - 50 mg/L). Nitrogen load applied to the LAT area would be approximately 30 pounds per acre per year (Brunner, 2005). This level is in the range of agricultural application and is not expected to pose a risk to herbivores. Higher levels of nitrogen applied to the grasses would make them more nutritious, benefiting elk calves (Miller, 2005).

Although deer and elk would be attracted to forage high in nitrogen, the irrigated LAT area is small relative to total available foraging range. Foraging over a larger home range would dilute concentrations of ingested nitrogen. Seasonal use during the snow-free season (no big game winter in, or near, the project area) would also limit exposure of animals to elevated nitrate levels in forage. The potential for negative effects of nitrate on herbivores, primarily deer and elk, would be low.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Alternative IV would eliminate direct impacts to isolated wetlands in the TWSF area and would reduce the total disturbance area to 112 acres as compared with Alternative II (129 acres) and Alternative III (324 acres). The reduction in habitat disturbance would allow continued maturation of seral vegetation that has been affected by the Clear Creek fires. The TWSF (northern location) would contain the same storage volume as in Alternative II, while covering a slightly larger footprint, resulting in slightly greater direct habitat loss than under Alternative II and III.

Potential direct and indirect impacts of Alternative IV would be substantially the same as those described under Alternative II.

Threatened And Endangered Species – There would be no predicted impacts to threatened or endangered species from Alternative IV.

Region 4 Sensitive Species - There would be no significant impacts to USFS Region 4 Sensitive species from Alternative IV. Reducing the size of the TWSF to avoid elimination of 0.22 acres of isolated wetlands would reduce the risk of impacts to wildlife that rely on wetland habitat for security, foraging or breeding (e.g. northern spotted frog).

Management Indicator Species - There would be no significant impacts to SCNF Management Indicator species from Alternative IV.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Alternative V is the same as Alternative IV except for the location of the water treatment facilities. Alternative V would eliminate direct impacts to isolated wetlands and reduce the total disturbance area as compared to Alternatives II and III. The reduction in habitat disturbance because the LAT area would not be developed would allow continued maturation of seral vegetation. Potential impacts of Alternative IV would be substantially the same as those with other action alternatives.

Threatened And Endangered Species – There would be no impacts to threatened or endangered species from Alternative V.

Region 4 Sensitive Species - There would be no significant impacts to USFS Region 4 Sensitive species from Alternative V. Reducing the size of the TWSF to avoid elimination of 0.22 acres of isolated wetlands would reduce impacts to wildlife that rely on wetland habitat for security, foraging or breeding (e.g., northern spotted frog).

Management Indicator Species - There would be no significant impacts to SCNF Management Indicator species from Alternative V.

All Alternatives

Disclosure Statement for compliance with the Migratory Bird Treaty Act (MBTA) and Executive Order 13186 - This project complies with Executive Order 13186 since the analysis meets Forest Service requirements as defined under the January 16, 2001 MOA between the USDA-Forest Service and the USDI-Fish and Wildlife Service. The purpose of the MOA is to strengthen migratory bird conservation through enhanced collaboration between the USFS and FWS in coordination with state and local governments.

Fisheries Resources

Effects of the proposed Idaho Cobalt Project alternatives on fisheries resources and aquatic habitats are discussed in this section. The main issues identified for fisheries resources are potential effects to aquatic habitat and fish and macroinvertebrate populations downstream from the project and along the transportation route. In particular, the presence of special status species (Chinook salmon, steelhead, cutthroat and bull trout) within the area (see Chapter 3 Fisheries) necessitates an assessment of the effects of proposed actions associated with each alternative. The potential effects to ESA-listed species will also be discussed in the biological assessment (BA) which will be prepared after the preferred alternative is selected.

Summary

Potential Effects of Project Actions - All action alternatives involve water management actions and facilities that could affect the quantity and quality of water in nearby streams. The primary sources of water quality and quantity effects from mining are: 1) handling and transportation of potentially hazardous materials; 2) increased sedimentation to streams from road construction and increased traffic along the proposed transportation route and ground disturbances within the ICP project boundary; and 3) effects from mine water management actions and facilities.

Stream flow is important to fish because it regulates the amount of useable habitat for spawning and rearing through changes in water depth and velocity (Bjornn and Reiser, 1991). In general, the amount of spawning and rearing habitat increases with flow up to a point where water velocity or

depth become too great and useable habitat decreases. Thus, project actions that decrease stream flow can affect the amount of available habitat, which is particularly important during low (base) stream flow. Project actions may also change the amount or timing of water delivered to streams. For water quality, the main concern from mining is the potential for adverse sediment impacts and/or chemical contamination to nearby streams. Effects to fisheries from water quantity and water quality changes are based on DSM predictions of water quality changes and sediment model predictions of changes in the delivery of sediment to streams as described in the Water Resources section and in Appendix B.

Mining and road construction have been recognized as major sources of fine sediment (e.g. silt, clay and fine sand) that can degrade salmonid habitat (Furniss et al., 1991; Nelson et al., 1991; Waters, 1995). Suspended fine sediment in streams reduces light penetration and thus photosynthesis and primary production of biota in the stream system, delays fish migration, disrupts fish feeding and therefore growth, interferes with respiration through gills, and increases gill irritation that may cause fungal or bacteria infections. Deposition of excessive fine sediment eliminates habitats for invertebrates, reduces the permeability of spawning gravels, and blocks the interchange of subsurface and surface waters. Fine sediments also trap metals that can then become available for bottom feeding aquatic insects that will be consumed by fish. Typically, sediment from mining activities enters streams from road surfaces and ground disturbances. Fine sediment production along the transportation route is a concern because Chinook, steelhead, bull trout, and westslope cutthroat trout live and depend on the resources provided by streams along the proposed transportation route. Effects to fisheries from sediment impacts are based on predictions of the amount of sediment delivered to streams as described in the Water Resources section.

The risk of transporting potentially hazardous materials is common to all of the action Alternatives (II-V). The potential for a hazardous spill to cause significant adverse effects to fisheries resources or ESA-listed fish for the action alternatives was evaluated based on the types and amounts of hazardous materials transported and the likelihood and effects if a spill were to occur. A list of the hazardous materials transported for the ICP, the characteristics of the materials transported, the risk of spill of the materials, and the estimated frequency of a spill for each material is provided in **Table 4-12**. Additional chemicals are listed for those Alternatives (II, IV, and V) that include additional water treatment of excess water prior to direct discharge to streams.

The quantity of transported materials necessary to reach aquatic toxicity levels in transportation route streams during low flow are presented in **Table 4-13** for materials common to all action alternatives and in **Table 4-14** for alternatives that involve water treatment. A simplified method was used to calculate toxic quantities and assumes material is dissolved and completely mixed into the water column (TTE, 2006). One-minute and 30-minute quantities were used to simulate a short spill versus a longer spill.

Small streams are more susceptible than large streams to a hazardous spill because of dilution and the fact that more of the transportation route is along small streams. Accidental spills of hazardous material, should they occur, would cause direct toxic effects if released into the stream. Sensitive species would be impaired by sublethal effects (i.e., respiration, reduced productivity, growth, mobility, etc.) or could be killed by a lethal concentration. Typically, direct effects of toxicants would reduce organism abundance, while indirect effects may lead to changes in community composition, reduced performance, and altered behavior. The most hazardous spills would probably result from a direct spill of diesel or copper sulfate into area streams.

TABLE 4-12. Materials transported for the ICP alternatives along with spill risk, amount transported, toxicity, and accident occurrence near a stream (from TTE 2006).

Reagent / Chemical or Product	Amount Transported/ Trip	Trucks/Year (per day)[1]	Container Type/ Size	Aquatic Toxicity $LC50_{96}$)[4] (mg/L)	Spill Risk[5]	Est. Years Between Accidents Near a Stream
AERO® 343 Xanthate	40,000 lbs	14	Flo Bin/ 1 ton	595 mg/L	Low	424
AERO® 350 Xanthate	40,000 lbs	16	Flo Bin/ 1 ton	12 mg/L	Low	371
Copper Sulfate	32,000 lbs	20[2]	Super Sack/1 ton	0.006 mg/L	Moderate	297
AEROFROTH®65 Frother	28,000 lbs	3	Plastic Barrel/ 55 gal	NA	Moderate	1978
Sodium Sulfide	20-100 tons	1 – 5	Sacks/ 50 lbs	NA	Low	1187
Superfloc	8 tons	3[3]	Sacks 50 lbs	300 mg/L	Low	1978
Lime	37,500 lbs	4	Super Sack/ 1000lbs	92 mg/L	Low	1978
Diesel	4,500 gallons	150	Fuel Truck/ 4,500 gal.	160-4000 mg/L	High	40
Gasoline	34 gallons	150[3]	Fuel Truck/4,500 gal	40-100 mg/L	High	40
Cement	44,000 lbs	115	Sacks/ 94 lbs	92 mg/L	Low	52
Oils, Lubricants, Grease, Antifreeze	67 gallons	150[3]	Barrel/ 55 gal	NA	Moderate	40
Propane	9,400 gallons	5	Fuel Truck/ 9,400 gal	NA	Low	1187
Antiscalant	4,000 gallons	1	250 gal. tote/ 4,000 gal	2,660 mg/L	Low	5933
Ammonium Nitrate	10 tons	45	Bulk Container/ 10 tons	800 mg/L	Low	132
Bulk Concentrate	16 tons	700	Sealed Container/ 16	Insoluble	Low	8
Water Treatment Chemicals and Reagents (Alternative II, IV, & V)						
Polymer Flocculant (Alt. II, IV, &V)	20 gallons	1[3]	Sealed Pail/ 5 gal	2.7 mg/L	Low	5,933
Hydrated Lime (Alt. II, IV, &V)	2,000 lbs	1	Super Sack/ 1000 lbs	NA	Low	5,933
Hydrochloric Acid (Alt. II, IV, &V)	200 gallons	2	Plastic Drum/ 55 gal	pH	Moderate	2,966
Methanol (Alt. II, IV, &V)	250 gallons	2	Plastic Drum/ 55 gal	20,000 mg/L	Moderate	2,966
Treatment Plant Waste (Alt IV & V)	20 tons	110	Bulk Dump Truck	NA	Low	54
Sodium Hypochlorite (Alt. II only)	200 gallons	1[3]	Plastic Drum/ 55 gal	0.1-0.3 mg/L	Moderate	5,933
Sodium Bisulfite (Alt. II only)	250 gallons	2	Plastic Drum/ 55 gal	240 mg/L	Moderate	2,966
RO Scale Inhibitor (Alt. II only)	50 gallons	1[3]	Sealed Pail/ 5 gal	330 mg/L	Low	5,933
RO Alkaline Cleaner (Alt. II only)	1.5 tons	1[3]	Sealed Pail/ 5 gal	pH	Low	5,933
RO Acid Cleaner (Alt. II only)	1.5 tons	1[3]	Sealed Pail/ 5 gal	pH	Low	5,933
Cement (Alt. II only)	22 tons	148	Sacks/ 94 lbs	92 mg/L	Low	40
Bentonite (Alt. II only)	22 tons	41	Sacks/ 50 lbs	NA	Low	145

1. Average values and actual truck count will vary.
2. Does not add to truck count. Product will be backhauled from the refinery. Described in FCC's Storm Water Management Plan for the ICP (Telesto 2006a).
3. Does not add to truck count, as the small quantity will be transported with other materials.
4. Aquatic toxicity ($LC50_{96}$) expressed as the lethal concentration (LC) of the chemical needed to result in 50 percent mortality for a given organism (Chinook, rainbow trout or other salmonid) over a given time interval (96 hours). "pH" signifies that chemicals are not acutely toxic but could pose local pH problems (irritation of skin, eyes, and gills of fish) that could lead to death. "NA" indicates material was not assessed because there were no aquatic toxicity or water quality criteria available.
5. The risk of spilling transported materials depends on several factors, including weather, transportation container, accident severity, and form and quantity of the material being transported (TTE, 2006 Simons & Associates, Inc., 1996).

TABLE 4-13. Transport material information and quantity of material required to reach aquatic toxicity levels in ICP area streams simulating a short spill (lbs/min) versus a longer spill (lbs/30 min) (from TTE 2006).

Material Information		343 Xanthate	350 Xanthate	Copper Sulfate	Superfloc	Lime/ Cement	Diesel	Gasoline	Antiscalant	Ammonium Nitrate
Quantity/Trip (lbs) or (gal)		**40,000**	**40,000**	**32,000**	**16,000**	**37,500**	**4,500 gal**	**34 gal**	**4,000 gal**	**20,000**
Annual Trips		**14**	**16**	**20**	**3**	**4**	**150**	**150**	**1**	**45**
Form		**Dry**	**Dry**	**Dry**	**Dry**	**Dry**	**Liquid**	**liquid**	**Liquid**	**Dry**
Container		**Flo Bin**	**Flo Bin**	**Sack**	**Sack**	**Sack**	**Fuel Truck**	**Fuel Truck**	**250 gal tote**	**Bulk Container**
Aquatic Toxicity (mg/L)		**595**	**12**	**0.006**	**300**	**92**	**160**	**40**	**2,660**	**800**
Spill Risk		**Low**	**Low**	**Moderate**	**Low**	**Low**	**High**	**High**	**Low**	**Low**
Stream	**Flow (cfs)**	**Quantity Required to reach toxic (Dry-lbs/min; Liquid-gal/min)**								
Moccasin Ck	1.0	2.32	0.047	0.00002	0.12	0.36	0.09	0.024	1.04	3.1
Blackbird Ck	2.5	5.48	0.111	0.00006	0.28	0.85	0.22	0.057	2.60	7.4
Williams Ck	3.0	6.69	0.135	0.00007	0.34	1.03	0.27	0.070	3.11	9.0
Deep Ck	4.1	9.09	0.183	0.00009	0.46	1.41	0.36	0.095	4.26	12.2
Panther Ck below Blackbird Ck	20.0	44.57	0.899	0.00045	2.24	6.89	1.77	0.466	20.76	59.9
Salmon R.- below Williams Ck	700	1560.06	31.463	0.01573	78.54	241.22	62.06	16.321	726.76	2097.6
Salmon R- Below Panther Ck	1,300	2874.98	57.983	0.02899	144.75	444.53	114.37	30.077	1349.70	3865.5
		Quantity Required to reach toxic (Dry-lbs/30 min; Liquid-gal/30 min)								
Moccasin Ck	1.0	69.53	1.40	0.00070	3.50	10.8	2.8	0.73	31.15	93.5
Blackbird Ck	2.5	164.48	3.32	0.00166	8.28	25.4	6.5	1.72	77.87	221.1
Williams Ck	3.0	200.58	4.05	0.00202	10.10	31.0	8.0	2.10	93.44	269.7
Deep Ck	4.1	272.79	5.50	0.00275	13.73	42.2	10.9	2.85	127.70	366.8
Panther Ck	20	1337.20	26.97	0.01348	67.32	206.8	53.2	13.99	622.94	1797.9
Salmon R.-below Williams Ck	700	46801.94	943.90	0.47195	2356.35	7236.6	1861.8	489.63	21802.89	62927.0
Salmon R.-Below Panther Ck	1,300	86249.29	1739.48	0.86974	4342.41	13336.0	3431.0	902.32	40491.08	115965.4

TABLE 4-14. Transport material information for alternatives with water treatment and quantity of material required to reach aquatic toxicity levels in ICP area streams simulating a short spill (lbs/min) versus a longer spill (lbs/30 min)(from TTE 2006).

Material Information		Polymer Flocculant	Hydrochloric Acid	Methanol	Sodium Hypochlorite	Sodium Bisulfite	RO Scale Inhibitor	RO Alkaline Cleaner	RO Acid Cleaner
Quantity/Trip (lbs)		**20 gal**	**200 gal**	**250 gal**	**200 gal**	**250 gal**	**50 gal**	**3,000**	**3,000**
Annual Trips		**1**	**2**	**2**	**1**	**2**	**1**	**1**	**1**
Form		**Liquid**	**Liquid**	**Liquid**	**Liquid**	**Liquid**	**Liquid**	**Dry**	**Dry**
Container		**Sealed Pail**	**Plastic Drum**	**Plastic Drum**	**Plastic Drum**	**Plastic Drum**	**Sealed Pail**	**Sealed Pail**	**Sealed Pail**
Aquatic Toxicity (mg/L)		**2.7**	**300**	**20,000**	**0.1**	**240**	**330**	**100**	**200**
Spill Risk		**Low**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Low**	**Low**	**Low**
Stream	**Flow (cfs)**	**Quantity Required to reach toxic (Dry-lbs/min; Liquid-gal/min)**							
Moccasin Ck	1.0	0.0539	0.1132	11.3420	0.0000	0.0810	0.1089	0.0001	0.0010
Blackbird Ck	2.5	0.1348	0.2829	28.3550	0.0001	0.2025	0.2723	0.0003	0.0025
Williams Ck	3.0	0.1618	0.3395	34.0260	0.0001	0.2430	0.3267	0.0003	0.0031
Deep Ck	4.1	0.2211	0.4639	46.5022	0.0002	0.3321	0.4465	0.0005	0.0042
Panther Ck below Blackbird Ck	20.0	1.0783	2.2632	226.8402	0.0008	1.6199	2.1783	0.0022	0.0204
Salmon R.- below Williams Ck	700	37.74	79.21	7939.41	0.0269	56.70	76.24	0.0786	0.7129
Salmon R- Below Panther Ck	1,300	70.09	147.1	14744.6	0.0499	105.3	141.6	0.1459	1.3239
		Quantity Required to reach toxic (Dry-lbs/30 min; Liquid-gal/30 min)							
Moccasin Ck	1.0	1.618	3.3947	340.260	0.0012	2.4299	3.2674	0.003	0.0306
Blackbird Ck	2.5	4.044	8.4868	850.651	0.0029	6.0748	8.1686	0.008	0.0764
Williams Ck	3.0	4.853	10.1842	1020.781	0.0035	7.2898	9.8023	0.010	0.0917
Deep Ck	4.1	6.632	13.9184	1395.067	0.0047	9.9627	13.3965	0.014	0.1253
Panther Ck	20	32.350	67.8948	6805.205	0.0230	48.5984	65.3487	0.067	0.6111
Salmon R.-below Williams Ck	700	1132.259	2376.3	238182.2	0.8056	1700.9	2287.2	2.357	21.39
Salmon R.-Below Panther Ck	1,300	2102.768	4413.2	442338.3	1.4962	3158.9	4247.7	4.376	39.72

Transported fuels have the greatest potential to affect area streams based on aquatic toxicity, spill risk, and potential occurrence of an accident near a stream (**Table 4-12**). If petroleum products (diesel, gasoline, oil, lubricants) were accidentally spilled, aquatic organisms could exhibit both acute lethal toxicity and long-term sublethal toxic effects (USEPA, 1986). Oil can directly affect fish by adhering to the gills of fish causing asphyxia and can destroy the food chain by poisoning aquatic invertebrates that fish feed on (Werner et al., 1983). The recurrence interval for a fuel spill near a stream is projected to be 40 years based on current traffic and accident statistics. This suggests that an accident near a stream would be fairly rare (occurring once every 40 years).

Copper sulfate is extremely toxic ($LC50_{96}$ of 0.006 mg/L) to fish. Its toxicity to fish varies with fish species and the physical and chemical characteristics of the water. Toxicity of copper sulfate to fish generally decreases as water hardness increases. Fish eggs are more resistant than young fish to the toxic effects of copper sulfate. The recurrence interval for a spill of copper sulfate near a stream is projected to be 297 years, which suggests that an accident near a stream would be extremely rare.

The actual probability of an accident occurring along the transportation route that will affect streams and aquatic organisms is probably much lower than estimated for several reasons. The majority of the materials have either a low spill risk or a very low accident recurrence. The more toxic materials are shipped in smaller quantities and have a low to moderate spill risk with a low accident recurrence (>200 years). Finally, the transportation statistics used to estimate accident recurrence do not account for vehicles that operate under comprehensive transportation plans where built in safety and precaution guidelines could dramatically lower the potential for an accident to occur.

Water Quantity - Alternative I would have the least potential adverse impacts to ICP area streams because there would be no change in base flow conditions (unrelated to BMSG cleanup), water quality, sediment production or aquatic habitat elements.

Of the action alternatives, Alternatives II and IV would have the least effect on current baseline fish and habitat conditions related to streamflow. Alternatives II and IV are predicted to produce only slight flow reductions (less than two percent) in Big Deer Creek and Big Flat Creek (five percent). Alternatives III and V are predicted to show the largest degree of change from current streamflow conditions. Although Alternatives III and V show positive increases in base flow to Blackbird and Little Deer creeks, those changes are offset by larger decreases (three percent) in base flow to Big Deer Creek. Alternatives III and V involve water transfer to other watersheds from mine dewatering and delivery to land application treatment (Alternative III) and discharge through an NPDES permit of treated water to Blackbird Creek (Alternative V).

Water Quality - Concentrations of cobalt and copper were generally the most significant chemical constituents predicted to be contributed by the ICP alternatives (see Chapter 4 Water Resources). Expected cobalt concentrations from action alternatives even under worst case did not increase to levels sufficient to exceed the Blackbird cleanup level, thus no aquatic toxicity effects from cobalt are anticipated.

None of the alternatives are expected to cause measurable increases in copper concentrations in Panther Creek that would affect ESA-listed fish or their critical habitat. However, copper concentration increases for Alternative II during closure may not be sufficiently mitigated by groundwater capture and treatment if worst case conditions occur. If Alternative II mitigation is inadequate, copper concentrations could increase above aquatic life standards. Continued poor water quality would hinder BMSG management goals and cleanup activities for Big Deer, Panther, and South Fork Big Deer creeks and recovery of fish and macroinvertebrate populations would likely be hindered. None of the alternatives are expected to cause a substantial increase in other metal constituents (Hydrometrics 2006) and nitrate and sulfate levels are not predicted to exceed primary (10 mg/L) and secondary (250 mg/L) drinking water standards.

Hazardous Materials - All action alternatives (II through V) would require transportation of hazardous materials near or adjacent to streams where an accidental spill could affect fish and their

impacts. If water quality mitigation under Alternative II during closure was inadequate, copper concentrations could remain above aquatic life standards within portions of the Big Deer Creek drainage. Continued poor water quality would hinder BMSG management goals and cleanup activities for Big Deer, Panther, and South Fork Big Deer creeks, and could inhibit recovery of rainbow and cutthroat trout populations in Big Deer Creek.

Macroinvertebrate Populations - While direct impacts to fish resources from a hazardous materials spill would be primarily short-term, the effects of a spill on the fish food base (macroinvertebrates) could occur over a longer timeframe. Long-term effects could occur if the chemical persists in the environment or is bioaccumulated in the food chain. The magnitude of the spill and size of affected area, as well as other chemical and environmental factors (described above) would influence the persistence of the chemical in the food chain. With time, the affected stream reach would be re-colonized as long as macroinvertebrate populations exist in the vicinity of the affected area. As spill risks are low among all alternatives, risks to macroinvertebrate populations from chemical contamination are also generally low. As described above, with no transport of hazardous materials, risks to macroinvertebrate populations would be lowest under the No Action alternative. Among the action alternatives, Alternative III would pose a slightly lower risk to macroinvertebrate populations than would Alternatives II, IV and V which share similar risks.

Based upon analysis of potential impacts to water quantity, water quality and aquatic habitat elements of project area streams, none of the alternatives are expected to significantly affect macroinvertebrate population. However, if water quality mitigations under Alternative II during closure are inadequate, copper concentrations could remain above aquatic life standards within portions of the Big Deer Creek drainage. Continued poor water quality would hinder BMSG management goals and cleanup activities for Big Deer, Panther, and South Fork Big Deer creeks, and could impair macroinvertebrate populations in Big Deer Creek.

Alternative I – No Action

Aquatic Habitat – Under the No Action Alternative, activities conducted under the Blackbird cleanup project are predicted to result in improved water quality over time. BMSG cleanup and water quality are discussed in greater detail in the Water Resources section of this Chapter. Short-term and long-term significant improvements in surface water quality (reduction in copper concentration) would occur from ongoing cleanup operations. Streams that do not currently meet water quality standards and have impaired aquatic life conditions (Big Deer Creek, South Fork Big Deer Creek, and Panther Creek) would be improved and are projected to meet water quality standards.

Blackbird cleanup actions (BT-5 pipeline diversion of Bucktail Creek around South Fork Big Deer Creek) would reduce base stream flows in lower Bucktail Creek by up to 100 percent and by 25 percent in South Fork Big Deer Creek by year 2009. The reductions in base flow related to the BMSG cleanup will also occur in all the action Alternatives (II-V). Alternative I would not change base flow conditions in Big Deer, Panther, Big Flat, Little Deer and Blackbird creeks.

Under the No Action Alternative, no hazardous materials would be transported to the ICP project area or stored at the project site. There would be no risks of chemical spill which could result in additional impacts to the existing water quality of Williams Creek, Moccasin Creek, Deep Creek, Panther Creek, Blackbird Creek, Bucktail Creek, South Fork Big Deer Creek or Big Deer Creek.

Aquatic habitat elements, including riparian vegetation, pool frequency and quality, off-channel habitat, channel morphology (width:depth ratios) streambank stability and floodplain development would be unaffected by implementation of the No Action Alternative. Minor natural increases in large woody debris loadings may occur along streams impacted by the Clear Creek fire as fire-killed trees continue to fall into the stream channels. As there would be no mine-related increases in traffic on the proposed transportation route, there would be no changes to current rates of sediment delivery to Williams Creek, Moccasin Creek, Deep Creek, Panther Creek or Blackbird Creek.

Fish Populations - The current distribution and abundance of fish populations throughout most of the analysis area would remain unchanged under the No Action Alternative. With no project activities being implemented, there would be no direct impacts to fish or indirect impacts to aquatic habitats which could influence fish population levels and or distribution patterns beyond currently-occurring natural levels of variation in Williams Creek, Moccasin Creek, Deep Creek, Panther Creek, Blackbird Creek and Little Deer Creek. Continuing improvements in water quality in the Big Deer Creek and Blackbird Creek drainages as a result of ongoing mine cleanup operations are expected to result in continued reintroduction and recovery of fisheries resources over time in both stream systems.

Macroinvertebrate Populations - No direct or indirect impacts to existing macroinvertebrate populations within the project area would occur as a result of implementation of the No Action Alternative. Increases in macroinvertebrate diversity and or biomass may be realized over time within the Blackbird Creek and Big Deer Creek drainages, and in Panther Creek below Blackbird Creek, in association with improving water quality as a result of ongoing Blackbird mine cleanup operations.

Alternative II - Company's Proposal

Aquatic Habitat - Under Alternative II, base flow in Big Deer Creek is expected to be reduced by two percent during operations and closure but would return to existing flows during the post-closure period if water quality goals can be met without groundwater capture and treatment. In Big Flat Creek base flow is expected to be reduced three to five percent during operations and closure periods and would return to existing flows during the post-closure period. Short-term flow reductions are predicted in Bucktail Creek (44 percent) and South Fork Big Deer Creek (11 percent) for the action alternatives as a result of ICP mine dewatering prior to 2009. Base flow conditions would not change in Panther, Little Deer, and Blackbird creeks as a result of Alternative II.

Copper is the primary chemical constituent that has the potential to affect fish resources since it is the primary cause of the existing water quality impairment from the Blackbird Mine, is abundant in the ICP ore and waste rock, and is relatively toxic to fish (i.e., low aquatic life criterion). Therefore, the evaluation of water quality effects to fisheries will focus on copper. Predicted changes in all constituents of concern are presented in the Water Resource section and in Appendix B.

Water quality conditions in the South Fork Big Deer Creek are primarily controlled by the effects of the Blackbird cleanup and the BT-5 diversion. During Ram operations before the BT-5 pipeline and the Blackbird cleanup is completed, metal concentrations in South Fork would remain similar to current conditions and likely would remain poorer than water quality standards and cleanup goals. Water quality is not predicted to be significantly affected by mining the ICP, as no release of mine water to the stream would occur during operations. After BT-5 is installed and the cleanup is complete, the South Fork water quality is predicted by EPA (Allans, 2005) and IDEQ to improve to meet cleanup goals and water quality standards for the duration of the ICP operations and closure period.

Water quality conditions in Big Deer Creek are primarily controlled by the discharge of treated mine water from the ICP and the effects of the Blackbird cleanup. As described in the draft NPDES permit (USEPA, 2006) and in the Water Resources section, ICP water discharges to Big Deer Creek would contain low metal concentrations and would be required to meet or be better than water quality standards prior to mixing with the stream (i.e., at end-of-pipe). Because of the anticipated very low effluent limits for treated water, Big Deer Creek is not expected to be adversely affected by mine discharges during the operations period.

During the closure period, the Ram and Sunshine mines would be allowed to refill with groundwater and release of mine water to streams via groundwater would occur. Without groundwater capture and treatment, it is expected that changes in metal concentrations in Big Deer and Panther Creeks would be negligible, with the possible exception of copper. Changes to copper concentrations in Big Deer and Panther Creeks likely could be mitigated by groundwater capture and water treatment as proposed in Alternative II. Therefore, no significant adverse effects are expected during closure.

The worst case water quality predictions for Big Deer Creek differ from the expected case in predicted metal concentrations, potential impacts, and potential effectiveness of Alternative II groundwater capture systems in controlling adverse impacts during closure. As described in the Water Resources section, achievement of a sufficiently high groundwater capture efficiency to mitigate the worst case conditions as proposed in Alternative II would be difficult and can not be assumed with a high degree of certainty. Therefore, surface water quality impacts to Big Deer Creek in Alternative II are considered to have the potential to become significant, since mitigation is not certain, and if they occurred, potential impacts would likely result in exceedance of water quality standards and cleanup goals.

If proposed mitigation measures cannot meet water quality standards this alternative has the potential to have an adverse direct impact on fish and Forest Service sensitive species in Big Deer Creek.

Alternative II and all other action alternatives would require transport of hazardous materials to the project. As described above, the risk of transporting hazardous materials is minimal because of comprehensive safety and spill response guidelines that will be employed during transportation and significant adverse affects from a hazardous spill affecting fisheries resources or ESA-listed fish are not predicted for any alternatives.

Sediment modeling (described in Water Resources section) for Alternative II with the planned road upgrades has shown that sediment production would decrease along the transportation route. Improvements to the transportation route from Williams Creek to the gate at Blackbird Creek would decrease sediment leaving the road by approximately 50 percent compared to existing conditions. From the Blackbird gate up to the project site Alternative II is predicted to decrease sediment production 82 percent over existing conditions.

With the exception of the Panther Creek cable car, project activities have little potential to impact or influence the current conditions of riparian vegetation, pool frequency and quality, off-channel habitat, channel morphology (width:depth ratios) streambank stability and floodplain development of project area streams. Alternative II, along with all other action alternatives, includes installation of a cable car across Panther Creek south of Big Flat Creek to access water quality monitoring site WQ-2. Installation operations, scheduled for spring of the year prior to high water, would result in localized vegetation removal and streambank disturbance on each bank, and localized, transient disturbance of the steambed from crossing of a backhoe or excavator to access the far-bank deadman site. No measurable lasting impacts to fish are anticipated in association with these construction actions.

Fish Populations - With application of mitigations designed to reduce sediment introductions to roadside streams, this alternative would have a potential long-term positive effect on fishery production capabilities, and thus fisheries resources, along the transportation route. Short-term reductions in streamflow in Bucktail Creek and South Fork Big Deer Creek would have no additional effect on fish resources in the project area, as these streams currently are fishless due to water quality impacts.

Based upon analysis of potential impacts to water quality, Alternative II is not expected to significantly affect ESA-listed fish or their critical habitat. However, if water quality mitigations under Alternative II during closure are inadequate, copper concentrations could remain above aquatic life standards within portions of the Big Deer Creek drainage. Continued poor water quality would hinder BMSG management goals and cleanup activities for Big Deer, Panther, and South Fork Big Deer creeks, and could inhibit recovery of rainbow and cutthroat trout populations in Big Deer Creek.

Macroinvertebrate Populations - The minor short-term flow reduction in Big Deer Creek and long-term reduction in Big Flat Creek identified under this Alternative would not be of sufficient magnitude to significantly reduce or retard existing macroinvertebrate populations in these streams. Reduction in sediment delivery rates to streams along the transportation rate as a result of road mitigations could be expected to result in improved conditions for, and potential increases in, sediment-intolerant macroinvertebrate species in Williams Creek, Moccasin Creek, Deep Creek and Panther Creek.

Based upon analysis of potential impacts to water quality, Alternative II is not expected to significantly affect macroinvertebrate populations. However, if water quality mitigations under Alternative II during closure are inadequate, copper concentrations could remain above aquatic life standards within portions of the Big Deer Creek drainage. Continued poor water quality would hinder BMSG management goals and cleanup activities for Big Deer, Panther, and South Fork Big Deer creeks, and could inhibit recovery of macroinvertebrate populations in Big Deer Creek.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Aquatic Habitat - Alternative III is expected to reduce streamflows in Bucktail Creek (44 percent) and South Fork Big Deer Creek (11 percent) as a result of ICP mine dewatering prior to 2009. Alternative III would cause permanent decreases of about three percent during base flow periods in Big Deer Creek. Increased flow is predicted in Little Deer Creek (three percent) and Big Flat Creek (five percent) because of land application treatment to manage excess mine water. Base flow conditions would not change in Panther or Blackbird Creeks.

Copper and other metal concentrations would not increase in ICP area streams.

As with all action alternatives, Alternative III involves transportation of potentially hazardous materials. As land application treatment is proposed instead of water treatment, this Alternative would require transport of fewer chemicals that Alternative II. Road improvements along Williams Creek would reduce the risk of an accidental spill.

Alternative III would have a direct, predicted positive effect on the amount of sediment leaving the site facilities, access roads and site roads. While Alternative II would reduce sediment delivery to streams by 50 percent from existing conditions due to access route mitigation measures on 10.9 miles of road, Alternative III would include mitigation measures along the entire 40-mile access route. Proportionately greater reductions in sediment delivery from roads are therefore anticipated. As a result, this alternative has a greater potential long-term positive effect on fine sediment levels in streams along the transportation route than Alternatives I and II.

Conditions of other habitat elements of project area streams, including riparian vegetation, pool frequency and quality, off-channel habitat, channel morphology (width:depth ratios) streambank stability and floodplain development would be largely unaffected by implementation of Alternative III. Short-term and localized impacts to Panther Creek riparian vegetation, streambanks and stream substrate would be the same as those described under Alternative II. The minor increases in flow predicted in Little Deer Creek and Big Flat Creek and the decrease in flow in Big Deer Creek would not be expected to measurably influence channel attributes in these streams. Project activities associated with Alternative III would not have any additive or diminishing influence on the expected natural increases in large woody debris loading in fire impacted streams as described under the No Action Alternative.

Fish Populations - The predicted three percent reduction in Big Deer Creek base streamflow is not expected to have measurable flow-related influence on recovery of fish populations in this stream.

Due to the greater projected reductions in transportation system sediment deliveries as a result of more comprehensive road mitigations, this alternative has a greater potential long-term positive effect on fish reproduction capabilities, and therefore fisheries resources within streams along the transportation route, than Alternatives I and II. As in Alternative I, improvement in Big Deer Creek water quality, due to the Blackbird cleanup, would additionally promote ongoing natural repopulation of the stream over time.

Macroinvertebrate Populations - Land application, rather than discharge of water to Big Deer Creek could potentially impede recovery of macroinvertebrate populations in Big Deer Creek below the

South Fork relative to Alternative II although the magnitude of predicted flow differences in the stream is small. Increases in streamflow levels in Little Deer Creek and Big Flat Creek could increase macroinvertebrate biomass in these streams as a result of increases in amount of aquatic habitat. Along the transportation corridor, conditions for sediment-intolerant species could be improved in areas where levels of surface fines decrease due to reductions in road-generated sediment.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Aquatic Habitat - Alternative IV includes water treatment and a discharge location in Big Deer Creek. As with Alternative II, this alternative would result in a short-term flow reduction of 44 percent in Bucktail Creek and 11 percent in South Fork Big Deer Creek during mine dewatering prior to 2009. Change in base flow in Big Deer Creek during this period is expected to be less than two percent. No changes to copper or cobalt concentrations in area streams are predicted in Alternative IV.

Alternative IV water treatment system is able to attain effluent limits without requiring reverse osmosis treatment. Alternative IV would require fewer materials for water treatment than Alternative II but more than Alternative III (**Table 4-12)**. Spill risks, and corresponding risks to aquatic habitats along the transportation route are therefore potentially slightly less than those of Alternative II and greater than those of Alternative III. Under Alternative IV, waste products generated through water treatment would be transported off site for landfill disposal after mine closure. Road improvements along Williams Creek would further reduce the risk of an accidental spill.

With road mitigation measures along the entire transportation route, Alternative IV is viewed as having a similar overall effect on sediment as Alternative III. This alternative would have direct, positive effects on the amount of sediment leaving the site facilities, access roads and site roads which are greater than those predicted under Alternatives I or II.

Effects to other habitat elements of project area streams (including riparian vegetation, pool frequency and quality, off-channel habitat, channel morphology (width:depth ratios), streambank stability and floodplain development) would include short-term impacts during installation of a cable car across Panther Creek near Big Flat Creek and would be similar to those described for Alternatives II and III. Project activities would not be expected to measurably influence current conditions or naturally occurring processes.

Fish Populations - Overall effects of Alternative IV on fish populations within the analysis area are similar to those described under Alternative III, providing greater potential long-term positive effect on fish reproduction capabilities and therefore fisheries resources, within streams along the transportation route, than Alternatives I and II. Improvement in Big Deer Creek water quality would promote ongoing natural repopulation of the stream over time.

Macroinvertebrate Populations - Along the transportation corridor, conditions for sediment-intolerant species could be improved, similar to Alternative III, in areas where levels of surface fines decrease in response to reductions in road-generated sediment.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Aquatic Habitat – Mine dewatering during operations and closure in Alternative V would produce a long-term three percent decrease in Big Deer Creek and a two to four percent decrease in Big Flat Creek base flow. With discharge of mine waters in the Blackbird Creek drainage, base flows in Blackbird Creek would increase by 10 percent in areas below the water treatment plant. Water quality in Blackbird Creek would improve slightly from dilution with this treated water. Alternative V is not predicted to change flow conditions in Panther or Little Deer Creeks. As with Alternatives II, III and IV, short-term flow reductions are predicted in Bucktail Creek (44 percent) and South Fork Big

Deer Creek (11 percent) as a result of ICP mine dewatering prior to 2009. No changes to copper or cobalt concentrations in area streams are predicted in Alternative V.

Like Alternative IV, Alternative V potentially requires fewer materials for water treatment than Alternative II but more than Alternative III. As with Alternative IV, water treatment waste products would be transported off-site for landfill disposal after mine closure.

With road mitigation measures along the entire transportation route, Alternative V would have a similar overall effect on sediment delivery to streams as Alternatives III and IV. This alternative would have direct, positive effects on the amount of sediment leaving the site facilities, access roads and site roads which are greater than those predicted under Alternatives I or II.

Effects to other habitat elements of project area streams, including riparian vegetation, pool frequency and quality, off-channel habitat, channel morphology (width:depth ratios) streambank stability and floodplain development are generally similar to those of Alternatives II, III and IV, although the increase in Blackbird Creek base flow of 10 percent could produce some minor increases in scour rates below the discharge point. Project activities would not be expected to measurably influence current conditions or naturally occurring processes.

Fish Populations - Overall effects of Alternative V on fish populations within the analysis area are generally similar to those described under Alternatives III and IV, providing greater potential long-term positive effect on fish reproduction capabilities and therefore fisheries resources, within streams along the transportation route, than Alternatives I and II. The predicted three percent reduction in Big Deer Creek base streamflow is not expected to have measurable flow-related influence on recovery of fish populations in this stream. Opportunities for utilization of the lower reaches of Blackbird Creek may be enhanced by the increased flow and improved water quality under this alternative.

Macroinvertebrate Populations - Routing of mine waters to the Blackbird Creek drainage for treatment may result in improved conditions for reestablishment of macroinvertebrate populations in that stream, at the expense of potential enhancement of Big Deer Creek. As with Alternatives III and IV, conditions for sediment-intolerant species could be improved where levels of surface fines decrease in response to reductions in road-generated sediment along the length of the transportation route.

Road and Access Management

Summary

Construction and operation of the ICP under all action alternatives would result in increased traffic on major transportation and project access routes. The proposed Williams Creek route to the ICP site is from Salmon south on US Highway 93 then taking Williams Creek road (FS#60021) to Deep Creek road (FS#60101) to Morgan Ck - Panther Creek road (FS#60055) to Blackbird road (FS#60115) to the project site. The distance from Salmon to the ICP site is about 45 miles.

Six ICP access routes were evaluated in the EIS analysis. These routes utilize existing County (Lemhi and Custer) roads and Salmon-Challis National Forest roads. Access route alternatives were evaluated based on location and ownership, road standards, traffic loads, public safety, proximity to streams, maintenance, total length and other issues. Two of these routes included new road construction in undeveloped areas from the Morgan Creek - Panther Creek road to the Project Area via Big Deer Creek or Little Deer Creek and were dismissed from further analysis. The Moccasin - Napias Road (FS#60076) access route was dismissed because portions are steep, single lane, not designed for trucks traffic, a significant portion is on private land and is not currently kept open in the winter. Using the Salmon River road (FS#60030) option was dismissed due to conflicts with recreational users, hazardous material spill risks, and wild and scenic river management issues. The Morgan Creek access option was dismissed because of the long distance of streamside road, longer

distances for employees and materials emanating from Salmon, and it currently is not kept open in the winter.

A number of safety and sediment-yield issues were identified with the proposed Williams Creek access route. These include segments of road that are in the flood plain of Panther Creek and Blackbird Creek and are occasionally flooded; sections of unsurfaced road with high-sediment production potential; corners with limited visibility; lack of adequate turnouts on narrow sections of road where passing oncoming truck traffic is not always feasible; and a section of steep, sharp switch backs that has a history of accidents and difficult passage, particularly for larger trucks and during winter driving conditions. ICP has proposed to resurface (gravel surface) about 10.9 miles of this route to improve trafficability and reduce sediment yield. Alternatives III, IV and V propose additional road improvements and resurfacing to reduce potential impacts to streams and improve driver safety. Improvements proposed by the agencies would occur in a phased approach that along with ICP's proposal would result in resurfacing the entire project access route over the project life as increased traffic and wear due to the Project will need additional maintenance.

The Forest Service currently manages the Project access roads. The FS has a cooperative agreements with Lemhi County and private parties to maintain and plow snow off all or portions of the Williams Creek road, Deep Creek, Panther Creek to the Cobalt townsite and Blackbird Creek roads. The road is currently kept open as far as the Blackbird water treatment plant. Lemhi County performs maintenance on the road surface. FCC would be required to obtain a FS road-use permit based on anticipated increased traffic loads and maintenance.

The Blackbird Road is currently under a FS road-use permit to the Blackbird Mine. The Project road - use permit would also include use of Blackbird road, additional traffic loads, and associated costs. The ICP would also need a road use permit for use of this road which would include allocation of responsibility for the incremental increase in road maintenance costs.

Some mine and mine construction employees would be from the Challis, Idaho area. These workers may elect to use the Morgan Creek access route instead of driving to Salmon and ride the Project bus. This route would not be available in the winter since it is not plowed for snow removal. Increased traffic due to workers using this route would have to be documented and accounted for in the road-use permit.

The Project would require approximately 87,600 annual miles of vehicle travel relating to transportation of fuels, supplies, concentrate, and reagents. Transport of Project personnel would account for approximately 408,800 annual miles of travel in vans and pickups. This amount of traffic would result in an increased risk of accidents. Accidents related to transportation of fuels and reagents pose a risk of spilling toxic substances into streams.

Alternative I – No Action

Under the No Action Alternative current primary and secondary road use would continue without the proposed Project. Access to the ICP site would continue to be closed to the public at the Blackbird gate on Blackbird Creek. Current Average Daily Traffic (ADT) on Highway 93 varies from approximately 3,600 in the summer to 2,000 in the winter (**Table 3-14**). Current Average Daily Traffic (ADT) on Idaho State Highway 28 varies from approximately 700 in the summer to 250 in the winter. Increased ADT on the Major Transportation Routes may slowly increase in the future due to population growth in the Salmon, ID area.

Access roads to the ICP site are currently managed for activities such as logging, fire suppression and recreation. The Blackbird Mine Site Group (BMSG) currently uses the Williams Creek route for ongoing cleanup operations. Williams Creek road (FS#60021), Deep Creek road (FS#60101), Morgan Ck - Panther Creek road (FS#60055), and Blackbird road (FS#60115) are also currently used by BMSG for clean-up operations. Realignment of a portion of Williams Creek road near mile marker 8 (**Figure 4-1**) where steep grades and sharp corners have historically been a problem for larger vehicles is currently under consideration by the Forest Service. However, work on this section

habitat. Accidental release of toxic substances, and in particular metals and petroleum fuels, can produce both chronic and lethal conditions to aquatic organisms. Exposure of fish to metals such as copper can result in tissue and organ damage, death, avoidance behavior, impaired mobility, altered migratory behavior, reduce embryonic development and can retard sexual development, fecundity, and growth in reproductive adults (Sorensen, 1991).

For all alternatives, the risk of transporting hazardous materials would be managed through implementation of a comprehensive safety and spill response guidelines that will be employed during transportation and significant adverse affects from a hazardous spill affecting fisheries resources or ESA-listed fish are not predicted for any alternatives.

Alternative III will not require transportation of additional materials associated with advanced water treatment and therefore the risk of a spill is slightly lower than for Alternatives II, IV, and V. Potential spill risks would be greatest for Alternative II. Alternatives IV and V potentially do not require as many treatment materials as Alternative II, which reduces spill risk from water treatment chemicals. However, under Alternatives IV and V waste from the water treatment process would be transported offsite in bulk for landfill disposal. Common among all alternatives is close management of the process pond and mill facility, HDPE liners, double-contained pipelines, pipe-in-pipe connections, leak detection and inspection. These types of safety designs reduce the potential of hazardous material spills on site under all alternatives.

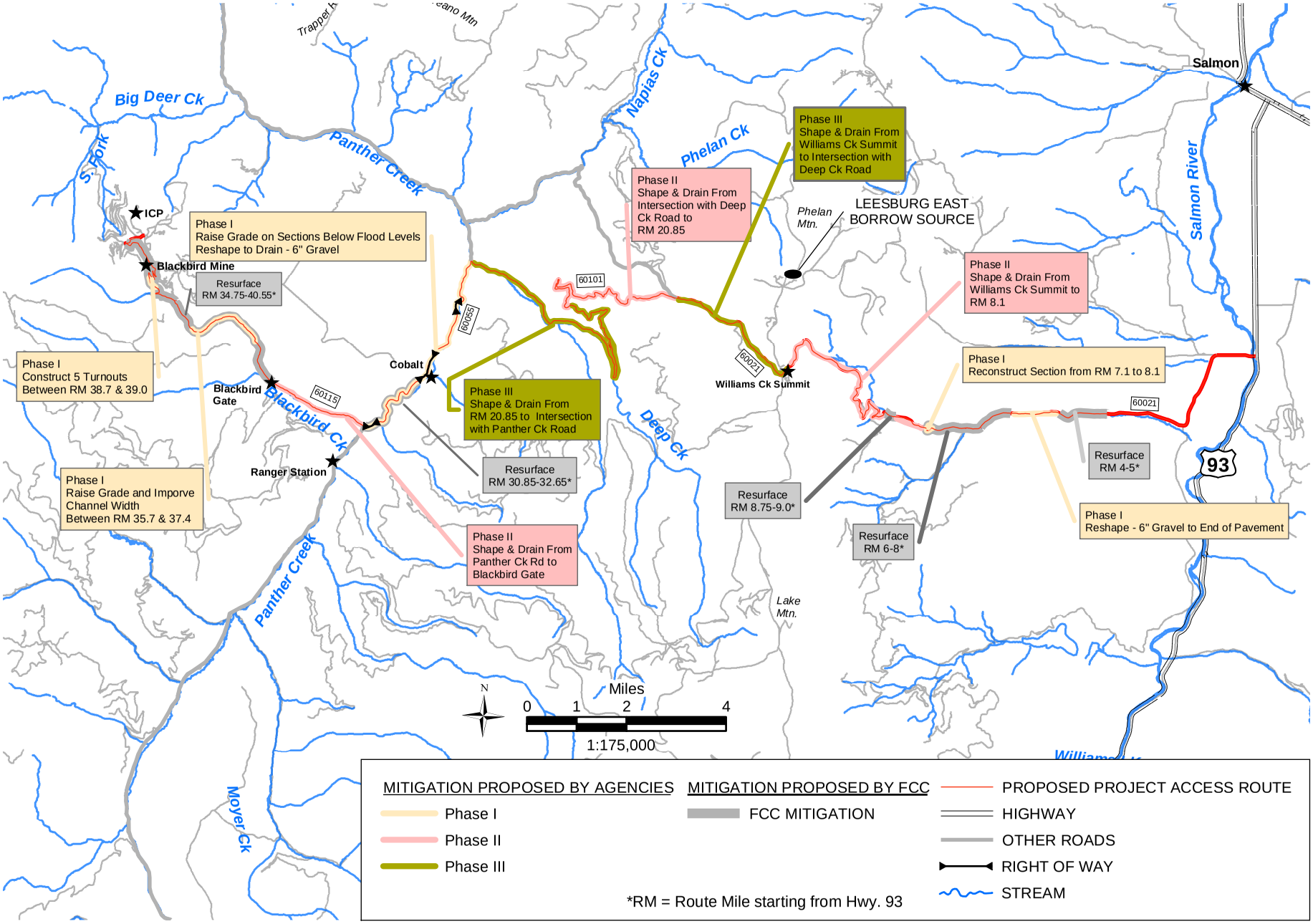
Other habitat elements of concern include stream substrate, riparian vegetation, pool frequency and quality, off-channel habitat, channel morphology (width:depth ratios), streambank stability and floodplain development. Road upgrades to the transportation route would reduce sediment production for all action alternatives, and along with additional road reclamation would improve current conditions. However, while Alternative II would reduce sediment delivery to streams by 50 percent from existing conditions due to access route mitigation measures on 10.9 miles of road, Alternative III, IV and V would include mitigation measures along the entire 40-mile access route. Proportionately greater reductions in sediment delivery from roads are therefore anticipated under these alternatives. No significant adverse impacts on the headwater streams of Little Deer, Blackbird, Big Flat, and Bucktail Creeks and along the transportation route are predicted under any of the action alternatives.

Because BMPs would be visually inspected monthly and after significant storm or snowmelt events it is unlikely that chronic sediment conditions would develop due to roads and ground disturbances at the ICP. There also would be no physical structures placed in surrounding fish bearing streams that could hinder migrating fish. Finally, routine repairs, improvements, and preventive maintenance implemented onsite would help to prevent chronic conditions that could degrade stream habitat.

With the exception of the Panther Creek cable car, the proposed project activities of the action alternatives have little potential to impact or influence the current conditions of riparian vegetation, pool frequency and quality, off-channel habitat, channel morphology (width:depth ratios) streambank stability and floodplain development of project area streams. All action alternatives include installation of a cable car across Panther Creek south of Big Flat Creek to access water quality monitoring site WQ-2. Installation operations, scheduled for spring of the year prior to high water, would result in localized vegetation removal and streambank disturbance on each bank, and localized, transient disturbance of the streambed from crossing of a backhoe or excavator to access the far-bank cable tower site. No measurable lasting impacts to fish are anticipated in association with these construction actions.

Among the action alternatives Alternative IV has the least environmental consequence to aquatic habitat, due to mitigations for sediment production, water quality, total disturbance area and changes in flow to ICP area streams.

Fish Populations - Based upon analysis of potential impacts to water quantity, water quality and fish habitat elements of project area streams, none of the alternatives are expected to significantly affect ESA-listed fish or their critical habitat. However, Alternative II has the potential for significant



IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**ACCESS ROUTE MITIGATION** **WILLIAMS CREEK ACCESS ROUTE**	Figure 4-1

is not funded or scheduled for construction. Sections of the Williams Creek/Deep Creek/Blackbird Creek roads are prone to flooding, have poor drainage or have surface treatments that have the potential to contribute sediment to streams. If the No Action Alternative were selected it is uncertain if or when the road improvements proposed under action alternatives would be completed.

Alternative II - Company's Proposal

FCC proposes to use the Williams Creek route as the primary access to the ICP site.

Major Transportation Routes - Under FCC's proposal ADT on U.S. Highway 93 between Salmon and the Williams Creek turnoff would increase by about 35 vehicles per day, or 1 percent to 2 percent. Some of the ADT due to the Project may use Idaho State Highway 28 if emanating from the railhead or Interstate Highway near Dubois, ID. Annual average ADT for Idaho State Highway 28 at Leadore, ID is approximately 550. ADT would increase approximately 6 percent if all ADT used Highway 28. Traffic on Idaho State Highway 28 in the immediate Salmon area is probably higher than the available ADT data from Leadore shows and not all of Project related traffic would use Highway 28.

Project Access Routes - The Williams Creek Route begins at the intersection of Williams Creek road and Highway 93 approximately five miles south of Salmon. All of Williams Creek road is in Lemhi County, entering the Salmon-Challis National Forest at milepost (MP) 5. The Williams Creek route is 40 miles of dirt and gravel surfaced road from the junction with Highway 93 to the ICP site. The Williams Creek route is currently plowed in the winter as far as the Cobalt Ranger Station and current maintenance levels are adequate for current use. There are three bridges on the Williams Creek route and no new bridges would be required for ICP use. There would be an additional traffic load of 34 ADT under this alternative. There are approximately 26 miles of streams within 300 feet of this access route.

The Project proposes resurfacing 10.9 miles of this route (**Table 4-15**) to improve trafficability and to reduce sediment loads in streams.

TABLE 4-15. Project Access Route Mitigation – Alternative II vs. Alternatives III-V

Alternative	Miles of Mitigation	Type(s) of Mitigation
Alternative II	10.9	Resurfacing only
Alternatives III-V	40.0 *	Improve turnouts, improve visibility, raise grade to drain, realignments & resurfacing

* Includes the 10.9 miles proposed by ICP

Project Roads - New roads would be constructed to access the Ram portal, the Tailings Waste Storage Facility, Land Application Treatment Areas, and Mill facilities. Existing roads would be upgraded to access the Sunshine Portal, the Ram Portal and water monitoring and pumpback stations. A total of 3.2 miles of existing road would be upgraded and 2.6 miles of new roads would be constructed (**Table 4-16**). The Project would also use approximately 9.4 miles of existing road for occasional light vehicle travel. Approximately 4.45 miles of existing site roads which do not meet Forest Service needs would be reclaimed during the construction period.

The Project proposal would present risks for traffic accidents, some of which could result in an accidental release of fuel or reagents. ADT on the Project Access route would increase 16 percent to 45 percent over current ADT. Accident potential was calculated based on 9.8 accidents per million miles driven (TTE, 2006). Transportation of mine personnel would total 408,000 miles per year. This translates into and accident rate of four per year. Transportation of fuels and reagents would total 87,000 miles per year. This presents an accident rate of 0.86 per year.

TABLE 4-16. ICP Site Road Comparison				
Alternative	**Upgraded Existing Roads**	**New Roads**	**Existing Tertiary Roads (Not Upgraded)**	**Total Site Roads**
II	3.2	2.6	9.4	15.2
III	3.1	5.6	4.4	13.1
IV	3.1	3.0	8.9	15.0
V	3.1	2.4	8.4	13.9

Note: Distances show in miles

Accidental release of fuel and reagents poses a risk to the environment especially when the accident occurs near a stream. Forty three percent of the Project access route is within 100 feet of a stream. ICP proposes to mitigate accidental release risks by having emergency response caches along the route as well as transporting all supplies with a pilot car, which would have an emergency response kit. Concentrate would be hauled from the site in sealed steel containers. The potential environmental impacts of an accident that releases fuel or chemicals to surface water varies widely depending on a number of factors including the location, time of year, flow, material released and amount reaching the stream. Most accidents would have little or no impacts to surface water, but a major spill could have significant impacts including mortality of fish and other aquatic organisms.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Major Transportation Routes – Major Transportation Routes under Alternative III would be the same as under Alternative II.

Project Access Routes - Under Alternative III the 10.9 miles of resurfacing proposed by ICP would be done and additional road improvements would be required to improve public safety and reduce potential sediment yield to streams (**Table 4-15**). Mitigation proposed by the Agencies would improve safety, reduce sediment delivery to streams, and reduce spill risks associated with transporting hazardous materials. The mitigation measures proposed by the Agencies would occur in a phased approach, which along with the Project's proposal (Alternative II), would result in resurfacing the entire Project Access route. The phased work would include:

Phase I – Repair or replace areas with safety and environmentally sensitive concerns.

1. Reconstruct sections of Morgan Ck – Panther Ck. Road, No. 60055, to raise the road grade through the sections lying within the floodplain, shape and drain the subgrade and place 6" of gravel between Deep Ck. Road and Blackbird Ck. Road.
2. Construct a new section of road on Williams Ck. Road, No. 60021, between M.P.7.1 and 8.1 to bypass the switchbacks and create a steady grade climbing to the upper bench. Recontour and reclaim the replaced section of road between M.P. 7.1 and 8.1. Shape the subgrade and place 6" of gravel from the end of the pavement at M.P.4.0 to the end of the new construction at M.P. 8.1.
3. Construct five turnouts on Blackbird Ck. Road, No. 60115 between M.P. 36.6 and 38.7 to allow safe passing of vehicles
4. Reconstruct segments between M.P.35.7 and 37.4 to raise the grade above the floodplain and improve channel width. Shape the subgrade and place 6" of gravel from the Blackbird gate to the mine site.

Phase II – Replace gravel in worn areas.

1. Shape and drain the subgrade of Blackbird Ck. Road and place 6" of gravel from Morgan Ck. – Panther Ck. Road to the Blackbird gate.

2. Shape and drain the subgrade of Deep Ck. Road, No. 60101, from the junction with Williams Ck. Road to M.P. 20.85 and place 6" of gravel.
3. Shape and drain Williams Ck. Road from Williams Ck. Summit to M.P. 8.1, with the exception of the segment between M.P.12.45 to 12.85, reinforce the subgrade between M.P. 11.65 and 12.45, and place 6" of gravel.

Phase III – Place surface rock replacement on worn areas not surfaced under Phase I and Phase II.

1. Place 4" of gravel on Williams Ck. Road between M.P. 12.45 and 12.85 and from Williams Ck. Summit to the Deep Ck. Road junction.
2. Place 4" of gravel on Deep Ck. Road from M.P. 20.85 to the Morgan Ck – Panther Ck. junction.
3. Place 4" of gravel on any sections of Phase I and Phase II that show excessive wear.

Additionally, the Project Access Route would be treated with dust abatement for safety and to protect the investment in the gravel by keeping the fines in the gravel structure. Impacts on traffic loads and maintenance would be the same as under Alternative II.

Negotiations for an easement through Homestead Entry Survey 71 (Cobalt Townsite) would need to be finalized.

Project Site Roads - New roads would be constructed to access the Ram portal, the Tailings Waste Storage Facility, Land Application Treatment Areas, Big Deer Creek water discharge site and Mill facilities. Existing roads would be upgraded to access the Sunshine Portal, the Ram Portal, Land Application Treatment Areas, and water monitoring and pumpback stations. A total of 3.1 miles of existing road would be upgraded and 5.6 miles of new road would be constructed (**Table 4-16**). The Project would also use approximately 4.4 miles of existing road for occasional light vehicle travel. Approximately 7.6 miles of existing site roads that do not meet Forest Service needs would be reclaimed.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Major Transportation Routes – Impacts to Major Transportation Routes under Alternative IV would be the same as under Alternative II.

Project Access Routes – Modifications to Project Access Routes under Alternative IV would be the same as under Alternative III.

Project Site Roads - Under Alternative IV there would be 3.1 miles of road upgrades and 3.0 miles of new road construction (**Table 4-16**). The Project would also use approximately 8.9 miles of existing road for occasional light vehicle travel. Approximately 7.6 miles of existing site roads that do not meet Forest Service needs would be reclaimed.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Transportation Routes – Impacts to Major Transportation Routes under Alternative V would be the same as under Alternative II.

Project Access Routes – Modifications to Project Access Routes under Alternative V would be the same as under Alternative III

Project Site Roads – An access road to the Big Deer Creek discharge point would not be necessary under Alternative V. There would be 3.1 miles of road upgrades and 2.4 miles of new roads constructed (**Table 4-15**). The Project would also use approximately 8.4 miles of existing road for occasional light vehicle travel. Approximately 7.6 miles of existing site roads which do not meet Forest Service needs would be reclaimed

Comparison of Alternatives

The primary differences in road use and management between the alternatives are the amount of new site roads required and the amount of project access route improvements required. **Table 4-16** summarizes the amount of new and upgraded project site roads required for each of the alternatives. The Project's proposal (Alternative II) would result in resurfacing 10.9 miles of the Project Access Route. Under Alternatives III, IV and V, the entire Project Access route would eventually be resurfaced and additional mitigation would be employed to reduce sediment delivery to streams, improve safety, and reduce spill risks.

Land Use

Summary

Mining of the ICP under all alternatives would not require any changes to the SCNF Forest Plan. The Forest Plan preferred alternative in the FEIS (USFS, 1988) prescribes management of Forest lands open to mineral entry as allowing "conventional exploration and development with appropriate stipulations to protect soils resources, water quality and other surface resources." The Plan provides measures "to help guide the evaluation and approval of Notice of Intent and Plans of Operation which are processed under the authority of the Forest Service Mining Regulations (36 CFR 228)." The Plan also requires "A bond or other form of significant surety will be required for operations which are expected to result in significant resource disturbance."

Management Areas (MAs) affected by actions proposed by the Idaho Cobalt Project (Project) are shown on Figure 3-15**.** The Project and proposed Project Access Route (Williams Creek road (FS#60021) to Deep Creek road (FS#60101) to Morgan Ck - Panther Creek road (FS#60055) to Blackbird road (FS#60115) to project site are located in three MA prescriptions.

- 4A – Emphasis is on managing key big game winter range to insure required forage and cover conditions exist to meet big game needs.
- 5A – Emphasis is on producing long-term timber outputs through a high level of investment in regeneration and thinning.
- 5B – Emphasis is on producing long-term timber outputs through a moderate level of investment in regeneration and thinning.
- The Project Access Route is within all three of the MAs listed above. Disturbance areas associated with the mines, mill, land application treatment areas, tram, and tailings waste storage facility are in MA 5B.

Two roadless areas, West Panther Creek and South Panther Creek (**Figure 3-15**) are located to the north, west and east of the Project disturbance area. Roadless areas near the Project are within MAs 4A, and 5B. Activities under the 1872 Mining Law constitute a preexisting right under law that would allow roads to be constructed within inventoried roadless areas.

There will be incursions into the West Panther Roadless area under all alternatives. Incursions will consist of using up to 1.6 miles of existing Tertiary roads (Alternative II) and constructing up to 0.6 miles of new Tertiary road (Alternative IV). There would be 21.9 acres of LAT within the roadless boundary under Alternative III. Impacts on roadless area characteristics are based on how they affect wilderness characteristics, thereby affecting the potential wilderness reclassification of the area. Impacts to wilderness characteristics will primarily be in the form of noise and occasional traffic. Impacts will be short term (life of mine) and ultimately reclaimed under all Alternatives considered. These incursions will not affect the roadless area's eligibility for wilderness reclassification in the long term.

Alternative I – No Action

Under the No Action Alternative land use and Forest Service land management direction would continue to emphasize multiple uses including long-term timber production and allow for mineral exploration and production in the Project Area. Continued mineral exploration and evaluation throughout the Idaho Cobalt Belt would be expected.

Alternative II - Company's Proposal

Under the Company's proposal there would be no disturbance in MAs 4A and 5A and 129 acres in MA 5B (**Table 4-17**). There would be 3.1 acres of disturbance in the West Panther Creek roadless area. There would be no need for changes to the Forest Plan.

TABLE 4-17. ICP Alternative Disturbance by Land Management Area

Land Use Management Area	Alt. II (Acres)	Alt. III (Acres)	Alt. IV (Acres)	Alt. V (Acres)
5B	129	324	112	111
West Panther Creek Roadless*	3.1	23.9	3.1	2.2

Note: Does not include any disturbances associated with mitigation on Project Access Route
* Included in Management Area 5B

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

There would be 324 acres of disturbance in MA 5B. There would be 23.9 acres of disturbance in the West Panther Creek roadless area primarily associated with the LAT. There would be no need for changes to the Forest Plan.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

There would be 112 acres of disturbance in MA 5B. There would be 3.1 acres of disturbance to the West Panther Creek roadless area. There would be no need for changes to the Forest Plan.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

There would be 111 acres of disturbance in MA 5B. There would be 2.2 acres of disturbance to the West Panther Creek roadless area. There would be no need for changes to the Forest Plan.

Recreational Resources

Summary

A description of the existing recreational resources and opportunities in the project study area is located in the Recreation Resources section of Chapter Three. Construction, operation, and reclamation of the ICP under Alternatives II, III, IV, and V would result in similar impacts to recreational resources. Under Alternative I, the proposed ICP would not be approved and no impacts to the area's recreational resources would occur.

Impacts to recreational resources under Alternatives II, III, IV, and V include:

- Indirect short-term adverse impacts to developed Salmon-Challis National Forest recreation sites (small campgrounds located along the ICP proposed transportation route) associated with increased vehicle use along the ICP proposed transportation route (dust and noise).
- Indirect short-term adverse impacts associated with a potential increase in the use of developed and dispersed recreational opportunities by employees of ICP and their families.
- Potential indirect short-term adverse impacts for recreationalists using nearby area primary forest trails (blasting noise during the initial surface development of the Ram and Sunshine mine portals).
- Potential Indirect short-term adverse impacts to winter sports trail access areas along the proposed transportation route.

Source: Driear, Technical Report, Recreation, Visuals, and Wilderness, June 2005

The proposed ICP site, immediately adjacent areas (Blackbird Mine CERCLA site), and the access road to the ICP site (beyond the Blackbird Mine gate on the Blackbird Creek Road) are closed to public access, and will remained closed during the development, operation, and reclamation of the ICP site. As a result, no direct impacts to recreational resources will occur should Alternatives II, III, IV, or V be implemented. The proposed ICP transportation route, however, is open to year-round public use and access. Alternative I, No Action, would result in a continuation of the existing recreation resources and opportunities. Future changes to the existing recreation resources and opportunities would result from natural forces, future changes in Salmon-Challis National Forest Plan recreation management policies, and future population growth in the area. Recreation resource impacts under Alternatives II, III, IV, and V are discussed below.

Alternative I - No Action

No direct or indirect impacts would occur to developed and dispersed recreation resources and opportunities of the ICP project area and off-site areas under the No Action Alternative. Direct and/or indirect impacts to developed and dispersed recreation resources would occur as a result of natural processes, potential future changes to recreation management policies implemented via the Salmon-Challis National Forest Plan, or other future timber sales, mineral development proposals, road and/ or trail construction, future expansion of existing developed and dispersed recreational facilities, and future area population growth and increased public use of Forest Service recreational resources. The significance of potential future recreation resource impacts associated with the No Action Alternative is not possible to predict, but is considered to be minimal.

Alternative II - Company's Proposal

No direct impacts would occur to developed or dispersed recreation resources and opportunities of the ICP project area under Alternative II. No developed or dispersed recreation resources or opportunities are present on the proposed ICP mine and facilities site. No public access for trail use or recreational activities is present on the proposed ICP mine and facilities site or immediately adjacent areas. Public access to the proposed ICP site and immediately adjacent areas is closed beyond the Blackbird Mine gate on the Blackbird Creek Road, and will remain closed to public access during ICP construction, operation, and reclamation.

Under Alternative II, indirect adverse impacts will occur to developed and dispersed recreation resources in the vicinity of the ICP site, and are primarily associated with increased ICP-related vehicle use along the proposed transportation route during the life of the mine.

Developed Recreational Sites - Three developed recreational facilities administered by the Forest Service are located along the proposed ICP transportation route: the Williams Creek Picnic Area, the Cougar Point Campground, and the Deep Creek Campground (Chapter 3, Figure 3-21). The

predominant public use of these developed facilities is associated with the Autumn big game hunting season. Summer use of these facilities is typically low and intermittent.

Under Alternative II, it is predicted that there would be an additional traffic load of 34 vehicle trips (Average Daily Traffic) along the proposed ICP transportation route associated with the construction and operation of the ICP. Additional vehicle trips would include transportation of mine employees via vans, routine mine administration vehicle use, and transportation of supplies, fuels, milling reagents, and concentrate product. Increased daily vehicle use of the proposed transportation route will result in short-term (life of the mine) indirect adverse impacts to the existing use of the developed Forest Service campgrounds adjacent to the transportation route. Indirect impacts include increased dust, noise, a potential for vehicle accidents, and a diminishment of the existing recreational experience associated with camping use of the subject forest campgrounds.

The majority of ICP mine employees are anticipated to be hired from the existing available work force in the Salmon and Challis, Idaho area. As a result, use of the subject Forest Service campgrounds by ICP mine employees and families is not predicted to significantly increase. In consideration of the existing use of these campgrounds primarily by big game hunters in the Autumn, with a typically low and intermittent use during the summer season, the impact significance for developed federal recreation sites along the proposed ICP transportation route would be minor to moderate depending on the season of campground use.

Trails and Winter Sports - The site of the proposed ICP provides no public access for trail use or recreational activities. Forest trails in the general area of the proposed ICP and along the proposed ICP transportation route, however, provide an important recreational resource and opportunities. Hiking, horseback riding, off-road vehicle travel, snowmobiling and cross-country skiing are popular forms of trail-related recreation in this area. Primary trails near to the proposed ICP site, or along the proposed transportation route include Forest Service trails No. 029 (Big Creek Trail), No. 028 (Gant Ridge Trail), and No. 079 and No. 078 (in the Williams Creek Picnic area). Use of these forest trails is popular by hikers during the summer months and hunters during the Autumn hunting season.

Under Alternative II, use of the primary recreational trails in the project area is not predicted to increase or decrease as a result of the ICP, nor will access be adversely affected. Recreation resource impacts regarding major forest trails and winter sports opportunities associated with implementation of Alternative II will be indirect and short-term. These impacts primarily involve ICP-related construction and operational noise, transportation, and limited visual impacts, and would include:

- Increased noise potentially audible primarily from the Big Deer Creek Trail and the Gant Ridge trail during the ICP initial development and construction of the Ram and Sunshine portals (blasting)
- Limited long-distance background line-of-sight opportunities (limited by area topography) for viewing the operational ICP facilities from the Big Deer Creek Trail and the Gant Ridge trail.
- The addition of 34 mine-related vehicle trips per day year-round for the life-of-mine along the proposed ICP transportation route in the area of the Williams Creek summit, Cougar Point, and Ridge Road winter sports trail-heads (cross-country skiing and snowmobiling).

The Noise section of this chapter contains the following pertinent conclusions regarding area recreation trails and winter sports.

- *"In general, the noise sources (except blasting) associated with the project may be audible up to 2 miles from the sources depending on the location of the receptor relative to the sources, the background noise at the receptor location, and atmospheric conditions."*
- *"…blasting near the ground surface could be audible at many locations within a radius of several miles or more depending on the location of the receptor relative to the blasting location and the background noise levels at the receptor location. However, blasting noise*

would be very short-term, and as the project proceeds further underground, the blasting noise would be significantly reduced."

- *"…therefore, the short"-term noise levels during construction and reclamation activities are not predicted to be significant beyond a 0.5 to 1 miles radius around the equipment."*
- *"…the long-term noise levels due to the mill and TWSF operations are not predicted to be significant beyond a 0.5 to 2 mile radius around the equipment."*
- "*Except for blasting noise during the brief period that blasting occurs at or near the surface, the noise sources associated with construction and operation will typically be attenuated to near ambient background levels within approximately one mile of the mine."*
- *"…traffic noise is not predicted to be significant beyond 1 miles from the roads."*

Under Alternative II, it is predicted that 34 additional mine-related vehicle trips per day, year-long, will be added to the transportation route in the area of the Williams Creek summit, Cougar Point and Ridge Road. These areas provide trail-heads for cross-country skiing and snowmobiling. Increased mine- related traffic in these trail-head and parking areas may provide short-term adverse impacts regarding potential traffic congestion and vehicle conflicts.

Fish and Wildlife - Under Alternative II, impacts to the hunting and fishing opportunities in the general vicinity of the proposed ICP site will be minimal and short-term. Public access to the proposed ICP site is closed at the Blackbird Mine gate, and no public fishing or hunting opportunities are present on the proposed mine site.

Wild and Scenic Rivers - Panther Creek, from it's headwaters to the Salmon River is eligible for a recommendation for inclusion in the National Wild and Scenic Rivers System with a classification as a Recreational River area. A short segment of the proposed ICP transportation route is located along Panther Creek. Under Alternative II, recreation-related impacts would be short-term and minor as a result of the predicted addition of 34 mine-related vehicle trips per day, year-long, along the short portion of the Panther Creek road located adjacent to Panther Creek.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Indirect and direct impacts for recreational resources and opportunities under Alternative III would remain short-term as described under Alternative II with the following exception. Alternative III contains a mitigation measures to reduce sedimentation and improve safety on the Project Access route

Under Alternative III and implementation of the above road-related mitigation requirements, indirect long-term significant beneficial impacts would occur concerning improved public transportation safety associated with use of the proposed ICP transportation route for public access to recreational activities. During the construction period of the road improvements, however, short-term adverse impacts would occur concerning public use of the affected portions of the roads for recreational access. All road improvements will be designed to maintain the Wild and Scenic River values along Panther Creek.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Under Alternative IV, indirect and direct short-term and long-term impacts to recreation resources and opportunities would occur as described under Alternative III. Alternative IV contains the same road improvement-related mitigation measures as required under Alternative III.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Under Alternative V, indirect and direct short-term and long-term impacts to recreation resources and opportunities would occur as described under Alternative III. Alternative V contains the same road improvement-related mitigation measures as required under Alternative III.

Visual Resources

Summary

A description of the existing visual resources of the project study area is located in the Visual Resource section of Chapter Three and contains the following information:

- The Salmon-Challis National Forest Resource Management Plan directs the Forest to apply the Forest Service's Visual Management System to all lands administered by the Forest. The Forest Service implements the Visual Management System through the use of Visual Quality Objectives (VQO's). VQO's for the area of the proposed ICP mine site are shown on Figure 3-22, Chapter 3.
- The majority of the areas near the proposed ICP mine site, including the ICP site, have a VQO of Modification or maximum modification.
- Several smaller areas with a VQ) of Partial Retention are located in the general project area, including a larger area located east and northeast of the proposed ICP mine site and extending to the Panther Creek Road Corridor.
- The Panther Creek Road corridor has a VQO of Retention and a Sensitivity Level designation of 1.
- The Frank Church River of No Return Wilderness area, located approximately four miles west and southwest of the proposed ICP mine site has a VQO of Preservation.
- Past mining operations and the 2000 Clearwater Fire have had an impact to the views of the area.

Construction, operation, and reclamation of the ICP under Alternatives II, III, IV, and V would result in similar impacts to visual resources.

Impacts to visual resources include:

- Indirect short-term adverse visual impacts for recreationalists using nearby trails that provide limited medium-distance middle ground or long-distance background views of the construction, operation, and reclamation activities associated with the proposed ICP mine site. The significance of this impact would be minimal and dependent on line-of-site opportunities, viewing distance, topography, and viewer expectations.
- Indirect short-term night-time visual impacts associated with lighted facilities and sky-glow from the ICP site during project construction and operation.
- Indirect short-term and long-term cumulative visual impacts (in consideration of the adjacent historic Blackbird Mine existing surface disturbance) for recreationalists using nearby trails providing a medium-distance middle ground or long-distance viewing opportunity of both mine sites.

Source: Driear, Technical Report. Recreation, Visuals, and Wilderness, June 2005

Alternative 1, No Action, would result in a continuation of the existing visual resources of the project area. Future changes to the existing visual resources would result from natural forces, any future changes in Salmon-Challis National Forest Plan visual resource management policies, and FS implementation of potential future timber sales and/or approval of other potential mineral development proposals in the project area.

Alternative I - No Action

No direct or indirect impacts would occur to visual resources/important viewsheds of the ICP project area and off-site areas under the No Action Alternative. Direct and/or indirect impacts to visual resources/important viewsheds would occur as a result of natural process, potential future changes to visual resource management polices implemented via the Salmon-Challis National Forest Plan, or Forest Service approval of potential future timber sales, and or approval of potential future mineral development projects in the area. The significance of potential future visual resource impacts associated with the No Action Alternative is not possible to predict, but is considered to be minimal.

Alternative II - Company's Proposal

Direct short-term impacts would occur to the visual resources currently characterizing the site of the proposed ICP. These impacts would result from alteration of the existing topography through cut and fills and/or native vegetation removal required for the construction and operation of the ICP mine facilities, including new internal access roads, development of the Ram and Sunshine portals, development of the borrow area adjacent to the Ram Portal, the Tailing and Waste Rock Storage facility (TWSF), mill building, ore and waste rock tram, water management ponds, ore and topsoil stockpiles and other support facilities. Following completion of reclamation activities at the end of mine life, surface buildings and facilities would be removed (with the exception of the TWSF), and disturbed areas recontoured, returned as nearly as possible to pre-mine development, and revegetated.

The ICP site and proposed development of surface facilities are located in an area characterized by a VQO of Modification. Forest Service management of activities within areas with a VQO of Modification, as pertaining to the type of facilities associated with the proposed ICP is summarized as follows:

> *"Under the modification VQO, management activities may visually dominate the original characteristic landscape…Additional parts of these activities such as structures, roads, slash, root wads, etc. must remain visually subordinate to the proposed composition…Activities which are predominately introduction of facilities such as buildings, signs, roads, etc., should borrow from naturally established form, line, color and texture so completely and at such scale that its visual characteristics are compatible with the natural surroundings."* (USDA, 1974)

Under Alternative II, the construction and operation of the proposed ICP surface facilities, and the mill building and ore/waste rock tram in particular, may result in short-term deviation from the above described Forest Service visual management guidelines for the Modification VQO. Construction designs and specifications for the ICP mill building and ore/waste tram have not been submitted by FCC to the Forest Service for review. Mitigation opportunities exist for reducing direct visual impacts, including neutral coloring of buildings and other surface structures, reduction of facility size and height to the extend practicable, and feathering of vegetation removal areas and linear pipeline or powerline corridors.

Indirect short-term visual impacts will result from implementation of Alternative II. These impacts will result from limited opportunities for middle-distance/middle-ground and long-distance/background views of some components of the ICP construction, operation, and reclamation activities as viewed from the primary recreation trails in the general area; specifically FS Trail No. 029 (Big Creek Trail) and FS Trail No. 028 (Gant Ridge Trail). The Gant Ridge trail generally defines the ridge top eastern boundary of the Frank Church River of No Return Wilderness located approximately 1.5 miles west and south of the proposed ICP. The significance of the indirect short-term visual impacts along these recreational trails is predicted to be minimal and not significantly affect viewer expectations as a result of existing limited viewing opportunities of other historic mining development (Blackbird Mine) adjacent to the proposed ICP development.

With the exception of the Panther Creek Road corridor, no other Visual Sensitivity Level 1 or 2 trails or view points used by Forest visitors are located in the general vicinity of the proposed ICP, or that

would provide an opportunity for viewing the ICP. The Panther Creek Road corridor has a VQO of Retention and a Sensitivity Level designation of Level 1. A short segment of the Panther Creek Road is included in the proposed ICP transportation route. No direct or indirect visual impacts affecting the Panther Creek Road corridor Visual Sensitivity Level 1 would result from the construction, operation, and reclamation activities of the proposed ICP under Alternative II.

Under Alternative II, the occurrence of night-time sky-glow from lighting of the ICP facilities would provide an indirect short-term visual impact. Night-time travelers along the ICP transportation route from the Williams Creek summit westward would have occasional views of the facilities sky-glow in the distance, the significance of which would be dependent on atmospheric conditions. The sky-glow may be visible from some of the nearest portions of the Frank Church River of No Return Wilderness.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Direct and indirect short-term and long-term impacts to visual resources associated with Alternative III would not be significantly different from those described for Alternative II, and would include:

- The TWSF would be relocated to the northeast of the mill site. This would result in a moderate increase in the direct short-term visual impact and a slight increase in the indirect visual impact of the facility over that described in Alternative II.

- An additional 175 acres of vegetation removal (timber burned by the 2001 Clear Creek Fire) would be added with the LAT area. This would moderately increase the direct short-term visual impact and slightly increase the indirect short-term visual impact of the facility as described in Alternative II.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Direct and indirect short-term and long-term impacts to visual resources associated with Alternative IV would not be significantly different from those described for Alternative II, and would include:

- The TWSF would be located as in Alternative II, but would initially have a smaller footprint. This would moderately decrease the direct short-term visual impact, and slightly decrease the indirect short-term visual impact of the facility as described in Alternative II.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Direct and indirect short-term and long-term impacts to visual resources associated with Alternative V would be essentially the same as described for Alternative IV.

Wilderness Resources

Summary

The Frank Church River of No Return Wilderness (FCRNRW) is located approximately four miles west of the proposed ICP site (Chapter 3, **Figure 3-16**). The wilderness area was established in 1980 when congress passed the Central Idaho Wilderness Act, and covers over two million acres in Central Idaho. The Frank Church River of No Return Wilderness is the largest contiguous wilderness area in the lower 48 states, and the largest in the National Forest System.

- No direct short-term or long-term impacts to the wilderness resources of the FCRNRW would result from the construction, operation, and reclamation of the ICP under Alternatives II, III, IV, and V.

- Short-term and cumulative impact potential to the wilderness resources of the FCRNRW as a result of the construction, operation, and reclamation of the ICP under Alternatives II, III, IV, and V would not be significant, and is described in the Recreation Resources and Visual Resources section of Chapter 4.
- Alternative I would not result in any short-term or long-term impacts to the wilderness resources of the FCRNRW.

Social and Economic Resources

Summary

FCC anticipates most of the permanent employees would reside in the local labor market of Salmon and Challis. Contract construction workers with specialized skills, however, may be hired from outside the local labor market to work during the construction phase.

Positive impacts which would occur under any of the action alternatives would be direct employment in the mining industry and secondary employment in the retail and service sectors of the study area; income generated from wages paid by FCC at the Idaho Cobalt Project and by secondary job employers within the study area communities; and taxes paid by FCC for the mining operation collected by local and state jurisdictions. Negative impacts, under the Company's Proposal would be potential stress on community service providers and housing in the area, primarily during the construction phase. However, since only a small number of construction and mine workers with specialized skills are expected to be hired from outside the local labor area, negative impacts are not expected to be significant.

Under the Alternative I (No Action), the mine would not be permitted and no associated employment, tax revenues, or additional stress on housing would be realized.

Early closure of mining and processing operations (in the event that economic conditions for cobalt production changed) would create negative impacts, such as increased unemployment, reduced wages spent in the local economy, decreased revenues to local and state jurisdictions, increased stress on public assistance programs, and decreased quality-of-life of some residents.

Alternative I – No Action

Negative socioeconomic impacts under the No Action Alternative would include no change in the employment picture, no increase in wages spent in the local economy, no additional revenues to local and state jurisdictions, and a reduced quality-of-life of some residents. No additional stress on housing would be a positive impact under the No Action Alternative.

Alternative II - Company's Proposal

Impacts to socioeconomic resources usually occur when a significant number of workers and their families move into the study area as a result of jobs either directly or indirectly created by a mining development. Since it is anticipated that a limited number of employees outside of the local labor market would be hired for the construction phase and only a few employees outside the local labor market would be hired for the operation phase, few newcomers are expected to move into the area due to the project. Negative impacts to socioeconomic resources, such as stress on housing or community services, would be minimal.

Positive impacts that would occur under the Company's Proposal would be direct employment by FCC and secondary employment in some retail and service sectors in the study area. High salaries paid to workers employed at the mine would occur under Alternative II. Wages paid to economic sectors induced by the mining operation as well as sales taxes paid by workers spending their salaries in local businesses also would be realized.

Company and personal taxes (including property, sales, and mine license taxes, and state and federal income taxes) would peak in Year 2 of operations at approximately $12,508,000 a year. Primarily due to employment opportunities created by the mining operation, workers and their families would enjoy an improved quality-of-life as a result of the project.

Negative impacts would be minimal since it is anticipated that most workers would be hired from the local labor market. Local housing, however, is limited with or without the proposed mine. Temporary housing, such as RV parks and motels, used by workers during the construction phase may displace tourists visiting the area, primarily during the summer months. The limited housing market may make it difficult to find housing for any workers from outside the area.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Impacts on socioeconomic resources in the study area under Alternative III would be the same as described under Alternative II, the Company's Proposal.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Impacts on socioeconomic resources in the study area under Alternative III would be the same as described under Alternative II, the Company's Proposal.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Impacts on socioeconomic resources in the study area under Alternative III would be the same as described under Alternative II, the Company's Proposal.

Heritage Resources

Summary

Review of the heritage resource data indicates that only one of the proposed mine facilities is located on National Register-eligible heritage resource properties identified in this analysis. The company's proposed pipeline route for the treated water discharge would cross a National Register-eligible prehistoric site near the confluence of Big Deer and South Fork of Big Deer Creeks. Also, farther upstream, the agency's proposed route would pass through an historic site, although it would not impact individual features. All other properties considered in this analysis appear to be outside the areas proposed for mine development. In the following discussions of potential impacts, minor variations on this general conclusion are detailed. Where any possibility of adverse effect has been identified, specific management measures are identified and would result in impact avoidance. Once these measures are implemented, the Project would have no adverse effect on known heritage resource properties. In any approval of the project, SNF should make appropriate provisions for management attention to heritage resource properties that might be discovered during mine construction and/or future operations.

Alternative I - No Action

This alternative would have no impact on heritage resources. The management of National Register eligible properties on public lands under the jurisdiction of the SNF would remain the responsibility of the agency, under the provisions of Sections 106 and 110 of the National Historic Preservation Act and other applicable federal authorities.

Alternative II - Company's Proposal

No properties listed in the National Register of Historic Places are within the area of surface disturbance outlined in FCC's Proposal. However, two properties eligible for listing have been recorded along the water discharge pipeline route. Therefore, the Company's Plan would have an impact on significant heritage resources. Additionally, several other heritage resources properties are in the general vicinity of proposed ground disturbing activities under Alternative II.

SL-506 is a prehistoric campsite consisting of chipped stone tools and debitage covering a 90,000 square foot area at the confluence of Big Deer and South Fork of Big Deer Creeks. The pipeline alignment in Alternative II would traverse through the center of this site and has the potential to disturb significant archaeological materials. Therefore, the Alternative II pipeline route would have an adverse effect on that resource and impact mitigation by archaeological excavation would be required.

SL-1319A is an historic mining camp ruin along Bucktail Creek, which was first documented in 1997. It is bisected by the route of the agency's proposed water discharge pipeline. Having suffered some damage over the last 10 years, today the only feature remaining at SL-1319A that might render the property National Register eligible is a household dump. FCC proposes to find and mark that dump in the field prior to pipeline placement, and thus avoid all direct impacts. Therefore, the project would have no adverse effect on that resource.

Historic features documented as SL-1558 were recorded during the 2001 baseline heritage resource inventory. This site is a mining camp ruin in the general vicinity of FCC's tailings/waste rock stockpile. This property was revisited, GPS mapped, and flagged in 2005. These actions would allow FCC to construct and operate the TWSF so as not to intrude on the boundaries of SL-1558, and consequently there would be no impact to that property.

Historic sites associated with the Thunder Mountain Trail (Features SL-937–20N-19E-6 and SL-937–20N-19E-7) are located along sections of the Panther Creek Road where FCC proposes to raise the existing road grade. That work would extend from road miles 29.51 to 29.63 (near SL-937–20N-19E-6) and from 32.20 to 32.24 (near SL-937-20N-19E-7). Construction activities would, however, be confined entirely to the existing road bed. The 2005 inventory relocated, GPS mapped, and flagged features associated with the trail (telephone poles/ruins). These actions would allow FCC to avoid both features during construction. Therefore, no impacts to these features would occur.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Effects on heritage resources under Alternative III would be the same as under Alternative II except for issues associated with the pipeline and road improvements proposed for improving traffic safety and road drainage. Relocation of the TWSF under Alternative IV would have no impact on heritage resource properties. The road improvement areas were examined during the 2005 heritage resource study. Two heritage resource properties are in the road improvement corridors. Improvements to the Williams Creek and Panther Creek roads would consist of localized realignment, resurfacing, grade raising, ditch reconstruction, and grade modifications.

The first heritage property adjacent to the proposed road improvements, as noted above, involves pieces of the Thunder Mountain Trail, located along the Panther Creek Road. Documented trail features are confined to remnants of historic telephone poles. Construction activities in the vicinity of these poles would be confined entirely to the existing roadbed. The 2005 inventory relocated, GPS mapped, and flagged the telephone poles/ruins. These actions would allow the features to be avoided during construction. Therefore, no impacts to these features would occur.

A prehistoric site (SL-708) for which its National Register eligibility is unresolved lies close to the Williams Creek road. Although not specifically proposed, any construction or road maintenance activity outside of the existing road prizm has the potential to impact this site. The Forest would

monitor any proposed road activity in the vicinity of site SL-708 to assure that no disturbance to the site occurs.

Alternative III has a modified pipeline alignment in the vicinity of SL-506 near the confluence of Big Deer and South Fork of Big Deer Creeks intended to avoid impacts to the site. Archaeological testing in 2006 revealed that the east edge of the site, where the water discharge pipeline would be re-routed, does not contain significant archaeological materials. Therefore, the pipeline would have no adverse effect on that resource.

One heritage site, SL-1557, is near the road and pipeline that would convey water to the Bucktail Creek discharge location under Alternative IV. This site is a log hoist house. In 2005 it was relocated, flagged, and located with GPS coordinates. If Alternative III and this road/pipeline alignment are selected, the site would be identified on the ground to ensure that it is avoided during proposed road reconstruction and pipeline installation.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Effects on heritage resources under Alternative IV would be the same as under Alternative III. Where facilities appear in Alternatives II and III, which also are included in Alternatives IV, the potential for impacts from those facilities are discussed above. Road and pipeline mitigation intended to remove impacts to heritage resources described in Alternative III also would be included in Alternative IV. With the realignment of the water discharge pipeline and other mitigation measures identified for Alternative III there would be no effects to prehistoric or heritage sites under Alternative IV.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Effects on heritage resources under Alternative V would be the same as under Alternative IV except that the road reconstruction/pipeline installation in the lower Bucktail Creek drainage would not be required. Mitigation measures required under Alternative III would also apply to Alternative V and no effects to prehistoric or heritage sites are anticipated under Alternative V.

Blackbird Mine Site

Summary

An agency objective associated with the ICP is to ensure no adverse impacts to the ongoing CERCLA cleanup activities at the Blackbird mine site. Careful coordination between ICP and the Blackbird cleanup will be required to ensure that no adverse impacts occur. The agencies would require monitoring to determine the effects of both the ICP and the Blackbird activities, particularly with respect to water quality. Under some of the action alternatives there is a potential for the ICP to impact BMSG activities and specific monitoring and mitigation measures have been identified to minimize the potential for any adverse impact.

BMSG facilities that may potentially be affected by the ICP include (**Figure 2-1**):

- The earth fill clay-core dam (7000 level dam) and associated pipeline and open-channel spillway that collects, stores, and diverts contaminated water to the Blackbird water treatment plant via the 6930 level adit to the underground mine workings. The 7000 level dam is approximately 70 feet high and impounds a reservoir with a maximum surface area of 0.52 acre and a maximum storage capacity of 5.85 acre-feet.
- The temporary sediment control dam that was built to settle out sediment generated during construction activities and sediments from residual debris flow materials along Bucktail Creek. The lower sediment control dam is located just upstream from the lower access road crossing of Bucktail Creek and remains in place in 2007.

- BMSG Phase I and Phase II capture systems in Upper Bucktail Creek. The BMSG Phase I and II capture systems consist of a series of spring/seepage collection systems and alluvial pumpback wells in Upper Bucktail drainage bottom. Seepage water and alluvial groundwater captured through the system is pumped back to the Blackbird mine workings for treatment at the BMSG water treatment plant and discharge to Blackbird Creek.
- The proposed BT-5 pipeline that would capture and divert Bucktail Creek around South Fork Big Deer Creek to Big Deer Creek. The pipeline is expected to be constructed in 2009.

Impacts to the Blackbird cleanup could occur if the ICP were to interfere with the proper functioning of these facilities. Impacts to the cleanup could also occur if the ICP were to cause changes in water quality or quantity such that water quality standards and water quality cleanup goals could not be attained.

Alternative I – No Action

Under the No Action Alternative, work would continue at the Blackbird mine site as described in Chapter 3. The EPA projects continuing improvement in water quality in area streams with South Fork Big Deer Creek, Big Deer Creek and Panther Creek eventually achieving water quality standards. Bucktail Creek and groundwater in the upper Bucktail drainage would continue to have elevated levels of metals into the indefinite future but would be cleaned up to the extent necessary to meet standards in South Fork Big Deer Creek, Big Deer Creek and Panther Creek.

Groundwater - In Alternative I the Blackbird Cleanup would continue dewatering of shallow bedrock and alluvial groundwater systems along Bucktail Creek and groundwater in the Bucktail Creek drainage would continue to be of poor quality with metal concentrations that exceed federal drinking water standards and Blackbird groundwater cleanup levels in some areas.

Surface Water - BMSG and EPA (USEPA, 2003) predict long-term improvements in water quality (decrease in metal concentrations) in South Fork Big Deer Creek, Big Deer Creek and Panther Creek. However, EPA and IDEQ have determined that it is unlikely that Bucktail Creek and Blackbird Creek would ever attain aquatic life standards or support fisheries (IDEQ, 1997 and 2002). Blackbird cleanup actions are also expected to result in long-term decreases in streamflow in Bucktail Creek and South Fork of Big Deer Creek due to the continued pumping and transport of groundwater and surface water from Bucktail Creek to the BMSG water treatment plant in the Blackbird Creek drainage. Planned diversion of surface water in the Bucktail drainage would also significantly reduce flows in South Fork Big Deer Creek and entirely dewater lower Bucktail Creek certain times of the year.

Alternative II - Company's Proposal

Under all of the action alternatives the BMSG would continue to do the cleanup work and operate the Blackbird water treatment system as required by existing CERCLA agreements.

Access - Under ICP's proposal the ICP and BMSG/Noranda would develop agreements for ICP access across Noranda's property and use of the powerline supplying the existing Blackbird treatment plant and crossing Noranda property. As a Plan of Operation condition under Alternative II, and the other agency action alternatives, ICP would be required to obtain an easement on the Morgan Creek - Panther Creek road (FS 60055) through Cobalt townsite.

Groundwater – Proposed mining is not likely to induce groundwater inflow from the Blackbird mine site under any Alternatives. However, groundwater monitoring to verify and confirm this conclusion would be necessary under Alternative II and all ICP mining alternatives (see Water Resources section of this Chapter).

At its peak during mine operations, mine dewatering would reduce the total estimated bedrock groundwater flux within Bucktail Creek drainage by about 43 percent. Reduction of the groundwater flux

would cause indirect effects to spring, seep and stream flows in Bucktail Creek. Thus, flows to BMSG capture facilities might be reduced due to ICP mine dewatering.

Flows to BMSG capture facilities might continue to be reduced due to post-mining groundwater capture by the ICP. Groundwater quantity effects during the closure period would depend on whether groundwater capture is needed to mitigate water quality effects from mine water. If groundwater capture is instituted, groundwater flow effects could be as much as 50 percent higher than the operational period (i.e., about 60 percent reduction in total bedrock groundwater flux) due to capture and diversion of bedrock groundwater downgradient of the two mines. Groundwater flow reductions are not anticipated to interfere with proper functioning of BMSG facilities.

After cessation of mining, the mines would be allowed to refill with groundwater and some metals, nitrate and sulfate would be leached from the mine and migrate with groundwater downgradient of the mines towards Bucktail Creek. Operation of the Alternative II groundwater capture system for the Sunshine mine would reduce (by an estimated 75 percent), but not eliminate, effects to Upper Bucktail alluvial groundwater. Groundwater and metals originating from the flooded Sunshine Mine and bypassing the capture system would move through the bedrock groundwater system to the Upper Bucktail alluvium and the BMSG capture system. From there it would be pumped back to the Blackbird mine workings for treatment at the BMSG water treatment plant and discharged to Blackbird Creek. It would be necessary for ICP and BMSG (with approval of EPA and Idaho DEQ) to come to agreement on how to account for this additional treatment load.

Groundwater and associated metals, nitrate, and sulfate from the flooded Ram mine would move through the bedrock groundwater system toward middle Bucktail alluvium/Bucktail Creek. Alternative II capture wells at the Ram Mine are expected to achieve about 90 percent capture of Ram mine water and associated chemical mass loads. The majority of the groundwater and associated ICP chemical mass load that bypasses the ICP capture system would discharge to Bucktail Creek or the alluvial groundwater system. A small portion (0 to 5 percent) of the ICP chemical mass load that bypasses the ICP capture system could be intercepted by the BMSG Phase I/II capture systems where it would be pumped back to the Blackbird mine workings for treatment at the BMSG water treatment plant and discharged to Blackbird Creek. It would be necessary for ICP and BMSG (with approval of EPA and Idaho DEQ) to come to agreement on how to account for this additional treatment load if this were to occur.

The remaining groundwater and chemical mass loads from the ICP that are not captured by the ICP or BMSG capture systems would flow to Bucktail Creek/lower Bucktail alluvium and would report to the BT-5 pipeline and be diverted to Big Deer Creek.

Surface Water – Mine development under Alternative II and all action alternatives would reduce flows in the Bucktail and South Fork Big Deer Creek drainages (see Water Resources section of this Chapter). Flows to BMSG's BT-5 pipeline diversion would be reduced during mine operations and would continue as long as post-mining groundwater capture and treatment is needed. Flow reductions are not expected to interfere with function of the BMSG facilities or preclude attainment of cleanup goals.

During Ram operations before implementation of BT-5, metal concentrations in South Fork would remain similar to current conditions and likely would remain poorer than water quality standards and cleanup goals. Alternative II and all action alternatives are predicted by the DSM to cause slight increases in cobalt and copper concentrations in South Fork Big Deer Creek in the early years of the project, prior to completion of the Blackbird cleanup. These model-predicted increases are not considered to be significant because it is unlikely that the changes would significantly worsen stream quality or interfere with the Blackbird cleanup; cobalt and copper chemical mass loads to the stream from the ICP are actually decreased during this period; and the ICP is predicted to result in decreases in cobalt and copper concentrations in Big Deer Creek during this same period. Upon completion of the cleanup and installation of the BT-5 diversion, the ICP is not predicted to cause adverse changes in cobalt or copper concentrations in South Fork Big Deer Creek.

No significant adverse changes in water quality and quantity in Big Deer Creek, Panther Creek or Blackbird Creek are expected to occur in Alternative II (with post-closure mitigation of groundwater capture and treatment) during and after mine operations. In the expected (most likely) case with post-mining groundwater capture and treatment, Alternative II would adequately mitigate post-mining water quality effects from the underground mines. However, if actual conditions were to be worse than expected (but within the range of possible outcomes), the changes in water quality caused by Alternative II might not be fully mitigated by the proposed groundwater capture and treatment system and exceedance of the copper aquatic life criterion in the streams could occur. Exceedance of the criterion would potentially interfere with attainment of the Blackbird cleanup goals.

Alternative II and all action alternatives that allow mine flooding during and after closure (Alternatives II, IV, and V) would cause water quality changes in Ram Spring, a tributary to Bucktail Creek. Currently, copper concentrations in Ram Spring are much lower than Bucktail Creek but higher (worse) than the surface water quality standard. Alternatives II, IV, and V would cause copper concentrations in Ram Spring to increase. This increase in copper concentration in Ram Spring is not considered to be significant because Bucktail Creek is not expected to be cleaned up to meet water quality standards (IDEQ, 2002) and the copper mass load from Ram Spring is very small and would have a negligible effect on Big Deer Creek. The changes in Ram Spring have the potential to become significant only if the changes preclude attainment of water quality standards in Bucktail Creek or downstream waters.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

Access – Access agreements as described under Alternative II would be required for this alternative.

Groundwater – In Alternative III mine dewatering during and after mine operations would reduce the total estimated bedrock groundwater flux within Bucktail Creek drainage by about 43 percent. Reduction in the groundwater flux would cause indirect effects to spring, seep and stream flows in Bucktail Creek. Thus, flows (and metal loads) to BMSG capture facilities might be reduced due to ICP mine dewatering. Groundwater flow reductions are not anticipated to interfere with proper functioning of BMSG facilities.

Surface Water – Mine development under Alternative III would reduce flows in the Bucktail and South Fork Big Deer Creek drainages. Flows to BMSG's BT-5 pipeline diversion would be reduced during mine operations and would continue indefinitely due to perpetual mine dewatering. Flow reductions are not expected to interfere with function of the BMSG facilities or preclude attainment of cleanup goals.

Alternative III and all action alternatives are predicted by the DSM to cause slight increases in cobalt and copper concentrations in South Fork Big Deer Creek in the early years of the project, prior to completion of the Blackbird cleanup as described above for Alternative II. These model-predicted increases are not considered to be significant because it is unlikely that the changes would significantly worsen stream quality or interfere with the Blackbird cleanup; cobalt and copper chemical mass loads to the stream from the ICP are actually decreased during this period; and the ICP is predicted to result in decreases in cobalt and copper concentrations in Big Deer Creek during this same period. Upon completion of the cleanup and installation of the BT-5 diversion, the ICP is not predicted to cause adverse changes in cobalt or copper concentrations in South Fork Big Deer Creek.

Alternative IV – Lower Bucktail Groundwater Capture, Modified Water Treatment to Reduce Waste Stream and Surface Discharge to Big Deer Creek

Access - Access agreements as described under Alternative II would be required for Alternative IV.

Groundwater – Effects to bedrock groundwater flow during mine operations under Alternative IV would be similar to Alternative II as described above. Flows to BMSG capture facilities might be reduced due to ICP mine dewatering.

Flows to BMSG capture facilities might be reduced further due to post-mining groundwater capture by the ICP. Groundwater quantity effects during the closure period would depend on the type of groundwater capture employed to mitigate water quality effects from mine water. If bedrock groundwater capture is instituted as under Alternative II, groundwater flow effects would be about 50 percent higher than the operational period (i.e., about 60 percent reduction in total bedrock groundwater flux) due to capture and diversion of bedrock groundwater downgradient of the two mines. Groundwater flow reductions in this scenario are not anticipated to interfere with proper functioning of BMSG facilities.

As described above for Alternative II, groundwater and metals originating from the flooded Sunshine Mine and bypassing the Alternative IV capture system would move through the bedrock groundwater system to the Upper Bucktail alluvium and the BMSG capture system. From there it would be pumped back to the Blackbird mine workings for treatment at the BMSG water treatment plant and discharged to Blackbird Creek. It would be necessary for ICP and BMSG (with approval of EPA and Idaho DEQ) to come to agreement on how to account for this additional treatment load.

As described above for Alternative II, groundwater and associated metals, nitrate, and sulfate from the flooded Ram mine would move through the bedrock groundwater system toward middle Bucktail alluvium/Bucktail Creek. Alternative IV bedrock capture wells at the Ram Mine would achieve similar capture efficiencies as described for Alternative II. A small portion (0 to 5 percent) of the ICP chemical mass load that bypasses the ICP capture system could be intercepted by the BMSG Phase I/II capture systems where it would be pumped back to the Blackbird mine workings for treatment at the BMSG water treatment plant and discharged to Blackbird Creek. It would be necessary for ICP and BMSG (with approval of EPA and Idaho DEQ) to come to agreement on how to account for this additional treatment load if this were to occur.

The remaining groundwater and chemical mass loads from the ICP that are not captured by the ICP or BMSG capture systems would flow to Bucktail Creek/lower Bucktail alluvium and would report to the BT-5 pipeline and be diverted to Big Deer Creek.

If additional capture of ICP-derived chemical mass load were necessary to achieve water quality goals, a supplemental surface water/alluvial groundwater capture system would be employed in lower Bucktail Creek drainage. This system would result in reductions in surface water/alluvial groundwater flows that would reduce the amount of water diverted by the BT-5 pipeline but is not expected to interfere with pipeline operation.

Surface Water – Mine development under Alternative IV would reduce flows in the Bucktail and South Fork Big Deer Creek drainages. Flows to BMSG's BT-5 pipeline diversion would be reduced during mine operations and would continue as long as post-mining groundwater capture and treatment is needed. Flow reductions are not expected to interfere with function of the BMSG facilities or preclude attainment of cleanup goals.

Alternative IV and all action alternatives are predicted by the DSM to cause slight increases in cobalt and copper concentrations in South Fork Big Deer Creek in the early years of the project, prior to completion of the Blackbird cleanup as described above for Alternative II. These increases are not expected to be significant and upon completion of the cleanup and installation of the BT-5 diversion, the ICP is not predicted to cause adverse changes in cobalt or copper concentrations in South Fork Big Deer Creek.

No adverse changes in water quality and quantity in Big Deer Creek, Panther Creek or Blackbird Creek are expected to Alternative IV during or after mine operations. In the expected case with post-mining groundwater capture and treatment, all action alternatives adequately mitigate post-mining water quality effects from the underground mines. Water quality standards would be met during and after mining, therefore no impact to the Blackbird cleanup is expected. As described for Alternative II above, following mine flooding, there would be water quality changes in Ram Spring. Although not expected,

the changes in Ram Spring have the potential to become significant if they affected attainment of water quality standards in Bucktail Creek or downstream waters.

Alternative V - Lower Bucktail Groundwater Capture, Water Treatment at Site of Blackbird Treatment Plant and Surface Discharge to Blackbird Creek

Under all of the action alternatives the BMSG would continue to do the cleanup work and operate the Blackbird water treatment system as required by existing CRECLA agreements.

Access - Access agreements as described under Alternative II would be required for this alternative. Additional agreements with Noranda/BMSG would be required for modification and operation of the water treatment facilities and discharge to Blackbird Creek.

Groundwater – Effects to bedrock groundwater flow during and after mine operations under Alternative V would be similar to Alternative IV as described above. Groundwater flow reductions are not anticipated to interfere with proper functioning of BMSG facilities.

Surface Water – Mine development under Alternative IV would reduce flows in the Bucktail, South Fork Big Deer Creek, and Big Deer Creek drainages. Flows to BMSG's BT-5 pipeline diversion would be reduced during mine operations and would continue as long as post-mining groundwater capture and treatment is needed. Flow reductions are not expected to interfere with function of the BMSG facilities or preclude attainment of cleanup goals.

Alternative V, as for other action alternatives, is predicted by the DSM to cause slight increases in cobalt and copper concentrations in South Fork Big Deer Creek in the early years of the project, prior to completion of the Blackbird cleanup as described above for Alternative II. These increases are not expected to be significant and upon completion of the cleanup and installation of the BT-5 diversion, the ICP is not predicted to cause adverse changes in cobalt or copper concentrations in South Fork Big Deer Creek.

No adverse changes in water quality and quantity in Big Deer Creek, Panther Creek or Blackbird Creek are expected in Alternative V during or after mine operations. In the expected case with post-mining groundwater capture and treatment, all action alternatives adequately mitigate post-mining water quality effects from the underground mines. Discharge of an additional quantity of treated water would be expected to improve the quality of Blackbird Creek water.

As described for Alternative II above, following mine flooding there would be water quality changes in Ram Spring. Although not expected, the changes in Ram Spring have the potential to become significant if they affected attainment of water quality standards in Bucktail Creek or downstream waters.

Cumulative Effects

Summary

The following is a brief summary of cumulative effects identified in the agency analysis of the four action alternatives. Cumulative Effects are then described in more detail for each of the individual resources.

Past activities and land uses in the Project Area and surrounding Forest lands that have had an impact on resources include road construction and maintenance, mining, timber harvest, livestock grazing and wildfires. Impacts from these activities include accelerated soil and streambank erosion and metals loading resulting in a degradation of aquatic habitat and impacts to beneficial water uses in the Panther Creek watershed.

Historic mining has impacted Blackbird Creek, Bucktail Creek, Big Deer Creek and Panther Creek. These streams have been and continue to be impacted by releases of acidity and heavy metals from the Blackbird Mine site.

In 2000 the Clear Creek Fire burned approximately 170,000 acres in the Panther Creek watershed. Post-fire effects on water quality, aquatic habitat and wildlife habitat have been significant. In addition to the direct loss of habitat to terrestrial wildlife, increased sediment and water yield has affected aquatic habitat.

Ongoing and proposed activities in the vicinity of the ICP include road maintenance, mineral exploration, mine site restoration, small timber sales and livestock grazing. The USFS fourth quarter 2006 SOPA includes five projects that could affect the ICP study area. These are:

- Deep Creek Road Culvert Replacement – this USFS project would replace a culvert that acts as a fish barrier with a naturalized stream crossing;
- Moyer/Salt Prescribed Burn – this USFS project would involve approximately 4,500 acres of prescribed burn and 484 acres of commercial thinning to develop forest stand characteristics that are more resilient to fire;
- Goldbug Commercial Fuelwood Sale – this USFS timber sale would allow removal of dead trees from 250 acres of the 2000 Clear Creek fire for firewood;
- Forney Fencing (two projects) – these projects include one funded by BMSG that would construct 2000 feet of fencing on SCNF land to exclude cattle from the riparian zone and a second on SCNF land along 4th of July and McGowen Creeks that would add 1.3 miles of fencing to exclude cattle from the riparian zone;
- Musgrove Exploration – this project would involve drilling of nine mineral exploration holes in the Musgrove Creek drainage resulting in 2.5 acres of disturbance by a private party;
- Ludwig Commercial Firewood Sale – this is a USFS timber sale that would allow removal of dead trees from 250 acres of the 2000 Clear Creek fire for firewood.

These activities have both potential adverse and beneficial impacts on water quality and aquatic habitat. Road maintenance, mineral exploration, logging and livestock grazing can be potential sources of stream sedimentation. The culvert replacement and cattle exclusion projects are targeted at improving fish habitat. The prescribed burn and Goldbug firewood sale will decrease fuel loads. The effects of road maintenance has been minimized with the implementation of best management practices for road maintenance as detailed in the Programmatic Consultation for Road Maintenance (USDI, 2003). Livestock grazing is being managed in consultation with several regulatory agencies to reduce the effects of livestock on water quality and aquatic habitat. Three grazing allotments are managed by the Forest Service in the upper Panther Creek drainage, two in the middle Panther Creek watershed and three in the Napias Creek watershed (Rose, 2005). Ongoing reclamation activities at the Beartrack Mine in the Napias Creek drainage and remediation of the Blackbird Mine under superfund (CERCLA) authority are expected to result in long-term improvements in water quality in Panther Creek and affected tributaries.

Geology and Geotechnical Resources

There would be no significant cumulative effects of any of the action alternatives with respect to geology, ore reserves, and topography.

Water Resources

Past activities and land uses in the Panther Creek watershed that have had an impact on water resources include road construction and maintenance, mining, timber harvest, livestock grazing and wildfires. Impacts from these activities include accelerated soil and streambank erosion and metals loading resulting in a degradation of aquatic habitat and impacts to beneficial water uses in the Panther Creek watershed.

Water quality limited stream segments in the watershed include Blackbird Creek, Bucktail Creek, Big Deer Creek and Panther Creek (**Table 3-3**). Blackbird Creek, Bucktail Creek and Big Deer Creek have been and continue to be impacted by releases of acidity and heavy metals from the historic Blackbird Mine site. Panther Creek has also been impacted by releases from the Blackbird Mine. In addition Panther Creek has been impacted by other past mining activities including the Blackpine Mine (Copper Creek) and historic mining activities in the Musgrove and Napias Creek drainages.

In 2000 the Clear Creek Fire burned approximately 170,000 acres in the Panther Creek watershed. Post-fire effects on water quality and aquatic habitat have been significant. In the years following the Clear Creek Fire numerous high intensity storms in lower Panther Creek caused large floods and debris flows in Clear Creek, Garden Creek and numerous unnamed drainages. Panther Creek is flushing out the large quantities of sediment that were deposited in the lower channels by post-fire floods and debris flows. Post-fire monitoring of fine sediment levels from numerous stations on Panther Creek is showing a return of sediment levels to pre-fire levels.

The Clear Creek Fire has also caused measurable increases in water yield and streamflow due to changes in snow interception and decreases in transpiration. An evaluation of streamflow data from the Napias Creek stream gage shows a distinct change in water yield following the Clear Creek Fire. This effect is expected to slowly diminish over time as the burned areas regenerate with timber stands.

Ongoing activities in the Panther Creek watershed include road maintenance, mineral exploration, mine site restoration and livestock grazing. These activities have both potential adverse and beneficial impacts on water quality. Both road maintenance and livestock grazing can be potential sources of stream sedimentation. The effects of roads maintenance have been minimized with the implementation of best management practices for road maintenance as detailed in the Programmatic Consultation for Road Maintenance (USDI, 2003). Livestock grazing is being managed in consultation with several regulatory agencies to reduce the effects of livestock on water quality and aquatic habitat.

Ongoing reclamation activities at the Beartrack Mine in the Napias Creek subwatershed include heap rinsing and re-vegetation of waste dumps and other disturbed areas. As part of the ongoing site reclamation, a discharge of excess mine water to Napias Creek has been authorized by the US Environmental Protection Agency (USEPA, 2003). Discharges of ammonia, cyanide and metals have been authorized under a National Pollutant Discharge Elimination Permit (NPDES). The effects of this discharge include an increase in metals loading to Napias Creek and downstream to Panther Creek.

Historic impacts from mining operations at the Blackbird Mine are currently being remediated by the Blackbird Mine Site Group (BMSG) under superfund (CERCLA) authority. These actions are predicted by BMSG and the EPA to result in significant long-term improvements in water quality (decrease in metals loading) in the South Fork of Big Deer, Big Deer and Panther Creek (USEPA, 2003).

The data presented in **Table 3-6** for Panther Creek below Big Deer Creek (WQ-25) would include the cumulative effects of the past and ongoing mining activities in the Panther Creek watershed including the Beartrack and Blackbird Mines. As shown in **Table 3-6** water quality has improved significantly in Panther Creek over the last decade. In 2004-2005 Panther Creek downstream of Big Deer Creek met water quality criteria for copper most of the year with the exception of the spring high flow period. Additional cleanup activities at the Blackbird Mine including the capture and treatment of contaminated groundwater in the Bucktail Creek drainage are expected to further reduce metals loading downstream in Big Deer and Panther Creek. After these additional cleanup efforts Panther Creek is expected to meet water quality criteria year long.

Future activities with the potential to impact water quality in the Panther Creek watershed include the proposed Idaho Cobalt Project and a fuels reduction project. The Moyer-Salt Fire Regime Condition Class Improvement Project proposes to treat hazardous fuels on approximately 5500 acres in the Upper and Middle Panther Creek watersheds. The proposed treatments are commercial thinning and pre-commercial thinning followed by jackpot or broadcast burning to treat residual or project-generated ground fuels. The objective of this project is to reduce the effects of wildfire in this area and the potential

for a large fire spread. The potential effects of this project include increases in stream sedimentation and water yield. Mitigation measures would be included in the project design to reduce the risk of stream sedimentation. The potential effects of increased water yield would be evaluated based on the inherent stability of the streams in the project area and downstream.

Alternative I Cumulative Effects

Under the no action alternative ongoing cleanup at the Blackbird Mine site and proposed activities on the SCNF are the principal effects on water resources in the vicinity of the proposed ICP.

Groundwater Quantity and Quality - Groundwater quality in the Bucktail Creek drainage would be affected by historic Blackbird impacts and flows from the Ram and Sunshine mines. Groundwater quality would continue to be of poor quality in a substantial part of the drainage with metal concentrations that exceed federal drinking water standards and Blackbird groundwater cleanup levels.

Surface Water Flows and Quality - BMSG cleanup actions will result in long-term decreases in streamflow in Bucktail Creek and South Fork of Big Deer Creek due to the continued pumping and transport of groundwater and surface water from Bucktail Creek to the BMSG water treatment plant in the Blackbird Creek drainage. The BT-5 diversion would be employed in approximately 2009 and would divert streamflows in Bucktail Creek around lower Bucktail Creek and South Fork Big Deer Creek to Big Deer Creek. The Bucktail Creek surface water diversion would cause continuous (year-round) reductions in flows in South Fork Big Deer Creek of about 11 percent and in lower Bucktail Creek of nearly 100 percent. Proposed activities on the SCNF including planned timber sales and a proposed mineral exploration project would have little effect on water quality or quantity outside of the immediate footprint of those activities.

This alternative combined with past, present and future actions is expected to improve water quality in the Panther Creek watershed. Surface water quality in South Fork Big Deer Creek, Big Deer Creek, and Panther Creek would improve and is expected to eventually meet water quality standards.

Sediment – Sediment production, both natural and man caused would continue to supply fine sediment to area streams at close to present rates. Increased sediment yields associated with the 2000 Clear Creek fire have subsided to near background levels; future fires will result in locally increased sediment production for a period of years following fire activity.

Proposed fuel reduction projects and commercial firewood sales will be designed to reduce the probability of sediment delivery to streams by the incorporation of filter strips as specified in the Forest Plan and sediment models. The use of filter strips has been evaluated and determined to be an effective best management practice to prevent sediment delivery from soil disturbances.

The effects of livestock grazing on stream bank stability and bank erosion will be reduced in the Upper Panther Creek Watershed by the proposed fencing projects that will exclude livestock grazing in some riparian areas within the Forney Allotment. Livestock grazing will continue to be managed to reduce adverse effects on streambank erosion and water quality.

Alternative II Cumulative Effects

Groundwater Quantity and Quality - Cumulative effects to groundwater quantity and quality in the Bucktail Creek drainage would arise from historic Blackbird mine effects, effects of ongoing and proposed Blackbird Mine cleanup actions, and the ICP Project. Cumulative groundwater quantity effects would include dewatering of shallow bedrock and alluvial groundwater systems along Bucktail Creek by BMSG and dewatering of the bedrock groundwater system near the Ram and Sunshine mines by FCC during operations and closure.

Groundwater quality in the Bucktail Creek drainage would be affected by historic Blackbird Mine impacts and flows from the Ram and Sunshine mines. Groundwater quality would continue to be of poor quality

in a substantial part of the drainage with metal concentrations that exceed federal drinking water standards and Blackbird groundwater cleanup levels.

Surface Water Flows - During Ram operations but before BT-5 is employed, Alternative II would reduce surface water flows during baseflow conditions in Bucktail Creek (44 percent), South Fork of Big Deer Creek (11 percent), Big Deer Creek (1 percent), and Big Flat Creek (3 percent). During Ram operations after BT-5 is employed, Alternative II would reduce surface water flows during baseflow conditions in Bucktail Creek (100 percent), South Fork of Big Deer Creek (25 percent), Big Deer Creek (3 percent), and Big Flat Creek (3 percent). During closure, surface water flows would return to no-action conditions as soon as groundwater capture and treatment is ceased.

Surface Water Quality - Alternative II combined with past, present and future actions is expected to improve water quality in the Panther Creek watershed, primarily due to the effects of the Blackbird cleanup. Under this alternative, surface water quality in South Fork Big Deer Creek, Big Deer Creek, and Panther Creek would likely improve and meet water quality standards.

Under expected (most probable) conditions, Alternative II is not expected to impede the attainment of water quality standards in streams. However, there is a low probability that this alternative could prevent the attainment of water quality standards in Big Deer Creek. Thus, Alternative II water quality impacts have the potential to become significant.

Sediment - Alternative II would have a short-term increase in sediment yield in the project area during the construction period. The BOISED model predicts that long-term sediment yield will return to natural levels in Big Flat Creek and sediment yields will be reduced by 12 percent below baseline levels in Bucktail Creek.

Road density in Bucktail Creek will decrease in both the short and long-term due to road reclamation during the construction and post-mining period. Road density in Big Flat Creek will increase slightly in the short-term but will be reduced in the long-term due to proposed road reclamation post mining. Alternative II have a net reduction of 4.3 miles of road in the project area.

Outside of the project area sediment production, both natural and man caused, would continue to supply fine sediment to area streams at close to present rates. Increased sediment yields associated with the 2000 Clear Creek Fire have decrease to pre-fire levels. Future fires will result in increased sediment yields to adjacent streams for a period of years following the fire activity.

The proposed mine and other projects in the Panther Creek watershed are not expected to increase sediment levels in the long-term over existing levels due to the design and incorporation of best management practices, such as filter strips. The proposed livestock fencing projects will reduce streambank erosion and improve bank stability within the livestock exclosures.

Alternative III Cumulative Effects

Groundwater Quantity and Quality - Cumulative effects to groundwater in Alternative III would be similar to Alternative II except in the Big Flat drainage. Groundwater quality would continue to be of poor quality in a substantial part of the Bucktail drainage as a result of historic mining with metal concentrations that exceed federal drinking water standards and Blackbird groundwater cleanup levels. In the Big Flat drainage water treatment and disposal in the LAT would result in an increase in sulfate, likely resulting in local exceedance of Idaho's groundwater quality standard of 250 mg/L.

Surface Water Flows - In Alternative III, there would be long-term cumulative effects (reductions) to surface water flows in South Fork Big Deer Creek and Big Deer Creek. Additionally, there would be short-term flow increases in Big Flat Creek as a result of increased recharge from the LAT area.

Surface Water Quality - Alternative III combined with past, present and future actions is expected to improve water quality in the Panther Creek watershed, primarily due to the effects of the Blackbird

cleanup. Under this alternative, surface water quality in South Fork Big Deer Creek, Big Deer Creek, and Panther Creek would likely improve and meet water quality standards.

Sediment - Alternative III would have a short-term increase in sediment yield in the project area during the construction period. Sediment yield in Big Flat Creek will have a small increase due to soil disturbance associated with construction of the LAT area. The BOISED model predicts that long-term sediment yield will return to natural levels in Big Flat Creek and sediment yields will be reduced by 15 percent below baseline levels in Bucktail Creek.

Road density in Bucktail Creek will be reduced in both the short-term and long-term due to road reclamation. Road density in Big Flat Creek will increase in the short-term due to construction of roads to access the LAT but will be reduced in the long-term due to road reclamation post mining. Alternative III will have a net reduction of 6.6 miles of road in the project area.

Outside of the project area sediment production, both natural and man caused, would continue to supply fine sediment to area streams at close to present rates. Increased sediment yields associated with the 2000 Clear Creek Fire have decrease to pre-fire levels. Future fires will result in increased sediment yields to adjacent streams for a period of years following the fire activity.

The proposed mine and other projects in the Panther Creek watershed are not expected to increase sediment levels in the long-term over existing levels due to the design and incorporation of best management practices, such as filter strips. The proposed livestock fencing projects will reduce streambank erosion and improve bank stability within the livestock exclosures.

Alternative IV Cumulative Effects

Groundwater Quantity and Quality - Cumulative effects to groundwater in Alternative IV would be similar to Alternatives II and III, with the exception that cumulative effects from groundwater capture would occur in lower Bucktail Creek drainage in Alternative IV. Groundwater quality would continue to be of poor quality in a substantial part of the drainage with metal concentrations that exceed federal drinking water standards and Blackbird groundwater cleanup levels.

Surface Water Flows - Cumulative effects to flows from Alternative IV are nearly identical to Alternative II with very minor exceptions in Big Flat and Big Deer Creeks. Because the TWSF in Alternative IV is smaller and captures less rain and snowmelt from the Big Flat Creek drainage, the model predicts flow reductions in Big Flat Creek to be slightly lower in Alternative IV than Alternative II. However, this difference would disappear if the Alternative IV TWSF were expanded to the full size as provided by Alternative IV.

Surface Water Quality - Alternative IV combined with past, present and future actions is expected to improve water quality in the Panther Creek watershed, primarily due to the effects of the Blackbird cleanup. Under this alternative, surface water quality in South Fork Big Deer Creek, Big Deer Creek, and Panther Creek would likely improve and meet water quality standards.

Sediment - Alternative IV would have a short-term increase in sediment yield in the project area during the construction period. The BOISED model predicts that long-term sediment yield will return to natural levels in Big Flat Creek and sediment yields will be reduced by 15 percent below baseline levels in Bucktail Creek.

Road density in Bucktail Creek will be reduced in both the short-term and long-term due to road reclamation. Road density in Big Flat Creek will increase slightly in the short-term but will be reduced in the long-term due to road reclamation post mining. Alternative IV will have a net reduction of 5.8 miles of road in the project area.

Outside of the project area sediment production, both natural and man caused, would continue to supply fine sediment to area streams at close to present rates. Increased sediment yields associated

with the 2000 Clear Creek Fire have decrease to pre-fire levels. Future fires will result in increased sediment yields to adjacent streams for a period of years following the fire activity.

The proposed mine and other projects in the Panther Creek watershed are not expected to increase sediment levels in the long-term over existing levels due to the design and incorporation of best management practices, such as filter strips. The proposed livestock fencing projects will reduce streambank erosion and improve bank stability within the areas where livestock is excluded.

Alternative V Cumulative Effects

Groundwater Quantity and Quality - Cumulative effects to groundwater in Alternative V would be similar to Alternative IV.

Surface Water Flows - In Alternative V, there would be long-term cumulative effects (reductions) to surface water flows in South Fork Big Deer Creek and Big Deer Creek that would be similar to Alternatives II and III. Additionally, surface water flows in Blackbird Creek would be increased.

Surface Water Quality - This alternative combined with past, present and future actions is expected to improve water quality in the Panther Creek watershed. Alternative V would cause similar effects to Ram Spring, South Fork Big Deer Creek, Big Deer Creek and Panther Creek as Alternative IV. Alternative V would also have un-quantified effects to Blackbird Creek from discharge of Project water. Effects to Blackbird Creek would depend on the effluent limits that would be approved or required by the Agencies (primarily EPA and IDEQ) and the performance of the water treatment system that would be employed. However, the effects of this discharge would likely be beneficial as the stream currently experiences high metal concentrations and it is likely that an NPDES permit would require discharge of cleaner water that would dilute the instream metal concentrations.

Sediment - Alternative V would have a short-term increase in sediment yield in the project area during the construction period. The BOISED model predicts that long-term sediment yield will return to natural levels in Big Flat Creek and sediment yields will be reduced by 15 percent below baseline levels in Bucktail Creek.

Road density in Bucktail Creek will be reduced in both the short-term and long-term due to road reclamation. Road density in Big Flat Creek will increase slightly in the short-term but will be reduced in the long-term due to road reclamation post mining. Alternative V will have a net reduction of 6.4 miles of road in the project area.

Outside of the project area sediment production, both natural and man caused, would continue to supply fine sediment to area streams at close to present rates. Increased sediment yields associated with the 2000 Clear Creek Fire have decrease to pre-fire levels. Future fires will result in increased sediment yields to adjacent streams for a period of years following the fire activity.

The proposed mine and other projects in the Panther Creek watershed are not expected to increase sediment levels in the long-term over existing levels due to the design and incorporation of best management practices, such as filter strips. The proposed livestock fencing projects will reduce streambank erosion and improve bank stability within the areas where livestock is excluded.

Watershed Risk Assessment

The level of activities and disturbances in a watershed determine the potential for adverse effects to hydrologic processes, water quality and aquatic habitat. Although watersheds are variable in their response to disturbance based on factors such as steepness of slope and soil erosion rates, two variables that have the greatest potential to indicate risk to watershed ecological integrity and hydrological function are road density and degree of vegetation removal from logging, fires or other disturbances. As a general rule, the probability that a watershed would experience negative effects from management activities is most effectively indicated by the variables of road density and the

percent of the watershed that is covered by "hydrologically immature" vegetation (USDA, 1993). "Hydrologic immaturity" describes forested stands that have root structures and canopy density that do not intercept and take up water in amounts equivalent to mature forest stands 30 years old or older.

Effects of roads on hydrologic functions and water quality are well documented. Roads influence groundwater interception, runoff distribution over time and space, stream shading and water temperatures, and the potential for sediment delivery to streams (USDA, 1993). **Table 4-18** shows the relationship of watershed risk with road density and watershed relief (i.e., steepness of slope greater or less than 30 percent).

TABLE 4-18. Road Densities (miles per Square mile) and Watershed Risk

Watershed Risk Category	Watershed Relief (Percent Slope)	
	>30 percent	<30 percent
Low Risk	<2	<3
Moderate Risk	2.1-3.5	3.1-4.5
Highest Risk	>3.6	>4.6

Hydrological immature vegetation is represented by Equivalent Clearcut Acres (ECA) which includes stands less than 30 years old such as, clearcuts, areas that have been partially logged, areas with vegetation removed for mining or other purposes and areas that have burned with severity that caused greater than 30 percent mortality. Studies have been done to establish the relationship between acres of partial timber harvest or mixed mortality fire and clearcut acres. This information has been used to convert these changes in vegetation to ECAs. **Table 4-19** shows the relationship between watershed risk and ECAs.

TABLE 4-19. Equivalent Clearcut Acres and Watershed Risk

Risk Category	Percent of Watershed with Stands less than 30 years old
Low Risk	<15 percent
Moderate Risk	15-30 percent
High Risk	> 30 percent

The existing watershed risk ratings (Alternative I) for watersheds within the Panther Creek drainage are shown in **Table 4-20**. The drainages that have the potential to be directly impacted by the ICP are Blackbird Creek, Little Deer Creek, Big Flat Creek and Big Deer Creek. These drainages are all within the Middle Panther Watershed. The Middle Panther Watershed has a high risk of cumulative watershed effects because of the high level of past disturbance in the watershed. The biggest disturbance in this watershed has been the Clear Creek Fire. This fire, along with several other smaller fires in the watershed, account for the majority of the watershed affects that can be attributed to changes in vegetation. Fire accounts for 31 percent of the 35.5 percent of the acres of hydrological immature vegetation in the watershed.

The action alternatives (Alternatives II, III, IV and V) would not increase ECAs in the Middle Panther Creek watershed because all of the proposed disturbance would occur in areas that burned in the Clear Creek Fire. The effect of the ICP on vegetation would be delaying the post-fire vegetative recovery approximately 22 years from the date of the fire until the proposed reclamation of the mine disturbances.

All of the Action Alternatives would have a small reduction in road density in the Middle Panther Watershed in both the short and long-term (range of 0.002 to 0.04 mi/square mi.), except for Alternative III that would have a very small increase in the short-term (0.004 mi/square mi).

Based on the indices of hydrological immature vegetation and road density the proposed ICP would not increase the risk of cumulative watershed effects and would have a small long-term reduction in road density.

Table 4-20. Risk of Cumulative Watershed Effects Under Existing Conditions

Watershed	Acres	Road Density (Mi/sq. Mi)	Equivalent Clearcut Acres				Risk of Cumulative Effects
			Logging	Mining	Fire	Total	
Upper Panther Creek	82,809	1.27	3,403 4.1 %	24 <0.1%	6,333 7.7 %	9,760 11.8 %	Low
Middle Panther Creek	117,709	1.47	5,066 4.3%	241 0.2%	36,481 31.0%	41,788 35.5%	High
Napias Creek	56,390	1.69	4,211 7.5%	145 0.3%	9,103 16.1%	13,459 23.9%	Moderate to High
Lower Panther Creek	83,742	0.45	1,507 1.8%	0	40,974 48.9%	42,481 50.7%	High
Entire Panther Creek	340,608	1.21	14,187 4.2%	410 0.1%	92,891 27.2%	107,488 31.6%	High

Source: Biological Assessment for Proposed and Ongoing Activities within the Panther Creek Drainage. Salmon-Challis National Forest. March 15, 2005 (Rose, 2005).

Soil Resources

Cumulative impacts to soils for all action alternatives would be associated with soil loss and reduced biological activity and organic matter in salvaged soils stored for a period of years prior to reclamation use. Erosion on roads and land affected by the ICP would be controlled with BMPs. Elsewhere on Forest Service lands similar BMPs would be used for new activities. Historic mining activities and cleanup actions by BMSG in the Bucktail and Blackbird drainage have resulted in loss of soils and long-term soil productivity. Some areas of historic mine wastes associated with the Blackbird Mine site will continue to exhibit metals toxicity, limited revegetation and higher than natural erosion rates. Impacts of the 2000 Clear Creek fire that caused an initial increase in erosion potential have diminished. However, erosion would continue to be associated with future fire, road construction, and noxious weed infestation within the ICP mining area. In the short-term during mine operations there would be a temporary loss of soil functions in disturbed areas. Following soil replacement and reclamation, there would be no significant net loss of soil productivity. Proposed road reclamation would result in a net decrease in road density and an associated long-term increase in vegetated area and soil productivity over existing conditions. Overall, the ICP would meet SCNF soil guidelines and there would be no significant loss of long-term soil productivity as a result of any of the action alternatives.

Air Resources

Cumulative effects on air resources in the study area (Blackbird and Big Deer drainages) would include elevated levels of TSP and PM_{10} particulates for all action alternatives as mining and construction activities begin and continue. Gaseous pollutants from the operation of gasoline and diesel-powered vehicles and equipment would also demonstrate a moderate increase. The cumulative effects on air resources would depend, to a degree, on other activities in the immediate area concurrent with ICP development and operation. Other known actions in the evaluation area include mobile emissions from BMDG cleanup construction activities, a proposed mining exploration project and 500 acres of proposed logging wood fuel sales; other such activities or natural fire may occur during the life of the ICP. Because air quality control measures are required as part of operating permits and the naturally low concentrations of fine particles and gaseous pollutants, the cumulative effects of ICP and other potentially foreseeable activities on the air quality in the Panther Creek sub-basin area are not expected to be significant.

Noise

Cumulative impacts from construction and operation of the ICP under the Action Alternatives include the added noise sources from the mine. In addition to natural sources, airplane noise, noise from recreational activities, ongoing cleanup activities at the Blackbird Mine site are the primary noise sources in the Project Area. Depending on receptor location ICP noise would increase the noise levels and duration of noise above background throughout the construction, operation and reclamation period. Since the mine and mill would operate on a 24 hour schedule the addition of noise sources at night would be most noticeable because of the contrast with natural lower night noise levels.

Increased traffic would result in increased frequency of traffic noise for residents and recreationists along the access route. The 24-hour operation schedule would result in traffic noise at night and other times when there is currently little traffic.

Under Alternatives II through V, ambient noise levels would be met within one to two miles from most noise sources (**Table 4-11**). Under Alternatives II through V, blasting near the ground surface during the first few weeks of mine construction could be audible at many locations within a radius of several miles or more (**Table 4-11**). However, the blasting noise would be essentially instantaneous, and as the project proceeds further underground, blasting noise would be reduced to the point that it is inaudible to humans.

Vegetation and Wetland Resources

Cumulative effects to vegetation under all alternatives would result from past and future fires; livestock grazing; noxious weed infestations; and forest management activities including logging, prescribed fires, thinning, Currently, the ICP area proposed for development and adjacent land are in early stages of ecological succession following the Clear Creek fires. Relatively high levels of sediment are being generated, especially on steep slopes, where vegetation has been removed by fires. Overstory tree canopies have been removed and understory plant communities consist mainly of tree seedlings and grasses. Many of the dominant grasses are non-native species seeded following fires. Reclamation of disturbed sites would likely increase the density of non-native grasses if they are seeded as part of post-mining reclamation.

Noxious weeds are present along roads and other disturbed sites. Future road construction, forest management activities, livestock grazing and development of the ICP would cumulatively increase the potential for establishment and proliferation of noxious weeds and other invasive species.

These cumulative land disturbance activities have altered the composition, density, and spatial distribution of native plant communities. The action alternatives would incrementally reduce amounts of vegetation on mine facility sites and increase the potential for noxious weed infestations.

A few tenths of an acre of jurisdictional wetlands would be directly impacted by Alternatives II and IV where the water discharge pipeline crosses riparian zones in the Bucktail and Big Deer Creek drainages. A few tenths of an acre of non-jurisdictional wetlands would be directly impacted by Alternative II and potentially by Alternative IV at the TWSF site on the Big Flat. Ongoing cleanup activities by the BMSG in the Bucktail drainage will result in a significant decrease in flows in this drainage after installation of the BT5 pipeline. This will likely cause a decrease in riparian wetlands along the Bucktail channel. Under Alternatives III, IV and V a road pullback along approximately 1.4 miles of Blackbird Creek will increase the area of floodplain and could potentially add to streamside wetlands as water quality improvements allow.

Wildlife Resources

Historic mining and ongoing cleanup activities at the Blackbird Mine site have resulted in a large area of direct habitat loss in the Blackbird Mine area. Blackbird activities have also had, and will continue to have indirect impacts to wildlife including temporary displacement during construction activities.

Restriction of public access to the Blackbird site and the Project Area by the BMSG has created refuge for some species, particularly big game during hunting season. If other mining or logging projects occur concurrently with ICP operations there would be a cumulative traffic impact on roads from Salmon to the Blackbird mine site that may result in increased displacement of wildlife from roads.

Fisheries

Ongoing and future actions, including the effects of the 2000 fire in the Panther Creek drainage analysis area, may contribute to the cumulative effects of the action alternatives analyzed in this EIS. These other actions in the analysis area include: the ongoing adverse effects of metal contributions from the Blackbird Mine on water quality; future salvage or logging and associated road construction in the watershed, and grazing. The extent of these actions impacting sediment, metal concentrations, and flows would be based on other sediment control practices in the watershed. The extent to which fishery resources would be impacted depends on the timing, magnitude, and proximity of the potential impact on fisheries habitat. Cumulative impacts are judged to be low, except during storm events in drainages where the 2000 fire increased the potential for slope failures. Blackbird Mine clean up activities are projected to reduce flow in Bucktail and South Fork Big Deer creeks, which is necessary to reduce chemical contamination to Big Deer, Panther, and South Fork Big Deer creeks to improve water quality. Improved water quality in these streams would be beneficial to all fish including ESA-listed and Forest Service sensitive species. The ICP alternatives are not likely, with the possible exception of Alternative II, to add cumulative impacts (chemical contamination, sediment production, water quantity) and may even improve current conditions (sediment production) in the Panther Creek drainage.

Road and Access Management

Alternatives II through V all use the same Major Transportation routes and would increase ADT by 1 percent to 2 percent. Major transportation route traffic under Alternative I may in time, increase by a similar amount due to population growth in the Salmon area. ADT on the project access route would increase by 16 percent to 46 percent under Alternatives III-V. There are no current logging sales proposed that would otherwise increase traffic on the project access route under Alternative I. Project access route traffic due to ongoing cleanup activity by the BMSG would remain at current levels for some time in the future under all Alternatives. The only project access route improvements that may be made under Alternative I is realignment of the Williams Creek road near mile post 7. This realignment has been designed by the Forest Service but has no definite schedule. Under Alternative II, 10.9 miles of road would be resurfaced to reduce sedimentation. Under Alternatives III-V the entire Project Access Route would be resurfaced and additional mitigation would be employed to raise grade in sections in the flood plain, improve turnouts, construct new turnouts, realign Williams Creek Road near mile post 7, and apply dust abatement on an annual basis. Between 2.4 (Alternative V) and 5.6 (Alternative III) miles of new Project site roads would be required. Higher road densities resulting from new site road construction would be offset with decommissioning 7.6 miles of current site roads. Under Alternative I no new roads would be constructed on the site except for roads necessary for continued mineral exploration and no roads would be decommissioned.

Mitigation that raises the grade on the Panther Creek Road (#60055) would take place adjacent to Panther Creek (**Figure 4-1**), which is eligible for Wild and Scenic classification. The proposed road improvements would take place in the existing road prism and would not degrade the free-flowing condition or identified outstanding resource values. Panther Creek would maintain its eligibility for Wild and Scenic River classification.

FCC's proposed Transportation Procedures and Plans (TTE, 2006) identifies ways to mitigate risks related to the accidental release fuel and reagents. The Plan provides for emergency response caches along the Access route and for a pilot car with an emergency response kit accompanying traffic carrying fuels and reagents.

Land Use

The ICP would not require any changes to the Salmon National Forest Land Use and Management Plan. Disturbance would primarily be in MA 5B. All alternatives would impact the West Panther Creek Roadless, with Alternatives III having the largest impact. Alternatives II, IV and V would have similar impacts to the West Panther Roadless area.

All alternatives have some Disturbance in the West Panther Creek Roadless Area under Alternatives II and III would be primarily land application areas. Tertiary roads would also be constructed to provide access to and control sedimentation from the land application areas. These roads would be considered temporary roads under CFR 36 §294.11 (3) since the roads would not be considered part of the Forest travel plan and would be reclaimed when mining activity ceases. The Forest Service has authority under CFR 36 §294.12 to allow incursion into a roadless area.

Roadless area characteristics that would be affected include impacts to undisturbed soil and water and changes to natural appearing landscape. Roadless area characteristics that are not impacted include sources of public drinking water, diversity of plant and animal communities, habitat for threatened or endangered species, use for dispersed recreation or traditional cultural properties or sacred sites. Roadless area characteristics would not be permanently affected and would not preclude the area's future consideration for wilderness designation.

Recreation Resources

Cumulative effects to recreation resources and opportunities from the construction and operation of the proposed ICP under Alternatives II, III, IV, and V include the following:

- The addition of indirect short-term noise sources from the mine that will likely be audible from nearby trails and developed campgrounds depending on line of sight, topography, and atmospheric conditions. This noise-related cumulative impact is primarily related to the initial development of the Ram and Sunshine portals (blasting nose) prior to blasting progressing further underground.
- Increased mine-related traffic noise and road use that will affect recreationalists using the ICP transportation route for access to area recreational opportunities and use of adjacent developed campgrounds.

Under Alternative I, the proposed ICP mine would not be approved, and no cumulative effects to recreation resources would occur.

Visual Resources

Cumulative effects to visual resources from the construction and operations of the proposed ICP under Alternatives II, III, IV, and V would not significantly differ, and would include the following:

- The addition of short-term indirect impacts to visual resources in the general area as a result of the addition of topographic modification, surface disturbance, and facilities (buildings) in an area immediately adjacent to existing mining-related disturbance (Blackbird Mine).

Under Alternative I, the proposed ICP would not occur, and no cumulative effects to visual resources would result.

Wilderness Resources

There would be no significant cumulative impacts to the wilderness resources of the FCRNRW as a result of the construction, operation, and reclamation of the ICP under Alternatives II, III, IV, and V.

Potential impacts to wilderness as a result of the ICP include increased noise and visible light; ongoing BMSG cleanup activities could also create traffic noise audible in the wilderness.

Socioeconomic Resources

Cumulative socioeconomic impacts would result from mining exploration activities and mine expansion, construction projects taking place in the area such as the building of school facilities, or any developments in the area, which would have the potential to increase population.

Depending on the timing of construction activities, it may be possible for members of the existing construction work force to satisfy construction labor demands without large influxes of new workers. However, if all construction activities were to occur concurrently, substantial numbers of new employees would be needed to satisfy construction labor demands.

Increased numbers of construction workers and their families moving into the area would stress temporary housing. Some workers would camp or live in motor homes on federal lands or in recreation areas. Permanent residents of the study area would be displaced from some recreation areas and feel their quality-of-life was degraded by uncontrolled growth. Increased traffic, crime, and demands for retail and community services commonly occur with substantial increases in temporary work force.

Heritage Resources

The ICP is not expected to have any cumulative effects on heritage resources. There are few National Register eligible properties in or near the project area, and sufficient adjustments would be made during project construction to insure impact avoidance.

Short-term Uses and Long-term Productivity

Geology and Geotechnical Resources

The TWSF facility would be permanent and would result in a long-term change to the landscape. New roads not scheduled for reclamation would result in long-term changes to the landscape. Other disturbances would be reclaimed and result in little if any long-term change.

Water Resources

Mining and milling processes would result in short-term use of water during the operating life of the mine. This use would result in no long-term changes to water resource productivity for any alternative.

During closure, continued use of groundwater might occur in all alternatives if groundwater capture and treatment are needed to mitigate water quality impacts. For Alternatives II and IV, there would be no decrease in water productivity since the water would be returned to Big Deer Creek drainage in quantities and qualities similar to ambient conditions. In Alternatives III and V, the treated water would be discharged in the Big Flat Creek and Blackbird Creek drainages, respectively, and would result in slight (one percent) long-term decreases in Big Deer Creek flows and increases in Big Flat Creek and Blackbird Creek flows. These changes are no expected to result in significant changes in productivity.

Soil Resources

Soil productivity decreases would be short-term for that portion of the Project Area that would be reclaimed over natural materials. However, soil productivity would be slightly decreased for the long-term in the TWSF and new road sites because soil profile characteristics would be significantly changed over pre-mine conditions.

Air Quality

There are no long-term productivity issues with air quality related to the ICP.

Noise

There are no long-term productivity issues with noise related to the ICP.

Vegetation and Wetlands

Short-term changes to vegetation and wetlands would occur under all action alternatives. Short-term indirect impacts to wetlands would include decrease in flow where recharge to shallow groundwater is captured by mine facilities in the Bucktail and Big Flat drainages. Under Alternative II use of non-native vegetation for reclamation would result in long-term changes to species composition in the vicinity of the ICP site. Under Alternative II there would be long-term impacts to 0.22 acres of isolated wetlands that would be covered by the TWSF.

Wildlife

Short-term impacts would occur under through the removal of habitat under all action alternatives. Under any alternative long-term impacts will diminish following completion of mining and subsequent reclamation and revegetation. As understory and overstory vegetation becomes established, more wildlife will use the area. It is expected that in the long-term density and diversity of wildlife will be at least equal to what existed prior to the Clear Creek Fire.

Fisheries

Realignment of the transportation route at Williams Creek and raising the grade at several locations along Panther Creek would benefit fisheries by moving the road away from the stream and reducing sediment inputs. No significant short-term or long-term fishery productivity changes are projected from any of the ICP action alternatives.

Transportation

Short-term impacts of increased traffic and modifications to the road system would not result in significant long-term changes. Removal of 4.4 to 7.6 miles of existing site roads would decrease sediment yield, but not significantly affect access to the area. Access road improvements would have long-term beneficial effects on traffic safety and reduce impacts to streams by moving the road alignment at Williams Creek milepost 7 and raising the grade at locations along Panther and Blackbird Creeks that are currently in the floodplain.

Land Use

There would be short-term incursions into the West Panther roadless area under Alternatives II, III, IV and V; however, there would be a reduction of roads in the West Panther roadless area when the Project is reclaimed. Development of the Project would not require any changes in SCNF Management Area prescriptions.

Recreation Resources

Implementation of Alternatives II, III, IV, and V would not result in significant impacts associated with short-term uses and long-term productivity of the recreation resources of the ICP site or adjacent Forest Lands. During the life of the ICP operations, increased mine-related traffic along the proposed

transportation route will likely result in slight to moderate adverse impacts to the recreational experience of the public using the transportation route for recreational access to adjacent campgrounds and recreational trails and areas.

Visual Resources

Implementation of Alternatives II, III, IV and V would not result in significant impacts associated with short-term uses and long-term productivity of the visual resources of the ICP site or adjacent Forest Lands.

Wilderness Resources

Implementation of Alternatives II, III, IV and V would not result in significant impacts associated short-term uses and long-term productivity of the wilderness resources of the Frank Church River of No Return Wilderness area.

Social and Economic Resources

The ICP would bring short-term jobs with higher than average salaries and benefits to the Salmon area. Although small, the influx of workers from outside the area would make the current housing shortage more difficult in the short-term.

Heritage Resources

There are no long-term productivity issues related to heritage resources for the ICP.

Unavoidable Adverse Effects

Geology and Geotechnical Resources

The recoverable portion of the ICP ore body would be permanently removed. Approximately 15 percent of the metals in the ore would not be recovered during mining and milling and would remain underground and in the tailings.

Water Resources

Changes to groundwater quality in and around the flooded mine working are unavoidable for all alternatives. Mining and backfilling will change the geochemistry of the orebody and will result in changes in groundwater quality. Although all alternatives mitigate impacts to surface water from the post-mining groundwater, alternatives II, IV and V allow mine water to flow away from the mine to capture wells. Alternative III minimizes the flow of mine water away from the mine but some incidental flow would still occur.

Changes to groundwater quality due to leakage from the TWSF is unavoidable in all alternatives. Although the TWSF would have a low permeability membrane underliner, some incidental leakage through the liner is unavoidable.

Insignificant changes to stream flows would occur in all alternatives due to water use during mining/milling of the ore and due to transfer of water between drainages. Alternatives II and IV result in the least change to flows.

Changes to Ram Spring flows and/or water quality are unavoidable in all alternatives. Alternative III would minimize or avoid water quality changes through perpetual mine dewatering but this would

likely permanently dewater the Spring. Alternatives II, IV, and V would restore flow to the Spring but Spring water quality would likely be adversely affected.

Insignificant changes to surface water quality are unavoidable in all alternatives. Even after advanced water treatment such as reverse osmosis, it is likely that minor increases in some chemical constituents such as sulfate would occur.

Soil Resources

Soil productivity would be reduced in some locations such as the TWSF area where soil profile characteristics would be changed over pre-mine conditions and in areas that would be unreclaimed such as some sections of new road. Overall, there would be no significant loss of soil productivity within the Project Area.

Air Quality

Even after compliance with applicable state and federal ambient air quality and emission standards, there would be some minimal air quality degradation associated with the project.

Noise

There would be elevated noise levels in the immediate vicinity of the ICP generated by project construction and operations. Additional traffic would generate slight increases in traffic noises along the access routes.

Vegetation and Wetlands

There would be a loss of existing habitat (primarily recovering burned area) and a loss of 0.22 acres of isolated non-jurisdictional wetlands and a loss of an estimated 0.14 acres of jurisdictional wetlands along the water discharge pipeline under FCC's proposed plan (Alternative II). The direct impact to isolated wetlands would only occur under Alternative II and under Alternatives IV or V if the tailings impoundment were allowed to expand in the future.

A similar level of short-term vegetation habitat impact would occur under all of the action alternatives, but would be in direct proportion to disturbed area so Alternative III would create the greatest adverse effect on vegetation.

Wildlife

Wildlife habitat would be affected under all action alternatives. Some habitat would be directly lost through mine construction, rendered less effective because of increased disturbance, and fragmented because of increased human activities and mine facility development. Wildlife mortality from traffic collisions would increase within along the primary access roads to the project area as a result of mine-related traffic. During construction and operations some wildlife species would be displaced from areas immediately adjacent to facilities or roads. There are large areas of nearby suitable habitat, where habitat is improving following the fire that can support these species.

Fisheries

Increased traffic and employment as a result of the ICP could increase recreational fishing pressure within the Panther Creek drainage that could lead to unavoidable loss of some fish through harvest and hooking mortality. Potential insignificant changes to surface water quality are unavoidable in all alternatives. Even after advanced water treatment such as reverse osmosis, it is likely that minor increases in some chemical constituents such as sulfate would occur. Minor changes to stream flows

would occur in all alternatives due to water use during mining/milling of the ore and due to transfer of water between drainages. Alternatives II and IV result in the least change to flows.

Transportation

The ICP would convert certain SCNF lands to roads. Traffic and potential for traffic accidents would increase on the Williams Creek access route during mine life.

Land Use

Mine facilities would alter land use and habitat conditions on NFS lands during construction, operations and until reclamation returned the site to approximate existing conditions.

Recreation and Wilderness Resources

There would be no significant adverse impacts to recreation or wilderness resources under any of the alternatives.

Social and Economic Resources

Mine related employment would increase pressure on an already tight housing market in the Salmon area.

Heritage Resources

There would be no significant impacts to heritage resources under any of the alternatives.

Irreversible and Irretrievable Commitment of Resources

Geology and Geotechnical Resources

The TWSF facility would be a permanent irreversible change to the landscape. The recoverable portion of the ICP ore body would be irreversibly removed. Under all of the action alternatives approval of the ICP would irretrievably devote NFS lands to mining uses for the life of the mine.

Water Resources

The changes in mine water and groundwater quality due to mining, backfilling of the mine and mine flooding would have localized irreversible effects in the immediate vicinity of the Ram and Sunshine underground mines. Changes in groundwater quality associated with the leakage from the TWSF would also be irreversible in the area beneath and immediately downgradient of the TWSF. However, proper application of the mitigation measures associated with Alternative IV would ensure that these changes to groundwater are localized and would not cause significant adverse impacts to surface waters in Big Flat Creek, South Fork Big Deer Creek or downstream in the Panther Creek drainage. No irreversible or irretrievable commitment of those water resources is identified.

Soil Resources

Some amount of soil would be irretrievably lost for disturbed areas during construction and operation of the mine prior to the re-establishment of vegetation. Soil productivity in disturbed areas would be slightly, but irretrievably reduced under all action alternatives. Soil productivity for the TWSF and new roads that would not be reclaimed would be irreversibly reduced. However, overall soil productivity in the Project Area would not be significantly reduced.

Air Quality

No irreversible or irretrievable commitment of air resources would result from the Proposed Action or any of the alternatives.

Noise

No irreversible or irretrievable commitment related to noise would result from the Proposed Action or any of the alternatives.

Vegetation and Wetlands

There would be a short-term irretrievable loss of existing habitat (primarily recovering burned area) until reclamation resulted in successful revegetation and an irreversible loss of 0.22 acres of isolated wetlands under FCC's proposed plan (Alternative II). A similar level of habitat impact would occur under all of the action alternatives, but the direct irreversible loss of 0.22 acres of isolated wetlands would only occur under Alternative II.

Wildlife

There would be a short-term irretrievable loss of existing wildlife habitat (primarily recovering burned area) from the direct disturbance during the operation period. There would be no long-term irreversible or irretrievable commitments of wildlife or wildlife habitat under any of the action alternatives.

Fisheries

Alternative II would have the highest possibility of increasing metal concentrations if mitigation measures were not able to recapture sufficient levels additional metals. Alternative IV and V would prevent irreversible and irretrievable commitments in terms of any increases in metal concentrations because discharge effluents will have to meet the NPDES permit requirements. Alternatives III and V are the most likely to affect base stream flow conditions during the warmest and driest years the ICP will be in operation. All the alternatives would in both the short- and long-term reduce fine sediment levels in Williams, Moccasin, Deep, and Panther creeks with the application of road and travel mitigations.

Transportation

No irretrievable or irreversible commitment of transportation resources would result from Alternatives II, III, IV, or V.

Land Use

Loss of timber production on the TWSF would be irretrievable and irreversible under Alternative II due to limited growth medium thickness in the reclamation cap at closure. Loss of timber production would be retrievable and reversible under Alternatives III, IV, and V which all would have an added foot of growth medium over that proposed in Alternative II.

Recreation Resources

No irretrievable or irreversible commitment of recreation resources would result from Alternatives II, III, IV, or V.

Visual Resources

No irretrievable or irreversible commitment of visual resources would result from Alternatives II, III, IV, or V.

Wilderness Resources

No irretrievable or irreversible commitment of the wilderness resources of the Frank Church River of No Return Wilderness would result from Alternatives II, III, IV, or V.

Social and Economic Resources

No irretrievable or irreversible commitment of social or economic resources would result from Alternatives II, III, IV, or V.

Heritage Resources

No irretrievable or irreversible commitment of heritage resources would result from Alternatives II, III, IV, or V.

Evaluation of Other Effects

NEPA requires analysis of a wide range of potential effects on additional resources of the proposed action that may or may not be relevant to the ICP. These potential effects are discussed briefly in this section and where appropriate are evaluated in greater detail elsewhere in this Chapter. Other resources required to be evaluated for potential effects include: prime farmland, range land and forest land; wetlands and floodplains; possible conflicts between the proposed action and objectives of other Federal, regional, State and local plans, policies or controls; energy requirements of the various alternatives.

Financial Assurance

The Forest Service is required to hold a bond or other financial assurance for the plan of operations to assure completion of reclamation. Forest Service guidance for calculating the amount of financial assurance (USDA Forest Service, 2004) includes costs to structure removal, regrading/recontouring the surface, soil replacement, revegetation, administration and costs for long term water treatment, if such treatment were needed to meet water quality requirements.

It is not known with certainty whether water treatment will be required following completion of mining or how long treatment would need to continue. In trying to predict the potential future need for water treatment, the EIS evaluation has considered the hydrology and geochemistry of the ICP site and the impacts of the mines on these natural systems. Although there is considerable site specific data available for this analysis, there are also a number of factors that result in some uncertainty as to the ultimate need for water treatment following mine closure. Factors contributing to this uncertainty include: the effectiveness of the proposed amendment of backfill to control pH in the underground mine voids; the effectiveness of the groundwater capture system; the timing and magnitude of pH and other geochemical changes in the underground mines and groundwater system relative to the flushing of groundwater through the mined areas following closure; and the natural variability of the chemistry of the orebody and surrounding rock. The evaluation of post mining water quality has determined that without post-mine collection and treatment of groundwater there is a reasonable possibility that some chemical load from the mines could affect surface or groundwater to the extent that water quality standards or CERCLA site cleanup goals could be affected. Collection and treatment of groundwater downgradient of the mines (as described in the agency alternatives) could

effectively reduce the risk of those impacts to the point where it is unlikely that unacceptable impacts to surface or groundwater would occur.

In the event that post closure water treatment is required, there is further uncertainty in how long a period the treatment would be needed. Although water treatment could be needed for only a few years following closure as the first flush of groundwater moves through the underground mine areas, a longer period of treatment could be required if the amendment of backfill material was not entirely effective at controlling the backfill pH. In calculating a value of the required financial assurance, the Forest Service will determine if a component of that financial assurance will include post closure water treatment.

Possible Conflicts With Other Plans, Policies Or Programs

A potential conflict between the proposed action and other objectives of Federal, regional, State, or local land use plans, policies and controls identified in the EIS analysis is with the ongoing CERCLA cleanup actions associated with the Blackbird Mine Site. Potential for the ICP to affect the Blackbird cleanup actions are discussed in detail in this Chapter and in the water resources technical report (Hydrometrics, 2006).

Environmental Justice

An Executive Order (EO 12898) addressing Environmental Justice was signed February 11, 1994. This order requires federal agencies to address environmental justice issues when implementing their respective programs. The Order directs federal agencies to take the lead role in coordinating environmental justice issues with Federally-recognized American Indian Tribes.

No “environmental justice” issues were raised during scoping. Other than members of Native American Tribes within the region, the agencies have not identified any other racial minorities or impoverished populations within the project area that might be affected by approval of any of the action alternatives. The proposed mine is not located within or adjacent to any Native American reservations. Since the project is neither adjacent to or near reservations there would be no risk of direct impacts to the reservation lands. Members of any Tribes living off the reservations and in the project area would be affected to the same extent as other people in the area from an economic standpoint.

There are no environmental justice issues related to the ICP that violate the intent of Executive Order 12898.

CHAPTER 5. CONSULTATION AND COORDINATION

Public Involvement Summary

The Supervisor, Salmon-Challis National Forest (Forest) determined early in 2001 that the Forest's consideration of Formation Capital Corporation, U.S. (FCC) proposed plan of Operations for the Idaho Cobalt Project (Project) submitted in January 2001 required the preparation of an Environmental Impact Statement (EIS) to ensure Forest compliance with the provisions of the National Environmental Policy Act (NEPA) regarding project review and approval decisions, including public involvement. In April 2001, the Forest selected an independent Environmental Consulting Firm (Contractor) to begin preparation of an EIS, with participation by the Forest's Interdisciplinary Team (ID Team), and other participating state and federal agency representatives.

The Federal Council on Environmental Quality (CEQ) defines scoping as " … an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). Among other things, the scoping process is used to invite public participation, to help identify issues, and to obtain public comment at various stages of the EIS process. The Forest's public scoping process for FCC's proposed Idaho Cobalt Project began in mid-2001 regarding the Forest's identification of Issues, Concerns, and Opportunities for the development of the EIS for the Project. The Forest's scoping process for the proposed project is an iterative process that continues until a Project decision (Record of Decision) is made by the Forest following completion of a final EIS.

An initial informational Scoping Packet was distributed to interested parties on July 10, 2001 with a request for written comments, concerns, or suggestions regarding the proposed Idaho Cobalt Project and EIS being developed by the Forest. The information packet included a summary of the proposed mining and milling project. A public notice of meeting time and place for the July 10, 2001 public Scoping meeting was placed in the *Recorder Herald*, the newspaper of Record for Salmon, Idaho.

Subsequent to the July 20, 2001 public Scoping meeting, a Notice of Intent (NOI) to prepare an EIS for the proposed mining project was published by the Forest in the Federal Register on September 10, 2001. This was followed by the distribution of another information Scoping Packet to interested parties on the Forest's Forest-wide mailing list detailing modifications to the Plan of Operations proposed by Formation to incorporate a number of changes as a result of agency review and previous Scoping efforts, as well as a description of a Minimum Impact Alternative. In addition, the meeting times and places for additional public scoping meetings were placed in the papers of Record for Salmon and Challis, Idaho, the *Recorder Herald* and *Challis Messenger*. The Forest Service held additional public Scoping meetings in Challis, Idaho on October 10, 2001 and in Salmon, Idaho, on October 11, 2001. Comment forms were also provided at these meetings. It can be noted that the majority of individuals providing comments at the public Scoping meetings, and local government and business representatives providing oral and written comments, provided comments in support of the proposed mining project on the basis of an opportunity for increased employment, jobs, and benefits to the local economy.

The official public Scoping comment period ended on October 31, 2001. In response to the 2001 public and agency Scoping activities, the Forest received oral and/or written comments from 58 private individuals, federal agencies, groups, Native American Tribes, local governments, businesses, and the Blackbird Mine Trustees. These comments have been compiled and documented in a Public Scoping Content Analysis Report (Driear, 2003). Subsequent public comments received by the Forest have been considered during development of the DEIS. Since the beginning of the public involvement and scoping process, Project information and update letters regarding progress on the Forest's preparation of the DEIS for FCC's proposed Idaho Cobalt Project have been periodically mailed to those included on the Forest's Forest-wide Interested Party mailing list. Outreach was also made to the Nez Perce Tribe and the Shoshone-Bannock Tribe through formal letters to the Tribal Chairmen, meetings, and field reviews.

Interested Party letters have been distributed by the Forest Service to those on the ICP mailing list as follows:

- July 10, 2001;
- October 2, 2001;
- January 3, 2003;
- March 27, 2003;
- March 5, 2004;
- June 23, 2004;
- November 22, 2004;
- March 29, 2005; and
- August 18, 2005.

In addition to Interested Party letters, updated information regarding preparation of the DEIS has been included in each of the Forest's published quarterly Schedule of Project Actions (SOPA) since July 2001.

Consultation with Agencies, Organizations, and Tribal Governments

A key component of the Forest's consultation process with agencies, organizations and Tribal governments for the preparation of the EIS for the Idaho Cobalt Project is the Idaho Joint Review Process (JRP). The Idaho Joint Review Process was developed by the State of Idaho in 1996 to provide for a structured inactive consultation process between the State of Idaho agencies and federal land management agencies designed to address an often complex interaction of laws and regulations concerning mineral development proposals on public lands in Idaho. The intent of the JRP is to increase communication and cooperation between mineral development companies, state and federal agencies, and the public in Idaho to reduce conflict and delays in the state and federal permitting process concerning proposed mineral development projects.

The Forest's EIS contractor team and Forest ID team initiated the JRP process in May 2001, and have continued the JRP process throughout the evaluation of FCC's proposed Plan of Operations and supporting technical reports, and the development of the Project's EIS process. In addition to routine interagency cooperation and joint reviews of the FCC Plan of Operations' baseline information and technical reports, several formal JRP meetings have been held to discuss the review of pertinent Project-related information necessary to complete a science-based impact evaluation for the Project's EIS process. Official JRP meetings have occurred as listed below during the Forest's ongoing development of the EIS for FCC's proposed Idaho Cobalt Project:

- May 3, 2001: Initial JRP meeting, Salmon, Idaho;
- September 10 - 11, 2003: JRP meeting and on-site field review, Salmon, Idaho;
- June 8 - 9, 2004: JRP meeting and on-site field review, Salmon, Idaho;
- March 8, 2005: JRP meeting, IDEQ offices, Boise, Idaho; and
- October 26, 2006: JRP meeting, IDEQ offices, Boise, Idaho.

Representatives of FCC have participated in most of the JRP meetings and on-site reviews, and have provided project overviews, specific project design and operational information, and have responded to questions of the JRP meeting participants.

Participation in the Forest's JRP meetings and on-site field reviews has involved representatives from the following state and federal agencies, including tribal representatives:

- Idaho Department of Environmental Quality (IDEQ);
- Idaho Department of Fish and Game (IDFG);
- U.S. Environmental Protection Agency (EPA);
- National Oceanographic and Atmospheric Agency (NOOA / National Marine Fisheries Service (NMFS);
- Shoshone-Bannock Tribe; and
- Nez Perce Tribe.

In addition, a representative from the U.S. Army Corps of Engineers (COE) has participated in a 2004 on-site review of project area wetlands and Waters of the U.S.

Cooperating Agencies

US Environmental Protection Agency (EPA)
Idaho department of Environmental Quality (IDEQ)

Other Governmental Agencies Consulted

US Army Corps of Engineers (COE)
US Fish and Wildlife Service (USFWS)
US National Oceanic and Atmospheric Administration – Fisheries (NOAA)

Idaho Department of Water Resources
Idaho State Historic Preservation Office
Idaho Department of Fish and Game
Idaho Department of Environmental Quality, Air Quality Division

Lemhi County Board of Commissioners, Custer County, Idaho
City of Salmon, Idaho
Challis Area Chamber of Commerce, Custer County, Idaho

Tribal Governments Consulted

Nez Perce Tribe
Shoshone-Bannock Tribes

Organizations Consulted

Boulder-White Clouds Council, Bellevue, Idaho
Idaho Rivers United, Boise, Idaho
Idaho Conservation League, Boise, Idaho
Idaho Mining Association, Boise, Idaho
Blackbird Mine Site Group, Salmon, Idaho
Blackbird Mine Trustees
Friends of the Bitterroot, Hamilton, Montana
The Ecology Center, Inc., Missoula, Montana
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The following people were involved in preparing, researching, writing and reviewing the draft EIS.

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Distribution of the Environmental Impact Statement

Copies of this draft EIS were distributed to the following agencies, Tribes and organizations:

Federal and State Agencies

US Forest Service
US Corps of Engineers
US Environmental Protection Agency
US Fish, Wildlife Service
National Oceanic Atmospheric Administration – National Marine Fisheries Service
Department of Justice
Idaho Department of Environmental Quality
Idaho Department of Lands
Idaho Department of Fish and Game
Idaho Department of Water Resources
Idaho State Historical Society

Tribes

Shoshone-Bannock Tribes
Nez Perce Tribe

Local Government

Lemhi County Commissioners
Custer County
City of Salmon
City of Stanley

Organizations

Wilderness Watch
Sawtooth Wildlife Council
Land and Water Fund of the Rockies
Boulder-Whiteclouds Council
Idaho Rivers United
Friends of the Clearwater
Custer County Farm Bureau
Idaho Environmental Council
Idaho Sporting Congress
Idaho State Snowmobile Association
Western Watershed Project
Friends of the Bitterroot
Idaho Conservation League
Forest Conservation Council
The Ecology Center, Inc.
Alliance for the Wild Rockies
Western Land Exchange Project
Idaho Trails Council
American Wildlands
Salmon Motorcycle Club
Columbia River Intertribal Fish

CHAPTER 6. ACRONYMS AND GLOSSARY

μg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
^0C	degrees Celsius
^0F	degrees Fahrenheit
ABA	Acid-Base-Analysis or Static Acid Generation Testing
ACHP	Federal Advisory Council on Historic Preservation
ADT	Average Daily Traffic
AGP	Acid Generation Potential
AIRFA	American Indian Religious Freedom Act
ANP	Acid Neutralization Potential
AOC	Administrative Order on Consent
ARD	Acid Rock Drainage
AUM	Animal Unit Months
Ave	average
BA	Biological Assessment
back	ceiling of mine/ore
BE	Biological Evaluations
BMPs	Best Management Practices
BMS	Blackbird Mine Site
BMSG	Blackbird Mine Site Group (Noranda)
BO	Biological Opinion
BRCP	Biological Restoration and Compensation Plan
CDC	Idaho Conservation Data Center
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (also referred to as Superfund)
CERT	Community Emergency Response Team
CFR	Code of Federal Regulations
cfs	cubic feet per second
closure period	after active mining has ceased; during final water quality reclamation management activities
cm/sec	centimeters per second
COCs	Contaminants of Concern
COE	U.S. Army Corps of Engineers
cu yd	cubic yard
CWA	Clean Water Act
dB	decibel
dbh	diameter at breast height
DEIS	Draft Environmental Impact Statement
DOC	Department of Commerce
DSM	Dynamic System Model
ECA	Equivalent Clear Cut Area
EIS	Environmental Impact Statement
EMT	Emergency Medical Technician
EPA	U.S. Environmental Protection Agency
EPM	Equivalent Porous Media
EPT	Ephemotera, Plecoptera, and Trichoptera
ESA	Endangered Species Act
ET	Evapotranspiration
FCC	Formation Capital Corporation, U.S. (also referred to as Formation)
FCRNRW	Frank Church River of No Return Wilderness
FEIS	Final Environmental Impact Statement
Forest Plan	Salmon National Forest Land and Resource Management Plan
FS	Forest Service
FSM	Forest Service Manual
ft	foot
ft/day	foot per day
gangue	waste minerals
gpd	gallons per day
gpm	gallons per minute
HDPE	High Density Polyethylene
HU	Hydrologic Unit
IBC	International Building Code
ICB	Idaho Cobalt Belt
ICBEMP	Interior Columbia Basin Ecosystem Management Project
ICOs	Issues, Concerns and Opportunities
ICP	Idaho Cobalt Project (also referred to as The Project)
ID	Interdisciplinary Team
IDAPA	Idaho Administrative Rules
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
INFISH	Inland Native Fish Strategy

ISO	Insurance Services Office
JRP	Idaho Joint Review Process
kg/day	kilograms per day
LAT	Land Application Treatment
LAU	Lynx Analysis Units
lb/ac	pound per acre
lbs/day	pounds per day
LC	Lethal Concentration
LWD	Large Woody Debris
m	meter
MA	Management Area
Max	maximum
MBI	Macroinvertebrate Biotic Index
MBTA	Migratory Bird Treaty Act
MCY	million cubic yards
MG	Million Gallons
ML	Metal Leaching
M.P.	Mile Point / Mile Post
mg/L	milligrams per liter
mgd	millions of gallons per day
mi	mile
Min	minimum
MIS	Management Indicator Species
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
mph	miles per hour
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSHA	Mine Safety and Health Administration
msl	Mean Sea Level
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNP	Net Neutralization Potential
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRDA	Natural Resource Damage Assessment
NRHP	National Register of Historic Places
NVUM	National Visitor Use Monitoring
operations period	active mining
overbank deposit	soil and contaminants deposited along creek banks during high flows
PACFISH	Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon, Washington, Idaho, and Portions of California
PAG	Potentially Acid Generating
PET	Potential Evapotranspiration
PFC	Properly Functioning Condition
PLS	Pure Live Seeds
PM_{10}	Particulates 10 microns in diameter or smaller
POO	Plan of Operations (also referred to as the operating plan or Plan)
post-closure	after final reclamation and water management activities (except monitoring)
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
PT	Total Suspended Particulates
PVC	Poly-vinyl Chloride
QA/QC	Quality Assurance / Quality Control
QRU	Quick Response Unit
RARE	Roadless Area Review and Evaluation
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation / Feasibility Study
ribs	walls of mine
RO	Reverse Osmosis
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
SCNF	Salmon Challis National Forest
SHPO	State Historic Preservation Office
slash	waste rock
SOPA	Schedule of Project Actions
SOW	Statement of Work
SPCC	Spill Prevention Control and Countermeasure

SPRP	Spill Prevention and Response Plan
stopes	openings created by ore excavation
SWMP	Stormwater Management Plan
SWPPP	Storm Water Pollution Prevention Plan
T&E	Threatened and Endangered
TMDL	Total Maximum Daily Load
tpd	tons per day
tpy	tons per year
TSP	Total Suspended Particulates
TWSF	Tailings and Waste Rock Storage Facility
UAO	Unilateral Order on Consent
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VFD	Volunteer Fire Department
VQOs	Visual Quality Objectives
VSEP	Vibratory Separation
WEPP	Water Erosion Prediction Project
WET	Whole Effluent Toxicity
WQS	Water Quality Standard
WTP	Wastewater Treatment Plant

Fisheries Habitat Indicator Conditions

PF	Properly Functioning
AR	At Risk
NPF	Not Properly Functioning
NS	Not Sampled

Visual Quality Objectives

P	Preservation
R	Retention
PR	Partial Retention
M	Modification
MM	Maximum Modification

CHAPTER 7. REFERENCES

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APPENDIX A

LIST OF SUPPORTING TECHNICAL REPORTS, MEMOS AND OTHER DOCUMENTS

APPENDIX A

List of technical reports, memos and other documents utilized in analysis of the Idaho Cobalt Project and alternatives.

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APPENDIX B

SURFACE WATER AND GROUNDWATER FLOWS AND PREDICTED WATER QUALITY

APPENDIX B

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TABLE B-1. IDAHO COBALT DEIS - PREDICTED GROUNDWATER QUALITY FOR METALS, SULFATE AND NITRATE (BUCKTAIL AND BIG FLAT CREEK DRAINAGES)

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B-1b. Most Probable Case Predictions for Sulfate Concentrations

B-1c. Most Probable Case Predictions for Dissolved Arsenic Concentrations

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B-1g. Most Probable Case Predictions for Dissolved Nitrate Concentrations

B-1h. Predictions for Dissolved Copper Concentrations

TABLE B-2. PERCENT CHANGE IN BASE FLOW IN STREAMS

TABLE B-3. IDAHO COBALT PDEIS - DSM PREDICTED STREAM WATER QUALITY SUMMARY

B-3a. Nitrate Concentrations: Most Probable or Expected Case (50th percentile)

B-3b. Sulfate Concentrations: Most Probable or Expected Case (50th percentile)

B-3c. Zinc Concentrations: Most Probable or Expected Case (50th percentile)

B-3d. Cobalt Concentrations: Most Probable or Expected Case (50th percentile)

B-3e. Nickel Concentrations: Most Probable or Expected Case (50th percentile)

B-3f. Arsenic Concentrations: Most Probable or Expected Case (50th percentile)

B-3g. Copper Concentrations: 90th percentile Case (90% probability that actual value will be lower than value shown).

B-3h. Copper Concentrations: 10th percentile Case (90% probability that actual value will be higher than shown)

B-3i. Copper Concentrations: Most Probable or Expected Case (50th percentile, 50% probability that actual value will be higher than value shown)

Table B-1a. Most Probable Case Predictions for Dissolved Copper Concentrations in Groundwater
Idaho Cobalt DEIS

Nov-06

Alternative / Project Phase*	Bucktail Drainage						Big Flat Creek Drainage			
	Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		Upper Bucktail Alluvium***		LAT Area		TWSF Area	
Alt I - No Action	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.500	No	0.033	Yes	0.003	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.500	No	0.033	Yes	0.003	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.500	No	0.033	Yes	0.003	Yes
Closure (Year 5)-Day 6636	0.036	Yes	0.016	Yes	1.500	No	0.033	Yes	0.003	Yes
Closure (Year 23)-Day 13210	0.036	Yes	0.016	Yes	1.500	No	0.033	Yes	0.003	Yes
Alt II - FCC Proposal										
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.500	No	Not Applicable		0.003	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.500	No	Not Applicable		0.003	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.500	No	Not Applicable		0.003	Yes
Closure (Year 5)-Day 6636	0.089	Yes	1.534	No	2.31	No	Not Applicable		0.0027	Yes
Closure (Year 23)-Day 13210	0.065	Yes	0.077	Yes	1.53	No	Not Applicable		0.0029	Yes
Alt III - Perpetual Dewatering & LAT										
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.500	No	0.033	Yes	0.003	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.500	No	0.033	Yes	0.003	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.500	No	0.033	Yes	0.003	Yes
Closure (Year 5)-Day 6636	0.036	Yes	0.016	Yes	1.500	No	0.033	Yes	0.003	Yes
Closure (Year 23)-Day 13210	0.036	Yes	0.016	Yes	1.500	No	0.033	Yes	0.003	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek										
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.500	No	Not Applicable		0.003	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.500	No	Not Applicable		0.003	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.500	No	Not Applicable		0.003	Yes
Closure (Year 5)-Day 6636	0.043	Yes	0.043**	Yes	1.491	No	Not Applicable		0.0026	Yes
Closure (Year 23)-Day 13210	0.044	Yes	0.044**	Yes	1.492	No	Not Applicable		0.0028	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek										
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.500	No	Not Applicable		0.003	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.500	No	Not Applicable		0.003	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.500	No	Not Applicable		0.003	Yes
Closure (Year 5)-Day 6636	0.043	Yes	0.043**	Yes	1.491	No	Not Applicable		0.0026	Yes
Closure (Year 23)-Day 13210	0.044	Yes	0.044**	Yes	1.492	No	Not Applicable		0.0028	Yes

Relative Impacts from ICP-Derived Dissolved Copper

green = decrease or negligible increase that is nonmeasurable (NM)
yellow = concentration increase; does not contribute to WQ standards exceedance
orange = substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
** Concentrations predicted to be similar to Ram Mine concentrations based on similar pH.
*** Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity.
Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.
Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).
Idaho Groundwater Quality Standard for Copper=1.30 mg/L.

Table B-1b. Most Probable Case Predictions for Sulfate Concentrations in Groundwater
Idaho Cobalt DEIS

Nov-06

	Bucktail Drainage						Big Flat Creek Drainage			
	Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		Upper Bucktail Alluvium***		LAT Area		TWSF Area	
Alternative / Project Phase*	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Mean Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?
Alt I - No Action										
Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	1.5	Yes	1.0	Yes
Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes
Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes
Closure (Year 5)-Day 6636	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes
Closure (Year 23)-Day 13210	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes
Alt II - FCC Proposal										
Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable		1.0	Yes
Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
Closure (Year 5)-Day 6636	315	No	315	No	73.0	Yes	Not Applicable		123	Yes
Closure (Year 23)-Day 13210	51	Yes	51	Yes	53.0	Yes	Not Applicable		92	Yes
Alt III - Perpetual Dewatering & LAT										
Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	283	No	1.0	Yes
Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	237	Yes	1.0	Yes
Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	76	Yes	1.0	Yes
Closure (Year 5)-Day 6636	27	Yes	27	Yes	39.5	Yes	76	Yes	169	Yes
Closure (Year 23)-Day 13210	27	Yes	27	Yes	39.5	Yes	76	Yes	52	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek										
Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable		1.0	Yes
Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
Closure (Year 5)-Day 6636	315	No	315	No	43.1	Yes	Not Applicable		169	Yes
Closure (Year 23)-Day 13210	52	Yes	51	Yes	41.1	Yes	Not Applicable		52	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek										
Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable		1.0	Yes
Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
Sunshine Operations-Day 4809	27	Yes	27	Yes	40.0	Yes	Not Applicable		1.0	Yes
Closure (Year 5)-Day 6636	315	No	315	No	43.1	Yes	Not Applicable		169	Yes
Closure (Year 23)-Day 13210	52	Yes	51	Yes	41.1	Yes	Not Applicable		52	Yes

Relative Impacts from ICP-Derived Sulfate

green = decrease or negligible increase that is nonmeasurable (NM)
yellow = concentration increase; does not contribute to WQ standards exceedance
orange = substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
*** Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity.
Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.
Water quality exceedances based on Idaho secondary constituent standard of 250 mg/L for sulfate

Table B-1c. Most Probable Case Predictions for Dissolved Arsenic Concentrations in Groundwater
Idaho Cobalt DEIS

Nov-06

	Bucktail Drainage						Big Flat Creek Drainage			
Alternative / Project Phase*	**Immediate Ram Mine Vicinity**		**Immediate Sunshine Mine Vicinity**		**Upper Bucktail Alluvium*** **		**LAT Area**		**TWSF Area**	
	Arsenic Concentration mg/L	**Groundwater Quality Standard Met?**	**Arsenic Concentration mg/L**	**Groundwater Quality Standard Met?**	**Arsenic Concentration mg/L**	**Groundwater Quality Standard Met?**	**Arsenic Concentration mg/L**	**Groundwater Quality Standard Met?**	**Arsenic Concentration mg/L**	**Groundwater Quality Standard Met?**
Alt I - No Action										
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	0.001	Yes	0.0009	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes
Closure (Year 5)-Day 6636	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes
Closure (Year 23)-Day 13210	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes
Alt II - FCC Proposal										
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable		0.0009	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
Closure (Year 5)-Day 6636	**	**	**	**	**	**	Not Applicable		0.0011	Yes
Closure (Year 23)-Day 13210	**	**	**	**	**	**	Not Applicable		0.0010	Yes
Alt III - Perpetual Dewatering & LAT										
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	<0.0015	Yes	0.0009	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes
Closure (Year 5)-Day 6636	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes
Closure (Year 23)-Day 13210	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek										
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable		0.0009	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
Closure (Year 5)-Day 6636	**	**	**	**	**	**	Not Applicable		0.0012	Yes
Closure (Year 23)-Day 13210	**	**	**	**	**	**	Not Applicable		0.0010	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek										
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable		0.0009	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
Closure (Year 5)-Day 6636	**	**	**	**	**	**	Not Applicable		0.0012	Yes
Closure (Year 23)-Day 13210	**	**	**	**	**	**	Not Applicable		0.0010	Yes

Relative Impacts from ICP-Derived Dissolved Arsenic

green =	decrease or negligible increase that is nonmeasurable (NM)
yellow =	concentration increase; does not contribute to WQ standards exceedance
orange =	substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

** Arsenic concentrations for groundwater not available from Dynamic Systems Model. DSM results indicate mine water concentrations may exceed 100 parts per billion; however groundwater concentrations are expected to be significantly lower (below drinking water standard of 50 parts per billion) due to chemical attenuation.

*** Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations)

Idaho Groundwater Quality Standard for Arsenic=0.05 mg/L

Table B-1d. Most Probable Case Predictions for Dissolved Cobalt Concentrations in Groundwater
Idaho Cobalt DEIS

Nov-06

	Bucktail Drainage						Big Flat Creek Drainage			
Alternative **Project Phase***	**Immediate Ram Mine Vicinity**		**Immediate Sunshine Mine Vicinity**		**Upper Bucktail Alluvium*** **		**LAT Area**		**TWSF Area**	
Alt I - No Action	**Cobalt Concentration mg/L**	**Groundwater Quality Exceedance?**	**Cobalt Concentration mg/L**	**Groundwater Quality Exceedance?**	**Cobalt Concentration mg/L**	**Groundwater Quality Exceedance?**	**Cobalt Concentration mg/L**	**Groundwater Quality Exceedance?**	**Cobalt Concentration mg/L**	**Groundwater Quality Exceedance?**
Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	0.009	NA	0.0016	NA
Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA
Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA
Closure (Year 5)-Day 6636	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA
Closure (Year 23)-Day 13210	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA
Alt II - FCC Proposal										
Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable		0.0016	NA
Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
Closure (Year 5)-Day 6636	0.072	NA	1.598	NA	0.78	NA	Not Applicable		0.0041	NA
Closure (Year 23)-Day 13210	0.056	NA	0.330	NA	0.71	NA	Not Applicable		0.0026	NA
Alt III - Perpetual Dewatering & LAT										
Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	<0.03	NA	0.0016	NA
Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA
Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA
Closure (Year 5)-Day 6636	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA
Closure (Year 23)-Day 13210	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek										
Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable		0.0016	NA
Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
Closure (Year 5)-Day 6636	0.042	NA	0.042**	NA	0.78	NA	Not Applicable		0.0058	NA
Closure (Year 23)-Day 13210	0.042	NA	0.042**	NA	0.72	NA	Not Applicable		0.0034	NA
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek										
Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable		0.0016	NA
Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
Closure (Year 5)-Day 6636	0.042	NA	0.042**	NA	0.78	NA	Not Applicable		0.0058	NA
Closure (Year 23)-Day 13210	0.042	NA	0.042**	NA	0.72	NA	Not Applicable		0.0034	NA

Relative Impacts from ICP-Derived Dissolved Cobalt

green =	decrease or negligible increase that is nonmeasurable (NM)
yellow =	concentration increase; does not contribute to WQ standards exceedance
orange =	substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
** Concentrations predicted to be similar to Ram Mine concentrations based on similar pH.
*** Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity.
Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.
Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations)
No Idaho Groundwater Quality Standard exists for Cobalt

Table B-1e. Most Probable Case Predictions for Dissolved Nickel Concentrations in Groundwater
Idaho Cobalt DEIS

Nov-06

	Bucktail Drainage				Big Flat Creek Drainage			
Alternative / Project Phase*	**Immediate Ram Mine Vicinity**		**Immediate Sunshine Mine Vicinity**		**LAT Area**		**TWSF Area**	
	Nickel Concentration mg/L	**Groundwater Quality Standard Met?**	**Nickel Concentration mg/L**	**Groundwater Quality Standard Met?**	**Nickel Concentration mg/L**	**Groundwater Quality Standard Met?**	**Nickel Concentration mg/L**	**Groundwater Quality Standard Met?**
Alt I - No Action								
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
Ram Operations-Day 1887	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
Closure (Year 5)-Day 6636	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
Closure (Year 23)-Day 13210	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
Alt II - FCC Proposal								
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Closure (Year 5)-Day 6636	0.0050	NA	0.036	NA	Not Applicable		0.0001	NA
Closure (Year 23)-Day 13210	0.0030	NA	0.010	NA	Not Applicable		0.0000	NA
Alt III - Perpetual Dewatering & LAT								
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	0.0014	NA		NA
Ram Operations-Day 1887	0.0025	NA	0.005	NA	0.0014	NA		NA
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	0.0014	NA		NA
Closure (Year 5)-Day 6636	0.0025	NA	0.005	NA	0.0014	NA		NA
Closure (Year 23)-Day 13210	0.0025	NA	0.005	NA	0.0014	NA		NA
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek								
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Closure (Year 5)-Day 6636	0.0020	NA	0.002**	NA	Not Applicable		0.0001	NA
Closure (Year 23)-Day 13210	0.0020	NA	0.002**	NA	Not Applicable		0.0001	NA
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek								
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
Closure (Year 5)-Day 6636	0.0020	NA	0.002**	NA	Not Applicable		0.0001	NA
Closure (Year 23)-Day 13210	0.0020	NA	0.002**	NA	Not Applicable		0.0001	NA

Relative Impacts from ICP-Derived Dissolved Nickel

green = decrease or negligible increase that is nonmeasurable (NM)
yellow = concentration increase; does not contribute to WQ standards exceedance
orange = substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
** Concentrations predicted to be similar to Ram Mine concentrations based on similar pH.
Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.
Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations)
No Idaho Groundwater Quality Standard exists for Nickel

Table B-1f. Most Probable Case Predictions for Dissolved Zinc Concentrations in Groundwater
Idaho Cobalt DEIS

Nov-06

	Bucktail Drainage				Big Flat Creek Drainage			
Alternative / Project Phase*	**Immediate Ram Mine Vicinity**		**Immediate Sunshine Mine Vicinity**		**LAT Area**		**TWSF Area**	
	Zinc Concentration mg/L	**Groundwater Quality Standard Met?**	**Zinc Concentration mg/L**	**Groundwater Quality Standard Met?**	**Zinc Concentration mg/L**	**Groundwater Quality Standard Met?**	**Zinc Concentration mg/L**	**Groundwater Quality Standard Met?**
Alt I - No Action								
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes
Closure (Year 5)-Day 6636	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes
Closure (Year 23)-Day 13210	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes
Alt II - FCC Proposal								
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Closure (Year 5)-Day 6636	0.043	Yes	0.234	Yes	Not Applicable		0.0003	Yes
Closure (Year 23)-Day 13210	0.042	Yes	0.026	Yes	Not Applicable		0.0001	Yes
Alt III - Perpetual Dewatering & LAT								
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	0.015	Yes		Yes
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	0.015	Yes		Yes
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	0.015	Yes		Yes
Closure (Year 5)-Day 6636	0.024	Yes	0.023	Yes	0.015	Yes		Yes
Closure (Year 23)-Day 13210	0.024	Yes	0.023	Yes	0.015	Yes		Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek								
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Closure (Year 5)-Day 6636	0.040	Yes	0.04**	Yes	Not Applicable		0.00053	Yes
Closure (Year 23)-Day 13210	0.040	Yes	0.04**	Yes	Not Applicable		0.00018	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek								
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes
Closure (Year 5)-Day 6636	0.040	Yes	0.04**	Yes	Not Applicable		0.00053	Yes
Closure (Year 23)-Day 13210	0.040	Yes	0.04**	Yes	Not Applicable		0.00018	Yes

Relative Impacts from ICP-Derived Dissolved Zinc

green =	decrease or negligible increase that is nonmeasurable (NM)
yellow =	concentration increase; does not contribute to WQ standards exceedance
orange =	substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
** Concentrations predicted to be similar to Ram Mine concentrations based on similar pH.
Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations)
Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.
Water quality exceedances based on Idaho secondary constituent standard of 5.0 mg/L for zinc

Table B-1g. Most Probable Case Predictions for Dissolved Nitrate Concentrations in Groundwater
Idaho Cobalt DEIS

Nov-06

	Bucktail Drainage				Big Flat Creek Drainage			
Alternative **Project Phase***	**Immediate Ram Mine Vicinity**		**Immediate Sunshine Mine Vicinity**		**LAT Area**		**TWSF Area**	
Alt I - No Action	**Nitrate Concentration mg/L**	**Groundwater Quality Standard Met?**	**Nitrate Concentration mg/L**	**Groundwater Quality Standard Met?**	**Nitrate Concentration mg/L**	**Groundwater Quality Standard Met?**	**Nitrate Concentration mg/L**	**Groundwater Quality Standard Met?**
Ram Operations (Pre BT-5)-Day 1521	0.5	Yes	0.55	Yes	0.3	Yes	0.3	Yes
Ram Operations-Day 1887	0.5	Yes	0.55	Yes	0.3	Yes	0.3	Yes
Sunshine Operations-Day 4809	0.5	Yes	0.55	Yes	0.3	Yes	0.3	Yes
Closure (Year 5)-Day 6636	0.5	Yes	0.55	Yes	0.3	Yes	0.3	Yes
Closure (Year 23)-Day 13210	0.5	Yes	0.55	Yes	0.3	Yes	0.3	Yes
Alt II - FCC Proposal								
Ram Operations (Pre BT-5)-Day 1521	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Ram Operations-Day 1887	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Sunshine Operations-Day 4809	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Closure (Year 5)-Day 6636	3.7	Yes	3.7	Yes	Not Applicable		NA	NA
Closure (Year 23)-Day 13210	0.54	Yes	0.54	Yes	Not Applicable		NA	NA
Alt III - Perpetual Dewatering & LAT								
Ram Operations (Pre BT-5)-Day 1521	0.5	Yes	0.55	Yes	0.3	Yes	NA	NA
Ram Operations-Day 1887	0.5	Yes	0.55	Yes	0.3	Yes	NA	NA
Sunshine Operations-Day 4809	0.5	Yes	0.55	Yes	0.3	Yes	NA	NA
Closure (Year 5)-Day 6636	0.5	Yes	0.55	Yes	0.3	Yes	NA	NA
Closure (Year 23)-Day 13210	0.5	Yes	0.55	Yes	0.3	Yes	NA	NA
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek								
Ram Operations (Pre BT-5)-Day 1521	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Ram Operations-Day 1887	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Sunshine Operations-Day 4809	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Closure (Year 5)-Day 6636	3.7	Yes	3.7	Yes	Not Applicable		NA	NA
Closure (Year 23)-Day 13210	0.54	Yes	0.54	Yes	Not Applicable		NA	NA
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek								
Ram Operations (Pre BT-5)-Day 1521	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Ram Operations-Day 1887	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Sunshine Operations-Day 4809	0.5	Yes	0.55	Yes	Not Applicable		NA	NA
Closure (Year 5)-Day 6636	3.7	Yes	3.7	Yes	Not Applicable		NA	NA
Closure (Year 23)-Day 13210	0.54	Yes	0.2	Yes	Not Applicable		NA	NA

Relative Impacts from ICP-Derived Dissolved Nitrate

green = decrease or negligible increase that is nonmeasurable (NM)
yellow = concentration increase; does not contribute to WQ standards exceedance
orange = substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.
Idaho Groundwater Quality Standard for Nitrate (as N) =10 mg/L

Table B-1h. Predictions for Dissolved Copper Concentrations in Groundwater
Idaho Cobalt DEIS

Nov-06

Alternative / Project Phase*	Bucktail Drainage																		Big Flat Drainage					
	Immediate Ram Mine Vicinity						Immediate Sunshine Mine Vicinity						Upper Bucktail Alluvium***						TWSF Area					
	Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?		
	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case
Alt I - No Action																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.500	7.500	7.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Alt II - FCC Proposal																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.052	0.089	0.372	Yes	Yes	Yes	1.083	1.534	2.333	Yes	No	No	2.07	2.31	2.73	No	No	No	0.0027	0.0027	0.0028	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.05	0.065	0.196	Yes	Yes	Yes	0.024	0.077	0.480	Yes	Yes	Yes	1.50	1.53	1.75	No	No	No	0.0029	0.0029	0.0030	Yes	Yes	Yes
Alt III - Perpetual Dewatering & LAT																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.500	7.500	7.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.500	7.500	7.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.041	0.043	0.046	Yes	Yes	Yes	0.041**	0.043**	0.046**	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0026	0.0026	0.0027	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.041	0.044	0.048	Yes	Yes	Yes	0.041**	0.044**	0.048**	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0028	0.0028	0.003	Yes	Yes	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek																								
Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.500	7.500	7.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.500	1.500	1.500	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Closure (Year 5)-Day 6636	0.041	0.043	0.046	Yes	Yes	Yes	0.041**	0.043**	0.046**	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0026	0.0026	0.0027	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.041	0.044	0.048	Yes	Yes	Yes	0.041**	0.044**	0.048**	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0028	0.0028	0.003	Yes	Yes	Yes

Relative Impacts from ICP-Derived Dissolved Copper

green =	decrease or negligible increase that is nonmeasurable (NM)
yellow =	concentration increase; does not contribute to WQ standards exceedance
orange =	substantial increase and/or contributes to WQ standard exceedance

* Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
** Concentrations predicted to be similar to Ram Mine concentrations based on similar pH.
*** Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity.
Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase I
Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).
Idaho Groundwater Quality Standard for Copper=1.30 mg/L.

Table B-2. Percent Change in Base Flow in Streams						
		Alternatives				
Stream	Period	I	II	III	IV	V
Bucktail Creek	Ram Operations (Pre BT-5)	0	-44%	-44%	-44%	-44%*
	Ram Operations	-100	-100	-100	-100	-100*
	Sunshine Operations	-100	-100	-100	-100	-100*
	Closure (Year 5)	-100	-100	-100	-100	-100*
	Closure (Year 23)	-100	-100	-100	-100	-100*
	Post-closure	-100	-100	-100	-100	-100*
S.F. Big Deer Creek	Ram Operations (Pre BT-5)	0	-11	-11	-11	-11*
	Ram Operations	-25	-25	-25	-25	-25*
	Sunshine Operations	-25	-25	-25	-25	-25*
	Closure (Year 5)	-25	-25	-25	-25	-25*
	Closure(Year 23)	-25	-25	-25	-25	-25*
	Post-closure	-25	-25	-25	-25	-25*
Big Deer Creek	Ram Operations (Pre BT-5)	0	-1	-3**	-1	-3**
	Ram Operations	0	-1	-3**	-1	-3**
	Sunshine Operations	0	+2	-3**	-1	-3**
	Closure (Year 5)	0	0	-3**	0	-3**
	Closure(Year 23)	0	0	-3**	0	-3**
	Post-closure	0	0	0**	0	0**
Panther Creek	Ram Operations (Pre BT-5)	0	0	0	0	0*
	Ram Operations	0	0	0	0	0*
	Sunshine Operations	0	0	0	0	0*
	Closure (Year 5)	0	0	0	0	0*
	Closure(Year 23)	0	0	0	0	0*
	Post-closure	0	0	0	0	0*
Big Flat Creek	Ram Operations (Pre BT-5)	0	-3	+5**	-3	-3*
	Ram Operations	0	-3	+5**	-3	-3*
	Sunshine Operations	0	-5	+5**	-4	-4*
	Closure (Year 5)	0	-3	+5**	-2	-2*
	Closure(Year 23)	0	-4	+5**	-3	-3*
	Post-closure	0	0	+5**	0	0*
Little Deer Creek	Ram Operations (Pre BT-5)	0	0	+3**	0	0
	Ram Operations	0	0	+3**	0	0
	Sunshine Operations	0	0	+3**	0	0
	Closure (Year 5)	0	0	+3**	0	0
	Closure(Year 23)	0	0	+3**	0	0
	Post-closure	0	0	+3**	0	0
Blackbird Creek	Ram Operations (Pre BT-5)	0	0	0	0	+10**
	Ram Operations	0	0	0	0	+10**
	Sunshine Operations	0	0	0	0	+10**
	Closure (Year 5)	0	0	0	0	+10**
	Closure(Year 23)	0	0	0	0	+10**
	Post-closure	0	0	0	0	0**

- Negative value denotes a reduction in flow; positive value denotes an increase in flow.
- *Flow change is assumed equal to change for alternative 4 DSM version 6.0
- **Flow change is based on DSM version 4.0 results (Hydrometrics, 2006)

Table B-3a.

Idaho Cobalt PDEIS - DSM Predicted Nitrate Concentrations in Streams

Most Probable or Expected Case (50th percentile)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.5	Yes	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Ram Operations	0.5	Yes	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	0.5	Yes	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	0.5	Yes	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 23	0.5	Yes	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.3	Yes	0.15	Yes	0.11	Yes	0.2	Yes	0.18	Yes
	Ram Operations	No flow	No flow	0.3	Yes	0.15	Yes	0.11	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	3.7	Yes	1.9	Yes	0.15	Yes	0.13	Yes	0.2	Yes	0.19	Yes
	Closure Year 23	0.9	Yes	0.5	Yes	0.15	Yes	0.08	Yes	0.2	Yes	0.18	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Ram Operations	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 23	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.3	Yes	0.15	Yes	0.12	Yes	0.2	Yes	0.18	Yes
	Ram Operations	No flow	No flow	0.3	Yes	0.15	Yes	0.11	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	3.7	Yes	1.9	Yes	0.15	Yes	0.13	Yes	0.2	Yes	0.19	Yes
	Closure Year 23	0.9	Yes	0.5	Yes	0.15	Yes	0.08	Yes	0.2	Yes	0.18	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Ram Operations	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	No flow	No flow	0.3	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	3.7	Yes	1.9	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.19	Yes
	Closure Year 23	0.9	Yes	0.5	Yes	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
Primary Drinking Water Standard		10		10		10		10		10		10	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV.
Estimation of alternative 2 and 4 nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.
Estimation of alternative 3 nitrate concentrations in Big Flat Creek based on alternative 4 DSM-predicted concentration to water treatment plant and predicted loads to land application compared to agronomic uptake.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

Table B-3b.

Idaho Cobalt PDEIS - DSM Predicted Sulfate Concentrations in Streams

Most Probable or Expected Case (50th percentile)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	22	Yes	23.3	Yes	22.8	Yes	7.3	Yes	1.6	Yes	10.4	Yes
	Ram Operations	22	Yes	9.3	Yes	4.5	Yes	4.7	Yes	1.6	Yes	10.1	Yes
	Sunshine Operations	22	Yes	9.3	Yes	4.5	Yes	4.7	Yes	1.6	Yes	10.1	Yes
	Closure Year 5	22	Yes	9.3	Yes	4.5	Yes	4.7	Yes	1.6	Yes	10.1	Yes
	Closure Year 23	22	Yes	9.3	Yes	4.5	Yes	4.7	Yes	1.6	Yes	10.1	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	23.3	Yes	22.3	Yes	7.3	Yes	1.6	Yes	10.4	Yes
	Ram Operations	No flow	No flow	9.3	Yes	4.5	Yes	4.6	Yes	1.6	Yes	10.1	Yes
	Sunshine Operations	No flow	No flow	9.3	Yes	4.5	Yes	4.3	Yes	1.6	Yes	10.0	Yes
	Closure Year 5	315.0	Yes	137.2	Yes	4.5	Yes	9.6	Yes	13.7	Yes	10.7	Yes
	Closure Year 23	51.8	Yes	20.6	Yes	4.5	Yes	5.1	Yes	9.9	Yes	10.2	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	23.3	Yes	22.8	Yes	7.3	Yes	186	Yes	10.4	Yes
	Ram Operations	No flow	No flow	9.3	Yes	4.5	Yes	4.7	Yes	155	Yes	10.1	Yes
	Sunshine Operations	No flow	No flow	9.3	Yes	4.5	Yes	4.7	Yes	50	Yes	10.1	Yes
	Closure Year 5	No flow	No flow	9.3	Yes	4.5	Yes	4.7	Yes	50	Yes	10.1	Yes
	Closure Year 23	No flow	No flow	9.3	Yes	4.5	Yes	4.7	Yes	50	Yes	10.1	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	23.3	Yes	22.3	Yes	9.9	Yes	1.6	Yes	10.6	Yes
	Ram Operations	No flow	No flow	9.3	Yes	4.5	Yes	7.1	Yes	1.6	Yes	10.3	Yes
	Sunshine Operations	No flow	No flow	9.3	Yes	4.5	Yes	4.3	Yes	1.6	Yes	10.1	Yes
	Closure Year 5	315.0	No	137.2	Yes	4.5	Yes	9.6	Yes	13.7	Yes	10.7	Yes
	Closure Year 23	51.8	Yes	20.4	Yes	4.5	Yes	5.1	Yes	4.7	Yes	10.2	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	23.3	Yes	22.3	Yes	7.3	Yes	1.6	Yes	10.6	Yes
	Ram Operations	No flow	No flow	9.3	Yes	4.5	Yes	4.7	Yes	1.6	Yes	10.3	Yes
	Sunshine Operations	No flow	No flow	9.3	Yes	4.5	Yes	4.7	Yes	1.6	Yes	10.1	Yes
	Closure Year 5	315.0	No	137.2	Yes	4.5	Yes	4.7	Yes	13.7	Yes	10.7	Yes
	Closure Year 23	51.8	Yes	20.4	Yes	4.5	Yes	4.7	Yes	4.7	Yes	10.2	Yes
Water Quality Standard - Aquatic Life Criterion		None (4)		None (4)		None (4)		None (4)		None (4)		None (4)	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV.
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

(4) For comparison, the Secondary Drinking Water Standard is 250 mg/L.

Table B-3c.
Idaho Cobalt PDEIS - DSM Predicted Zinc Concentrations in Streams
Most Probable or Expected Case (50th percentile)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.005	Yes	0.003	Yes	0.0025	Yes	0.0025	Yes	0.003	Yes	0.0025	Yes
	Ram Operations	0.005	Yes	0.001	Yes	0.0025	Yes	0.0024	Yes	0.003	Yes	0.0025	Yes
	Sunshine Operations	0.005	Yes	0.001	Yes	0.0025	Yes	0.0024	Yes	0.003	Yes	0.0025	Yes
	Closure Year 5	0.005	Yes	0.001	Yes	0.0025	Yes	0.0024	Yes	0.003	Yes	0.0025	Yes
	Closure Year 23	0.005	Yes	0.001	Yes	0.0025	Yes	0.0024	Yes	0.003	Yes	0.0025	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.001	Yes	0.0025	Yes	0.0019	Yes	0.003	Yes	0.0024	Yes
	Ram Operations	No flow	No flow	0.001	Yes	0.0025	Yes	0.0019	Yes	0.003	Yes	0.0024	Yes
	Sunshine Operations	No flow	No flow	0.001	Yes	0.0025	Yes	0.0018	Yes	0.003	Yes	0.0024	Yes
	Closure Year 5	0.103	No	0.004	Yes	0.0025	Yes	0.0026	Yes	0.003	Yes	0.0025	Yes
	Closure Year 23	0.117	No	0.003	Yes	0.0025	Yes	0.0025	Yes	0.003	Yes	0.0025	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.003	Yes	0.0025	Yes	0.0025	Yes	0.003	Yes	0.0025	Yes
	Ram Operations	No flow	No flow	0.001	Yes	0.0025	Yes	0.0024	Yes	0.003	Yes	0.0025	Yes
	Sunshine Operations	No flow	No flow	0.001	Yes	0.0025	Yes	0.0024	Yes	0.003	Yes	0.0025	Yes
	Closure Year 5	No flow	No flow	0.001	Yes	0.0025	Yes	0.0024	Yes	0.003	Yes	0.0025	Yes
	Closure Year 23	No flow	No flow	0.001	Yes	0.0025	Yes	0.0024	Yes	0.003	Yes	0.0025	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.001	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Ram Operations	No flow	No flow	0.001	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Sunshine Operations	No flow	No flow	0.001	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 5	0.040	Partial	0.002	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 23	0.040	Partial	0.002	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.001	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Ram Operations	No flow	No flow	0.001	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Sunshine Operations	No flow	No flow	0.001	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 5	0.040	Partial	0.002	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 23	0.040	Partial	0.002	Yes	0.0025	Yes	0.002	Yes	0.003	Yes	0.002	Yes
Water Quality Standard - Aquatic Life Criterion		0.0365		0.0365		0.0365		0.0365		0.0365		0.0365	
Hardness		25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:
(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV.
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

Table B-3d.

Idaho Cobalt PDEIS - DSM Predicted Cobalt Concentrations in Streams

Most Probable or Expected Case (50th percentile)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.02	Yes	0.13	No	0.093	No	0.017	Yes	0.021	Yes	0.019	Yes
	Ram Operations	0.02	Yes	0.05	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	0.02	Yes	0.05	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 5	0.02	Yes	0.05	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	0.02	Yes	0.05	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.13	Yes	0.100	No	0.0165	Yes	0.021	Yes	0.0185	Yes
	Ram Operations	No flow	No flow	0.06	Yes	0.003	Yes	0.0044	Yes	0.021	Yes	0.0171	Yes
	Sunshine Operations	No flow	No flow	0.05	Yes	0.003	Yes	0.0039	Yes	0.022	Yes	0.0171	Yes
	Closure Year 5	0.103	Partial	0.07	Yes	0.003	Yes	0.0056	Yes	0.021	Yes	0.0173	Yes
	Closure Year 23	0.117	Partial	0.06	Yes	0.003	Yes	0.0053	Yes	0.022	Yes	0.0173	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.13	No	0.100	No	0.017	Yes	0.021	Yes	0.019	Yes
	Ram Operations	No flow	No flow	0.05	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	No flow	No flow	0.05	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 5	No flow	No flow	0.05	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	No flow	No flow	0.05	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.13	Yes	0.100	No	0.017	Yes	0.021	Yes	0.018	Yes
	Ram Operations	No flow	No flow	0.065	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	No flow	No flow	0.046	Yes	0.003	Yes	0.004	Yes	0.022	Yes	0.017	Yes
	Closure Year 5	0.042	Yes	0.054	Yes	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	0.042	Yes	0.054	Yes	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.13	Yes	0.100	No	0.017	Yes	0.021	Yes	0.018	Yes
	Ram Operations	No flow	No flow	0.065	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	No flow	No flow	0.046	Yes	0.003	Yes	0.005	Yes	0.022	Yes	0.017	Yes
	Closure Year 5	0.042	Yes	0.054	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	0.042	Yes	0.054	Yes	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
Site-specific Blackbird cleanup value		0.086		0.086		0.086		0.086		0.086		0.086	
	Hardness	25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than cleanup value.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV.
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

Table B-3e.

Idaho Cobalt PDEIS - DSM Predicted Nickel Concentrations in Streams

Most Probable or Expected Case (50th percentile)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.0015	Yes	0.002	Yes	0.0016	Yes	0.0007	Yes	0.001	Yes	0.0006	Yes
	Ram Operations	0.0015	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
	Sunshine Operations	0.0015	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
	Closure Year 5	0.0015	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
	Closure Year 23	0.0015	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.002	Yes	0.0015	Yes	0.0007	Yes	0.001	Yes	0.0006	Yes
	Ram Operations	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0005	Yes
	Sunshine Operations	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0005	Yes
	Closure Year 5	0.005	Yes	0.002	Yes	0.0005	Yes	0.0006	Yes	0.001	Yes	0.0006	Yes
	Closure Year 23	0.003	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.002	Yes	0.0015	Yes	0.0007	Yes	0.001	Yes	0.0006	Yes
	Ram Operations	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
	Sunshine Operations	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
	Closure Year 5	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
	Closure Year 23	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.002	Yes	0.0015	Yes	0.0006	Yes	0.001	Yes	0.0006	Yes
	Ram Operations	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0005	Yes
	Sunshine Operations	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0005	Yes
	Closure Year 5	0.002	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
	Closure Year 23	0.002	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.002	Yes	0.0015	Yes	0.0007	Yes	0.001	Yes	0.0006	Yes
	Ram Operations	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0005	Yes
	Sunshine Operations	No flow	No flow	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0005	Yes
	Closure Year 5	0.002	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
	Closure Year 23	0.002	Yes	0.001	Yes	0.0005	Yes	0.0005	Yes	0.001	Yes	0.0006	Yes
Water Quality Standard - Aquatic Life Criterion		0.016		0.016		0.016		0.016		0.016		0.016	
Hardness		25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV.
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

Table B-3f.

Idaho Cobalt PDEIS - DSM Predicted Arsenic Concentrations in Streams

Most Probable or Expected Case (50th percentile)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (4)	Water Quality Standard Met? (1)	Concentration (mg/L) (4)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.037	Yes	0.0008	Yes	0.0010	Yes	0.0006	Yes	0.0024	Yes	0.0010	Yes
	Ram Operations	0.037	Yes	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Sunshine Operations	0.037	Yes	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Closure Year 5	0.037	Yes	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Closure Year 23	0.037	Yes	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.0008	Yes	0.0006	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Ram Operations	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Sunshine Operations	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0003	Yes	0.0024	Yes	0.0010	Yes
	Closure Year 5	***	Yes	***	Yes	0.0005	Yes	0.0022	Yes	0.0024	Yes	0.0012	Yes
	Closure Year 23	***	Yes	***	Yes	0.0005	Yes	0.0025	Yes	0.0024	Yes	0.0012	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.0008	Yes	0.0006	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Ram Operations	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Sunshine Operations	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Closure Year 5	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
	Closure Year 23	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0024	Yes	0.0010	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.0008	Yes	0.0006	Yes	0.0009	Yes	0.0024	yes	0.0042	yes
	Ram Operations	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0008	Yes	0.0024	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0003	Yes	0.0024	Yes	0.0032	Yes
	Closure Year 5	***	Yes	***	Yes	0.0005	Yes	0.0022	Yes	0.0024	Yes	0.0032	Yes
	Closure Year 23	***	Yes	***	Yes	0.0005	Yes	0.0024	Yes	0.0024	Yes	0.0032	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.0008	Yes	0.0006	Yes	0.0006	Yes	0.0016	yes	0.0042	yes
	Ram Operations	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.0003	Yes	0.0005	Yes	0.0005	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	***	Yes	***	Yes	0.0005	Yes	0.0005	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	***	Yes	***	Yes	0.0005	Yes	0.0005	Yes	0.0016	Yes	0.0032	Yes
Water Quality Standard - Aquatic Life Criterion		0.15		0.15		0.15		0.15		0.15		0.15	
Federal Primary Drinking Water Standard		0.01		0.01		0.01		0.01		0.01		0.01	
Idaho Human Health Standard		0.05		0.05		0.05		0.05		0.05		0.05	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

(4) Arsenic concentrations at Ram Spring and Bucktail Creek are expected to be similar to existing conditions as shown in the no action alternative.

Table B-3g.

Idaho Cobalt PDEIS - DSM Predicted Copper Concentrations in Streams

90th percentile Case (90 % probability that actual value will be lower than value shown).

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	No	0.065	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.03	No	0.068	No	0.0113	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0026	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0026	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.372	No	0.18	No	0.002	Yes	0.0087	Partial	0.0016	Yes	0.0039	Yes
	Closure Year 23	0.196	No	0.10	No	0.002	Yes	0.0057	Partial	0.0016	Yes	0.0036	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.011	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.046	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.048	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.043	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.044	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
Water Quality Standard - Aquatic Life Criterion		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
	Hardness	25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV.
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

Table B-3h.

Idaho Cobalt PDEIS - DSM Predicted Copper Concentrations in Streams

10th percentile Case (90 % probability that actual value will be higher than shown)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	No	0.065	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.03	No	0.068	No	0.0108	No	0.0016	Yes	0.0041	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0024	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0023	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.052	No	0.04	No	0.002	Yes	0.0036	Partial	0.0016	Yes	0.0033	Yes
	Closure Year 23	0.050	No	0.04	No	0.002	Yes	0.0033	Yes	0.0016	Yes	0.0033	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.011	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.041	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.041	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.043	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.044	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
Water Quality Standard - Aquatic Life Criterion		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
	Hardness	25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
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Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
Examples of BPJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV.
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.

Table B-3i.

Idaho Cobalt PDEIS - DSM Predicted Copper Concentrations in Streams

Most Probable or Expected Case (50th percentile, 50 % probability that actual value will be higher than value shown)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	No	0.065	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	0.026	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt II - FCC proposal without groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.03	No	0.068	No	0.0112	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0025	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0025	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.089	No	0.06	No	0.002	Yes	0.0044	Partial	0.0016	Yes	0.0034	Yes
	Closure Year 23	0.065	No	0.04	No	0.002	Yes	0.0037	Partial	0.0016	Yes	0.0033	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 5	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
	Closure Year 23	No flow	No flow	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0033	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.011	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.003	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.043	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.044	No	0.03	No	0.002	Yes	0.002	Yes	0.0016	Yes	0.0032	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.080	No	0.068	No	0.0117	No	0.0016	Yes	0.0042	Partial
	Ram Operations	No flow	No flow	0.026	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Sunshine Operations	No flow	No flow	0.027	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 5	0.043	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
	Closure Year 23	0.044	No	0.03	No	0.002	Yes	0.0031	Yes	0.0016	Yes	0.0032	Yes
Water Quality Standard - Aquatic Life Criterion		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
	Hardness	25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable and water quality standards are met.
yellow =	DSM predicts small increase that is potentially measurable; uncertain whether water quality standards would be met at all times.
red =	DSM predicts increase that is measurable and it is likely that water quality standard would be exceeded.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
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In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
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Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ & EPA, 1997) so water quality standards do not currently apply.