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, 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 or incremental impacts of 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 the 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 the mine life.
- It is anticipated that the majority of reclamation would be completed within 2 to 3 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 2.57 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 potentially supply approximately 18 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 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 storage 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 cut slopes and the reinforced earth fill at the Ram Portal that may reduce the risk of failure impacts of these.

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 storage 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 design 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
- Potential long-term commingling of Ram and Sunshine Mine waters with water collected by the BMSG water capture facilities and subsequent treatment of these waters by BMSG's water treatment system (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). Alternative IV would require the authorization of a mixing zone for sulfate in Big Deer Creek. 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) and potentially for release of water from the Sunshine Mine to Blackbird Creek via the BMSG

water capture and treatment facilities. All action alternatives would 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. The use of "significant" 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 anticipated 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 are expected to 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 operational 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 due to the planned BT-5 pipeline that would divert lower 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 mine closure. If actual conditions were to be worse than expected, 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. Ram Spring is a tributary to Bucktail Creek. Currently, metal 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, zinc and cobalt (Alternative II only) concentrations in Ram Spring to increase. This increase in metal concentrations 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 downstream waters.

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, assuming detailed field testing proves the Alternative II bedrock groundwater capture wells to be sufficiently effective at capturing ICP mine loads.
2. Surface water quality effects of Alternatives III, IV, and V are considered to not have the potential to become significant, in the worst case. 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 or if achievable bedrock groundwater capture efficiencies prove to be less than predicted.
3. Alternative II (expected and worst case) and Alternative IV (worst case) are predicted to cause increases in copper and sulfate concentrations in groundwater near the Sunshine Mine during and after closure that may exceed the Idaho groundwater quality standards of 1.3 mg/L and 250 mg/L, respectively. The environmental impact of the elevated copper and sulfate 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 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) may result in commingling of ICP mine waters and chemical mass loads with waters that are captured and treated by BMSG. From the perspective of environmental impact, this commingling 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.
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 Blackbird 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 in conjunction with 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 and Addendum (Hydrometrics, 2006 and 2008). 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 and the Addendum (Hydrometrics, 2006 and 2008). 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 or even 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 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 Mine cleanup, 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 Mine 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 and later 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.

Assumptions regarding the Blackbird Mine cleanup were required for modeling as water quality conditions in Bucktail Creek, Big Deer Creek, South Fork Big Deer Creek and Panther Creek are primarily controlled by the effects of historic Blackbird Mine contamination in Bucktail Creek, the Blackbird Mine cleanup, and the planned BT-5 diversion. For modeling purposes it was assumed that during Ram operations before BT-5, metal concentrations in these streams would remain similar to current conditions and likely would remain poorer than water quality standards and cleanup goals due to historic Blackbird Mine impacts. The Blackbird Mine Site ROD (USEPA, 2003) selected cleanup alternative BT-5 for Bucktail Creek, wherein Bucktail Creek and its associated metals mass load would be diverted around the South Fork through a pipeline. For modeling purposes it was assumed that after BT-5 is installed, water quality in Big Deer Creek, South Fork Big Deer Creek and Panther Creek would improve to meet cleanup goals and water quality standards for the duration of the ICP operations and closure period. These assumed water quality conditions after BT-5 are the requirements in the Blackbird ROD based on water quality projections provided by the BMSG in the feasibility analysis (Allans, 2005). Additionally, it was assumed that the BMSG would not remove any ICP chemical mass loads from the watershed.

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 relatively 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 Blackbird 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 drainage to the BMSG water treatment plant in the Blackbird Creek drainage. Prior to BT-5, ongoing BMSG water capture would reduce streamflow in Bucktail Creek, South Fork Big Deer Creek and Big Deer Creek by up to approximately 21, 4, and 1 percent, respectively. The BT-5 diversion is projected to be installed in 2010 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 around) 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. 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 capture and treatment, and also assess the degree to which water collection and treatment protects receiving waters. Effects of Alternative II with post-closure groundwater capture and treatment were evaluated outside the DSM and are described here also. 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 quality of groundwater and other waters that contact the rock. The quality of these mining-affected waters determines, in part, 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 is 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, water is expected to be acidic during all mining phases, starting with a pH of 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 0.09 mg/L during operations, approximately 0.09 mg/L for copper and 0.14 mg/L for cobalt during Closure Year 5, and dropping back to around 0.06 mg/L for copper and 0.08 mg/L for cobalt during Closure Year 23. Arsenic concentrations ranged from 0.2 mg/L during operations decreasing to about 0.10 mg/L during closure. Nickel and zinc concentrations in mine water are predicted to increase to about 0.009 mg/L and 0.05 mg/L, respectively throughout operations and closure.

Nitrogen (predominately nitrate with small amounts of nitrite and ammonia) is expected to occur in mine water when residual blasting agents are dissolved. The nitrogen 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 6 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 metal constituents during operations are higher than 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 more acidic condition (lower pH) that is expected to occur in the Sunshine. Lower pH is expected due primarily to the lack of cemented tailings backfill and associated alkalinity in the Sunshine. Expected copper and cobalt concentrations are predicted to be approximately 0.3 and 0.9 mg/L, respectively during operations, increasing to around 2.6 mg/L for copper and 6.4 mg/L for cobalt during Closure Year 5, and decreasing to around 0.08 mg/L for copper and 0.3 mg/L for cobalt in Closure Year 23. Arsenic concentrations ranged from 0.08 mg/L during operations to over 0.100 mg/L during closure. Nickel and zinc concentrations in mine water are predicted to be 0.04 and 0.06 mg/L respectively during operations, increasing to 0.3 mg/L in Closure Year 5 and decreasing to less than 0.03 mg/L in Closure Year 23.

Tailings and Waste Rock Storage Facility - In Alternative II, the TWSF would consist 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 within the mill complex. 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, 2006g). 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.

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

Notes:

(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, 2006g).

(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:

(1) Information presented as reported on Section V of NPDES Application Form 2D (FCC, 2006a).
(2) Maximum daily values based on design flow of 150 gpm, average daily values based on estimated discharge.
(3) This table describes the variability in predicted water treatment effluent (daily average and daily maximum concentrations) that would likely occur.
(4) Metal concentrations are as total metals.

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 (USEPA, 2007). 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**. A final NPDES for Alternative II is not available at the time of this FEIS. If Alternative II is selected as the preferred alternative in the ROD, the draft NPDES permit would be modified as needed based on public comment and EPA would issue a final NPDES permit.

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: Limits are NSPS from 40 CFR § 440.104(a)

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 exceedances 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 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 Total Suspended Solid (TSS) limit, the upper pH limit, and the flow limits, which 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 New Source Performance Standards (NSPS) to be 20.2 million gallons/year (average flow of 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 an average flow of 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 affect 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.

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 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.

(12) A final NPDES permit is not available at the time of this FEIS. If an alternative requiring an NPDES permit is selected as the preferred alternative in the ROD, the draft NPDES permit would be modified as needed based on public comment and EPA would issue a final NPDES permit.

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
Total Suspended Solid (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
Total Dissolved Solid (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.
(5) A final NPDES permit is not available at the time of this FEIS. If an alternative requiring an NPDES permit is selected as the preferred alternative in the ROD, the draft NPDES permit would be modified as needed based on public comment and EPA would issue a final NPDES permit.

TABLE 4-6. Ambient Surface Water Monitoring Requirements at WQ-24 and Downstream Station				
Parameter	**Units**	**Monitoring Frequency**	**Sample Type**	**Maximum Minimum Level (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
Total Suspended Solids (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	---
Total Dissolved Solids (TDS)	mg/L	1x/6 months	Grab	---

Notes:
(1) A final NPDES permit is not available at the time of this FEIS. If an alternative requiring an NPDES permit is selected as the preferred alternative in the ROD, the draft NPDES permit would be modified as needed based on public comment and EPA would issue a final NPDES permit.

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 17 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.

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 3 years of mining (as the Ram Mine is being developed) to approximately 58 gpm during the 3-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 40 to 45 percent. This 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 2 years of mining, or an average of 2.0 gpm. This equates to about 3.5 percent 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 not needed, groundwater flow rates and patterns would be similar to pre-mining conditions, although the higher permeability of the open or backfilled mine workings will cause some variation in groundwater flow patterns through the mine areas as compared to pre-mining flow patterns. For instance, due to the orientation of the Ram Mine workings and higher overall permeability of the backfilled workings as

compared to the surrounding bedrock, the majority of post-flooding groundwater outflow from the Ram Mine is expected to occur from the north half of the workings, where the hydraulic gradient from within the mine to the downgradient groundwater system would be greater than it would be in the south half of the workings (Hydrometrics, 2008).

If post-operational groundwater capture with wells is required, the volume of water captured (and thus the effects on groundwater quantity), would be up to 50 percent greater than it would be for the operational period (i.e., about 60 percent reduction in total bedrock groundwater flux). This larger reduction in ambient groundwater flows is due to the fact that once the mine water exits the mine workings, there would be considerable mixing and dilution of the mine outflow water with surrounding groundwater, thus requiring a greater volume of water to be pumped in order to capture the mine outflow. It is important to note that this analysis of closure period groundwater capture volumes assumes that 100 percent of the contaminant loads exiting the Ram and Sunshine Mines would have to be captured. Less groundwater would need to be captured if the goal were merely to maintain groundwater loading rates to Bucktail Creek similar to pre-mining loading rates. The percentage of ICP mine loads requiring capture in order to prevent an increase in copper loading to Bucktail Creek as compared to pre-mining conditions under Alternative II would be about 60 percent for the Ram Mine and 99+ percent for the Sunshine Mine (most probable case), and 90 percent for the Ram Mine and 99+ percent for the Sunshine Mine (worst case). Thus, if the post-mining groundwater capture volume requirements were based on maintaining post-mining copper loading to Bucktail Creek similar to pre-ICP mining levels, the groundwater quantities and flow effects would be less for the Ram Mine but similar for the Sunshine Mine as described above, based on current predictions. Post-mining groundwater capture requirements based on pre-mining conditions is discussed further in the Water Resources Technical Report Addendum (Hydrometrics, 2008).

Effects to Big Flat area groundwater quantities and flow would continue in the closure period due to continued operation of the TWSF to accommodate water treatment wastes.

During the mine post-closure period, 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 ICP mine 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 to the ICP mines from the Blackbird Mine site. However, groundwater monitoring to verify and confirm this conclusion, including completion of additional monitoring wells between the Blackbird Mine and the Ram and Sunshine Mines, 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 by the DSM 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 (waste rock only) mine workings during mine operations. 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 with outflow from both mines beginning within 1 year of shutdown (equilibrium groundwater flow-through conditions, where inflow equals outflow, would occur within about 3 years of shutdown at the Ram and 10 years of shutdown at the Sunshine). Some metals, nitrate and sulfate would be leached or flushed from the mine backfill material and migrate with groundwater downgradient 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- to three-fold (or less) over ambient concentrations but remain less than groundwater quality standards for the expected case (50th percentile). Groundwater sulfate concentrations downgradient of the Ram Mine are predicted to be about 300 mg/L in Closure Year 5, decreasing to about 50 mg/L in Closure Year 23. For comparison, the ambient groundwater sulfate concentration is about 27 mg/L and the Idaho groundwater quality standard is 250 mg/L.

At the Sunshine Mine, expected case copper, cobalt, nickel and zinc concentrations in groundwater during the mine closure/water management period would exceed ambient concentrations by about one to two orders of magnitude, but only copper is predicted to exceed the State of Idaho groundwater standard (1.3 mg/L). Groundwater sulfate concentration downgradient of the Sunshine Mine was predicted to be 126 mg/L in Closure Year 5, decreasing to 25 mg/L (similar to the 27 mg/L ambient concentration) in Closure Year 23.

ICP Groundwater Capture System and Effects to Upper Bucktail Alluvium and BMSG Capture System - FCC proposes to install, test and operate groundwater capture wells downgradient of the Ram and Sunshine Mines to capture contaminants derived from the mines for treatment as necessary. 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 past the capture wells towards the creek. Discharge from the groundwater capture

Table 4-7. Predicted Dissolved Copper Concentrations in Groundwater
Idaho Cobalt FEIS

Alternative / Project Phase [1]	Bucktail Drainage[2]																		Big Flat Drainage[2]					
	Immediate Ram Mine Vicinity [2]						Immediate Sunshine Mine Vicinity						Upper Bucktail Alluvium [3]						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	7.50	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	0.036	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 23)-Day 13210	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
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	0.090	0.370	Yes	Yes	Yes	0.396	2.652	19.51	Yes	No	No	1.54	1.84	4.10	No	No	No	0.0027	0.0027	0.0028	Yes	Yes	Yes
Closure (Year 23)-Day 13210	0.050	0.065	0.195	Yes	Yes	Yes	0.024	0.077	0.477	Yes	Yes	Yes	1.50	1.50	1.55	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	7.50	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	0.036	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 23)-Day 13210	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
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	7.50	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	0.041	0.043	0.046	Yes	Yes	Yes	0.062	0.337	2.417	Yes	Yes	No	1.50	1.54	1.81	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	0.016	0.016	0.020	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	7.50	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	0.041	0.043	0.046	Yes	Yes	Yes	0.062	0.337	2.417	Yes	Yes	No	1.50	1.54	1.81	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	0.016	0.016	0.020	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

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Creek.
(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by ICP bedrock groundwater capture wells.

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.

system would be piped to Big Flat for water treatment and discharge to Big Deer Creek under an NPDES permit. It is estimated that the Alternative II capture wells at the Ram Mine can achieve up to 90 percent capture of Ram Mine water and associated chemical mass loads if a reverse hydraulic gradient can be achieved through pumping. The actual capture system efficiency could be greater or less than 90 percent, depending on actual conditions along the proposed well field alignment, and would have to be confirmed through detailed field testing.

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.

Locating the Ram Mine capture wells near the drainage bottom 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. If 90 percent capture can be achieved, this may be enough to capture the increased copper and cobalt loads attributable to the Ram Mine as compared to the baseline copper and cobalt loads in the Ram area groundwater, but may not be adequate to capture the increased loads predicted for the worst-case scenario. Additional detail on the capture system performance, including potential capture system requirements and individual capture well zones of contribution, is provided in the December, 2006 Water Resources Technical Report and 2008 Water Resources Technical Report Addendum (Hydrometrics, 2006; Hydrometrics, 2008)

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 the 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.

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). 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 (75 percent) than the Ram system. The chemical mass load of copper from the flooded Sunshine Mine is estimated to be 0.25 lb/day (most probable case, Closure Year 5). With operation of the ICP Alternative II groundwater capture system, groundwater flow from the mine workings is predicted to cause a 20 to 30 percent

increase in copper concentrations in the alluvial groundwater at closure year 5, with groundwater concentrations decreasing to ambient levels by closure year 23 (**Table 4-7**). A groundwater capture efficiency of greater than 99 percent would be required to maintain expected case post-mining copper loading from the Sunshine Mine to Upper Bucktail Creek (as measured below the confluence of the East and West Forks) at pre-mining levels.

The lower (75 percent) capture efficiency used in the analyses for the Sunshine Mine groundwater capture wells as compared to the Ram Mine is considered to be appropriate 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. Although lower than the assumed efficiency of the Ram, the assumed capture efficiency for the Sunshine is considered to be relatively high given Sunshine conditions. The assumption of 75 percent capture for evaluation purposes is based on the further 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. The relatively high 75 percent capture efficiency is also based on the fact that the post-mining water level in the Sunshine workings is expected to equilibrate at an approximate elevation of 7,460 feet, meaning only the northern-most portion of the workings will be flooded and groundwater outflow will be concentrated in this area (thus simplifying mine water capture).

Adoption of the 90 percent and 75 percent capture efficiencies for the EIS analysis assumes that the ICP 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 groundwater 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 around 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 SS-10 and associated wetlands located downgradient of the TWSF in the headwaters of Big Flat Creek and 25 percent at SS-9 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 SS-11 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 could 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 about 300 mg/L in Closure Year 5, decreasing to 51 mg/L in Closure Year 23. An NPDES permit may 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, 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 to 65 percent), South Fork of Big Deer Creek (10 to 11 percent), Big Deer Creek (1 to 2 percent), and Big Flat Creek (3 to 4 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 (16 to 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 by the DSM to occur for Alternative II (assuming post-closure groundwater capture and treatment) 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 with post-closure groundwater capture and treatment systems operating. DSM predictions of the effects of Alternative II and IV on surface water quality without post-closure groundwater capture and treatment are described in the Water Resources Technical Report Addendum (Hydrometrics, 2008).

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 in surface water.

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), Panther Creek below Big Deer Creek (WQ-25), and Ram Spring.

Table 4-8.

Idaho Cobalt FEIS - 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 (3)		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	NA	0.065	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt II - FCC proposal with post-closure groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.090	No	0.07	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.065	No	0.01	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.043	No	0.05	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.044	No	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.043	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.044	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	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.
yellow =	DSM predicts small concentration increase that is potentially measurable.
red =	DSM predicts increase that is likely to be measurable.

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 concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in copper concentration in cases where the previous months copper load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table 4-9.
Idaho Cobalt FEIS - 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) (3)	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	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	0.026	No	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	0.026	No	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.026	No	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.026	No	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt II - FCC proposal with post-closure groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.069	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.370	No	0.64	No	0.002	Yes	0.009	No	0.002	Yes	0.004	Partial
	Closure Year 23	0.195	No	0.05	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.069	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek (4)	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.069	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.046	No	0.14	No	0.002	Yes	0.004	Yes (4)	0.002	Yes	0.003	Yes
	Closure Year 23	0.048	No	0.04	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	No	0.069	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.043	No	0.14	No	0.002	Yes	0.004	Yes (4)	0.002	Yes	0.003	Yes
	Closure Year 23	0.044	No	0.04	No	0.002	Yes	0.003	Yes	0.002	Yes	0.003	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.
yellow =	DSM predicts small increase that is potentially measurable.
red =	DSM predicts increase that is likely to be measurable.

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 concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in copper concentration in cases where the previous months copper load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Water quality conditions in the South Fork Big Deer Creek are primarily controlled by the effects of historic Blackbird Mine contamination in Bucktail Creek, 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 due to historic Blackbird Mine impacts. Water quality is not predicted to be significantly affected by mining the ICP, as no release of untreated 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. Moreover, during operations the ICP would reduce the metal mass load in Bucktail Creek. Presently, water quality in South Fork is dominated by flows of poor quality water from Bucktail Creek and the presence of Blackbird Mine 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.

Currently, the mass load of metals discharged to the South Fork from Bucktail Creek prevents the attainment of water quality standards in South Fork. The Blackbird Mine Site ROD (USEPA, 2003) selected cleanup alternative BT-5 for Bucktail Creek, wherein Bucktail Creek and its associated metals mass load would be diverted around the South Fork through a pipeline. After BT-5 pipeline is installed, the South Fork water quality is predicted to improve to meet cleanup goals and water quality standards for the duration of the ICP operations and closure period. Projected water quality conditions in Big Deer Creek and in Panther Creek provided by the BMSG feasibility analysis (Allans, 2005) were adopted as requirements in the Blackbird ROD.

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 Mine historic contamination and ongoing 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 due to continued contamination from the Blackbird Mine.

After BT-5 is installed and the Blackbird cleanup is completed, it is predicted (based on requirements in the Blackbird ROD and predictions in the BMSG Feasibility Analysis) 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 1 mg/L (from 5 to 6 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 0.14 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. With 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 not increase in comparison to the No-Action Alternative I after mine refilling. 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 with groundwater

capture and treatment, it is predicted that copper concentrations in Big Deer Creek would increase relative to the Non-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 be similar to the No-Action Alternative I in Closure Year 23. 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 may prove to be unachievable and can not be assumed with a high degree of certainty without installation and detailed field testing of such a system. 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.

Ambient copper concentration in Ram Spring is about 0.026 mg/L and is predicted to increase to about 0.090 mg/L (50th percentile case) during closure. Both ambient and predicted concentrations exceed the aquatic life criterion for copper of approximately 0.004 mg/L. Ambient zinc concentration (0.005 mg/L) is better than the aquatic life criterion (0.0365 mg/L) but is predicted to increase to 0.049 mg/L during post-closure. Ambient cobalt concentration (0.02 mg/L) is better than the Blackbird Cleanup Goal (0.086 mg/L) but is predicted to increase to 0.126 mg/L during post-closure. Sulfate in Ram Spring is predicted to increase to about 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 3 mg/L during the initial years of closure and decline to ambient baseline conditions (0.5 mg/L) within a few more years.

Big Flat Creek Drainage - Alternative II causes insignificant, likely not measurable, 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 lack of 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 historic Blackbird Mine contamination and ongoing 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 due to Blackbird Mine effects. Because of the anticipated very low effluent limits for treated water, Panther Creek is not expected to be adversely affected by ICP 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, no increase in concentration 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. With 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 be equivalent to the No-Action Alternative I throughout post-closure.

The 90th percentile case DSM results differ slightly from the expected case both in predicted metal concentrations and overall conclusions of impacts and mitigations during closure. In the 90th percentile case with post-closure groundwater capture and treatment, it is predicted that copper concentrations in Panther Creek would increase from 0.003 in the No Action case to 0.004 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 be approximately equivalent to 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.

Blackbird Creek - A portion of the metals loads from the Sunshine and Ram Mines have the potential to report to the BMSG Upper Bucktail capture and treatment system and be discharged to Blackbird Creek. As described in the Water Resources Technical Report Addendum (Hydrometrics, 2008), it is estimated that 25 percent of the Sunshine Mine loads and 0.5 percent of the Ram Mine loads could bypass the ICP Alternative II groundwater capture system. This bypass load would total approximately 0.064 lbs/day (expected case condition) to 0.474 lbs/day (worst case condition) of additional copper mass load from the Ram and Sunshine Mines. In 2005, copper concentrations in Blackbird Creek below the BMSG water treatment plant varied from approximately 0.019 to 0.044 mg/L. Assuming no further copper removal by the BMSG treatment plant, under typical Blackbird Creek low flow rates (0.5 cfs), the addition of the Ram and Sunshine Mine loads to Blackbird Creek would change instream concentrations in Blackbird Creek to range from 0.042 to 0.067 mg/L in the expected case and from 0.189 to 0.2144 mg/L in the worst case (90th percentile).

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 40 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. Effects of spills on aquatic resources are described in the Biological Assessment (Kuzis and Bauer, 2007) and in the Fisheries Resources portion of this Section.

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 Forest Service, 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 1 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 1 to 2 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 2 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. Effects of spills on aquatic resources are described in the Biological Assessment (Kuzis and Bauer, 2007) and in the Fisheries Resources portion of this Section.

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
- Commingling 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 with essentially no groundwater outflow. The amendment of waste rock slash in the Ram and Sunshine Mines in Alternative III would reduce the risk of mobilization of high concentrations of metals from the slash 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 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**) but would apply after treatment and percolation of water through soils. LAT is predicted to be able to meet the effluent limits proposed for Big Deer Creek, with the possible 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. 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 SS-11 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 (1 percent). Flows in Big Flat Creek would be increased by 3 percent due to land application treatment of excess mine water.

During Ram operations and closure after BT-5 is employed, surface water flows during baseflow conditions in Bucktail Creek above the diversion would be reduced by 44 to 65 percent. Below the BT-5 diversion, flows would be reduced in Bucktail Creek (100 percent), South Fork of Big Deer Creek (16 to 25 percent), Big Deer Creek (3 to 4 percent). Flows in Big Flat Creek would be increased by 3 to 5 percent due to land application treatment of excess mine water.

Surface 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 7 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 (3.0 additional 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 1 to 2 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 5.0 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 with a mixing zone in Big Deer Creek for sulfate;
- 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 bedrock groundwater capture system would be augmented as necessary with a surface water/alluvial groundwater capture system in lower Bucktail Creek drainage;
- The ICP would have to demonstrate the effectiveness of the groundwater capture systems through field testing and modeling in order for the operational mining phase to proceed; 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 more acidic waters (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. 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 0.090 and 0.370 mg/L, respectively for Alternative II.

An NPDES permit would be required for the discharge of treated water into Big Deer Creek. FCC has amended their NPDES application to include the water treatment process in Alternative IV and applied for a mixing zone for sulfate (FCC, 2008). A final NPDES permit and associated effluent limits for Alternative IV are not available at the time of this FEIS. If Alternative IV is selected as the preferred alternative in the ROD, FCC's draft NPDES permit would be modified to reflect the amended NPDES application and (as needed based on public comment) a final NPDES permit would be issued by EPA. The effluent limits for such a discharge are expected to be similar to the draft NPDES permit limits described for Alternative II (see **Table 4-5**) with the exception of the limit for sulfate. The effluent limit for sulfate in this alternative could be higher if DEQ were to grant a mixing zone for sulfate in Big Deer Creek.

The metals treatment process for Alternative IV is predicted to result in the discharge meeting the effluent limits based on bench-scale testing conducted by Apex Engineering (Apex and M-M, 2007). Alternative IV requires that additional treatability testing be performed before the treatment system is constructed to verify that the system will be able to meet the limits.

The water balance and wastewater flows for Alterative IV are the same as analyzed for Alternative II. Treatment and discharge 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.

Water treatment feedwater for Alternative IV would be as described for Alternative II in **Table 4-1**. Alternative IV 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**). Sulfate concentrations in effluent are projected by the DSM to average about 580 mg/L with maximum concentrations (worst case, or 90th percentile conditions) of 840 mg/L. Upon full mixing with the stream, instream sulfate concentrations (average flow conditions) would be approximately 14 mg/L, far less than the water quality standard of 250 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 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. 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. The ICP would have to demonstrate the effectiveness of the capture systems through field testing and modeling in order for the operational mining phase to proceed. 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 and/or alluvial groundwater capture system in Lower Bucktail Creek drainage, if the bedrock capture well systems cannot adequately control the ICP mine-derived groundwater 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 (50 to 60 percent reduction in bedrock groundwater flow in Bucktail drainage). If needed to increase the metal load capture efficiency, 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 would be located 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 Alternative II and 53 acres for Alternative III), these effects would be smaller than 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 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.

At mine closure, cessation of mine dewatering would be contingent on monitoring results and projections indicating no unacceptable effects to water quality objectives or CERCLA 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 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. Predicted groundwater concentrations of sulfate, copper and other metals in Alternative IV are tabulated in Appendix B and **Table 4-7** (copper only). At the Ram Mine, most probable case concentrations for some metals (i.e., copper and zinc), are expected to be slightly higher than baseline concentrations while for other metals (cobalt and nickel), predicted closure period concentrations are less than baseline concentrations. At the Sunshine Mine, metals concentrations are expected to increase by as much as an order of magnitude during closure period Year 5, then decease to values near or less than ambient concentrations by closure period Year 23. Concentrations of all metals during the Alternative IV closure period are less than applicable groundwater quality standards and are less than the Alternative II predicted concentrations (Table B-1). Alternative IV groundwater sulfate concentrations 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 TWSF under Alternative IV are expected to be virtually identical to those described for Alternative II because in both alternatives acid rock drainage is not expected to develop within the TWSF. Alternative IV is considered to have a lower potential for impacts to groundwater from the TWSF than Alternative II because Alternative IV mitigations (commingling of waste rock and tailings, geochemical monitoring program) reduce the risk of development of acid conditions and release of metals from the waste rock. Metals concentrations in downgradient groundwater would remain virtually the same as ambient while sulfate concentrations would increase from 1.0 mg/L to about 170 mg/L. During Closure Year 23, the sulfate concentration would decrease to about 50 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 SS-11 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 Alternatives 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 one-half (most probable case) to one-tenth (worst case) of those predicted for Alternative II, due to amendment of the waste rock slash in the Ram Mine.

In Alternative IV, the TWSF is smaller (36 acres versus 55 acres in Alternative II) and impacts to springs in the Big Flat area would be proportionately smaller. Flows in spring SS-10 in Big Flat Creek would be reduced by 22 percent in Alternative IV as compared to approximately 40 percent in Alternative II. However, this difference in impacts would not be realized if additional ore were processed and the Alternative IV TWSF needed to be expanded.

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 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 additional ore were processed and the Alternative IV TWSF needed to be expanded.

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 during average flow and discharge conditions are predicted by the DSM (Table B-3b, Appendix B) to increase from approximately 7 mg/L (baseline condition) to a peak of approximately 14 mg/L (after full mixing) during operations then decrease to about 5 mg/L following closure. Predicted peak sulfate concentration in Alternative IV (14 mg/L) is higher than peak sulfate concentration for Alternative II (7 mg/L) due to the lack of water treatment processes for sulfate removal in Alternative IV. Sulfate concentrations within the discharge mixing zone would be intermediate between the effluent concentration and 14 mg/L. Sulfate concentration in mine discharge (effluent) could be up to 840 mg/L (90th percentile case) and would be diluted by Big Deer Creek.

Within the sulfate mixing zone, the ICP discharge would be diluted to meet the water quality standard of 250 mg/L established in the draft NPDES permit. The actual length and width of the mixing zone would depend on the configuration of the effluent diffuser and on authorization of the mixing zone by IDEQ. According to IDEQ mixing zone policy (www.deq.idaho.gov/water/data_reports/surface_water/monitoring/mixing_zones.cfm), in defining a mixing zone, several guidelines should be followed, including:

- The mixing zone should not interfere with existing beneficial uses.
- Water quality within a mixing zone may exceed chronic water quality criteria so long as chronic water quality criteria are met at the boundary of any approved mixing zone.
- Acute water quality criteria may be exceeded within a zone of initial dilution inside the mixing zone.
- The mixing zone may not be acutely toxic to biota significant to the receiving water's aquatic community.
- The mixing zone should be limited to 25 percent of the width and volume of the stream to allow a zone of passage for aquatic life.

For purposes of this impact evaluation, the mixing zone is evaluated assuming that the mixing zone does not exceed 25 percent of the width or volume of flow. Based on the nature of flow in Big Deer Creek (turbulent), it is estimated that the mixing zone would extend several hundred feet in length.

Sulfate concentrations within the regulatory mixing zone were estimated based on ICP discharge and ambient Big Deer Creek water quality and flow estimates from the DSM modeling. A summary of the basis for the estimates and resultant instream sulfate concentrations are provided in **Table 4-10**.

At the point of discharge, sulfate concentrations immediately adjacent to the diffuser ports would be similar to the discharge, 400 to 840 mg/L. At the edge of the assumed regulatory mixing zone, sulfate concentrations would range from approximately 35 to 165 mg/L, during average conditions and low flow (7Q10) conditions respectively.

Outside of the regulatory mixing zone after mixing with the entire volume of Big Deer Creek is achieved, sulfate concentrations in Big Deer Creek are predicted to increase from approximately 7 mg/L (baseline condition) to approximately 14 mg/L during average flow conditions and 54 mg/L during low flow (7Q10) conditions.

An additional evaluation of mixing zone effects using the EPA CORMIX1 model was conducted for FCC (Telesto Solutions, 2008). This analysis predicts that sulfate concentrations would fall to less

than 250 mg/L within 3 feet of the effluent diffuser and to less than 99 mg/L at the edge of the regulatory mixing zone.

TABLE 4-10. Sulfate Mixing Analysis - Big Deer Creek				
Scenario 1: Average Conditions - Big Deer Creek Q50, Average Outfall Flow, Average Sulfate Discharge Concentration				
	Q50 (cfs)(1)	**Sulfate Concentrations Before Mixing (mg/L)(2)**	**Sulfate Concentrations in Big Deer Creek After Full Mixing (mg/L)**	**Sulfate Concentrations in Big Deer Creek After Mixing with 25% of Big Deer Creek Flow (mg/L)**
Outfall Average Discharge	0.25	581	---	---
Big Deer at Outfall	20.72	7.3	14	34
Scenario 2: Low Flow Conditions - Big Deer Creek 7Q10, Maximum Outfall Flow, 90th Percentile Sulfate Discharge Concentration				
Outfall Average Discharge	0.33	840	---	---
Big Deer at Outfall	5.6	7.3	54	166

Notes:

(1) Discharge flow estimate from ICP NPDES Permit application (FCC, 2006). Big Deer Creek average flow estimates from DSM results (see pg A-26, Appendix A, Water Resources Technical Report, Hydrometrics, 2006). Big Deer Creek 7Q10 estimated from duration curve developed from DSM daily flow results for the 100-year simulation period. For comparison, USGS estimates 7Q10 to be 4.9 cfs from USGS StreamStats model (see Mebane, 2007). The DSM value was chosen for this analysis for consistency with other DSM predicted values that are based on the watershed model.

(2) Big Deer Creek sulfate concentration during baseflow condition as used in DSM model (see **Table B-3b** FEIS). ICP discharge concentrations from DSM results (see pg A-24, Appendix A, Water Resources Technical Report, Hydrometrics, 2006).

Ambient copper concentration in Ram Spring is about 0.026 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. Ambient zinc concentration (0.005 mg/L) is better than the aquatic life criterion (0.0365 mg/L) but is predicted to increase to 0.040 mg/L during post-closure. Sulfate in Ram Spring is predicted to increase to about 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 3 mg/L during the initial years of closure and decline to ambient baseline conditions (0.5 mg/L) within a few more years.

Blackbird Creek - A portion of the metals loads from the Sunshine and Ram Mines have the potential to report to the BMSG Upper Bucktail capture and treatment system and be discharged to Blackbird Creek. As described in the Water Resources Technical Report Addendum (Hydrometrics, 2008), it is estimated that only a small portion of the total groundwater load from the ICP has the potential (25 percent of the Sunshine Mine loads and 0.5 percent of the Ram Mine loads) to bypass the ICP Alternative II groundwater capture system and be captured by BMSG. This bypass load would total approximately 0.008 lbs/day (expected case condition) to 0.059 lbs/day (worst case condition) of additional copper mass load from the Ram and Sunshine Mines. In 2005, copper concentrations in Blackbird Creek below the BMSG water treatment plant varied from approximately 0.019 to 0.044 mg/L. Based on typical Blackbird Creek low flow rates (0.5 cfs), the addition of the Sunshine and Ram loads to Blackbird Creek would change instream concentrations in Blackbird Creek to range from 0.022 to 0.047 mg/L in the expected case (50th percentile) and from 0.040 to 0.065 mg/L in the worst case (90th percentile).

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. 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. Effects of spills on aquatic resources are described in the Biological Assessment (Kuzis and Bauer, 2007) and in the Fisheries Resources portion of this Section.

Sediment Yield - Alternative IV is predicted to produce 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.

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 1 percent increase over the baseline level with sediment delivery returning to baseline levels within 1 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 2 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.

Sediment Quality - 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, since 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 the Blackbird Creek drainage 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 NPDES permit (2006; **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 (3 percent), and Big Flat Creek (3 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 (44 to 65 percent upstream of BT-5 and 100 percent below BT-5), South Fork of Big Deer Creek (16 to 25 percent), Big Deer Creek (3 to 4 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, zinc, 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.

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 1 percent increase over the baseline level with sediment delivery returning to baseline levels within 1 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 2 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 130 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 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. The soil disturbance associated with Alternative II would be in compliance with Forest Plan directives.

Alternative III - Perpetual Mine Dewatering and Land Application Water Discharge

The increased disturbed area under Alternative III (324 acres including 175 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 III 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 115 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 4-11**), 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 4-11. 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(1)	39.0	30.0	69.0	150
Annual(2)	7.0	7.5	14.5	50

Notes: (1) = 24-hour concentration expressed as high, second-high values
(2) = 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 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 in the immediate vicinity of the mine and mill areas and along the transportation corridor. 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, 1978) 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 1 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 4-12** 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 4-12**, 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 1 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.

TABLE 4-12. Estimated Noise Levels at Various Distances from Source(s)				
Proposed Action	**Examples of Typical Mining Equipment / Noise Sources**	**Noise Level at Receptor**		
		1/2 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 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.

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, 92 to 116 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 92 acres of vegetation not including the Blackbird Creek borrow area and new and upgraded roads. Plant communities that would be removed or altered are dominated by lodgepole pine communities in early stages of ecological succession. Of this disturbed acreage, 88 acres burned with high severity, four 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 firewood 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 effluent diffuser 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 115 acres of vegetation from mine-related facilities plus 175 acres of vegetation disturbance in the LAD area. The 290 acre vegetation impact under Alternative III does not include borrow areas or new and upgraded roads. 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, 110 acres burned with high severity and 5 acres burned with medium severity.

On the mine site, 5.7 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 1 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.

Unlike Alternative II, Alternative III 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 additional project Access Route mitigation would be implemented including reconstruction of segments along Panther Creek and Blackbird Creek to raise the grade above the floodplain, realignment of Williams Creek Road between mile markers 7.1 and 8.1, constructing turnouts on Blackbird Road and eventually reshaping and resurfacing the entire 40 mile route.

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. Alternative III 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 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, 76 acres (versus 92 for Alternative II and 115 acres for Alternative III) would be disturbed. This alternative would result in the disturbance of 76 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 tailings and waste rock storage facility (36 acres) would be less than for Alternatives II or III. Alternative IV would impact no special-status vegetation species.

This alternative would have a similar effect on wetlands as Alternative II, except the reduced TWSF footprint would avoid direct impacts to 0.22 acres of non-jurisdictional wetlands in the Big Flat. The water discharge pipeline and effluent diffuser 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 pipeline and effluent diffuser used to discharge water to Big Deer Creek.

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 130 acres of habitat. These losses would be temporary, lasting for the life of the Project. Following operations, all areas would be reclaimed. Assuming a 10-year life of operations and time for vegetation to become established, it would be 5 to 10 or more years 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.

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. Because there are no denning or rendezvous areas in the vicinity of the Project area there should not be any impacts associated with mine operation affecting wolf activities or territory use (Huffman, 2007). 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 Species: Canada Lynx - The Canada lynx which is listed as a Threatened Species by the USFWS nationally, is not listed as occurring in the Salmon-Challis National Forest. 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 (LAU), which includes the Project area, currently has 85–90 percent unsuitable habitat. The Lynx Conservation Assessment Strategy (Ruedigger, 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.

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 Project 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: Fisher - 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: 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.

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 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 move 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). The TWSF (northern location) would contain the same storage volume as in Alternative II, while covering a slightly smaller footprint. 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 115 acres as compared with Alternative II (130 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 reduced TWSF footprint would result in less direct habitat loss than under Alternative II or III.

Potential direct and indirect impacts to wildlife resources 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 USFWS 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 have been discussed in the biological assessment (BA), which has been prepared for the preferred alternative (Kuzis and Bauer, 2007). The USFWS subsequently completed a Biological Opinion on impacts to bull trout and the National Marine Fisheries Service prepared a Biological Opinion on Chinook salmon and steelhead. Both Biological Opinions are attached to this EIS as appendices (Appendix E and Appendix F) and describe Reasonable and

Prudent Measures and Terms and Conditions (mitigation measures) that would be required to address project impacts on listed fish and fish habitat.

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.

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. Road and sediment impacts for the ICP alternatives are summarized in **Table 4-13**.

TABLE 4-13. Summary of Changes to Road and Watershed Sediment Conditions for ICP Alternatives

Issue	Alternative I	Alternative II	Alternative III	Alternative IV	Alternative V
New Roads	Baseline Conditions	2.6 miles	5.7 miles	4.1 miles	2.6 miles
Site Road Upgrades		12.7 miles	7.5 miles	11.3 miles	11.9 miles
Access Road Upgrades		10.9 miles	40.0 miles	40.0 miles	40.0 miles
Total Net Road Reduction		4.5 miles	7.5 miles	7.5 miles	7.5 miles
WEPP Model Road sediment delivery		50% reduced sediment delivered to Williams, Panther and Deep Creeks	50% reduced sediment delivery. Additional road improvements and road relocation along Williams Creek further reduce sediment.	50% reduced sediment delivery. Additional road improvements and road relocation along Williams Creek further reduce sediment.	50% reduced sediment delivery. Additional road improvements and road relocation along Williams Creek further reduce sediment.
BOISED Model Watershed Sediment Yield (short-term)		1% increase Big Flat Creek. 34% increase Bucktail Creek.	7% increase Big Flat Creek. 31% increase Bucktail Creek.	1% increase Big Flat Creek. 31% increase Bucktail Creek.	1% increase Big Flat Creek. 31% increase Bucktail Creek.
Total Disturbance		130 acres	324 acres	115 acres	111 acres

Note: For long-term sediment impacts see sediment discussion under Water Resources in this chapter.

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. Predicted changes in stream flow are summarized in **Table 4-14.**

TABLE 4-14. Summary of Surface Stream Flow Changes by Alternative					
Issue	**Alternative I**	**Alternative II**	**Alternative III**	**Alternative IV**	**Alternative IV**
Decreased Stream Flow	Bucktail-100% S.F. Big Deer-16 to -25%	Bucktail-100% S.F. Big Deer-16 to 25% Big Deer-1 to -2% Big Flat-5%	Bucktail-100% S.F. Big Deer-16 to 25% Big Deer-3 to -4%	Bucktail-100% S.F. Big Deer-16 to 25% Big Deer-1 to -2% Big Flat-4%	Bucktail-100% S.F. Big Deer-16 to 25% Big Deer-3 to -4% Big Flat-4%
Increased Stream Flow	None	Big Deer +1 to 2%	Big Flat-5% Little Deer-3%	None	Blackbird-10%

For water quality, the main concern from mining is the potential for adverse sediment impacts and/or chemical contamination to nearby streams. A summary of predicted changes to surface water quality from project alternatives are presented in **Table 4-15.** 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.**

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 4-16 and Table 4-17**. Spill risk following an accident is based on container and form of material. Containerized solids are considered low risk, containerized liquids are a moderate risk, and bulk liquids are high risk (**Table 4-16**). The estimated frequency of an accident occurring near a stream was calculated based on an accident probability of 9.8 accidents per million vehicle miles (1997) and was calculated using Forest Service data for the Williams Creek/Moccasin Creek Road (**Table 4-16**). Since only 43 percent of the access road is in proximity to streams, this percentage was used to calculate an accident frequency near streams and years between accidents.

The quantity of transported materials necessary to reach aquatic toxicity levels in transportation route streams during low flow are presented in **Table 4-18**. A simplified method was used to calculate toxic quantities and assumes material is dissolved and completely mixed into the water column (TTE, 2006). The quantity necessary to become toxic in streams along the Access Route was modeled for a short (one-minute interval) direct spill event. Chemicals, quantities and length of time utilized would vary between the alternatives. Alternative III would have the lowest chemical usage and Alternatives IV and V would have the highest (since they assume long-term post-closure water treatment). The specific chemicals used in the water treatment process would also be slightly different between alternatives and depending on final treatment process design. The chemicals and quantities for Alternative IV are utilized in this analysis to represent potential impacts to aquatic resources.

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, could cause direct toxic effects if released into the stream. Sensitive species could 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 liquids (e.g. diesel) or very highly toxic materials such as copper sulfate into area streams.

TABLE 4-15. Summary of Predicted Changes to Surface Water Quality by Alternative

Issue	Alternative I	Alternative II	Alternative III	Alternative IV	Alternative IV
NPDES outfall location	No Change	Discharge to Big Deer Creek	Land application to Big Flat watershed for water treatment	Discharge to Big Deer Creek	Discharge permit to Blackbird Creek
Mine Operation Before BT-5 Years 0-5	EPA and IDEQ have determined that it is unlikely that Bucktail and Blackbird Creeks would ever attain aquatic life standards or support fisheries. During this period Big Deer and South Fork Big Deer Creeks would continue to not meet water quality standards. 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.				
Mine Operations After BT-5 Years 5-14	Blackbird ROD requires cleanup goals and water quality standards for metals to be met as predicted by BMSG in the Blackbird feasibility analysis.	Slight increase in sulfate in Big Deer and Panther Creeks and a slight increase in nitrate in Big Deer Creek.	No significant effects to surface water quality are predicted. There is expected to be an increase in sulfate in Big Flat Creek from about 2 mg/L to a peak of about 190 mg/L during operations then decrease to about 50 mg/L during closure.	There is expected to be an increase in sulfate concentration in Big Deer and Panther Creeks and a slight increase in nitrate in Big Deer Creek.	No significant effects to surface water quality are predicted to occur during any mine periods. The possible exception may be copper, sulfate and nitrate in Ram Spring during closure. Surface water quality changes from a discharge to Blackbird Creek have not been assessed. Effects of this discharge would likely be beneficial because it would dilute the current high metal concentrations with cleaner water sufficient to meet standards set by an NPDES permit.
Mine Closure Year 5-23		Without groundwater capture the predicted (90th percentile) copper concentration in Big Deer Creek would likely exceed aquatic life standards. If the proposed groundwater capture mitigation system was employed it may not be sufficient to prevent exceedance of water quality standards.		No significant effects to surface water quality are predicted during any mine periods. The possible exception may be copper, sulfate and nitrate in Ram Spring during closure and post-closure periods.	

TABLE 4-16. Risk of Materials Release in Case of an Accident During Transport to the ICP Project (from TTE, 2006 and Kuzis and Bauer, 2007)

Material	Amount transported per trip	Number of trips per year	Form	Container type and size	Spill risk(1)
AERO 343 Xanthate	40,000 lbs	14	Dry	Flo Bin/ 1 ton	Low
AERO 350 Xanthate	40,000 lbs	16	Dry	Flo Bin/ 1 ton	Low
Copper Sulfate	32,000 lbs	20	Dry	Super Sack/1 ton	Low
AEROFROTH 65 Frother	28,000 lbs	3	Liquid	Plastic Barrel/ 55 gal	Moderate
Sodium Sulfide	20-100 tons	5	Dry	Sacks/ 50 lbs	Low
Superfloc	8	3	Dry	Sacks/ 50 lbs	Low
Diesel	4,470 gal	167	Liquid	Fuel Truck/ 4,500 gal.	High
Gasoline	30 gal	150	Liquid	Fuel Truck/4,500 gal	High
Lime	37,500	4	Dry	1000 Super Sack	Low
Cement	44,000	115	Dry	Dry Bulk 22 tons	Low
Oils, Lubricant, Grease, Antifreeze	60 gal	150	Liquid	Barrel/ 55 gal	Moderate
Propane	9,400 gal	5	Gas	Fuel Truck/ 9,400 gal	Low
Antiscalant	4,000 gal	1	Liquid	250 gal. tote/ 4,000 gal	High
Ammonium Nitrate	10 tons	40	Dry	Bulk Container/ 10 tons	Low
Bulk Concentrate	16 tons	700	Dry	Sealed Container/ 16 tons	Low
Water Treatment Materials					
Alternative II Only					
Sodium Hypochlorite	200 gal	1	Liquid	Plastic Drum/ 55 gal	Moderate
Sodium Bisulfite	250 gal	2	Liquid	Plastic Drum/ 55 gal	Moderate
RO Scale Inhibitor	50 gal	1	Liquid	Sealed Pail/ 5 gal	Moderate
RO Alkaline Cleaner	1.5 tons	1	Dry	Sealed Pail/ 5 gal	Low
RO Acid Cleaner	1.5 tons	1	Dry	Sealed Pail/ 5 gal	Low
Cement	22 tons	148	Dry	Sacks/ 94 lbs	Low
Bentonite	22 tons	41	Dry	Sacks/ 50 lbs	Low
Alternative II, IV & V					
Polymer Flocculent	20 gal	1	Liquid	Sealed Pail/ 5 gal	Moderate
Hydrated Lime	2 tons	1	Dry	Super Sack/ 1000 lbs	Low
Methanol	250 gal	2	Liquid	Plastic Drum/ 55 gal	Moderate
Hydrochloric Acid	200 gal	2	Liquid	Plastic Drum/ 55 gal	Moderate
Alternative IV Only					
Zeolites	3 tons	1	Dry	Super Sack	Low

Note: (1) Spill risk following an accident is based on container and form of material: Containerized Solid = Low Risk; Containerized Liquids = Moderate Risk; Bulk Liquids = High Risk

TABLE 4-17. Materials Transported for the ICP Alternatives Along with Accident Probabilities and Estimated Years Between an Accident Near a Stream (from TTE, 2006)

Material	Amount transported per trip(1)	Number of trips per year(1)	Annual truck miles(2)	Annual accident frequency(3)	Years between accidents(4)	Accident frequency near stream(5)	Year between accidents near streams(5)
AERO 343 Xanthate	40,000 lbs	14	534.1	0.0052	191	0.0023	444
AERO 350 Xanthate	40,000 lbs	16	610.4	0.0060	167	0.0026	389
Copper Sulfate	32,000 lbs	20	763	0.0075	134	0.0032	311
AEROFROTH 65 Frother	28,000 lbs	3	114.45	0.0011	892	0.0005	2073
Sodium Sulfide	20-100 tons	5	190.75	0.0019	535	0.0008	1,244
Superfloc	8	3	114.45	0.0011	892	0.0005	2,073
Lime	37,500	4	152.6	0.0015	669	0.0006	1,555
Cement	44,000	115	4387.25	0.0430	23	0.0185	54
-Diesel -Gasoline -Oils, Lubricant, Grease, Antifreeze(6)	4,470 gal 30 gal 60 gal	150	5722.5	0.0561	18	0.0241	41
Propane	9,400 gal	5	190.75	0.0019	535	0.0008	1,244
Antiscalant	4,000 gal	1	38.15	0.0004	2675	0.0002	6,220
Ammonium Nitrate	10 tons	40	1526	0.0150	67	0.0064	156
Bulk Concentrate	16 tons	700	26705	0.2617	4	0.1125	9
Water Treatment Materials							
Alternative II Only							
Sodium Hypochlorite	200 gal	1[3]	38.15	0.0004	2675	0.0002	6,220
Sodium Bisulfite	250 gal	2	76.3	0.0007	1337	0.0003	3,110
RO Scale Inhibitor	50 gal	1[3]	38.15	0.0004	2675	0.0002	6,220
RO Alkaline Cleaner	1.5 tons	1[3]	38.15	0.0004	2675	0.0002	6,220
RO Acid Cleaner	1.5 tons	1[3]	38.15	0.0004	2675	0.0002	6,220
Cement	22 tons	148	5,646.2	0.0553	18	0.0238	42
Bentonite	22 tons	41	1,564.2	0.0153	65	0.0066	152
Alternative II, IV & V							
Polymer Flocculent	20 gal	1	38.15	0.0004	2675	0.0002	6,220
Hydrated Lime	2 tons	1	38.15	0.0004	2675	0.0002	6,220
Methanol	250 gal	2	76.3	0.0007	1337	0.0003	3,110
Hydrochloric Acid	200 gal	2	76.3	0.0007	1337	0.0003	3,110
Alternative IV & V							
Zeolites	3 tons	1	38.15	0.0004	2675	0.0002	6,220
Treatment Plant Waste(7)	23 tons	2	76.3	0.0007	1337	0.0003	3,110

Notes: (1) Revised Plan of Operations.
(2) One way of the trip only-when reagent is being transported (38.15 miles).
(3) Assumes 9.8 accidents per million miles driven (from TTE 2006).
(4) Reciprocal of annual accident frequency.
(5) 43 percent of the haul route is near a stream.
(6) Diesel, gasoline, and other products shipped on the same truck.
(7) Post-mining period only, if continued water treatment is needed to meet water quality goals.

TABLE 4-18. Transport Material Information and Quantity of Material Required to Reach Aquatic Toxicity Levels in ICP Area Streams Simulating a Short Spill (lbs/min)

Material Information		343 Xanthate	350 Xanthate	Copper Sulfate	Superfloc	Lime/ Cement	Diesel	Gasoline	Antiscalant	Ammonium Nitrate
Toxicity Hazard Rating[1]		Not acutely toxic	Slightly toxic	Very highly toxic	Highly toxic	Slightly toxic	Slightly toxic	Slightly toxic	Not acutely toxic	Moderately toxic
Aquatic Toxicity (mg/L)		595	12	0.005	0.22	92	18	2.7	2,660	8.01
Source Information		CYTEC MSDS 2000; No 00290	CYTEC MSDS 2000; No. 00290	Welsh et. al 2000; acute water quality criterion	CYTEC MSDS 2001;No. 01922	Meinke et. al. 1956	CONOCO MSDS 2000	EPA 1976	CYTEC MSDS 2002 No. 0004022	Aquatic Toxicology 41:325-342
Quantity/Trip (lbs) or (gal)		40,000 lbs	40,000 lbs	32,000 lbs	16,000 lbs	37,500 lbs	4,500 gal	34 gal	4,000 gal	20,000 lbs
Stream	Flow (cfs)	Quantity Required to reach toxic (Dry-lbs/min; Liquid-gal/min)								
Moccasin Ck	1.0	2.3	0.04	0.00002	0.0008	0.36	0.01	0.002	1.0	0.03
Blackbird Ck	2.5	5.5	0.11	0.00005	0.0021	0.85	0.02	0.004	2.6	0.08
Williams Ck	3.0	6.7	0.14	0.00006	0.0025	1.03	0.03	0.005	3.1	0.09
Deep Ck	4.1	9.1	0.18	0.00008	0.0034	1.4	0.04	0.006	4.3	0.12
Panther Ck below Blackbird Ck	20	44.6	0.90	0.0004	0.0165	6.89	0.2	0.031	20.8	0.60
Salmon R.- below Williams Ck	700	1,560	31.5	0.013	0.58	241	6.9	1.102	727	21.0
Salmon R- Below Panther Ck	1,300	2,875	57.9	0.024	1.07	445	12.9	2.046	1,350	39.0

(1) Toxicity Hazard Rating is a narrative description of toxicity assigned based on LC50 values according to the guidelines in M. A. Kamrin, *Pesticides Profiles: Toxicity, Environmental Impact, and Fate*, Lewis Publishers (Boca Raton, FL, 1997). Ratings: Very highly toxic 96hr LC50 <0.1 mg/L; highly toxic = 0.1-1.0 mg/L; moderately toxic = 1.0-10 mg/l, slightly toxic = 10-100 mg/L; not acutely toxic > 100 mg/L.

TABLE 4-18. Transport Material Information and Quantity of Material Required to Reach Aquatic Toxicity Levels in ICP Area Streams Simulating a Short Spill (lbs/min) (continued)

Material Information		Sodium Sulfide	Polymer Flocculent	Hydrochloric Acid	Methanol	Sodium Hypochlorite	Sodium Bisulfite	RO Scale Inhibitor	RO Alkaline Cleaner	RO Acid Cleaner
Toxicity Hazard Rating[1]		Highly Toxic	Not acutely toxic	Not acutely toxic	Not acutely toxic	Highly toxic	Not acutely toxic	Not acutely toxic	Slightly toxic	Not acutely toxic
Aquatic Toxicity (mg/L)		0.55	8,800	282	15,320	0.1	240	330	100	200
Source Information		Solvay MSDS 2003 No. 1003	NALCO MSDS 2004	HASA MSDS 2004	Kaviraj A. et al. 2004	PAN Pesticide Database	ClerTech MSDS	Accepta 2051 MSDS	EIS Team	EIS Team
Quantity/Trip (lbs) or (gal)		20-100 tons	20 gal	200 gal	250 gal	200 gal	250 gal	50 gal	3,000 lbs	3,000 lbs
Stream	Flow (cfs)	Quantity Required to reach toxic (Dry-lbs/min; Liquid-gal/min)								
Moccasin Ck	1.0	0.000005	0.05	0.11	11.3	0.0000	0.0810	0.1089	0.0001	0.0010
Blackbird Ck	2.5	0.0052	0.13	0.28	28.4	0.0001	0.2025	0.2723	0.0003	0.0025
Williams Ck	3.0	0.0062	0.16	0.34	34.0	0.0001	0.2430	0.3267	0.0003	0.0031
Deep Ck	4.1	0.0084	0.22	0.46	46.5	0.0002	0.3321	0.4465	0.0005	0.0042
Panther Ck below Blackbird Ck	20	0.041	1.08	2.26	226.8	0.0008	1.620	2.18	0.0022	0.02
Salmon R.- below Williams Ck	700	1.44	37.7	79.2	7,939	0.0269	56.7	76.2	0.0786	0.71
Salmon R- Below Panther Ck	1,300	2.68	70.1	147.1	14,745	0.0499	105.3	142	0.14	1.32

Note: (1) Toxicity Hazard Rating is a narrative description of toxicity assigned based on LC50 values according to the guidelines in M. A. Kamrin, *Pesticides Profiles: Toxicity, Environmental Impact, and Fate*, Lewis Publishers (Boca Raton, FL, 1997). Ratings: Very highly toxic 96hr LC50 <0.1 mg/L; highly toxic = 0.1-1.0 mg/L; moderately toxic = 1.0-10 mg/l, slightly toxic = 10-100 mg/L; not acutely toxic > 100 mg/L.

The occurrence of an accident (frequency) near a stream is generally greater than 100 years except for diesel (41 years), bulk concentrate (9 years) and cement (42-54 years). Bulk concentrate would not be soluble in the short (<6 months) term and treatment plant waste would physically behave like a heavy sand material not readily leaching any potential metals in neutral leaching conditions prevalent in area streams. The most toxic materials such as copper sulfate, superfloc, sodium sulfide, and sodium hypochlorite have low accident frequency near a stream that ranges between 311 to 6,220 years. Based on the material form and container there are 16 transported materials with a low spill risk, eight materials that have moderate spill risk, and three materials that have a high risk of spill should an accident occur. The information suggests that most materials have a low risk of spill and a spill frequency near a stream that is unlikely to occur during the life of the ICP project. The consequences of materials spilled are probably most harmful from a spill of either diesel or copper sulfate based on accident frequency, risk of spill, and aquatic toxicity.

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 (**Tables 4-16, 4-17, and 4-18**). If petroleum products (diesel, gasoline, oil, lubricants) were accidentally spilled, ESA-listed species and other 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 41 years based on current traffic and accident statistics. This suggests that an accident near a stream would be fairly rare (occurring once every 41 years). The amount of diesel fuel required to become toxic during a short spill event lasting 1 minute varies from 0.1 to 12.9 gallons per minute (**Table 4-18**). The range in quantity needed represents the difference in quantity needed for a small stream such as Moccasin Creek (0.1 gallons) and the quantity (12.9 gallons) for a larger stream like the Salmon River below Panther Creek.

Copper sulfate is the most toxic ($LC50_{96}$ of 0.005 mg/L) material that would be transported for the ICP. 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. Direct effects of a spill could be lethal resulting in decreased abundance of fish and other aquatic organisms. The recurrence interval for a spill of copper sulfate near a stream is projected to be 311 years, which suggests that an accident near a stream would be extremely rare. The amount of copper sulfate required to become toxic during a short spill event varies from 0.00002 to 0.024 lbs in the smallest and largest streams along the transportation route (**Table 4-18**).

The actual probability of an accident occurring along the transportation route that would affect streams, ESA-listed, 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 2 percent) in Big Deer Creek and Big Flat Creek (5 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 Little Deer and Blackbird Creeks, those changes are offset by larger decreases (3 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 2008) and nitrate and sulfate levels are not predicted to exceed primary (nitrate 10 mg/L) and secondary (sulfate 250 mg/L) drinking water standards outside of a mixing zone.

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 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 would 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 would be 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.

Habitat - 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 and discharge pipeline, 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 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 2010. 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 2 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 3 to 5 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 2010. 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 to meet cleanup goals and water quality standards as required by the Blackbird ROD 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. 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 and Panther Creeks 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. If copper levels exceed (as predicted in the 90th percentile) the cold water aquatic life chronic standard (3.5 μg/L) it is likely that resident rainbow and westslope cutthroat trout could avoid areas of Big Deer Creek downstream of the South Fork Big Deer Creek confluence.

Implementation of Alternative II or other action alternatives would require transport of hazardous materials to the Project. As described above, the risk of transporting hazardous materials would be minimized by use of comprehensive safety and spill response guidelines that would be employed during transportation. 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 and discharge pipeline, 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 2010. Alternative III would cause permanent decreases of about 3 percent during base flow periods in Big Deer Creek. Increased flow is predicted in Little Deer Creek (3 percent) and Big Flat Creek (5 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 3 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 2010. Change in base flow in Big Deer Creek during this period is expected to be less than 2 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 4-17)**. 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.

Sulfate concentrations in water treatment effluent are projected by the DSM to average about 400 mg/L with maximum concentrations (worst case, or 90th percentile conditions) of 840 mg/L. Upon full mixing with the stream, instream sulfate concentrations (average flow conditions) would be approximately 14 mg/L, far less than the water quality standard of 250 mg/L. Within the sulfate mixing zone, the ICP discharge would be diluted to meet the water quality standard of 250 mg/L established in the draft

NPDES permit. The actual length and width of the mixing zone would depend on the configuration of the effluent diffuser and on authorization of the mixing zone by IDEQ. According to IDEQ mixing zone policy (www.deq.**idaho**.gov/water/data_reports/surface_water/monitoring/**mixing_zone**s.cfm), in defining a mixing zone, several guidelines should be followed, including:

- The mixing zone should not interfere with existing beneficial uses.
- Water quality within a mixing zone may exceed chronic water quality criteria so long as chronic water quality criteria are met at the boundary of any approved mixing zone.
- Acute water quality criteria may be exceeded within a zone of initial dilution inside the mixing zone.
- The mixing zone may not be acutely toxic to biota significant to the receiving water's aquatic community.
- The mixing zone should be limited to 25 percent of the width and volume of the stream to allow a zone of passage for aquatic life.

For purposes of this impact evaluation, the mixing zone is evaluated assuming that the mixing zone does not exceed 25 percent of the width or volume of flow. Based on the nature of flow in Big Deer Creek (turbulent), it is estimated that the mixing zone would extend several hundred feet in length.

Sulfate concentrations within the regulatory mixing zone were estimated based on ICP discharge and ambient Big Deer Creek water quality and flow estimates from the DSM modeling. A summary of the basis for the estimates and resultant instream sulfate concentrations are provided in **Table 4-10**. At the point of discharge, sulfate concentrations immediately adjacent to the diffuser ports would be similar to the discharge, 400 to 840 mg/L. At the edge of the assumed regulatory mixing zone, sulfate concentrations would range from approximately 35 to 165 mg/L, during average conditions and low flow (7Q10) conditions, respectively.

Outside of the regulatory mixing zone after mixing with the entire volume of Big Deer Creek is achieved, sulfate concentrations in Big Deer Creek are predicted to increase from approximately 7 mg/L (baseline condition) to approximately 14 mg/L during average flow conditions and 54 mg/L during low flow (7Q10) conditions. An additional evaluation of mixing zone effects using the EPA CORMIX1 model was conducted for FCC (Telesto Solutions, 2008). This analysis predicts that sulfate concentrations would fall to less than 250 mg/L within 3 feet of the effluent diffuser and to less than 99 mg/L at the edge of the regulatory mixing zone.

Neither the State of Idaho nor EPA have promulgated criteria for sulfate to protect aquatic life, so the evaluation of sulfate effects is based on the best available science as described in the BA (Kuzis and Bauer, 2007). In summary, the No Observed Effect Concentration (NOEC) for an early life stage of a salmonid species of 1,060 mg/L is considered protective (BC Research 1998) and was used in the BA to evaluate the potential effluent toxicity to the listed species of fish that may occur in Big Deer Creek. Because peak instream sulfate concentrations are below the NOEC, no impact is expected from the mixing zone.

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 installation of the discharge pipeline to Big Deer 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 3 percent decrease in Big Deer Creek and a 2 to 4 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 2010. 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 3 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.

Consultation with NMFS and FWS on Fisheries

The Forest Service prepared a combined Biological Assessment and Biological Evaluation (BA/BE) on the DEIS preferred alternative (Alternative IV) (Kuzis and Bauer, 2007) that concluded that: "The proposed action is **LIKELY TO ADVERSELY AFFECT** federally threatened Snake River

spring/summer Chinook salmon, threatened Snake River basin steelhead, and threatened Upper Columbia River population segment of bull trout, and their spawning and rearing habitats within the middle Panther and Williams Creek watersheds." And that: "It has additionally been determined that the proposed action is **LIKELY TO ADVERSELY AFFECT** R4 sensitive westslope cutthroat trout fish and their habitats." Based on this conclusion, National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service both produced Biological Opinions (BOs) to address anadromous fisheries (NMFS) and bull trout (USFWS). The agency BOs are contained in Appendices E and F. These BOs identified Reasonable and Prudent Measures and specific Terms and Conditions required to reduce potential ICP impacts to the listed species to acceptable levels. These Terms and Conditions include measures to reduce impacts of road reconstruction on bull trout and a number of operational procedures, Best Management Practices (BMPs), monitoring and reporting requirements that would protect listed fish and their habitat.

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 Creek - 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 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.

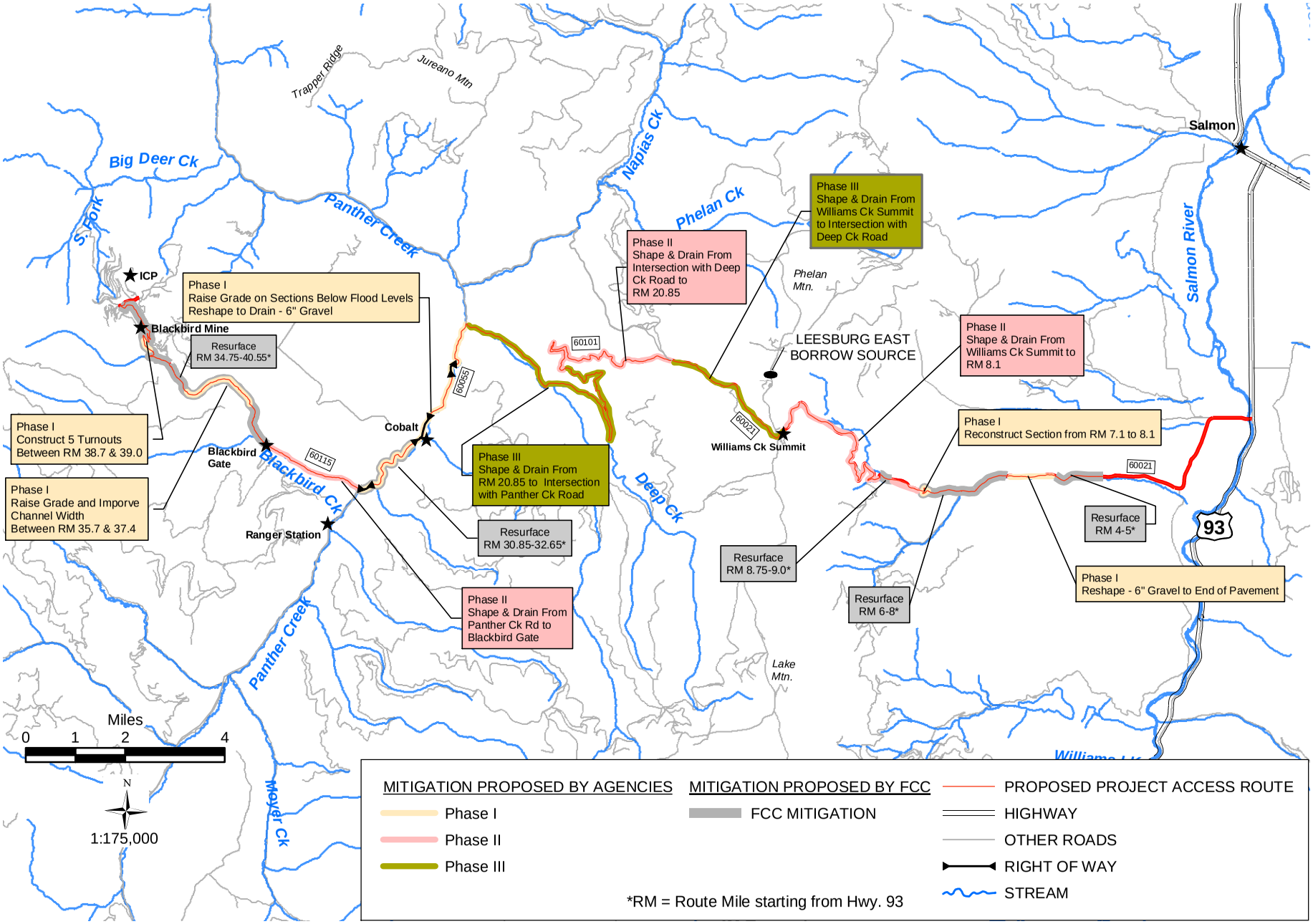
Access roads to the ICP site are currently managed for activities such as logging, fire suppression and recreation. The Blackbird Mine Site Group (BMSG) currently uses the Williams Creek route (FS#60021), Deep Creek Road (FS#60101), Morgan Ck - Panther Creek Road (FS#60055), and Blackbird Road (FS#60115) 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 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 5 miles south of Salmon. All of Williams Creek Road is in Lemhi County, entering the Salmon-Challis National Forest at mile post 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 BMSG water treatment plant and



IDAHO COBALT PROJECT FORMATION CAPITAL CORP. U.S. LEMHI COUNTY, IDAHO	**ACCESS ROUTE MITIGATION** **WILLIAMS CREEK ACCESS ROUTE** January, 2006	Figure 4-1

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 4-19**) to improve trafficability and to reduce sediment loads in streams.

TABLE 4-19. 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 4-20**). The Project would also use approximately 9.5 miles of existing road for occasional light vehicle travel. Approximately 4.5 miles of existing site roads which are not needed for the ICP would be reclaimed during the construction period, resulting in a net decrease in road density as a result of the ICP.

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 an 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 4-20. ICP Site Road Comparison

Alternative	Upgraded Existing Roads	New Roads	Existing Tertiary Roads (Not Upgraded)	Total Site Roads
II	3.2	2.6	9.5	15.2
III	3.1	5.7	4.4	13.2
IV	3.1	4.1	8.2	15.4
V	3.1	2.6	8.8	14.5

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 4-19**). 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 Creek – Panther Creek 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 Creek Road and Blackbird Creek Road.
2. Construct a new section of road on Williams Creek 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 inches 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 Creek Road, No. 60115 between M.P. 38.7 and 39.0 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 inches 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 Creek Road and place 6" of gravel from Morgan Creek – Panther Creek Road to the Blackbird gate.
2. Shape and drain the subgrade of Deep Creek Road, No. 60101, from the junction with Williams Creek Road to M.P. 20.85 and place 6 inches of gravel.
3. Shape and drain Williams Creek Road from Williams Creek 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 inches of gravel on Williams Creek Road between M.P. 12.45 and 12.85 and from Williams Creek Summit to the Deep Creek Road junction.
2. Place 4 inches of gravel on Deep Creek Road from M.P. 20.85 to the Morgan Creek – Panther Creek junction.
3. Place 4 inches 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 5.7 miles of new road would be constructed (**Table 4-20**). The Project would also use approximately 4.4 miles of existing road for occasional light vehicle travel. Approximately 7.5 miles of existing site roads not needed for the ICP would be reclaimed, resulting in a net decrease in road density.

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 4.1 miles of new road construction (**Table 4-20**). The Project would also use approximately 8.2 miles of existing road for occasional light vehicle travel. Approximately 7.5 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 2.6 miles of new roads constructed (**Table 4-20**). The Project would also use approximately 8.8 miles of existing road for occasional light vehicle travel. Approximately 7.5 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 4-20** 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 Salmon National Forest Plan. The Forest Plan preferred alternative in the FEIS (USDA Forest Service, 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 that: "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 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 1.7 miles of existing Tertiary roads (Alternative II) and constructing up to 1.44 miles of new Secondary and Tertiary road (Alternative IV). There would be 22 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 130 acres in MA 5B (**Table 4-21**). There would be 3.2 acres of disturbance in the West Panther Creek Roadless Area. There would be no need for changes to the Forest Plan.

TABLE 4-21. ICP Alternative Disturbance by Land Management Area

Land Use Management Area	Alt. II (Acres)	Alt. III (Acres)	Alt. IV (Acres)	Alt. V (Acres)
5B	130	324	115	111
West Panther Creek Roadless*	3.2	23.5	6.2	1.7

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 23.5 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 115 acres of disturbance in MA 5B. There would be 6.2 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 1.7 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 3. 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 around 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 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 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 fall 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 fall, 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 fall 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 around 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 1 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. 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 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 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 3 and contains the following information:

- The Salmon National Forest Land and 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 VQO 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 4 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. November, 2006.

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 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 Forest Service, 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 extent 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 would 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 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 4 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.
- Indirect short-term 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 would not be significant.
- 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 local 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 could 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 IV 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 V 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. 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; 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 similar to those under Alternative II with the exception that the water discharge pipeline and road to Big Deer Creek would not be utilized in Alternative III. Relocation of the TWSF under Alternative III would have no impact on heritage resource properties.

The access 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. 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 Alternative III would 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 both of these 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 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 similar to Alternative II with the main exception that the water discharge pipeline would be re-routed to avoid potential impacts to cultural sites. 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 also would be included in Alternative IV.

Alternative IV 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 IV and this road/pipeline alignment were selected, the site would be identified on the ground to ensure that it is avoided during proposed road reconstruction and pipeline installation.

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 and restoration activities at the Blackbird Mine site. Careful coordination between ICP activities (road use, powerline, etc.) and the Blackbird site activities will be required to minimize potential impacts. 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 (7,000 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 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.
- 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 as of 2007.
- BMSG Phase I and Phase II capture systems in Upper Bucktail Creek. The BMSG Phase I and II capture systems 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 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 during 2010.
- Pre-existing waste rock piles, roads and surface water channels.

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 expects 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 dry up lower Bucktail Creek a portion of the time.

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 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 the 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 40 to 45 percent. Reduction in 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, if 100 percent capture of the ICP mine chemical loads is necessary. 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 could 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 where it would be pumped back to the Blackbird Mine workings for treatment at the BMSG water treatment plant and discharged to Blackbird Creek. Although the amount of contaminant load reaching the BMSG pumpback system would be small, it might 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 may achieve up to 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. Although unlikely, a portion 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. However, as described in the Water Resources Technical Report Addendum (Hydrometrics, 2008), the probability of groundwater contaminants from the Ram Mine to commingle with the BMSG capture facilities is considered to be low since the majority (if not all) outflow from the Ram Mine is expected to occur from the north half of the workings. Only outflow from the extreme south end of the Ram Mine would have the potential to report to the BMSG capture facilities.

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. 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 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.

Likelihood of 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 (assuming complete capture of ICP mine loads is necessary). Groundwater flow reductions in this scenario are not anticipated to interfere with proper functioning of BMSG facilities.

As described above for Alternative II, any 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 where a portion of it would be pumped back to the Blackbird Mine workings for treatment at the BMSG water treatment plant and discharged to Blackbird Creek. Although the amount of contaminant load reaching the BMSG pumpback system would be small, it may 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 it were to occur. However, based on amendment of the backfill slash, it may be feasible to capture a sufficient portion of the Sunshine Mine groundwater load (less than 75 percent) to maintain post-mining metals loading rates to Bucktail Creek from the Sunshine Mine at pre-mining loading rates.

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. Although unlikely (as described under Alternative II), a portion 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 may 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.

Any remaining groundwater and chemical mass loads from the ICP that are not captured would flow to Bucktail Creek/lower Bucktail alluvium and a substantial portion of it 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 the implementation of an alluvial capture system would not expected to interfere with pipeline operation or achievement of water quality standards downstream of Bucktail Creek.

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 occur with 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 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 V 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 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. 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 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. A more detailed description of past impacts and ongoing cleanup activities is provided in Chapter 3 – Blackbird Mine Site History.

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, proposed and reasonably foreseeable activities in the vicinity of the ICP include road maintenance, mineral exploration, mine site restoration, small timber sales and livestock grazing. The following USFS projects include those that could affect the ICP study area which were noticed in SCNF 2006, 2007 and 2008 Schedules of Proposed Actions.

- Deep Creek Road Culvert Replacement - this USFS project would replace a culvert along the proposed ICP Access Route 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;
- Musgrove Exploration - this project would involve drilling of 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;

- SCNF Forest–Wide Weed Plan - describes procedures and priorities for weed control in the SCNF; and
- Moyer and Musgrove Creek Culvert Replacements - these USFS projects would replace culverts that act as a fish barriers.

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 project is targeted at improving fish habitat. The prescribed burn and firewood sales 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. Metal levels in South Fork Big Deer Creek, Big Deer Creek and Panther Creek are expected to consistently meet aquatic life standards in the next few years in accordance with requirements in the Blackbird ROD and based on water quality projections provided by the BMSG in the feasibility analysis (Allans, 2005).

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. It is reasonably foreseeable that the ICP will develop additional ore reserves during the life of the mine. A press release by FCC dated January 20, 2006 documents that ongoing exploration drilling since FCC submitted the ICP Plan of Operations has identified additional resources. The 2005 and 2006 drilling program is reported to have expanded the mineral resource from 2.57 million tons to 2.65 million tons.

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 road 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) 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 5,500 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 continue to be affected by historic Blackbird impacts and flows from the natural mineralized zones associated with the Blackbird, 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 2010 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 around) 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 have been reduced in the Upper Panther Creek watershed by the fencing projects that 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 continue to 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 and Panther Creek.

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 would have a net reduction of 4.5 miles of road in the Project area following closure and reclamation.

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.

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 decreased 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. Past mining, logging, livestock and road building activities have increased sediment loads throughout the Panther Creek Basin above baseline conditions. The livestock fencing projects on 4th of July and McGowen Creeks 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 7.5 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 decreased 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 livestock fencing projects are expected to 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 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.

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 ultimately 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 would be reduced in both the short-term and long-term due to road reclamation. Road density in Big Flat Creek would increase slightly in the short-term but would be reduced in the long-term due to road reclamation post-mining. Alternative IV would have a net reduction of 3.4 miles of road in the Project area during operations and 6.4 miles of reduction following closure.

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 decreased 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 livestock fencing projects are expected to 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 7.5 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 decreased 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 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 Forest Service, 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 Forest Service, 1993). **Table 4-22** shows the relationship of watershed risk with road density and watershed relief (i.e., steepness of slope greater or less than 30 percent).

TABLE 4-22. 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 4-23** shows the relationship between watershed risk and ECAs.

TABLE 4-23. 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 4-24**. 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 hydrologically 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 mile/square miles), except for Alternative III that would have a very small increase in the short-term (0.004 mile/square miles).

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 4-24. 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 and soil loss 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 Forest Plan 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 BMSG cleanup construction activities, a proposed mining exploration project and 500 acres of proposed logging fuelwood 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 drainage 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. Past higher levels of activity at the Blackbird and Bear-Track Mines, particularly the blasting and truck haulage associated with open pit mining, were accompanied by higher and more prolonged noise levels than those that will occur at the ICP.

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. Past mining (Blackbird and Bear-Track) and logging activities would have resulted in similar or higher traffic noise impacts.

Under Alternatives II through V, ambient noise levels would be met within 1 to 2 miles from most noise sources (**Table 4-12**). 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 4-12**). 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, and thinning. Currently, the ICP area proposed for development and adjacent land are in early stages of ecological succession following the Clear Creek 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. Approximately two tenths of an acre of non-jurisdictional wetlands would be directly impacted by Alternative II 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 BT-5 pipeline. This will likely cause a decrease in riparian wetlands along the Bucktail channel. Past mining, road building and remediation activities have impacted riparian zones in Bucktail, Big Deer and Blackbird Creeks. Mine waste deposits have altered channel geometry and likely reduced riparian wetlands. Remediation, including channel isolation, along sections of Blackbird Creek has eliminated portions of the riparian zone and whatever wetlands were historically associated with those stream reaches. Under Alternatives III, IV and V a road pullback along approximately 1.4 miles

of lower Blackbird Creek will increase the area of floodplain and could potentially add to streamside wetlands as water quality improvements allow.

Wildlife Resources

Past and future mining, logging and recreational activities have and will continue to impact wildlife and habitat both in the immediate vicinity of the ICP and regionally. 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.

The Clear Creek fire in 2000 resulted in the change of a large area of relatively mature forest to early seral stage forest types. Periodic fire has and will continue to be an important factor shaping wildlife habitat in the area.

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 sediment delivery. Blackbird Mine cleanup 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 to the existing chemical contamination. Although there will be some short-term increase in sediment production associated with construction activities, the proposed road reclamation under all alternatives is expected to have a benefit in relation to sediment production in the Panther Creek drainage.

Road and Access Management

Alternatives II through V all use the same Major Transportation routes (highways) and would increase ADT by 1 percent to 2 percent. Major transportation route traffic under Alternative I would likely 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. Currently proposed logging/timber management activities in the general area would result in small and short-term increases in traffic on the Project Access Route under Alternative I. There will be a small decrease in traffic on the portion of the Project Access route from the highway to Williams Creek summit when the Beartrack mine completes closure activities. 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. No Project Access Route improvements are currently scheduled, but the realignment of the Williams Creek Road near mile post 7 designed by the Forest Service is a long-term objective of the SCNF. 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 throughout the life of the Project 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 2.6

(Alternative II) and 5.7 (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 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. The ICP has indicated they will require up to 20,000 feet (3.8 miles) of new site road for continued exploration. This amounts to an additional total of 13.8 acres of disturbance. The location and timing of exploration road construction cannot be determined at this time. Any additional new roads will need to be approved on an as needed basis by the FS. Any new roads would be constructed using BMPs, would be required to not generate a net increase in sediment production, and would be reclaimed when no longer needed.

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. These improvements are not otherwise planned by the Agencies and would not be made under Alternative I. Therefore these road segments along Panther Creek would continue to be flooded under high stream flows. 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 of 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 and Resource Management Plan. Disturbance would primarily be in MA 5B. All alternatives would impact the West Panther Creek Roadless Area, with Alternative 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 Alternative III disturbance would be primarily land application areas. Tertiary roads would 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.

There may be additional temporary roads built in the West Panther Creek Roadless Area for further mineral exploration activity. These roads would be considered temporary under CFR 36 §294.11 (3) and would be reclaimed when no longer required.

Cleanup activity by the BMSG will continue into the foreseeable future, but additional incursions into the West Panther Creek Roadless Area are not anticipated.

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. Existing noise impacts include exploration drilling at the ICP and occasional drilling and construction activity associated with BMSG cleanup activity.
- 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. BMSG traffic noise will continue for an indefinite time and traffic noise associated with closure of the Bear Track mine will cease at final closure.
- Camper, fishermen, hunter, and tourist traffic will continue in the area and will experience increased traffic along the Williams Creek Access Route if the mine is built, particularly during shift changes at the mine.
- Hikers using the Deer Creek trail may notice the MPDES outfall along the creek.
- Access and hunting behind the Blackbird gate will continue to be prohibited.

Past mining at the Blackbird, particularly the pit in the Bucktail drainage, would have generated similar or greater traffic and noise levels as that projected for the ICP. Projected increased future demand for recreational opportunities will mean increased use of National Forest System lands including wilderness.

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).
- Lights may be visible at night from portions of the Frank Church River of No Return Wilderness, access trails, and other scenic vantage points.

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. Past mining activities at the Blackbird Mine would have had similar or greater noise and visual effects. Current and future Blackbird remediation work includes traffic and construction noise of a similar magnitude as would result from the ICP.

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 Beartrack and Blackbird construction work forces 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 (1 percent) long-term decreases in Big Deer Creek flows and increases in Big Flat Creek and Blackbird Creek flows. These changes are not 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 spring flows 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. Under all action alternatives surface disturbance would delay the ongoing recovery of vegetation that continues following the Clear Creek fire.

Wildlife

Short-term impacts would occur 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 4.5 to 75 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 mile post 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 Forest Plan 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 with 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 likely make the current Salmon area 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 but some portion of the mineralized zone would be left underground due to inefficiencies in the mining technique or economics. Approximately 7 percent of the metals in the ore would not be recovered during milling and would remain in the tailings.

Water Resources

Changes to groundwater quality in and around the flooded mine workings are unavoidable for all alternatives. Mining and backfilling will change the geochemistry in the vicinity of the mines 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.

Small and 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 action 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.

Small and 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 0.1 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 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. 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.

The possibility of a chemical or fuel spill during transport is possible under all action alternatives and, although of low probability, could result in significant short-term impacts to fisheries depending on circumstances.

Transportation

The ICP would convert certain SCNF lands to roads, although in the long-term there would be a net reduction in road miles. 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 Resources

There would be no significant adverse impacts to recreation resources under any of the alternatives.

Visual Resources

Although mine activities would be visible from a variety of locations on National Forest lands including the Frank Church River of No Return Wilderness, there would be no significant adverse impacts to visual resources under any of the alternatives.

Wilderness Resources

There would be no significant adverse impacts to 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, 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 of 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.

The Forest Service will require a bond or other financial assurance for the ICP Plan of Operations to assure completion of reclamation and restoration of surface resources. 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 has determined that the financial assurance will include a component to cover long-term 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.