CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter contains the Agencies' analysis of probable impacts to the human environment that would result from construction and operation of the proposed Rock Creek Mine and its associated facilities (the Project). It also contains the analysis of probable cumulative impact that would result from adding the proposed project to other existing and reasonably foreseeable activities in the project area and the Cabinet Mountains Wilderness, in the vicinity of Noxon, Montana. The following resource sections have been modified since the draft and/or the supplemental EIS. Many of these changes were made in response to public comments. All other sections had only minor changes, although cumulative impacts sections for many resources were revised to incorporate changes relative to newly included reasonably foreseeable actions described in Chapter 2.

Kootenai Forest Plan. *Use of GIS (geographical information system) mapping has generated more accurate numbers and slightly modifying the analysis.*

Geology. *The acid rock drainage section has been expanded and information from Klohn-Crippen report (1998) has been incorporated. Monitoring has been expanded and contingency mitigations, should ARD be identified, have been included. New information regarding variability of predicted ore removal rates and years of mine production has been added.*

Hydrology. *Effluent limits from the MPDES permit were incorporated into the Hydrology section along with new data on Troy Mine water quality. The MPDES permit and statement of bases have been revised (Appendix D). An alternate waste water treatment plan has been developed and analyzed for Alternative V. New information regarding low flow of the Clark Fork River and the TMDL for Rock Creek as well as any new water quality data collected since the draft EIS was released have been incorporated into the analyses. Additional analysis on the capabilities of the water treatment systems was included.*

Wetlands. *New wetlands mitigation sites have been developed/expanded and analyzed for Alternative V and agencies' 404 showing (Appendix F) has been revised based on the preferred alternative, Alternative V. The wetland mitigation plan has been revised to include contingency mitigations for potential mine-related impacts to wetlands in the CMW.*

Aquatics/Fisheries*. The listing of bull trout as a threatened species necessitated the preparation of a biological assessment for this species rather than a biological evaluation (see Appendix B). Bull trout analyses have been moved to the Threatened and Endangered Species section. Additional information regarding sedimentation impact and mitigations for those impacts has been included.*

Biodiversity. *Several major additions to the information base for plant species of special concern and wildlife species (harlequin ducks, fisher, lynx, and wolverine habitat) were obtained. The draft EIS had assumed a "worst-case analysis" based on limited available habitat and species population information. The analysis for lynx was moved to the Threatened and Endangered Species section because lynx have become a federally listed species. The additional information and revised analyses have resulted in changes in various wildlife* *mitigation and monitoring plans. Changes in old growth acreages resulted when calculations were generated from a GIS database rather than from manual measurements on maps.*

Threatened and Endangered Species. *Bull trout and lynx analyses have been moved to this section because of a change in status. Additional information and modeling on grizzly bears have been incorporated and analyses on other threatened or endangered species has been updated. The biological assessment for terrestrial species was revised (Appendix B) and it and the biological assessment for bull trout were submitted to USFWS. The biological opinion has been received and is included in Appendix E.*

Socioeconomics. *The entire socioeconomics section has been written to provide a more detailed and documented discussion of impacts. The analysis for Alternative I, the No-Action alternative, has been expanded. The analyses for all alternatives includes discussions regarding impact to Sanders, Lincoln, and Bonner counties. The cumulative impacts section has been expanded to more fully display what would happen if Rock Creek were permitted and operating and the Troy and/or Montanore mines then resumed operations.*

Scenic Resources. *Forest Plan VQOs during mine operation were eliminated as a result of review of Kootenai Forest Plan requirements.*

Assumptions for the Action Alternatives

Certain assumptions were made in the following discussions. The following assumptions are for the purpose of this analysis only. These assumptions are not intended to be the final projection of future activities that may or may not materialize in the area over the next 30 years.

Assumptions used by the Agencies to perform the impact analysis for Alternatives II through V include:

- Mining and reclamation technology would not change substantially throughout mine life.
- Labor, equipment, and/or market shortages/surpluses would not materially change projected levels of development.
- Impacts to copper/silver supply or demand are beyond the scope of this EIS.
- Mine production would last about 35 to 37 years. Exploration would last about 1 year and premining construction/development about 1.5 to 4.5 years. Although reclamation would be ongoing, postmining reclamation would last for 2 years. However, the tailings impoundment in Alternatives II to IV would be reclaimed as it consolidated and dried which could take more than 2 years. Life of the project is estimated to last about 30 to 36.5 years depending upon the actual amount of ore reserves and extraction rates compared to estimated reserves and rates. However, some monitoring or mitigation might continue several years after mine closure.
- The project would be initiated sometime within the next 8 years.

- The ***short-term*** impacts and uses 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 reclamation bond release. 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.*

- 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 started a "process" (chemical, biological, and/or physical) that could not be stopped. As a result, the resource, or its productivity, and/or its utility would be consumed, committed, or lost forever. Commitment of a resource would be considered ***"irretrievable"*** when the project would directly eliminate the resource, its productivity, and/or its utility for the life of the project. *These impacts are discussed at the end of this chapter only if they would occur to a given resource.*

- Qualitative terms are used to describe anticipated magnitude of impacts and, where appropriate, anticipated importance of impact to the human environment. ***"Significant"***, ***"potential to become significant"***, and ***"insignificant"*** describe importance (see Appendix A). *Impacts are considered to be insignificant unless identified otherwise.*

- ***Cumulative*** impacts are defined as collective impacts for the project when considered in conjunction with other past, present, and reasonably foreseeable activities. (These activities are described in Chapter 2.) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. *Cumulative impacts are discussed at the end of each resource impact section.*

Methodology

Methods used to gather data for impact analysis for all resource areas are on file at Kootenai National Forest (KNF) and the Montana Department of Environmental Quality (DEQ) and may be reviewed by any person or party.

PART 1: ANALYSIS OF IMPACTS BY RESOURCE

Impacts are addressed by alternative within each resource. Alternative I, the no-action alternative, has substantially different impacts than any of the action alternatives. *For all of the action alternatives, only those impacts that would differ from previous action alternative(s) are listed. The reader may assume then that all impacts listed under Alternative II would occur under the subsequent alternatives (III, IV, and V) unless otherwise stated. All impacts under Alternatives III and IV would occur under Alternative V unless otherwise stated.*

FOREST PLAN DIRECTION

Summary

The NFMA allows for changes in the Forest Plan. The KNF proposes changes to land management allocations from MA 11 (big game timber/winter range), MA 13 (old growth), and MA 14 (grizzly timber) to MA 23 (electric transmission corridor), and MA 31 (mineral development). These changes would be needed if the project were approved. This would be accomplished in one amendment. This change would identify the management allocation for these areas with their associated goals, objectives, standards and guidelines. Appendix O contains the amendment that describes the new MA 23 and 31 management areas. All alternatives would retain sufficient MA 13 acreage to be in compliance with the Forest Plan (see Biodiversity for effects on old growth-dependant wildlife).

The Kootenai National Forest Plan requires that proposed activities meet or exceed State water quality standards. Through a memorandum of understanding between the State of Montana and the U.S. Forest Service, the Forest Service has been designated as the management agency regarding water quality issues on National Forest Service lands. In this regard, the Montana Water Quality Act requires the protection, maintenance, or improvement of water quality to the level necessary to support beneficial uses. Both Rock Creek and the Clark Fork River are included on the State of Montana's 303(d) list of impaired water bodies. Any of the proposed actions need to prevent further degradation to the condition of the listed stream segment they flow into.

Alternative I

Under Alternative I, there would be no changes to the Forest Plan. Compartment 711 would retain the current amount of acreage managed for old growth (MA 13) (see Table 4-1). The Forest Plan requirement of 10 percent designated old growth would be met.

Acreage affected by roads is calculated differently for Forest Plan (MA 13) old growth (see Table 4-1) and effective old growth (see Biodiversity, Alternative I, Wildlife Habitat/Vegetation in this chapter). In the Forest Plan, roads are considered as part of the old growth acres (MA 13) (see Table 4-1). For effective old growth, roads are not considered as part of effective old growth acreages and are subtracted.

TABLE 4-1
Changes to Forest Plan Old Growth (MA 13) by Alternative

Old Growth Type	Alternative Number				
	I[1]	II	III	IV	V
Old Growth Acres	1032	990	1010	1020	1031*
Percent in Compartment 711	7.4	7.1	7.2	7.3	7.3
Replacement Old Growth Acres	650	645	648	650	650
Percent in Compartment 711	4.6	4.6	4.6	4.6	4.6
Total MA 13 Acres	1575	1528	1551	1563	1574
PERCENT MA 13 (TOTAL)	12.0	11.7	11.8	11.9	11.9

Source: Kootenai National Forest 1997. (GIS database)
1 This column contains existing acreages and percentages of old growth.
Notes: There are 14,029 acres in Compartment 711 below elevation 5,500 feet.
Percentages do not add directly due to rounding.
* Less than one acre (0.4 acre) is physically removed along the utility corridor below the mill.

Under Alternative I, no mining-related activities would occur and there would be no additional peakflow or ECA increase over existing conditions. No additional degradation or improvement in water quality would occur within the Rock Creek watershed. There would be no change in water quality to the Clark Fork River from implementation of this alternative.

Alternative II

Timber sale offerings by the KNF in the Rock Creek drainage requires NEPA analysis to ensure that grizzly bear habitat is maintained at or above Forest Plan levels in these Bear Management Units (BMU). Under this alternative, timber sale offerings may be highly restricted.

Mining activities will be encouraged under the appropriate laws and regulations and according to the direction established by the Forest Plan. While mineral exploration is an authorized use within these management areas (MAs), large scale mining development would reduce the area available for providing either grizzly bear or old growth dependent species habitat. MA mitigation measures (revisions) to be implemented by KNF are discussed below.

The proposed evaluation adit would convert about 10 acres of grizzly timber (MA 14) to mining uses for 1 year, and would permanently cover about 4 acres of grizzly habitat with waste rock.
The proposed mine exploration adit, mine conveyer and air intake ventilation adits, mill site, and that part of the tailings impoundment on NFS lands would be incompatible with all or part of the management requirements of MAs 11, 13, and 14.

The road and/or utility corridor (including the proposed widening of FDR No. 150 to the mill site, the construction of water and tailings pipelines, mine access road, and 230 kV powerline) would disturb about 96 acres for over 30 years. The utility corridor would cross MAs 11, 13, and 14. (Rights-of-way for powerlines and pipelines may be authorized on a case-by-case basis in these MAs).

The proposed tailings impoundment would disturb about 324 acres. Only a portion of this land is managed by KNF (about 69 acres in MA 11); the remainder is owned by Sterling and has been partially logged.

About 0.1 acre would be permitted for an air intake ventilation adit on the north face of Saint Paul Peak, within the Cabinet Mountains Wilderness (CMW) (MA 7). The CMW is managed to keep the imprint of humans substantially unnoticeable and to allow ecosystems to operate naturally. The applicant has established valid mineral rights by having acquired mineral patents, giving the company subsurface mineral ownership within the CMW.

Twenty-four acres of old growth (MA 13) would be directly affected by timber removal in order to access the borrow materials in borrow areas 2 and 3 (see Figure 2-13). These areas are located on either side of FDR No. 150B adjacent to Rock Creek. There would be sufficient MA 13 remaining after implementation of Alternative II to remain in compliance with the Forest Plan Standard.

Management Area Revisions

Mining activities would require changes to the Forest Plan by KNF. Under this alternative, KNF would amend the Forest Plan by changing management area allocations on 201 acres of National Forest System (NFS) lands managed for big game winter range (MA 11), old growth (MA 13), and grizzly timber (MA 14) (USFS KNF 1987) (see Tables 4-1 and 4-2).

Under Alternative II, Sterling's proposal would be permitted. Peakflow and ECA increases would remain within Forest Plan standards and a limited amount of mitigation work would occur within the Rock Creek watershed. This amount of mitigation would be enough to maintain the existing conditions but not improve upon them. Water quality conditions in the Clark Fork River would be met by the proponents by meeting the requirements of the MPDES permit.

Alternative III

Management Area Revisions

Under Alternative III, changes in the utility corridor and mine access road locations would result in revisions to MAs 11, 13, and 14 (see Tables 4-1 and 4-2).

KNF MA revisions would reallocate 197 acres (see Table 4-1). Twenty-two acres of MA 13 would be removed for development of a borrow area (B-3), located on along FDR No. 150B, adjacent to Rock Creek (see Figure 2-13). This 22 acres would be redesignated as MA 11. The Forest Plan standard for MA 13 would be met.

Under Alternative III, the Agencies have modified the proposed action and additional mitigations would occur. With respect to the Forest Plan for peak flow and ECA increases, this alternative is essentially the same as Alternative II. The amount of mitigation would be the same as Alternative II but additional monitoring would occur. The existing water quality conditions in Rock Creek would continue with very little improvement. Water quality conditions in the Clark Fork River would be met by the proponent by meeting the requirements of the MPDES permit.

Alternative IV

Management Area Revisions

Under Alternative IV, shorter road and utility corridors and the lower mill site would result in fewer KNF revisions to MAs 11, 13, and 14 (see Tables 4-1 and 4-2). The Forest Plan standard for MA 13 would be met.

Under Alternative IV, the Agencies have modified the proposed action and have included more mitigations than those for Alternative III. The most notable mitigations affecting water quality include the relocation of the mill site to the confluence area, and the implementation of a 300-foot stream buffer along the mill site. With respect to the Forest Plan for peak flow and ECA increases, this alternative remains within the Forest Plan standards. The existing water quality conditions in Rock Creek would continue with a moderate amount of improvement due to the additional mitigations. Water quality conditions in the Clark Fork River would be met by meeting the requirements of the MPDES permit.

Alternative V

Under Alternative V soil borrow sites along FDR No. 150B would not be needed, thus resulting in fewer KNF revisions to MA 13 and 14. Because of the paste plant, a few more acres of MA 11 would be impacted (see Tables 4-1 and 4-2). Proposed management area amendments to the forest plan are shown on Figure 4-1. The Forest Plan standard for MA 13 would be met.

Under Alternative V, the Agencies have modified the proposed action and have included additional mitigations than those for Alternative IV. The most notable mitigation affecting water quality includes the sediment reduction plan which requires all the sediment reduction activities to be completed within the Rock Creek watershed. The existing water quality conditions in Rock Creek would begin an immediate improvement as the sediment reduction plan was implemented during the first stages of mine development. With respect to the Forest Plan for peak flow and ECA increases, this alternative disturbs the least amount of acres of all the alternatives and remains within the Forest Plan standards. Water quality conditions in the Clark Fork River would be met by the requirements contained in the MPDES permit. The deposition of mine tailings as a paste rather than as a slurry will also reduce seepage to ground water and enhance stability.

TABLE 4-2
Acres of NFS Lands to be Reallocated

Present Management Area	Areas reallocated to MA 31 - Mining				Areas reallocated to MA 23 - Utilities				Areas reallocated to MA 11 - Big Game				Total Acreage Reallocated			
	Alt. II	Alt. III	Alt. IV	Alt. V	Alt.II	Alt. III	Alt. IV	Alt. V	Alt.II	Alt. III	Alt. IV	Alt. V	Alt.II	Alt. III	Alt. IV	Alt. V
MAs suitable for timber harvest																
MA 11 Big Game Winter[2] Range Timber	67	67	67	74	10	20	20	24	0	0	0	0	77	87	87	98
MA 14 Grizzly Timber[2]	52	60	43	34	25	26	14	14	0	0	0	0	77	86	57	48
MAs unsuitable for timber harvest																
MA 13 Old Growth [1,3]	24	8	0	0	11	5	1	1	12	11	11	0	47	24	12	1
Total Acres to be Reallocated	143	135	110	108	46	51	38	39	12	11	10.4	0	201	197	156	147

Source: U.S. Forest Service KNF 1997.

1 Old growth acreage is acreage physically impacted along with an area between the mill and mine portals. For effective old growth habitat disturbed, see Biodiversity.
2 Suitable for timber harvest.
3 Unsuitable for timber harvest.

MA = Management Area

Note: Roads through each MA are included in MA acreage calculations.

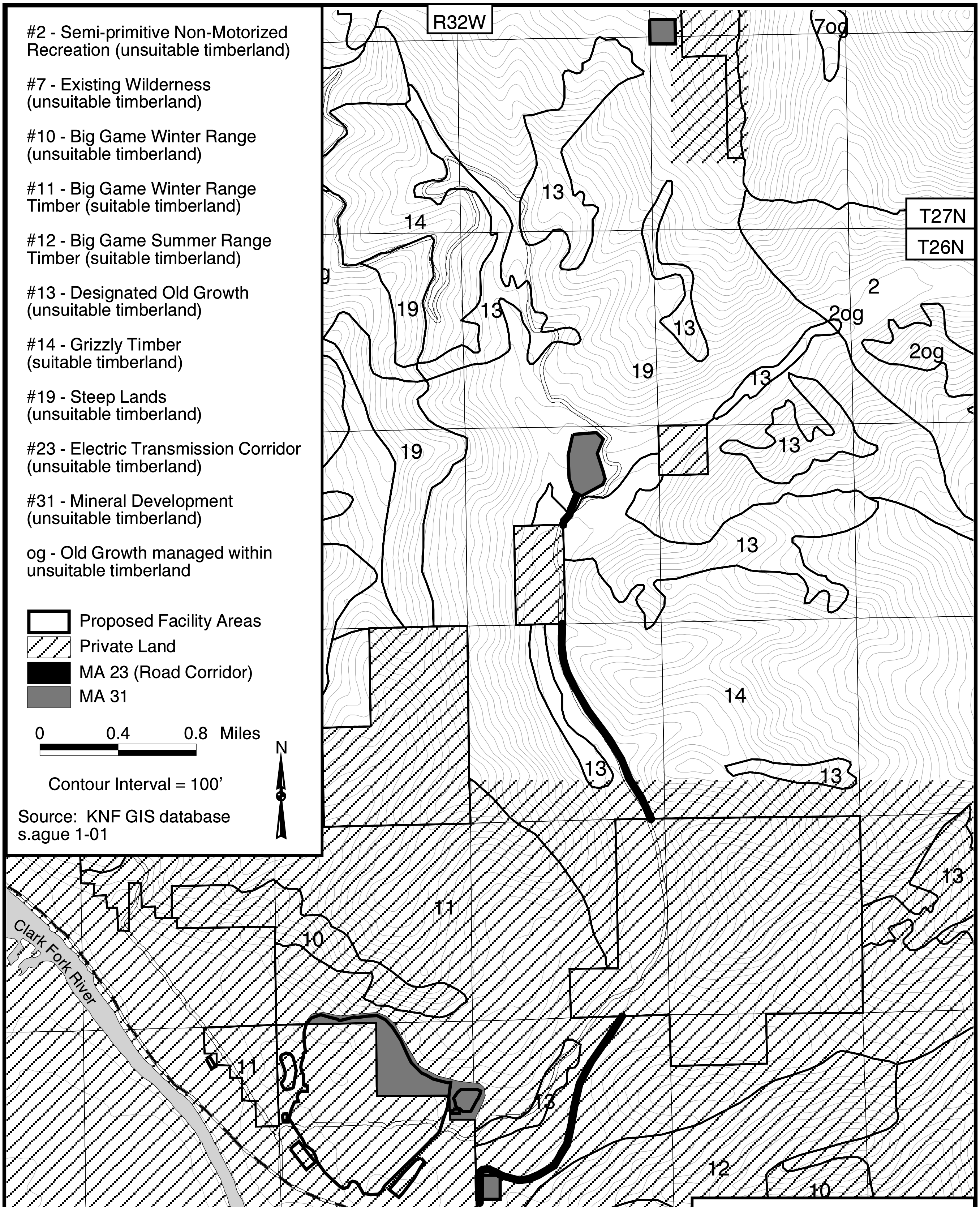

FIGURE 4-1
Forest Plan Amendment
Management Areas 23 and 31
Alternative V
Rock Creek Project

CLIMATE

Mining of the project under all alternatives would not have a detectable effect on the climate of the area. The amount of air pollutant emissions would be too small to affect precipitation or radiation balance.

AIR QUALITY

Summary

Based on anticipated air pollutant emission levels and corresponding analyses under all action alternatives, the overall impact to air quality in the area, including the wilderness area, would be minor. If the Class I increment were triggered for NO_2, Sterling could potentially consume 96% of the Class I increment for NO_2 assuming the mine were operated continually at the maximum level allowed. There would be a relatively small, localized increase in particulate and gaseous pollutants at the mill site and tailings impoundment areas. Air pollutant levels should remain well below state and federal ambient air quality standards. Sterling would implement an ambient air monitoring program. Following completion of operations, air quality conditions would return to near-current levels assuming adequate revegetation success.

Alternative I

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

Alternative II

Air pollutant emissions associated with the operation would originate primarily from three distinct sources: 1) the underground mine with the exhaust ventilation adits being the points of emission discharge (initially the service adit and later primarily the evaluation adit), 2) the mill site, and 3) the tailings impoundment. Table 4-3 lists the estimated emissions from the project, including the emission control equipment and practices that would be used.[1]

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[1]Experience and data gained from the Troy Mine and other similar mines have been used in this air quality analysis. However, the Troy Mine permit was issued in 1979. At the time, emission calculations were not placed in permits and permits were issued for specific pieces of equipment not for the site. It would be very difficult, if not impossible, to calculate a number that you can compare with the numbers that have been calculated as potential emissions in the EIS for the Rock Creek Mine.

TABLE 4-3
Estimated Pollutant Emission Inventory and Emission Controls for the Proposed Rock Creek Mine
Alternatives II, III, and IV

Source/Activity	Pollutant	Uncontrolled Emissions (tons/year)	Type of Control Equipment/Practice	Estimated Control Efficiency (percent)	Controlled Emissions (tons/year)
Blasting	TSP	0.2	Stemming. Drill Hole Size Optimization. Rubble Watering.	--	0.2
	NOx	12.8	Control Overshooting.	--	12.8
	SO^2	1.5	Control Overshooting. Low Sulfur Fuel Oil.	--	1.5
	CO	50.3	Control Overshooting	--	50.3
Diesel Equipment	TSP	4.1	Particulate Matter Trap Renewal: Low Ash Fuel.	--	4.1
	NOx	132.3	DATA Engines[1]	65	46.3
	SO_2	8.4	Low Sulfur Diesel Oil	--	8.4
	CO	25.4	Frequent Tune-ups to Manufacturer's Specs	--	25.4
	HC	9.4	Frequent Tune-ups to Manufacturer's Specs	--	9.4
			Evap. Control System Maintenance	--	
Space Heating	TSP	0.2	Use Propane, Routine Maintenance Schedule	--	0.2
	NOx	5.0	Maintain Near-Stoichiometric Atmosphere	--	5.0
	CO	1.2	Maintain Near-Stoichiometric Atmosphere	--	1.2
	HC	0.2	Routine Fuel Delivery and Burner System	--	0.2
Primary Crushing	TSP	820.0	Inspection/Renewal	98	16.4
Secondary Crushing	TSP	1,735.0	High Efficiency Wet Scrubber High Efficiency Wet Scrubber	98	34.7
Convey, Storage and Transfer of Ore and Concentrate[2]	TSP	1,180.0	Enclosed Bins (Storage) Enclosed Conveyors Baghouses (3) on Vents for Bins/Conveyors	90 90 99	11.8
Road Dust	TSP	----	Paving	--	Neg.
Tailings Impoundment	TSP	59.2	Ponding, Sprinklers	50	29.6

Source: TRC Environmental Consultants, *In* ASARCO Incorporated 1987-1997.

Note: The service adit is the emission point for blasting, diesel equipment, space heating, and primary crushing.
[1] DATA - Direct Injection Turbo - Charged Aftercooling
[2] This represents a combination of sources - the emission points are the tower vent, the ore bin vent and the ore silo vent

Total estimated emissions by pollutant type from the project are as follows:

Total suspended particulate (TSP)	=	97.0 tons per year
Nitrogen oxides (NOx)	=	64.0 tons per year
Sulfur dioxide (SO_2)	=	9.9 tons per year
Carbon monoxide (CO)	=	76.9 tons per year
Hydrocarbons (HC)	=	9.6 tons per year

As part of the original air quality permit application, the applicant used EPA's Complex I and Industrial Source Complex (ISC) computer simulation models to predict TSP, PM-10 (particulate matter less than 10 microns), and NOx concentrations resulting from the project. The ISC model was used to predict TSP and PM-10 impacts near the proposed tailings area and the Complex I model was used for TSP, PM-10, and NOx from the proposed mine and mill area. A rectangular receptor grid 5 by 5.5 kilometers, centered in the proposed plant complex, was used for the Complex I model, with a receptor spacing of 500 meters. Additional receptors were located along the permit boundary. A rectangular array of receptors 1.8 kilometers by 1.8 kilometers with 200-meter spacing, centered on the proposed tailings area, was used with the ISC model.

An analysis of visibility impacts was also done using EPA's Level 1 and Level 2 screening techniques. Contrast parameters were computed to be less than criteria set by EPA, indicating that there would be no perceptible contrast change or general haze at the Cabinet Mountains Wilderness Area (CMW). The reduction in visual range was also predicted to be below perceptible levels. Infrequent, episodic events, such as high winds causing erosion of the tailings surface, could cause minor, short-term visual impacts from dust plumes that could be visible from the CMW and other areas.

Table 4-4 lists the modeling results. The maximum predicted concentration values include measured and assumed baseline concentrations. Applicable state and federal standards are included for comparison. All predicted concentrations are well below the applicable standards. Updated modeling was prepared as part of the air quality permit application review process. The results can be seen under Alternative V.

Concentrations of potentially toxic trace metals in the particulate emissions were also analyzed. Specific metals included were lead, arsenic, cadmium, antimony, chromium, zinc, copper, and iron. This type of analysis is required for most large mining operations to identify whether any of these metals are present in sufficient quantities in the ore and/or tailings to create a hazardous condition from airborne particulate levels. The modeled TSP concentrations were multiplied by the mass fraction (percentage) of each metal in the ore and tailings. (Metals contents were based on data from the Troy Mine Project.) The resulting metals concentrations were then added to the measured background levels in the area. Predicted concentrations of lead are well below state and federal ambient air quality standards. There are no standards for the other metals. Concentrations for those metals are therefore compared against guideline values used by the Montana Air and Waste Management Bureau. All concentrations were predicted to be below the guideline values.

TABLE 4-4
Comparison of TSP Modeling Results with Ambient Air Quality Standards Alternatives II, III, and IV

Source	Averaging Time	Max. Predicted Concentration (ug/m^3)	Federal Standard (ug/m^3)	Montana Standard (ug/m^3)[1]
Mine/Mill	Annual (geom)	30.2	60	--
	Annual (arith)	36.9	--	75
	24-Hour	91.5	150	200
Tailings	Annual (geom)	15.7	60	--
	Annual (arith)	22.7	--	75
	24-Hour	34.1	150	200

Comparison of PM-10 Modeling Results with Ambient Air Quality Standards

Source	Averaging Time	Max. Predicted Concentration (ug/m^3)	Federal and Montana Standard
Mine/Mill	24-Hour	107.4	150
	Annual (arith)	24.2	50
Tailings	24-Hour	58.6	150
	Annual (arith)	16.7	50

Comparison of NO^2 Modeling Results with Ambient Air Quality Standards

Source	Averaging Time	Max. Predicted Concentration (ug/m^3)	Federal Standard (ug/m^3)	Montana Standard (ug/m^3)
Mine/Mill	Annual (arith)	21.1	100	100
	1-Hour	319.9	---	566

Source: TRC Environmental Consultants, Inc. 1987.
Note: [1]ug/m^3 = micrograms per cubic meter

As part of the original air quality permit application review, the Montana Air and Waste Management Bureau has reviewed and approved the above-referenced analyses. Proposed emission control practices (see Table 4-3) were determined to represent Best Available Control Technology as required by the Montana Air Quality Rules. Under the original air quality permit application, performance testing of specific control equipment and ambient air quality monitoring would be required as a condition of the air quality permit.

A specific air quality concern is the potential for wind erosion from the tailings impoundment area. If tailings surfaces were allowed to dry, there would be a significant potential for wind erosion to occur, given the fine texture of tailings material. The impoundment would be designed such that a third of the surface would be completely submerged at all times. The remainder, along with the impoundment face, would have a water-sprinkling system for dust control. Naturally occurring precipitation would also provide some measure of dust control. The factors noted above, as well as average meteorological conditions, were used in estimating potential wind erosion emissions. Even with these controls, some wind erosion may occur during high wind conditions; however, particulate levels should remain well below the applicable ambient air quality standards and should not cause a nuisance from blowing dust. The overall efficiency of control would depend primarily on the company's diligence in maintaining a wetted surface. The adequacy of this control would be evaluated through ongoing ambient air quality monitoring and visual observation. Other wind erosion control measures that the company may use or that may be required by the Agencies in the future, based on the evaluation noted above, may include:

1. The establishment of a temporary vegetative cover on portions of the tailings surface and embankment;

2. chemical stabilization of some areas;

3. upgrading of the sprinkler system to provide more extensive coverage and water availability; and

4. development of a detailed sprinkler operating plan that would be updated as the tailings surface expanded. This may include specific record-keeping requirements such as times of sprinkler operation and the amount of water used. A minimum threshold wind speed, above which sprinkling would be required, could also be developed.

When the Troy permit was issued, it was believed that because of the moisture content in the tailings and the amount of moisture that fell in that area, there would be no dust problems. However, problems did occur and the operator put a sprinkling system in place. Of course, there's still a potential for a high wind occurrence that may cause a dust problem.

The Rock Creek air quality permit will be issued for Alternative V so this scenario would not apply. However, if the air quality permit was issued for Alternative II, the permit would contain requirements for a sprinkling system to resolve the wind blown dust issue.

Another specific concern is the potential air quality impact to the CMW. This area is designated as Class I under the Prevention of Significant Deterioration (PSD) regulations as described in Chapter 3, Air Quality. The review of PSD requirements is carried out primarily through the analysis of permit applications for "major stationary sources." The Rock Creek Project is not classified as a major stationary source because potential emissions by individual pollutant type are less than 250 tons per year. Although the source is not a major stationary source, many of the specific major stationary source requirements have been applied. These include 1) preconstruction and postconstruction ambient air monitoring, 2) computer simulation modeling of emission impacts, 3) an analysis of visibility impacts, and 4) the application of Best Available Control Technology to emission sources.

Table 4-5 lists modeling results showing the maximum predicted pollutant increases in the wilderness area. The corresponding PSD allowable Class I increments are also shown for comparison purposes although the Montana DEQ does not believe they are directly applicable to the project.

Construction activities, primarily on the tailings impoundment, have a high potential for fugitive dust emissions. Work areas and temporary haul roads would be watered or chemically stabilized to control these emissions, and topsoil storage areas would be promptly revegetated to minimize wind erosion. Paving FDR No. 150 would alleviate dust problems associated with haul trucks on the gravel road. Slash burning related to construction activities would be regulated under the open burning provisions of the Montana Air Quality Rules.

TABLE 4-5
Maximum Predicted Increases in Class I Area
Alternatives II, III, and IV

Pollutant	Averaging Time	Increase (ug/m^3)[1]	Allowable Increment (ug/m^3)
TSP	24-Hour	4.2	10
	Annual	0.4	5
NO_2	Annual	0.7	2.5

Source: TRC Environmental Consultants, *In* ASARCO Incorporated 1987-1997.
Note: [1]ug/m^3 = micrograms per cubic meter

Development of the evaluation adit would cause short-term particulate and gaseous emissions similar to development of the primary adits. Additional emissions, primarily nitrogen oxides, would result from onsite diesel generators. Use of the adit for exhaust ventilation in the future would not increase project emissions but would shift some of the emissions location from the mill area to the evaluation adit area. Additional emissions from power generators and the ventilation emissions would not occur at the same time. These impacts would be minor.

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

Alternative III

Mitigations proposed under other disciplines would not appreciably affect the air quality impacts described under Alternative II. The use of the alternative rail loadout at Miller Gulch would result in a shift of the relatively minor amount of emissions associated with this activity. The use of a modified centerline construction method for the tailings impoundment increases the amount of exposed tailings surface due to delayed reclamation of the embankment face. This would result in a higher potential for wind erosion during the 7 years of centerline construction.

Alternative IV

There would be a slight increase in particulate emissions associated with the alternative mill site. This would result from the additional waste rock handling needed. The emission points and impacted areas would change corresponding to the new location of the mill. Neither the slight changes in emissions or the relocation of emission points would substantially alter the overall air quality impacts of the project.

Alternative V

Several components of Alternative V would reduce air pollutant emissions and resulting impacts. The following describes these:

1. Paste Technology Tailings Management - A tailings paste with a much lower water content than a slurry would be generated. This allows for alternative construction methods. Paste tailings would be deposited in panels with some concurrent reclamation and reduced exposed tailings area reducing the potential for wind erosion.[2] There is a vegetation mitigation to add seed to paste to help provide interim revegetation and help with dust control.

2. Electric Underground Mining Equipment - Most underground mobile equipment would be electric powered. The diesel fueled equipment would be cleaner burning. Air pollutants reductions of about 60 percent are estimated from these changes.

3. Propane Generators - Two cleaner burning propane generators (545 kW and 735 kW) would be used during the evaluation adit development phase of the operation.

4. Concentrate Slurry - Processed concentrate would be transported from the plant site to the Miller Gulch rail siding by slurry pipeline rather than by haul trucks, eliminating the emissions associated with hauling.

5. Semi-Autogenous Grinding (SAG) Mill - The surface dry milling operation (secondary crushing) would be replaced by a fully wet milling operation (SAG mill), reducing particulate emissions.

Appendix C contains a copy of the Department Decision on the air quality permit application for this project. The applicant submitted revisions to the air quality permit application on March 28, 1997, May 29, 1997, and July 24, 1998. These revisions correspond to Alternative V. More detailed information on the following items can be found in the Department Decision and the revised air quality permit application (TRC Environmental Consultants, Inc. 1997).

Total estimated emissions (tons per year) by pollutant type from the production phase and the evaluation adit development phase (propane generators) are shown in Table 4-6. Production phase and evaluation adit development emissions would not be generated concurrently. Table 4-7 summarizes the estimated emissions and emission control practices for the production phase of the project.

Computer dispersion modeling (BEEST-X model) was used to predict PM-10, NO_x, and SO_2 concentrations resulting from this operating scenario. The results are included in Table 4-8 and indicate compliance with state and federal ambient air quality standards. Table 4-9 compares the modeling results to prevention of significant deterioration (PSD) increments. An updated visibility analysis was also done. The estimated reduction in visual range caused by plumes was estimated at 0.015 percent compared to the commonly accepted limit of perceptible visual range reduction of 5 percent. The VISCREEN model was used to estimate the potential impact of a plume resulting from individual emission sources. No screening criteria were exceeded in this level 2 analysis.

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[2] Because of the paste technology, dust control problems are not anticipated. So the lack of saturated tailings will not increase operational dust concerns. The paste technology itself was proposed to decrease the potential dust problem. It is stated that revegetation will occur. The air quality permit will not require the revegetation.

TABLE 4-6
Total Estimated Emissions (Tons per year)
Alternative V

	Production Phase	Evaluation Adit
PM-10	5.6	--
NOx	29.9	8.06
SO_2	1.8	--
CO	98.1	83.4
HC	3.4	4.5

Source: TRC Environmental Consultants, Inc. 1997
-- Not Applicable

TABLE 4-7
Estimated Pollutant Emission Inventory and Emission Controls
Alternative V

Source/Activity	Pollutant	Uncontrolled Emissions (tons/year)	Type of Control Equipment/Practice	Estimated Control Efficiency (percent)	Controlled Emission (tons/year)
Blasting	PM-10 NOx SO_2 CO	0.3 19.4 1.5 92.5	Stemming, Drill Hole Size Optimization, Rubble Watering Control Overshooting Control Overshooting, Low Sulfur Fuel Oil Control Overshooting	-- -- -- --	0.3 19.4 1.5 92.5
Diesel Equipment	PM-10 NOx SO_2 CO HC	-- -- -- -- --	Particulate Matter Trap Renewal: Low Ash Fuel DATA Engines[1] Low Sulfur Diesel Oil Frequent Tune-ups to Manufacturer's Specs Frequent Tune-ups to Manufacturer's Specs Evap. Control System Maintenance	-- -- -- -- -- --	0.1 5.0 0.3 4.8 3.2
Space Heating Propane Comb.	PM-10 NOx CO HC	0.1 3.5 0.8 0.2	Use Propane, Routine Maintenance Schedule Maintain Near-Stoichiometric Atmosphere Maintain Near-Stoichiometric Atmosphere Routine Fuel Delivery and Burner System Inspection/Renewal	-- -- -- --	0.1 3.5 0.8 0.2
Primary Crushing	PM-10	15.0	High Efficiency Wet Scrubber	98	0.3
Surface Milling	PM-10	--	Wet Process	--	Neg.
Ore transfer	PM-10	106.2	Baghouse	99	1.1
Road Dust	PM-10	---	Paving	--	Neg.
Tailing Impoundment	PM-10	--	Paste Tailings, Concurrent Reclamation	--	3.7

Note: The service adit and later the evaluation adit are the emission points for blasting, diesel equipment, space heating, and primary crushing.
[1]DITA - Direct Injection Turbo-Charged Aftercooling
-- = Not Applicable

TABLE 4-8
Comparison of Maximum Predicted Concentrations
With National And Montana Ambient Air
(Production Scenario)
Alternative V

Time Interval	Maximum Contribution $\mu g/m^3$	Background Concentration $\mu g/m^3$	Contribution Plus Background $\mu g/m^3$	MAAQS/ NAAQS $\mu g/m^3$
PM_{10} 24-hour[a]	5.16	41.20	46.4	150
PM_{10} Annual [b]	2.00	10.54	12.54	50
SO_2 1-hour	257.1	35.0	292.1	1,316
SO_2 3-hour	67.09	26.0	93.1	1,300
SO_2 24-hour	12.16	11	23.2	263
SO_2 Annual [b]	0.52	3	3.52	53
NO_2 1-hour	--	--	0.159 ppm	0.30 ppm
NO_2 Annual [b]	--	--	7.17	100

(a) 24-hour concentration expressed as high, second-high values.
(b) Annual modeled contributions expressed as arithmetic mean.
$\mu g/m^3$ microgram per cubic meter
ppm parts per million

TABLE 4-9
Comparison of Maximum Modeled Concentrations
With Applicable PSD Increments
Alternative V

Pollutant	Time Interval	Class I Predicted Concentration $\mu g/m^3$	Class II Predicted Concentration $\mu g/m^3$	Class I Increment $\mu g/m^3$	Class II Increment $\mu g/m^3$
PM_{10}	24-hour	1.3	5.16	8	30
PM_{10}	annual	0.075	2.00	4	17
SO_2	3-hour	16.5	67.09	25	512
SO_2	24-hour	3.36	12.16	5	91
SO_2	annual	0.19	0.52	2	20
NO_2	annual	2.41	4.74	2.5	25

$\mu g/m^3$ = micrograms per cubic meter

TABLE 4-10
Comparison of Maximum Modeled Concentrations
With National and Montana Ambient Air and PSD Increments

Time Interval	Contribution Plus Background ($\mu g/m^3$)	MAAQS/NAAQS	Class I Predicted Concentration ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)
NO_2 1-hour	0.222 ppm	0.30 ppm	–	--
NO_2 Annual[b]	17.3	100	1.62	2.5

[a] 24-hour concentration expressed as high, second-high values
[b] Annual modeled contributions expressed as arithmetic mean

Computer Dispersion modeling (ISCT3) was used to predict NO_x, CO, and NMHC concentrations during the evaluation adit development phase. The pollutant of concern is NO_x. The results included in Table 4-10 indicate compliance with the state and federal air quality standards as well as the PSD increments.

A concern for acid deposition impacts to some wilderness lakes had been raised due to their low neutralizing capacity. The proposed project site facilities are located about 2.7 to 4.5 miles from upper and lower Libby lakes. The Libby lakes are key AQRV's (Air Quality Related Values) in the Class I wilderness area (Kettner 1993). Both lakes are positioned on the crest of the Cabinet Mountains in small Revett Quartzite watersheds (Harrison et al. 1992). The lake watersheds have very limited mineral weathering, poorly developed soils, and sparse vegetation. The low amount of alkalinity (which neutralizes acid deposition from rain, snow, and dry deposition) results in the high sensitivity of the Libby lakes to acid deposition induced chemical change.

Potential acid deposition effects on upper and lower Libby Lakes from the Rock Creek Project and cumulative effects for the Noranda Montanore project were evaluated using the MAGIC/WAND (Model of Acidification of Ground Water in Catchments/With Aggregated Nitrogen Dynamics). The MAGIC/WAND model (Cosby et al. 1985a and 1985b, Jenkins and Renshaw 1995) is a lumped parameter model of intermediate complexity, which predicts the long-term effects of acidic deposition on surface water chemistry constituents (Ca, Mg, K, Na, NH4+, H+, ANC, Cl, Al, H_2CO_3) in deposition, routing, and flux analysis of atmospheric deposition and watershed interactions (bedrock, soils, and lake dynamics).

The WAND component of the model factors in the primary nitrogen fluxes by accounting for nitrogen mineralization, nitrification rate, and plant uptake. The meteorological and deposition input requirements for MAGIC/WAND include wet deposition concentration, precipitation, and annual air temperature. The spatial and temporal scaling capability of the MAGIC/WAND model allows evaluation of changes in atmospheric deposition to a lake watershed from potential upwind emission sources but requires separate dispersion modeling to estimate and input deposition changes. Emission rates were based on the Alternative II scenario; these are higher than under Alternative V emission rates and represent a worst-case analysis.

The MAGIC/WAND modeling procedure for Libby lakes consisted of (Bernert et al. 1997, Story 1997):

1) Collection of watershed information for each lake (maps of watershed features and lake depths, soil and water chemistry, soil physical properties, and vegetation composition and chemistry, and climatic and hydrologic information).

2) MAGIC/WAND hindcasts (1845-1995) for both upper and lower Libby lakes to calibrate the lake chemistry to precipitation chemistry and watershed/soil conditions.

3) Potential incremental acid deposition to each lake watershed during the construction and production phase of the Rock Creek Project and the NORANDA Montanore Project were estimated using emission inventories and the ISC-ST3 dispersion model.

4) MAGIC/WAND forecasts of the Rock Creek Project only and Montanore cumulative emissions were run from 1996 to 2045 to model potential chemical changes upper and lower Libby lakes. The forecast assumed both mines would be constructed and operated in a simultaneous period from 2000 to 2030.

Table 4-11 includes a summary of modeling results for the 1995 (pre-mine) base year and 2030 (maximum cumulative 30-year emissions of the lake watersheds/soils/lake chemistry).

TABLE 4-11
MAGIC/WAND Modeling Results for Libby Lakes
Alternative V

Activity	Year	pH	Alkalinity µeq/L	Sum Base Cations µeq/L	Sum Acid Anions µeq/L
Upper Libby lake pre-mine base year	1995	5.69	8.90	17.39	10.4
Rock Creek Mine emissions only	2030	5.69	8.90	17.27	10.51
Rock Creek Mine + Montanore emissions	2030	5.69	8.90	17.27	10.68
Lower Libby lake pre-mine base year	1995	5.93	18.07	24.85	7.84
Rock Creek Mine emissions only	2030	5.93	18.07	24.7	7.94
Rock Creek Mine + Montanore emissions	2030	5.93	18.07	25.03	8.06

Source: Story 1997
µeq/L = microequivalents per liter

The upper Libby lake modeling results indicate less base cation generation and more release of acid anions than lower Libby lake. This is due to the smaller catchment and less soil and vegetation in the upper Libby lake watershed. In upper Libby lake, acid anions are projected to increase by a maximum of 2.9% in 2030 for the Rock Creek Mine + Montanore cumulative emissions while base cations would decrease by about 1%. In lower Libby lake, acid anions are projected to increase by an estimated 2.8% for the Rock Creek Mine + Montanore cumulative emissions while base cations would increase by about 1.1%. The increase in base cations, if it actually occurred, would be attributable to a modeled increase in weathering of bedrock and soils.

The estimated changes in acid anions and base cations are not sufficient for the MAGIC/WAND model to project any changes in pH or alkalinity in upper and lower Libby lakes for either the Rock Creek Mine emissions only or Rock Creek Mine and Montanore cumulative emissions. The modeling results are due to the relatively low levels of project mine emissions and associated low dispersion model projections of percent increases in nitrogen and sulfur deposition to the Libby lakes.

Cumulative Impacts

Cumulative air quality impacts under all action alternatives would be reviewed for specific proposed projects and developments that require air quality permits in the area. Logging and small scale mineral exploration activities typically do not require air quality permits; however, general air quality conditions would be analyzed through Sterling's ambient air quality monitoring program. Slash-burning activities are regulated by open burning rules. Particulate and gaseous emissions (primarily NOx and CO) would increase in proportion to increased vehicle activity associated with future logging and/or mineral development; however, it is not likely that ambient air quality standards would be approached. The air quality permit process and specifically the PSD regulations would act to regulate and possibly limit future development based on cumulative impact. Population growth unrelated to the project may increase vehicle traffic and home-heating/wood-burning emissions. Cumulative emissions likely would not exceed air quality standards. No measurable cumulative or additive impact would be expected with respect to Noranda's Montanore Project based on distance and topographic considerations. Noranda's Montanore Project was issued an air quality permit on November 5, 1992. The project's permitted allowable emissions are 38.58 tons/yr TSP, 140.54 tons/yr NOx, 22.15 tons/yr SO2, and 185.81 tons/yr of CO.

The air quality permit analysis, which includes the modeling analyses, increment consumption, and emission calculations, are based on the facility's potential to emit. However, the actual emissions from the facility would likely be less than the potential emissions. If the Class I increment were triggered for NO_2 the facility's potential increment consumption could be the majority of the NOx PSD Class I increment.

GEOLOGY

Summary

Construction of the project facilities for all action alternatives would alter the existing topography and surface water drainage patterns in the tailings storage area (Miller Gulch). The most noticeable alterations of existing topography would be the construction of a tailings impoundment or paste tailings facility and mill site.

Mining would result in total production ranging between 146 and 166 million troy ounces of silver and 1.20 to 1.37 billion pounds of copper depending upon the actual size of the ore body and the extraction rate. This would increase domestic production of these metals and would have a positive effect on the U.S. gross national product and balance of trade.

Under all alternatives the potential would exist for the project to influence water levels in overlying lakes and influence local springs or seeps.

Data that pertain to acid rock drainage (ARD) and metal leaching (ML) potential have been analyzed in a third party technical review and risk assessment. The review indicated low total acid production potential and a possibility of near neutral pH metal mobility. The report also stated the data available for review was insufficient to demonstrate that there would be no ARD or metal leaching issues and recommended more extensive static and kinetic testing should take place during mine operation. Additional testing, mitigation measures, and monitoring of ore, waste rock, and tailings added under Alternative V would lessen project risks. Appendix K provides an outline for these additional provisions.

Introduction

Acid Rock Drainage and Near Neutral pH Metal Leaching

Potential sources of acid and metal contamination for the proposed project are (1) waste rock that would be stored on the surface or exposed in the mine, used in tailings embankment construction or the mill site pad construction, (2) ore exposed in the mine or temporarily stockpiled on the surface, and (3) tailings or paste tailings deposited in the tailings/ paste tailings storage facility. Most of the proposed Rock Creek Project rock contains some metals that could mobilize if exposed to these geochemical processes.

Following release of the draft EIS, the agencies received comments regarding the potential for the project to cause ARD. The agencies contracted for a technical review and risk assessment regarding ARD aspects of the Rock Creek Project (Klohn-Crippen 1998). The format of the risk assessment was that of a Failure Modes Effects Analyses (FMEA). The FMEA procedure is explained in Appendix P. In the review process all geochemical data regarding the Rock Creek Project and the Troy Mine were evaluated. The reviewers pointed out that the key issue was not acid generation in itself, but rather, drainage water chemistry.

The potential for ARD and ML in a proposed mine setting can be evaluated by a number of methods. It is recommended that a variety of methods be evaluated simultaneously. Examples of techniques used to evaluate ARD and ML potential include static and kinetic tests, and geological analogs.

Static (acid-base accounting and leach or solubility tests) tests determine if the ingredients necessary for acid generation (pyrite and other sulfides) are present in sufficient quantities to turn a sample acidic, assuming all other conditions are present (Robertson and Broughton 1993). Static tests generally presume that all sulfide minerals would be reactive and that all buffering minerals (calcium carbonate, oxides, feldspars) would be available to buffer acid formation. Static tests are usually conducted prior to kinetic tests because they are relatively inexpensive and quick.

Static testing for ARD focuses primarily on (a) the measurement of present pH conditions of a mine rock sample and (b) inventory of the acid generating and acid consuming characteristics. Present pH conditions of a sample are measured with a pH probe. Depending on whether reported either in the field or laboratory, the sample consists of fine material collected or is crushed to <250 *u*m and mixed with water to a 2:1 solid: water ratio. In acid-base accounting (ABA), the net neutralization potential (NNP) of a sample (the tons of calcium carbonate needed to neutralize 1,000 tons of dry sample) is figured by subtracting the acid generating potential (AP) from the neutralizing potential (NP). A negative (-) NNP value is interpreted to indicate that the sample may turn acid while a positive (+) value indicates that the sample has an excess of neutralization potential and the sample would not turn acid. In a variation on the ABA test, an NP:AP ratio is sometimes calculated. Because there is low reliability in marginal conditions, and it is therefore difficult to interpret marginal ABA values, criteria have been developed to determine if a sample would actually produce acid in the field. For instance, NNP values between +20 and -20 and NP:AP ratios between 3:1 and 1:1 are generally considered to be in a zone of uncertainty. Under these criteria, NNP values greater than 20 and NP:AP ratios greater than 3:1 are considered to be not acid-producing, while NNP values less than -20 and NP:AP ratios less than 1:1 are considered potentially acid-producing.

These criteria have been shown to be effective in classifying ARD potential so that a rational decision can be reached regarding the need for further kinetic testing (Robertson and Broughton 1993). However, they are guidelines developed for situations where there exists a moderate acid potential and a moderate neutralization potential (pers. comm. A. Robertson, January 16-17, 1997). In the case of Revett type mineralization where neutralization potential values are generally low to very low and the acid potentials are lower still, these criteria may not be applicable.

Static tests that characterize metal mobility characteristics measure amounts of metals soluble under weakly acidic (EPA 1312) and highly acidic (EPA 3050) conditions. EPA 1312 data is a useful indicator of resultant water quality impacts but cannot be directly correlated to concentration due to higher solid to liquid ratios test conditions. Leaching tests are useful only in limited situations when considering a proposed mine. Stored alteration products resulting from sulfide oxidation would be the only situation applicable for the Rock Creek Project leach testing program. This data has not been assembled from a static testing program of the Rock Creek Project. However, the argument could be made that Troy Mine water quality would be comparable to a large leach testing program.

Kinetic (humidity cell, net acid generation (NAG), field) tests attempt to determine if a sample would turn acidic in a controlled weathering environment or under field conditions and usually make actual measurements of sulfate production, pH, and other values over time. Except for the net acid generation test, kinetic tests are expensive and take many months or years to perform.

Kinetic testing programs provide information on long term performance of ARD and ML rock components identified by static testing. Where static tests provide data on the composition of a sample, kinetic tests address how the sample will perform geochemically over time. Kinetic tests simulate weathering in a field setting or as a laboratory test. Relative rates of acid generation and acid neutralization can be interpreted from kinetic tests. Drainage chemistry and loading indications can also be interpreted from these types of tests. There are different types of kinetic testing techniques, the advantages of which differ. The type of kinetic test involved in the Rock Creek Project is the humidity cell. Further details of kinetic testing techniques can be found in the Saskatchwan Mine Rock Guidelines (Saskatchwan Environment and Public Safety 1992).

The net acid generating (NAG) procedure can be used both as a static test and as a kinetic test. The NAG test involves the addition of a solution of hydrogen peroxide to a prepared sample of mine rock to oxidize reactive sulfide. The pH of the reaction solution is then measured. This test can be used as a laboratory and even as a field test if calibrated for a particular site. The NAG test addresses oxidation rate issues if titration of any net acidity produced by the acid generation and neutralization occurring in the sample is measured. One NAG test result is provided for the Rock Creek Project on the same sample subjected to the humidity cell test. The NAG testing procedure is not standardized. For this reason, great care must be taken in the interpretation of NAG test results.

Alternative I

If the proposed project was denied, Sterling or other companies or individuals may conduct further evaluation of the Rock Creek or other nearby ore deposits. Continued exploration for other metals may occur. These exploration activities could lead to future development of one or more mines.

Alternative II

Geologic Resources

Current ore reserves of the Rock Creek deposit are estimated by the applicant to range between about 136 and 144 million tons at an average grade of 1.65 troy ounces of silver per ton and 0.68 percent copper, or about 14 pounds per ton. Sterling's proposed operation would remove approximately 65 to 75 percent, or about 88.4 to 100 million tons, of the mineral deposit. (This estimate is based on preliminary mine design information. Underground studies may change this figure.) Mining would result in a total production of about 146 to 166 million troy ounces of silver and 1.20 to 1.37 billion pounds of copper. This would increase domestic production of these metals and would have a positive effect on the U.S. gross national product and balance of trade.

Approximately 35 percent of the ore body would remain in the ground; about 30 percent to provide structural support for the mine workings and about 5 percent to protect underground installations and barriers to provide ventilation control. Sterling's plan also includes maintaining a minimum of 100 feet of rock overburden where the ore body occurs near outcrops. This amounts to a potential unrecoverable resource of up to 78.5 million troy ounces of silver and 647 million pounds of copper. The ability to recover the remaining ore would depend of metal prices and structural modifications necessary to mine the pillars without loss of structural support. Essentially all the recoverable ore from the Rock Creek ore body would be removed under all action alternatives.

Topography and Geomorphology

Construction of the surface facilities, tailings impoundment, and deposition of adit waste rock for the Rock Creek Mine project would alter the existing topography and surface drainage system. The tailings impoundment, mill site, and waste rock dumps would remain as permanent landforms following mining operations. Postmining topography of the impoundment embankment would be uniform and linear. (See Scenic Resources for discussion about visual impacts of operating and reclaimed mine facilities.)

Subsidence

The potential environmental consequences from the collapse of underground openings include surface subsidence, a change in the ground water regime, and drainage of surface waters. To reduce this possibility, the applicant has revised the proposed mine plan by committing to not remove support pillars (ASARCO Incorporated, September 6, 1996)

Subsidence is the observable topographic change from collapse of underground openings. The potential for and amount of surface subsidence is very much dependant on the strength of the rock, the amount of physical support provided by the mining method used (types of ground support used in the openings, number and size of pillars, and size of the rooms), and the stress distribution (way in which pressure is spread within rock) in the surrounding rock.

The applicant has not generated analytical rock mechanics data for the Rock Creek site with which to develop their mine plan. Most of this data would be obtained during the construction of the evaluation adit and the production adits were the project to proceed. Much of the existing information regarding rock strength, artificial support, and room-and-pillar sizing and spacing is extrapolated from experience gained at the Troy Mine. It is difficult to predict the consequences of the applicant's proposed plan at Rock Creek based on the current level of information, however, a preliminary assessment prepared by Camp, Dresser & McKee, Inc. (1989) concluded that the potential for subsidence was remote. Using rock strength information from the Montanore Project and the Troy Mine, both hosted in the same geologic formation as the Rock Creek deposit, rock strength and quality are expected to be of similar nature and therefore, not indicative of subsidence-prone conditions.

Two reports (Redpath Engineering 1991, Agapito and Associates 1991) addressed mine planning and subsidence potential at the nearby Montanore site. These reports concluded that given the proposed mine plan (which is also room-and-pillar) and geologic conditions, the potential for subsidence at Montanore is minimal provided adequate underground monitoring and rock analysis are carried out to refine the mine design once development is underway. Given the similarities in rock strength and mining method, a predisposition towards subsidence would not be expected to exist at the Rock Creek Mine site, contingent on adequate monitoring and rock analysis. Sterling has not committed to any specified level of monitoring and rock analysis as part of its proposed action, however.

The applicant has identified thick ore horizons (over 150-feet thick) next to the Copper Lake fault and Moran fault. The ore body is exposed at the surface (outcrops) on the southeast and northeast edges (see Figure 4-2). The applicant's plan is to mine to no closer than 100 feet of the ground surface (ASARCO Incorporated September 6, 1996) in areas where the ore body outcrops at the surface. These outcrop areas are exposed only on steep slopes. There exists the minor possibility that these areas (see Figure 4-2) could experience some surface subsidence under Alternative II if the induced stress field due to mining was larger than the strength of the surrounding rock. In simpler terms, once mining occurs, the overlying material has a tendency to collapse into the mine openings, depending on the ratio of overburden thickness to mine opening height, and mining method used. When ore is removed, some of the stress within the overlying rock is redistributed to the pillars and walls. Where there is no opportunity left for stress redistribution and/or stress exceeds rock strength, the back (roof) may collapse and/or the pillars fail. This, in turn, could cause surface subsidence. Conversely, water filling the mined

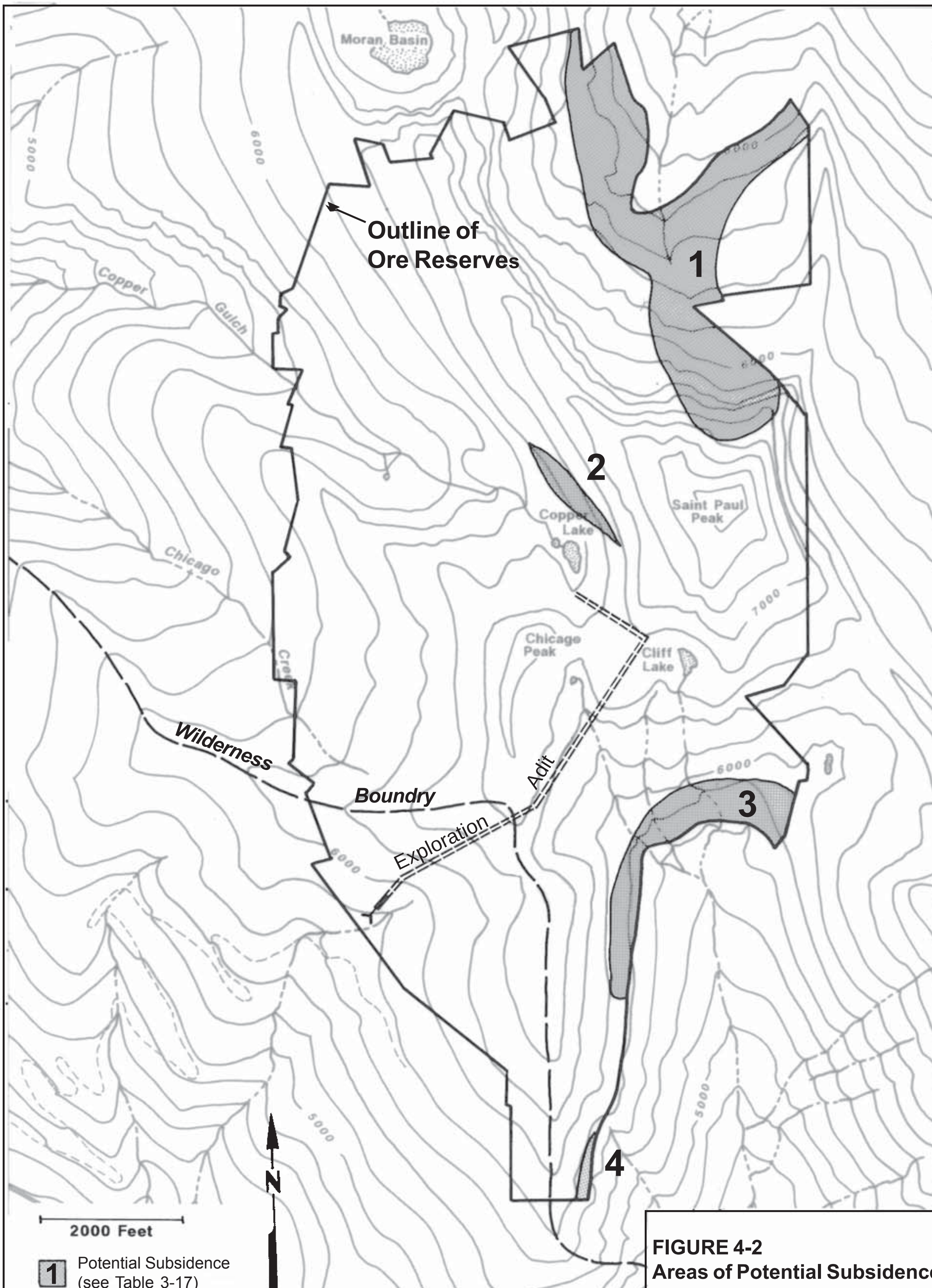


FIGURE 4-2
Areas of Potential Subsidence
Rock Creek Project

out voids that is blocked by adit plugs could exert sufficient force on existing rock fractures to cause seepage through these otherwise non-water bearing cracks. If these fractures are near the ground surface, seeps would develop near rock outcrops.

The potential location, magnitude, and severity of impacts to the ground surface, the ground water system, or to any surface lakes or streams in the area are unknown, given the limited information. However, were the remote possibility of subsidence and/or extensive rock fracturing to occur, possible effects could include partial to total dewatering of surface waters (e.g., Copper Lake, streams, and springs), a change in the ground water regime due to underground rock fracturing, and surface seep development from hydrofracturing. These impacts could be potentially significant.

Overburden thickness between the ore horizon and Copper Lake is about 900 feet while overburden thickness increases to 1,100 feet below Cliff Lake. Ore thickness is 100 to 150 feet and 10 feet, respectively, in these areas. Should rock immediately above mine openings fail, it would break into blocks. It would take fewer of the fallen blocks and intervening voids to fill the opening than the amount of material originally excavated. The increase in void space is known as the swell or bulking factor. Typical swell factors are between 40 and 60 percent for the type of material and rock strengths found at Rock Creek. The ability of rock to "swell," filling a greater space than what it once occupied when consolidated (or in place), is the phenomenon that would counteract potential for subsidence.

Predicting whether subsidence will occur, let alone its extent, historically has been based on an empirical approach. Mathematical models to predict zones of collapse from mining have been formulated, however these models are greatly dependent on characterizing the complex interaction of local rock type and structural conditions. Using summary information from observed incidents of subsidence (U.S. Geological Survey 1980), a gross estimate can be made regarding the extent of the roof collapse above the Rock Creek ore body. Given the rock type and swell factor of the overlying material, and using an average room height of 30 feet, upwards of 200 feet of rock above the ore horizon could be affected by mining. That is to say that the overlying rock could potentially collapse and (more likely) fracture for a height of 200 feet above the mined horizon. In the vicinity of Copper Lake, this would leave approximately 700 feet of undisturbed rock between the lake bottom and this zone of impacted rock. The depth to disturbance beneath Cliff Lake would be even deeper, approaching 1,000 feet.

The potential for subsidence increases as the ore thickness increases and/or the amount of overburden decreases. In areas where the ore horizon thickens to greater than 75 feet (Copper Lake and Moran fault zones) the applicant proposes to use one or more horizontal pillars between rooms to increase stability (see Figure 2-8). Doing so would minimize stresses the support pillars would carry, thereby reducing the potential for subsidence. The areas where these conditions exist are highlighted on Figure 4-2. Shaded areas Nos. 1, 3, and 9 to the north and to the south of Copper Lake represent areas where the orebody comes to within 100 feet of the surface. Shaded area No. 2 immediately adjacent to Copper Lake is an ore zone of exceptional thickness. In areas other than those depicted, subsidence is highly unlikely given the strength of the rock, thickness of the ore body, and the depth of the ore. The potential for subsidence above thick or shallow ore bodies is remote. Increased fracturing of the surrounding rock which could alter ground water flow patterns is more likely. If subsidence occurred, impacts could be potentially significant.

Slope Stability

There is some potential for slumping related to proposed construction (primarily cutslopes) of the new segment of FDR No. 150 on lacustrine silts and clays near Montana Highway 200 and of the mine adit access road in some steep areas on residual soil (see Soils and Reclamation). If slumping were to occur due to placement of access roads, potential for erosion and sediment yield would increase.

Acid Rock Drainage Potential

Waste rock excavated to develop the evaluation adit and service adits would be quartzites, siltites and argillites of the Revett Formation that have a low potential to form acid. Ore remaining in place underground and tailing placed on the surface would be quartzites and siltites. Static analyses suggest that exposure of Rock Creek ore and waste rock by mining would not likely generate acidic mine water. These conclusions will require kinetic verification of static testing on representative rock type samples and the applicant has not proposed to conduct this type of testing. Likewise, static testing of Troy tailings suggests a low potential to generate acidic water. Water quality testing at the Troy Mine, which is geologically very similar to the Rock Creek deposit, indicates that low levels of certain metals may be leached under near neutral pH conditions. However, the ability of near neutral pH adit water to leach significant levels of metals would be low.

Static and Kinetic Testing Results for the Rock Creek Project. Prior to release of the Rock Creek Project Draft EIS there were three ABA tests from the Rock Creek deposit, one from Troy Mine tailings, and 156 from within, above, and below Noranda's Montanore deposit (sixty one samples were waste rock tests conducted during Noranda's Libby Creek evaluation adit construction effort).

The Agencies also considered the Troy Mine as a multi-year and continuing kinetic field test. After approximately 18 years since operations began, all waters continue to run pH neutral but contain elevated levels of copper. Estimates of mine water chemistry from the proposed Rock Creek Mine in this EIS are based upon actual water quality data collected at the Troy Mine.

These data have been supplemented with the results from 55 additional ABA tests. Forty-nine of these were a part of a geochemical study conducted by Montana DEQ (Miller 1996a) . Thirty-three of these samples were from Rock Creek Project drill core (23 from the ore body and 10 from adit-area waste rock) and sixteen were from Troy Mine ore. The other six were from Troy tailings and were conducted as part of the paste tailings handling study conducted for the applicant (Golder Associates 1996).

Schafer & Associates, Inc., completed one 26-week kinetic humidity cell test of a composite sample of Rock Creek ore comprised of quartzite and siltite from a drill core. An ABA and a NAG test were also performed on the sample. A summary of ABA test results is shown in Table 4-12. The sample of Rock Creek ore that underwent a 26-week humidity cell test showed low and uniform sulfate levels, except for the initial flush, and neutral pH values throughout the test. The ABA test that was performed on the same sample had a NNP value of 4 and an NP:AP ratio of 2:1. These conditions are both within the uncertainty zone as described by Saskatchwan Mine Rock Guidelines (1992). The NAG test of the same ore tested by humidity cell yielded a pH value of 6.6. A NAG test with a resulting pH of above 5.0 or 6.0 is considered non-acid forming (pers comm. A. Robertson, January 16-17, 1997). Schafer concluded that this sample poses a negligible potential to form acid and the low levels of dissolved metals suggest that metal mobility is not a concern (Schafer & Associates 1997).

TABLE 4-12
Summary of ABA Test Results for Rock Creek Deposit and Troy Mine Ore, Rock Creek Waste Rock, and Troy Mine Tailings

	Rock Creek Ore	Troy Mine Ore	Rock Creek Waste	Troy Tailings
Average NP	8.2	8.9	7.5	0.9
Average AP	2.2	1.2	2.9	1.3
Average NNP	6.0	7.7	4.7	-0.4
Lowest NNP	-3.0	1.0	0.0	<-0.95
Highest NNP	21.0	20.0	14.0	0.2
Average NP:AP	3.7:1	7.4:1	1.6:1	0.6:1
Lowest NP:AP	0.4:1	1.5:1	1.2:1	0.02:1
Highest NP:AP	19.0:1 +	20.0:1 +	5.7:1	1.2:1
Number of samples	24	16	10	2*

Notes:

\+ Indicates sample had an AP value of zero, therefore a true ratio cannot be calculated. The number stated is a minimum value.

* Four of the six Troy tailings sample results are not included because cement was added to the samples, thus increasing their NNP and NP:AP values above what would be expected under natural conditions.

In the geotechnical report by Miller (1996a), the geochemistry of the Rock Creek and Troy Mine deposits and their potential for metal leaching were analyzed. The report concluded that Troy Mine and Rock Creek Project rock types are very similar, would be expected to weather similarly, and that because of these strong similarities the Troy Mine can be used as a model for predicting water quality effects of the Rock Creek Project. This conclusion supports the agencies' use of the Troy Mine as a field kinetic test.

Technical Review and Risk Assessment Conclusions. The ARD review in the FMEA report (Klohn-Crippen 1998) considered geochemical data that relates to Rock Creek Project tailings, waste rock and ore remaining underground. In regards to field water chemistry, the report concluded that data available (Tables 4-11 and 4-12) indicate that there are no significant water chemistry issues at the Troy Mine. While geochemical testing performed to date on the Rock Creek deposit and the Troy Mine is insufficient to demonstrate that there is no potential for net acid generation or metal leaching, the assumption that Rock Creek deposit tailings would not be expected to generate significant net acidic drainage over the long term appears to be reasonable based on the comparison with the Troy Mine and on the relatively low sulfide content of the ore. The association of sulfide minerals with calcite, the relatively low sulfide concentration, and the presence of euhedral pyrite would all indicate low total acid production potential and a low rate of oxidation. The report also stated the data available for review was insufficient to demonstrate that there will be no ARD or metal leaching issues. The third party reviewer recommended more extensive static and kinetic testing should take place during operation to further define metal leaching characteristics of different rock types and associated mineralization zones. The reviewer noted that there is variability in sulfide and metal content (notably lead and zinc) in the Revett Formation between the two sites may result in different metal leaching characteristics. Specifically, the generally higher sulfide content and subsequent higher potential for metal leaching in the Rock Creek ore must be addressed.

Klohn- Crippen (1998), a third-party consultant, assessed the acid generating/acid consuming and metal leaching data of the Rock Creek Project development. Klohn-Krippen performed a qualitative risk assessment based on their research (1998). This analysis cautioned that the similarity of the Rock Creek and Spar Lake (Troy Mine) ore deposits is not necessarily sufficient for environmental evaluation, and that there were some notable differences between the two ores. In particular, the FMEA noted that Rock Creek ore samples generally had a higher sulfide content and acid generation potential than the Troy ore samples. These uncertainties cannot be satisfied until further information can be collected during evaluation adit construction if the Rock Creek Mine is permitted.

Potential Impacts. Waste rock excavated to develop the evaluation adit and service adits would be quartzites, siltites and argillites of the Revett Formation that are believed to have a low potential to form acid. Ore remaining in place underground and tailings placed on the surface would be quartzites and siltites. As indicated above, static analyses suggest that exposure of Rock Creek ore and waste rock by mining would not likely generate acidic mine water. These conclusions will require kinetic verification of static testing on representative rock type samples and the applicant has not proposed to conduct this type of testing. Likewise, static testing of Troy tailings suggests a low potential to generate acidic water. Water quality testing at the Troy Mine, which is geologically very similar to the Rock Creek deposit, indicates that low levels of certain metals may be leached under near neutral pH conditions. However, the ability of near neutral pH adit water to leach significant levels of metals would be low. Without the collection of geochemical data during the evaluation adit construction and throughout mine operation, it would be difficult for Sterling to accurately identify whether potentially acid generating waste rock and tailings existed and needed to be handled differently to avoid or minimize impacts. The lack of contingency plans to deal with ARD and ML, should a problem arise during mine operation or after reclamation had occurred, could allow the degradation of surface and/or ground waters from acidic and potentially metal laden seepage and runoff. It could also reduce the success of revegetation subjected to those waters.

Alternatives III and IV

Geologic Resources

If pillar sizes were increased or areas of the deposit were restricted from removal, there would be a reduction in the amount of geologic resources mined by the proposed project. A reduction in the estimated ore reserves and ore recovery would result in a greater amount of ore being left unmined and less tailings would be generated. Secondary impacts would result to Sterling because revenues from the project would be reduced.

Topography

Under Alternatives III and IV, postmining topography of the impoundment embankment would appear more natural due to modified reclamation that would construct and regrade slopes to give them curvature and variety. Under Alternative IV, the mill site would be constructed and reclaimed to blend with adjacent natural topography.

Subsidence

Under Alternatives III and IV, Sterling would be required to provide the Agencies with an updated underground mine design within 2 years of operation (after mill startup). The Agencies would conduct a design review and identify any potential problems that could lead to subsidence or increased rock fracturing. The purpose of this review would be to verify conclusions reached during the preliminary mine design. The Agencies may require modifications of the mine plan if significant problems were noted that could lead to surface subsidence or fracturing and resultant effects to ground and surface waters. Sterling would be required to submit detailed mine development plans in advance of entering areas of suspected rock instability (see Figure 4-2). These requirements would effectively preclude subsidence or other surface effects related to mine-induced fracturing that are possible under Alterative II. The Agencies also may require leaving more ore in the ground for support. The amount of additional ore left underground, if any, would be small (several percent or less). The precise amount cannot be determined at this time. However, this amount could be equivalent up to 2 years of mine production.

These alternatives could also result in a secondary impact to Sterling because less ore would be available. The potential for subsidence would be reduced from Alternative II under Alternatives III and IV but impacts from subsidence would be potentially significant.

Slope Stability

These alternatives would involve relocation of FDR No. 150 and elimination of the proposed mine portal access road, thus precluding potential slope failure as discussed under Alternative II.

Acid Rock Drainage Potential

Research work performed on the Troy Mine and the Rock Creek deposit suggest these sites have similar geologic evolution and are comparable mineralogically when they are evaluated for ARD and ML characteristics. Exposure of the pyrite-chalcopyrite-pyrrhotite containing areas of the deposit will occur as the evaluation and development adits cross these halos at high angles. The acid generating potential of the ore zones is expected to be low, as most of the sulfide minerals in these zones are lacking iron, a necessary component of the ARD product. All sulfide minerals that will be exposed during the excavation are also not readily available to atmospheric oxidation.

All information obtained from studies using the methods described above indicates that the Rock Creek ore body and nearby rocks do not release detectable levels of sulfate when they weather naturally. Ore outcrops and/or exposed sulfide surfaces do weather, however, with resulting copper oxide and copper carbonate coatings on the faces of fractures. Such sources have the potential to cause metal leaching that may ultimately affect localized or site-wide drainage water chemistry. Metal leaching in a near neutral pH environment may present more potential to cause long-term water quality impacts than ARD for the Rock Creek Project. All project area water quality data indicate near neutral pH values.

The potential for the Rock Creek Project to develop acid rock drainage (ARD) and metal leaching in near neutral waters would be further defined and mitigated under Alternatives III and IV due to the requirement for a representative underground sampling, acid-base testing and monitoring program. Results of the program would help identify materials to be segregated to prevent production of acid leachate or drainage, but there is no requirement for the advance development of contingency plans should ARD or ML problems arise during mine operation or after reclamation has occurred. The plan is not as detailed as that proposed for Alternative V and could be less effective in mitigating impacts should waste rock, tailings, and/or ore actually have the potential for generating ARD or releasing metals at near neutral pH.

Alternative V

Geologic Resources

Affects of mining would be the same as for Alternatives III and IV.

1. The risks of potential impacts to the lakes, streams, springs and wetlands above the mine workings would be reduced because of the required underground buffer zones..

2. The recoverable amount of ore removed would be reduced as a result of the buffer zones. This amount would vary based on the ability of the operator to remove portions of the buffer zones and still maintain the same environmental integrity. If all of the buffer were to remain in-place an additional 18.42 million tons of minable ore would remain underground. Depending on the mining method and ore recovery this would be a potential lost that could vary between 26.29 and 16.83 million ounces of silver and 219.1 and 142.8 million pounds of copper to Sterling.

Topography

Under Alternative V, post mining topography of the tailings paste facility would appear more natural than under any of the other action alternatives due to the paste design and reclamation plan that would allow for more slope curvature and variety. While this would be true for all three Alternative V options, there would be differences in the final topography under each of the options as described under Scenic Resources.

Subsidence

Potential impacts would be less than those described for Alternatives III and IV. One thousand-foot buffer zones have been added under Cliff Lake, along Moran Fault, and near the ore outcrops at the north and south ends of the ore body. The minimum overburden thickness has been increased to 450 feet as well.

Slope Stability

Potential impacts due to potential slope failure would be the same as for Alternatives III and IV,

Acid Rock Drainage

The technical review and risk assessment (Klohn-Krippen 1998) of Rock Creek Project (including Troy) ARD and geochemistry data resulted in a recommendation of additional monitoring, mitigation and contingency measures. Alternative V contains these additional monitoring, mitigation and contingency measures in an Acid Rock Drainage and Metals Leaching Plan (see Appendix K). This plan would further define in greater detail than the other action alternatives and appropriately mitigate the potential for ARD and near neutral pH metal leaching from ore, waste rock, and tailings. The plan includes a geochemical testing program to begin during construction of the evaluation adit and continue throughout mine operation. Additional static and kinetic testing goals are addressed in Appendix K. Leach testing requirements included as static testing protocol will assess potential release of metals as a result of potential oxidation of sulfides in ore until direct transport to the mill begins of waste rock, and tailings.

Mitigations such as containment of mineralized waste rock and ore with metal leaching characteristics are defined. Comparison of Rock Creek data with geochemical conditions at the Troy (Spar Lake) Mine is included for prediction of closure conditions at Rock Creek. Water quality monitoring is included in the Water Resources Monitoring Plan in Appendix K and the MPDES permit in Appendix D. This monitoring would help to determine if ARD were occurring even after waste rock and tailings had been selectively placed as determined by the results of geochemical testing. Implementation of the Acid Rock Drainage and Metals Leaching Plan would have the greatest potential to reduce ARD and metals leaching compared to the other action alternatives. Early identification of rock materials potentially acid generating or subject to metals leaching and the development of contingency plans would prevent or minimize the risk of impacts to surface and ground waters and revegetation efforts from acid drainage and high concentrations of metals in seepage and runoff. ARD and ML are not anticipated given what is known about the rocks in the vicinity of the Rock Creek Mine, but the additional monitoring and mitigations required under Alternative V would provide the greatest level of assurance that these problems would be properly handled if they did occur compared to the other action alternatives.

Cumulative Impacts

Both Sterling and Noranda would mine stratabound copper-silver deposits from metasedimentary rock under the CMW. The combined size of both the Rock Creek and the Montanore ore bodies may be as large as 279 million tons. The mineral deposits are sufficiently isolated from each other that no cumulative subsidence or related water impacts are expected.

Construction and operation of both mines would likely result in more stringent requirements on other future minerals activities in the area in order to ensure sufficient undisturbed habitat for several wildlife species. The result would be a slowdown in potential mineral exploration and permitting of potential future mineral developments in the area during the life of these projects.

GEOTECHNICAL ENGINEERING

Summary

Geotechnical review and analysis indicate a tailings storage facility can be safely constructed on the proposed site. However, the original "upstream" design (Alternative II) did not contain enough *design and construction information to demonstrate adequate stability in the event of an earthquake. The "modified centerline" design, including review of the final design by a technical review panel and formal agency approval prior to construction (Alternatives III and IV), does provide adequate assurance of safety in the event of an earthquake. Prudent design practice and methods and construction monitoring would reduce the risk of catastrophic failure to an exceedingly low level, commensurate with other dams of this size.*

The use of paste technology for tailings disposal is a relatively new development in the mining industry as a means for waste management. The use of this technology, however, mitigates several issues related to a "wet" disposal system as is proposed for Alternatives II through IV. Specifically, by using tailings which have been partially dewatered, issues pertaining to liquefaction and seepage are substantially reduced. The use of paste would change the tailings storage facility from a water retaining-type structure (an impoundment) to one exhibiting characteristics of a large constructed embankment.

Paste tailings would improve the overall strength of the tailings medium, and with this a decreased susceptibility to failure from seismically induced liquefaction. A risk assessment employing the Failure Modes Effects Analysis (FMEA) protocol was conducted for Alternative V. This process identified potential failure modes, likelihood of occurrence, the environmental consequences associated with these events, and possible mitigations to reduce the likelihood of the occurrence.

Potential Impoundment Failure

Failure of the tailings impoundment, while highly unlikely to occur, would cause major significant impacts. Due to the speculative nature of precisely describing a catastrophic event, the exact impacts of a tailings impoundment collapse cannot be predicted. Past experience with such occurrences has shown that the combined water and tailings can flow for long distances over relatively flat ground. It would be possible that such an occurrence at Rock Creek would allow tailings and water to reach Montana Highway 200, Rock Creek, Miller Gulch, and the Clark Fork River. The drastic consequences associated with an impoundment failure, however unlikely, justify high degree of review during design and construction.

There are four general ways the tailings impoundment could possibly fail. These potential failure mechanisms are not unique to a particular design alternative, but the Alternative II impoundment design (upstream construction) is inherently less protective than the design for Alternatives III and IV (modified centerline construction) as well as the paste facility under Alternative V. The general potential failure mechanisms are briefly described below. Further discussion is included in Appendix G.

Foundation Sliding. Slippage in the ground beneath the tailings embankment could cause collapse of the impoundment and release of tailings and impounded water. Potential sliding in the foundation would be associated with soft clay deposits identified under some parts of the tailings embankment.

Seepage-Induced Piping. The tailings impoundment could collapse due to impounded water seeping through the dam and exiting on the downstream face with enough force to erode the sand in the embankment. This internal erosion, known as "piping", could lead to collapse of the impoundment and release of tailings and impounded water.

Overtopping. Wash-out of the impoundment could occur when the water level in the pond reached the crest height of the impoundment. An overtopping failure would release both tailings and water, but would involve more water than the sliding or piping. Threat of overtopping is typically associated with very extreme rainfall runoff events such as the probable maximum flood (PMF). For visualization purposes, the PMF at the site would be the flood resulting from roughly 15 inches of rain falling in 1 day. A PMF, with or without a tailings impoundment failure, would result in very severe flooding and associated damage simply from the tremendous volume of water a PMF event represents.

Earthquake-Induced Liquefaction. Collapse of the tailings impoundment could be caused by major earthquake shaking leading to "liquefaction" of the tailings in the impoundment. Liquefaction failure could lead to the release of tailings and impounded water.

The proposed action alternatives offer differing levels of resistance or design approach for these potential failure modes.

Alternative I

The risk of an impoundment failure and associated impacts would not exist.

Alternative II

Alternative II would involve an upstream tailings impoundment as proposed by Sterling. This alternative addresses the four potential failure mechanisms as follows:

Foundation Sliding. Soft clay deposits tend to slip if they are loaded too quickly for the water in the clay to drain away. Alternative II proposes to use a slow rate of loading and "wick drains" to enhance water drainage in the clay.

Seepage-Induced Piping. Piping tends to happen if the water seeping from inside the dam reaches the downstream face of the dam. Alternative II proposes a combination of free-draining starter dams and blanket drains to intercept seepage water before it could reach the face of the dam. Intercepted seepage water would be collected and pumped back to the impoundment.

Overtopping. Alternative II proposes diverting upgradient runoff from all precipitation events up to a PMF around the facility and having enough water storage to hold a PMF that might fall on the impoundment. However, for the first 3 years of impoundment construction, containing the PMF would require the water to move closer to the dam crest than the 200-foot distance given as the minimum operational distance in the proposed design. This encroachment would increase the risk of seepage-induced piping.

Earthquake-Induced Liquefaction. The upstream method of construction proposed for Alternative II is typically susceptible to earthquake-induced liquefaction. The applicant has committed to a final design process that would include detailed laboratory testing and verification of the liquefaction resistance of upstream-placed tailings, and monitoring of the placed tailings density to address susceptibility to liquefaction. Alternative II would include a life-of-mine construction monitoring plan with formal reports to the Agencies and periodic performance reviews by experienced professional engineers.

Foundation slippage and seepage-induced piping can be adequately addressed with ordinary construction methods, and the risk associated with overtopping is acceptable provided surface water diversions are constructed as planned. However, the level of information available regarding liquefaction resistance did not support preliminary approval (during application completeness reviews) of an upstream facility.

Impacts from a tailings impoundment failure would be significant if one occurred. The level of risk of occurrence under the Alternative II impoundment design would be unacceptable to the Agencies.

Alternatives III and IV

Agency concerns focused on the peak shear strengths of the clay foundation soils, the assumed densities of the in place tailings, and the appropriate seismic evaluation criteria to be used. In response to Agency concerns, the applicant developed an alternative design for the tailings impoundment which included a combination upstream and centerline design approach known as a "modified centerline" method. This modification in impoundment design was a principal change under Alternatives III and IV (see Figure 2-3). Centerline construction would be used for the first 7 years; the upstream method would be used after year seven. This design addresses the four potential failure mechanisms as follows:

Foundation Sliding. Same as Alternative II, however the excavation and removal of soft clay would reduce the sliding potential of the impoundment foundation.

Seepage-Induced Piping. Seepage would be intercepted by a 200-foot-wide shell of coarser sand placed at the downstream toe of the embankment during the initial 7 years of construction. The method of seepage collection is different because it is dependent on the method of construction, however the risk of piping remains about the same as Alternative II. Intercepted seepage would be returned to the impoundment similar to Alternative II.

Overtopping. Same as Alternative II, but the minimum operational distance between the pond and the top of the embankment would be 400 feet. Sterling would need to maintain this distance during operations; the Agencies would be responsible for ensuring Sterling maintained this distance. For an undetermined period of time during starter dam construction, the dams would not be capable of containing a PMF.

Earthquake-Induced Liquefaction. The modified centerline method of construction for Alternatives III and IV is typically less susceptible to earthquake-induced liquefaction than upstream construction. Alternatives III and IV would contain additional requirements to mechanically compact tailings as needed to meet liquefaction resistance criteria determined during final design.

In addition, Alternatives III and IV include the Agency-imposed requirement that final design be reviewed by a technical panel and approved by the Agencies prior to construction.

Under Alternatives III and IV, foundation slippage and seepage-induced piping can be adequately addressed with ordinary construction methods. The risk associated with overtopping is acceptable. Additional design and construction controls would improve earthquake resistance of the impoundment, and the Agency-imposed design review by a technical panel provides further analytical oversight of impoundment design.

Impacts from a tailings impoundment failure would be significant if it occurred. The level of risk of occurrence under the impoundment design for Alternatives III and IV would be acceptable to the Agencies.

Alternative V

Failure Mechanisms

In addition to the four previously identified failure mechanisms for the "wet" tailings impoundment (foundation sliding, seepage-induced piping, overtopping, and, earthquake-induced liquefaction), two additional failure mechanisms are included for Alternative V: surface erosion, and paste collapse.

Foundation Sliding. Soft clay deposits beneath the tailings paste facility could slip under the weight of the overlying paste, and could potentially threaten the stability of the embankment. As proposed in Alternatives III and IV, the soft clay deposits would be removed under Alternative V, thereby reducing the probability that there would be a foundation failure.

Seepage-Induced Piping. The physical character of paste (well graded material) would be an effective deterrent to piping. The permeability of the paste would be sufficiently low that migration of free water is negligible. However, if there was a significant increase in moisture content or an increase in the elevation of the phreatic surface, it is conceivable that conditions for piping could develop. A strict Quality Assurance/Quality Control (QA/QC) plan and monitoring program would identify any of these conditions long before they reached a critical point.

Overtopping. There would be no free water surface in a tailings paste facility. The proposed design calls for a construction sequence that would preclude water from impounding on or in the embankment. Any ponded water from excessive rainfall or snowmelt would either seep into the paste or be directed offsite to storm water ponds. Overtopping would not be possible.

Earthquake-Induced Liquefaction. The threat of liquefaction would be greatly reduced with a paste facility due to inherent paste strength and a reduced phreatic surface. While the paste would be capable of liquefying during a seismic event, design features such as a compacted shell and foundation drains would greatly reduce this risk by providing a resisting buttress and by lowering the phreatic surface within the paste embankment. The paste will consolidate and gain strength over time and unless the foundation drains become blocked and non-operational, the phreatic surface will not be a factor for long term stability.

Surface Erosion. The paste facility would not be susceptible to overtopping, however, the embankment surface may be prone to surface erosion. While erosion would not present a catastrophic threat to the stability of the embankment, it could present a chronic on-going maintenance problem. In addition to erosion, small localized slumps might occur from over saturated areas, again, there would be no threat to the overall stability, rather these type of events would require an ongoing maintenance commitment on the part of Sterling. Erosion control mitigations have been added to the paste method through the use of interim seeding (see Soils and Reclamation).

Paste Collapse. Preliminary laboratory testing suggests that the paste may exhibit characteristics similar to those of collapsible soils. Should the moisture content in the paste become elevated beyond its optimum, there could be a build-up of pore pressure within the paste and ultimately deformation of the paste pile. Again, this would not occur on catastrophic proportions or pose an environmental threat, rather it would present a maintenance problem which if left unchecked could eventually cause an environmental impact from the erosion and redeposition of paste material.

Stability Analysis

The FMEA included an analysis of the stability of the Alternative V paste facility indicates that either the Top-Down or the Bottom-Up design option would be stable under normal operating conditions as well as when subjected to the design earthquake, provided under-drains are included in the design**.** The analyses were conducted by modeling the paste facility at the end of mine life when the facility would theoretically be in the least stable condition. Stability analyses were run for static conditions (no external forces other than gravity), for conditions during the design earthquake, and finally for conditions immediately following a seismic event. Using varying water infiltration rates (from rainfall) and the presence or absence of under drains, the factor of safety for all paste construction options under static conditions ranged between 1.2 and 2.0; for the maximum estimated seismic event the factor of safety was found to range between 0.9 and 1.35. (Note: A factor of safety > 1.0 implies a structure is not subject to failure from the applied forces.) The 0.9 value was for the Top-Down configuration without under-drains and experiencing 20 inches per year of water infiltration into the paste pile. The seismic modeling suggests that Bottom-Up construction would provide a more stable facility. This is due to the embankment having a compacted outer shell which provides a resisting buttress for the remainder (upslope) of the tailings facility. By inference, the combined Bottom-Up/Top-Down design could also provide improved resistance to failure due to the compacted outer shell of the Bottom-Up component.

Stability analyses were also included in reports submitted by Knight Piesold (1997) and Golder Associates (1996). Factors of safety under static conditions contained in these reports were estimated at FS = 1.5, the minimum value for static conditions which the agencies customarily require. The difference in estimates between these two reports and that contained in the FMEA (see Appendix P) report can be attributed to different assumptions made by the reviewers. A difference in estimate does not necessarily make one wrong. The agencies consider the important point in the stability analysis of the paste embankment to be the fact that under static conditions, the analyses predict a stable embankment condition. During final design as additional information regarding paste properties are confirmed, a revised estimate of the static condition would be made. The agencies would require a minimum static factor of safety of FS = 1.5. In order to reach this, Sterling may be required to make design modifications to meet this standard. Common changes could include reducing the slope angle and/or adding a binder such as cement or fly ash.

In all of the design options, adequate foundation drains are provided to ensure against a phreatic surface build-up within the paste. An increase in the elevation of the phreatic surface within the paste embankment could lower the resistance to liquefaction in the event of an earthquake. Increased moisture content could also change the character and hence the behavior of the paste tailings. Tailings paste usually has a moisture content within the range of 20% to 25%. If the moisture content of the paste increased appreciably, it is conceivable that the stability of the paste embankment would be reduced. Localized increases in moisture content due to production problems, prolonged rainfall or snowmelt infiltration could create discrete areas of softer paste which perhaps could exhibit a reduction in strength, however, there would need to be a significant increase in moisture content throughout the entire paste deposit before the overall stability of the tailings facility would be compromised. Areas of elevated moisture in the paste could lead to areas of paste collapse, slumps along slope faces and localized mudlike flows. Occurrences such as these would not jeopardize the overall stability of the paste facility, rather they would create ongoing maintenance and repair liabilities during operations and post-closure.

Risk Analysis

A risk assessment was conducted for Alternative V (Klohn-Crippen 1998) using the Failure Modes and Effects Analysis (FMEA) protocol, a quantitative process which is intended to identify and characterize risks associated with the design and performance of engineered systems (see Appendix P). The risk assessment was limited to an analysis of the Top-Down and Bottom-Up designs, and considered these systems' performance for a period of 1000 years.

Impacts associated with a dam failure include the potential contamination of ground and surface water, and the associated impacts on aquatic life. However, if a slope failure were to occur, the mass evacuation of the paste from the impoundment would not be expected. Since the tailings have the consistency of a paste with relatively little free water available, a mass failure would not produce the kind of fluid flow that could be expected with tailings from a wet tailings impoundment where the tailings have little to no shear strength. Tailings discharge from a failed paste embankment would be minimal, probably localized in a small area, and not likely to reach the Clark Fork River or Rock Creek. There would not be the complete evacuation of retained material as one might expect should a water retention dam fail. However, as the moisture content of the paste increases, say from excessive precipitation or an elevation of the phreatic surface within the tailings pile, the more likely it is for the paste to flow greater distances in the event of a failure. This EIS does not include modeling for paste flow should a failure occur.

The FMEA looked at a complete failure of the paste facility nonetheless. The likelihood of failure of the paste pile with underdrains under seismic loading for the Bottom-Up design was assigned a likelihood of occurrence of 1 in 10,000 to 1 in 1,000,000; the likelihood of occurrence for the Top-Down approach was estimated at a 1 in a 100 chance to 1 in 10,000 chance. The consequences associated with a failure in both instances were designated as "high" to "extreme," which are defined as "short-term irreversible impact, long-term excursion of water quality," and "catastrophic event, long term impact" respectively. The socioeconomic impacts associated with a failure were estimated as "extreme" which was defined as an event garnering international scrutiny and a mitigation cost of in excess of $10 million.

Despite the estimated consequences associated with such an occurrence, there are several mitigating measures which could be implemented to reduce this risk of a failure. These include: employ the Bottom-Up construction sequence, install blanket and finger drains beneath the paste facility; continually model and monitor the moisture content of the paste pile during operations to better understand saturation levels, generate a detailed design of the paste plant operations and disposal system to ensure quality assurance and quality control during operation and post-closure. With these compensating factors fully employed, the FMEA analysis estimated the likelihood of failure under the Bottom-Up option as "negligible" (< 1 in 1,000,000 chance of occurring), and the confidence associated with this estimate was considered "high."

Alternative V also includes a technical panel review of all phases of the final design prior to design approval and construction. Stability issues previously identified as part of Alternatives II through IV, and which are germane to Alternative V as well, including foundation sliding, piping, liquefaction, and embankment erosion and estimates of parameters such as permeability and seepage can be addressed during the peer review and through a comprehensive quality control program as part of paste milling and tailings facility construction. Strict moisture content control during processing and placement would be required if the paste is to exhibit the physical characteristics which were modeled as part of the stability analyses. As part of Alternative V, the Agencies would require Sterling to submit a QA/QC plan for paste milling, paste placement and paste facility management so as to keep the paste within design tolerances.

SOILS AND RECLAMATION

Summary

Impacts on the soil resource under all action alternatives would be similar and would include loss of soil characteristics developed over 10,000 years. Recognition of these inherent soil properties and design of salvage and handling programs to minimize the loss of the soil properties can enhance reclamation success.

Soil impacts resulting from any of the action alternatives typical of any operation where soil is removed, stored and replaced would include (1) loss of soil development and horizonation, (2) soil loss from wind and water erosion and equipment handling, (3) changes in soil physical properties, (4) reduction in biological activity, and (5) changes in nutrient levels. Mine wastes used as subsoil and even some native subsoils may contain elemental concentrations of potentially harmful metals that could affect plant growth.

Soil development losses and site productivity reductions would be long term, primarily in the tailings impoundment/paste facility area. Modifications and mitigations proposed by the Agencies would minimize these impacts. In turn, the potential for reclamation success would be improved and mitigation of impacts identified for other resources would be enhanced by reclamation plan changes proposed by the Agencies. Overall impacts under Alternative V would be less than Alternatives II, III, and IV as summarized below.

Introduction

Recognition of inherent soil properties and design of salvage programs to retain favorable properties that have taken over 10,000 years to develop can enhance reclamation success. Soil characteristics that are important to consider for analyzing impacts and assessing soil salvageability and suitability for reclamation include:

- depth and horizon (developed soil layer) sequence;
- texture (relative proportion of sand-, silt-, and clay-sized particles);
- rockiness (both size and amount);
- erodibility;
- organic matter content;

- reaction (refers to the acidity or alkalinity of the soil solution and is expressed as pH ranging from 1 to 13, where 1 is most acid, 7 is neutral, and 13 is most alkaline or basic);
- nutrient status and soil biological activity;
- susceptibility to compaction;
- slope steepness; and
- location and extent of rock outcrop and talus.

Soil impacts resulting from any of the action alternatives, typical of any operation where soil is removed, stored, and replaced, would include 1) loss of soil development and horizonation, 2) soil erosion from disturbed areas and losses of suitable salvage materials through erosion and handling, 3) reduction of favorable physical properties, 4) reduction in biological activity, and 5) changes in nutrient levels. Mine wastes used as subsoil and even some native subsoils may contain elemental concentrations of potentially harmful metals that could affect plant growth.

These impacts, combined with the proposed project's reclamation plan, determine in part, the potential success of restoring the land to forest cover and wildlife habitat after operations ceased. Limited reclamation success, in turn, may result in secondary or long-term negative impacts including soil erosion and sedimentation to streams, reduced soil/site productivity, visual deterioration, and seasonal air pollution increases due to wind erosion.

Alternative I

Soil resource impacts would be limited in comparison to the other alternatives. Erosion and sedimentation would increase in the Rock Creek drainage by some amount as a result of private timber harvests, new road construction, and development of other private land (See Hydrology). Existing sediment loading from the unpaved Rock Creek roads would continue to impact Rock Creek unless more sediment reducing Best Management Practices (BMPs) are implemented. See Appendix H for a discussion of the BMP process and its effectiveness of implementation. Existing impacts from sediment in Rock Creek are discussed in the Hydrology and Aquatics/Fisheries sections.

Loss of soil development characteristics would be minimized and would only occur in the limited new disturbances envisioned for the area in the reasonably foreseeable future. Changes in physical biological and chemical (nutrient) characteristics would be minimal and relative short term.

Alternative II

Soil Impacts

Soil Loss. Under Alternative II, about 584 acres would be disturbed (see Table 2-2). Soil erosion caused by wind or water (rainfall and runoff) is likely to occur during all phases of the proposed project. Initial erosion rates are expected to be moderate to high due to soil characteristics, slope steepness, and precipitation patterns. Soil losses within the disturbed areas would exceed acceptable limits of two tons/acre/year on all disturbed areas until interim seeding is in place or the roads are paved.

Areas cleared of soil generally are more susceptible to erosive forces, primarily because of the removal of vegetation. Lacustrine subsoils in the area may become compacted during the soil salvage process and have lower inherent infiltration and permeability. Non-lacustrine soils in the area are not as susceptible to this compaction because they often have greater sand and coarse fragment contents. Regardless of subsoil characteristics left on a disturbed site, the sediment and erosion control, BMPs listed by the company will control erosion to acceptable limits.

The applicant's proposed relocation of FDR No. 150 would cross lacustrine soils. When wet, these soils have a high slump potential. Road fill slopes would be particularly susceptible to failure, and difficult to revegetate. Other soils generally are well suited to road building, although cut-and-fill slope raveling (movement of dry soils) can be difficult to control. Road construction on steep slopes (greater than 60 percent) through small drainages on colluvial/residual soils, such as the access spur roads to the mine portal and the waste rock dump, takes special consideration to ensure that slope stability is not affected (see Geology and Transportation).

The transportation corridor would result in a total disturbance area of 96 acres from road construction/reconstruction as well as pipeline and powerline construction. Erosion from the transportation system would likely increase during and after (up to 4 years) construction and reconstruction until cut-and-fill slopes were stabilized (see Hydrology).

Some areas such as the utility corridors would be reclaimed as work progressed, so surface erosion would be limited. It is well documented, however, that road-building in steep terrain results in accelerated erosion and sedimentation (Megahan and Kidd 1972, Packer 1966). Increases are highest within the first 2 years but erosion continues for long periods depending on site conditions. Because precipitation is high in the Rock Creek area, it is essential to stabilize cut-and-fills immediately to reduce potential erosion rather than waiting until spring or fall (pers. comm. L. Kuennen, USFS, with P. Plantenberg, DEQ, February 14, 2000). However, the applicant proposes to seed in the first appropriate season following construction. Planting and seeding are typically done in spring or fall when soil moisture conditions are optimum. Delays in seeding highly erodible sites, however, often results in crusting of the soil surface, in turn reducing seed establishment and resulting in more erosion.

Unprotected road surfaces would also be susceptible to erosion. Sterling plans to pave FDR No. 150 to the facilities area. This would greatly reduce potential erosion from this road surface. Other roads would be graveled which also reduces potential erosion but to a lesser extent. Drainage from road surfaces would be controlled using BMPs. With the exception of the access road to the evaluation adit and utility maintenance roads, no roads would be fully reclaimed (obliterated, recontoured, and reseeded). One new and two replacement bridges would be constructed (see Transportation). The skewed alignment of the new bridge would disturb more area than would a perpendicular alignment and also exposes more of the bridge structures and fill slopes to erosion or washout. The areas associated with construction and removal of detour bridges for the replacement bridges also would be subject to erosion until stabilized. Short-term increases in sedimentation may occur as a result.

Roads would be used year round. Maintenance activities such as ditch clearing and snowplowing may result in small increases in erosion. Where culverts discharged near Rock Creek or other streams, or where roads were close to streams, the potential for sedimentation would increase.

Erosion resulting from disturbances associated with upgrading the Hereford rail loadout facility would be minimal.

All soil stockpiles would be susceptible to erosion for several reasons. Constructed sideslopes and ramps would be relatively steep: at horizontal to vertical ratios of 2.5H:1V and 3H:1V, respectively. Some stockpiles would be expanded incrementally, leaving soil on the active face exposed. Some portion of all stockpiles would be in place for the life of the mine. The applicant proposes implementation of interim seeding (see Reclamation) only when stockpiles approached planned volume. If left exposed and unprotected for more than a couple of months, regardless of other characteristics, large amounts of soil may erode. This erosion would be localized and potential impacts to Rock Creek would depend on stockpile location and BMPs in place. Soil eroded from disturbed sites and stockpiles may move far enough to be deposited as sediment to floodplains and streams. Increased sediment loads in turn may adversely affect water quality and fisheries (see Hydrology and Aquatics/Fisheries).

Apart from erosion resulting from steep slopes and exposure, each stockpile would have a different potential for erodibility. Each stockpile includes soils from adjacent or nearby salvage areas (see Table 2-2), thus the nature of each stockpile would be different in terms of soil texture and rock content. Soils salvaged at the evaluation adit site would be salvaged in two lifts and stored separately. The surface lift, which includes the more suitable soil, would be comprised of volcanic ash-influenced, very gravelly and cobbly silt loams and loams. The second lift would be comprised of extremely gravelly and cobbly silt loams. Due to the high angular rock content, these stored soils would have a low-to-moderate erodibility potential.

Soil stored in stockpiles around the tailings impoundment would be dominated by volcanic ash-influenced loams and silt loams mixed with a relatively low percentage of gravelly loams and gravelly sandy loams. One stockpile would contain a large amount of, lacustrine soils which are silty clay loams. These stockpiles would have a high potential for erodibility (Kuennen and Gerhardt 1995). Where rock content was higher and of an angular nature, potential erodibility would decrease. However, less than 30 percent of the stored volume in these stockpiles would be rocky.

Stockpiles in the proposed facilities area would consist primarily of ash-influenced, gravelly sandy loams. These stockpiles would have a high-to-very- high potential for erodibility (Kuennen and Gerhardt 1995).

Soils salvaged along new roads, the utility corridor, and miscellaneous disturbances would be stored adjacent to the disturbance area. These soils are locally variable. Most are ash-influenced but textures include sandy loams, gravelly silt loams, and very gravelly sandy loams and loamy sands. These stockpiles would have a moderate to very high potential for erodibility (Kuennen and Gerhardt 1995), however, the size (height) of stockpiles would be small. Salvaging soil from new road construction in steep terrain would result in the need for a much wider corridor and ultimately result in greater soil disturbance and, in turn, erosion and sedimentation. In this situation, the potential benefits of soil salvage and respread on road fills is outweighed by the potential negative effects of greater disturbance.

Erosion would occur a second time during reclamation activities when salvaged soil was respread on recontoured surfaces. Areas reclaimed using direct-hauled soil (a reclamation technique whereby soil is stripped and immediately placed on the prepared surface), such as road cut and fill slopes, would have less potential for erosion than areas reclaimed with stored soil. Protective vegetation would establish more quickly because direct-hauled soil is still biologically active (see Biological Activity) and retains a higher level of favorable physical and chemical characteristics. However, only a small undetermined percentage of the total volume proposed for salvage would be handled this way. Soil losses during salvage and replacement activities could affect the volume of soil estimated for salvage, in turn affecting proposed redistribution depths (see Reclamation).

The applicant's proposed measures to control runoff and sediment listed in Chapter 2 combined with native topsoil and subsoil characteristics, such as rock fragment content, would help reduce erosion rates. Until vegetative ground cover reached predisturbance levels in 3 to 5 years, erosion rates would be higher than before disturbance and would exceed the 2 tons/acre/year soil loss threshold. Impacts on aquatic life from erosion and sedimentation are discussed in Aquatics/Fisheries. The agencies have concluded that soil losses within disturbed areas would not be a matter of concern because excess soil exists to meet the company's proposed reclamation plan.

Physical Characteristics. Physical properties of respread soil in the reclaimed areas would be very different from conditions before disturbance. Handling would result in the loss of the natural soil profile developed over 10,000 years, compaction (destruction of pore space continuity and soil structure), and a loss of organic matter due to mixing and dilution.

Aeration and bulk density changes would adversely affect soil plant relations due to decreased soil water-holding capacity, pore space, and increased bulk density (Sharma 1996). Coarse grained soils and fine grained matrix soils which have a large volume of coarse fragments may or may not be as impacted depending on the overall soil composition (Sowers 1979).

Soils should be handled at the minimal moisture content to reduce the risk of compaction of salvaged soil. The volcanic ash component of many of the soils proposed for salvage may provide some resistance to severe compaction caused by equipment operation and the sheer weight of the stockpiles. Volcanic ash-influenced soils in northwest Montana have lower initial bulk densities than soils derived from other sources. When disturbed during activities that used heavy equipment (such as logging), these soils would compact but not as severely as other soils (Kuennen, Edson, and Tolle 1979). The reasons for this are not well understood, but they appear to relate to the porous nature of ash particles, how they naturally aggregate, and how they interact with organic matter (Harwood and Youngberg 1969; Nimlos 1981). On the other hand, studies have not explored the behavior of ash-influenced soils under prolonged storage in deep piles, so it is not possible to quantify the potential benefits these soils may have in resisting compaction.

Sterling proposes standard reclamation techniques, such as discing and ripping, on slopes less than 33 percent, to prepare the recontoured surfaces for soil redistribution and also for seedbed preparation. These practices would tend to offset compaction on many reclaimed sites. Some areas, such as the mill site pad face and road fills, would receive direct-hauled soil. If seeded immediately, and provided that soils are handled when they dry, compaction would be of minimal concern.

The establishment of vegetation, root systems, rodent activity, and physical processes (such as freezing and thawing) would increase soil-building processes. In time, impacts related to poor physical characteristics of respread soils would be reduced (see Reclamation for additional detail by disturbance area).

Soil moisture stress in reclaimed areas may only limit plant growth for short periods in normal years because precipitation is usually balanced by or exceeds evapotranspiration (see Chapter 3, Climate). Soil moisture problems most likely would be expected for reclamation of the tailings impoundment, especially the dam faces. The combination of replacing a shallow layer of silty clay loam soils over well-drained sandy tailings on the steep south- and west-facing aspects would result in hot, droughty conditions. In the long term, soil redevelopment processes would begin to alter the underlying tailings beneath the soil.

Soil Biological Activity. Biological impacts would occur in most salvaged soils. Because most of the disturbances could not be reclaimed until the end of operations, it would be necessary to stockpile most of these salvaged soils for 30 years or more.

Prolonged storage decreases or eliminates populations of important soil microorganisms such as bacteria, fungi, and algae, which are essential in soil nutrient cycling (Miller and Cameron 1976). In addition, some favorable components normally found in native soils are lost through decomposition during storage. These components include seeds of native plants, rhizomes (underground stems), and other plant parts capable of producing new plants. Replenishment of these organisms would occur with interim revegetation but would be limited to the surface (the top 6 to 8 inches) of the stockpile. Thus, the vast remainder of stockpiled soil would have reduced biological activity.

Mycorrhizae (important structures that develop when certain fungi and plant roots form a mutually beneficial relationship) are also eliminated in soil stored for prolonged periods. Mycorrhizae serve as highly efficient extensions of plant root systems, especially for woody species. These associations are important to consider in maximizing plant establishment and productivity, since most plants depend on mycorrhizae for adequate growth and survival (Mallock, Pirozynski, and Raven 1980; Trappe 1981). This is especially true in nutrient deficient soils (Harley 1969). These structures are particularly important to plant phosphorus nutrition and water uptake (Christiansen and Allen 1980). Thus, the association of mycorrhizae with plants in the study area is especially critical since plant-available phosphorus is low.

The loss of mycorrhizae could lower plant species diversity (Reeves et al. 1979). Mycorrhizae would invade reclaimed sites from adjacent undisturbed areas, and species diversity would eventually increase. No large-scale field method exists for the artificial establishment of mycorrhizae in soils of disturbed sites; however, it is possible to inoculate tree-planting stock with the appropriate mycorrhizal fungi.

Sterling has not proposed any methods to restore or accelerate the recovery of soil biological activity. Therefore, the survival and growth of woody species, in particular, may be reduced.

Soil Nutrients. As is typical of many forest soils, nutrient levels in the study area soils are low to very low partially due to soil reactivity (low pH). During soil storage, these levels would only decrease as biological activity decreased and precipitation leached nutrients through the stockpiles. Coniferous forest debris in stockpiles could further decrease soil pH as the material weathers. (Liming could minimize this effect but Sterling has not proposed it.) Until vegetation became re-established and soil building processes began again on reclaimed areas, inadequate nutrient status would continue to be limiting.

This is particularly true with phosphorus, which is an essential plant element. Soils formed in volcanic ash often fix phosphorus in a form unavailable for plant uptake (Jones et al. 1979). Organic matter in the upper few inches of native soils acts as a reservoir for phosphorus. Plant-available phosphorus is released by microbial decomposition within and directly (1 inch) below the forest litter layer (pers. comm. L. Kuennen, USFS, with P. Plantenberg, DEQ, February 14, 2000). Respread soils would lack organic matter, as explained above, therefore, surface applications of soluble phosphorus fertilizer at the time of seeding, as proposed by Sterling, may be of little value.

Sterling proposes to determine other fertilizer requirements at the time of soil redistribution and to apply fertilizer at the time of seeding and in the season following seeding. This would further help reduce low-nutrient impacts.

Metal Contents in the Reclaimed Rooting Zone. Metals such as aluminum, iron, and manganese are common in native forested soils in the area. They are common metals released by the weathering of soil parent materials, even in nonmineralized areas. These metals can become concentrated in a particular soil horizon by various soil-formation processes. They usually are not available to plants at neutral reaction (pH) values. However, if soil surveys indicate soil pH is around 5.0, the Agencies require soil metal testing to identify possible naturally occurring concentrations of these and other metals. Most soil samples tested had pH values between 5.1 and 6.5. Several samples had pH values between 4.5 and 5.0. Samples with low pH were found at all proposed disturbance areas.

Soil samples in the study area were tested for a number of heavy metals that often are associated with mineralized zones and could hinder plant growth. These included lead, zinc, nickel, molybdenum, copper, aluminum, antimony, arsenic, and cadmium. With the exception of aluminum, the levels of each were near or below instrument detection limits. Aluminum was slightly elevated (0.9 to 3.4 parts per million, or ppm) in some study area soils proposed for salvage, particularly those derived from volcanic ash-rich loess over lacustrine deposits. These aluminum levels are common in forested soils of northwest Montana.

Native vegetation of the study area would be expected to be adapted to the ambient soil chemistry characteristics, including elevated aluminum levels. However, since many of the grass and forb species proposed in Sterling's revegetation seeding mixes are not native or locally adapted, limited phytotoxicity may be a concern to reclamation success. McLean and Gilbert (1927) showed that timothy (a grass species proposed in Sterling's interim and final revegetation seed mixes) is sensitive to aluminum at levels as low as 2 ppm. On the other hand, timothy occurs in the drier communities identified in the permit area (Scow, Culwell, and Larsen *In* ASARCO Incorporated 1987-1997) and has been used successfully in revegetation mixes for road cuts on the Kootenai National Forest (pers. comm. L. Kuennen, USFS, with P. Plantenberg, DEQ, February 14, 2000). The elevated aluminum levels may not accurately reflect the levels that would be available for plant uptake due to peculiarities of volcanic ash chemistry and testing procedures. The applicant has committed to identifying nutrient/ phytotoxicity problems in the event of poor germination and/or growth.

Seeps from other soil stockpiles in forested regions of Montana have elevated levels of iron and manganese. The levels of tannic acid are increased and soil pH is thereby reduced due to the breakdown of coniferous forest vegetation in the stockpiles. Low pH and increased levels of iron and manganese can result in complex nutrient deficiency and/or phytotoxicity problems in many plant species (Knezek and Ellis 1980; Kabata-Pendias and Pendias 1984.) Reduced plant growth and/or mortality would slow or severely impair reclamation. Applications of composted organic matter has helped improve plant growth on reclaimed sites with affected soils (Vodehnal 1993). Applications of lime are being used to increase pH. Without these amendments, plant growth has been limited.

The geochemical nature of waste materials generated during the mining operation were evaluated to determine whether they would pose problems for plant growth. The waste rock dump would be composed primarily of non-ore bearing stones and cobbles. Testing showed that this material has low leachable levels of metals (metals that would become soluble in soil water) that could affect plant growth (ASARCO Incorporated 1987-1997).

Tailings would consist primarily of fine sands and silts. Preliminary testing shows these materials are not potential sources of acid generation and that they have generally low levels of leachable metals (metals that would become soluble in soil) (see Hydrology or Geology sections). The levels of leachable metals that would be available to and potentially harmful to plants are less than levels reported in the literature (Gough et al. 1979 and Kabata-Pendias and Pendias 1984). This is verified by the fact that vegetation growing in the tailings at the Troy impoundment do not exhibit any toxicity problems.

Considering these results, the waste materials would have no potential adverse chemical impacts on respread soil or on plants whose roots may grow into these materials in the lower part of the rooting zone. Sterling would test waste rock and tailings prior to soil redistribution to reconfirm these results.

Reclamation Impacts

The goals of reclamation serve a number of purposes as described in Chapter 2. Tables 2-2, 2-4, 2-22, and 2-23 provide summary information on proposed disturbance and soil salvage acreage, revegetation approaches, postmining topography, and reclamation timing for all action alternatives. The discussion below focuses on soil handling and revegetation and the degree to which successful reclamation may be achieved.

Soil Salvage and Handling. The potential for reclamation success of disturbed lands is greatly improved when soil is salvaged and later replaced as a growth medium for plants. The primary limitations that affect soil suitability for salvage and reclamation at the Rock Creek Project include steep slopes, rock content, and texture. Salvage may be limited for soils with a volume of more than 50 percent hard rock fragments (larger than 1/16 inch diameter) or with large rocks (greater than 2 feet in diameter). Salvage is usually not required and not conducted on slopes exceeding 2:1 (50 percent) because of worker safety. Other reclamation limitations at the Rock Creek site include soils with high clay content, low fertility, low organic matter content, elevated aluminum concentrations where pH values are below 5.0, and nutrient deficiencies or toxicity problems if stored soils create acidic conditions.

To minimize compaction problems, soil would be handled only when the tilth is good and stored soils would not be disturbed again until respreading was scheduled. Surfaces to receive soil would be ripped to increase root penetration potential and to decrease slippage potential.

Concerns have been expressed about the depth of soils needed to reclaim proposed disturbances such that reclamation would achieve the goals of comparable stability and utility as required in MMRA (82-4-336 MCA). The tailings and waste rock are essentially inert and should not geochemically inhibit plant growth. Research generally has shown that replacement of 24 inches of soil over suitable mine waste rock would produce maximum revegetation (Coppinger, Ogle, and McGirr 1993). Depending upon the postmine land use, and availability of suitable salvageable soils, less soil may produce acceptable results. However, proposed soil replacement of 13 inches or less would not produce soil depths comparable to premine conditions. These depths likely would reduce successful revegetation, especially in areas where soils are naturally deeper (i.e., at the mill site and disturbed riparian zones).

At the evaluation adit, 8.3 acres are proposed for disturbance. Soils proposed for salvage have an ash-influence and have a very high rock content. Soil would be salvaged from the 4.3 acres (Lift 1) that are not rock outcrop or talus. A second lift soil would be salvaged from 2.0 acres (Lift 2) where soils are deeper. Soil would be respread in two lifts to an average depth of 12 inches on 5.0 acres on top of the portal and waste rock dump. The double-lift salvage and replacement provides for enhanced soil physical and chemical properties in the reclaimed surface soil layer because Lift 1 soils have more favorable conditions such as higher organic matter content. This practice salvages and then restores some of the natural soil profile that developed on the site since the last major climatic change. The remaining second lift soil would cover about 1.9 acres on the 1.25H:1V evaluation adit waste rock dump face at a depth of 13 inches. The rest of the steep waste rock dump faces, 1.4 acres, would be left as talus-like rock fingers.

The proposed support facilities area for the evaluation adit is located in Section 22 along Rock Creek. The disturbance area would be about 1.3 acres (see Table 2-2). Soil salvaged from parking lots and building sites would be minimal and stored adjacent to facilities after the facilities are removed and after regrading to approximate original contours. The soil would be respread at a depth of 24 inches and revegetated after the facilities were removed. (Dave Young, ASARCO Incorporated, in a letter to Kathy Johnson, May 16, 1994.)

Total proposed disturbance for the tailings impoundment area is 389 acres. The effective rooting depth for the native soils in this area varies between 18 and 33 inches, extending below the ash-influenced loess surface into the clay-rich subsoil (Noel *In* ASARCO Incorporated 1987-1997). However, the clayey subsoils (below 11 inches), which are poorly suited as a surface plant growth medium, were not proposed for salvage (Noel *In* ASARCO Incorporated 1987-1997). Sterling proposes a soil replacement depth of 9.5 inches. Most of these soils would be spread over the tailings impoundment (324 acres). The tailings material would be composed of fine sands and silts that would not be phytotoxic (lethal or damaging to plants). However, it is very likely that this material, especially the silts, would become very hard and compacted upon drying. Without scarification or deep ripping before soil placement, this fine tailings material could become an effective barrier to root penetration. Tailings on the dam face would be coarser and likely would not become a physical rooting barrier. However, a soil moisture differential may be created by two contrasting materials (soils and coarse tailings). Sterling proposes no segregation of fine or rocky soils. This fine texture soil would be placed on the 3:1 embankment slope and would be susceptible to erosion if revegetation efforts failed or vegetation was too sparse to hold the soil in place.

Soils stripped from the borrow areas 2 and 3 would be stored and then replaced during the 3-year predevelopment period. Because of the relatively short soil storage time, these sites would stabilize and approach premining productivity levels more quickly than other areas. Borrow area 3 would be used as a wetland mitigation site (see Wetlands). If possible, soils from impacted wetlands within the impoundment footprint would be used to reclaim borrow area 3. The borrow areas would be reclaimed to a depression below the original ground surface.

The total disturbance acreage for mill facilities and mine areas would be 79 acres. Salvageable soil depths in the mill site average about 21 inches (see Table 2-22). This depth corresponds to the ash-influenced loess surface and is where plant roots are concentrated. Substratum materials apparently provide little in terms of nutrients and normal water requirements for plants. Because the rock fragment content and slopes often exceed 50 percent in the mine and waste rock dump area, Sterling has proposed some salvage in this area depending upon operator safety. Sterling proposes to respread salvaged and stored soils from the mill site area over the mill site, mine, and waste rock dump areas. The average replacement depth would be 11.4 inches. As mentioned, this depth would be considerably less than the average topsoil depth for native soils in the facilities area. A substantial loss in existing productivity in the facilities area, which is important wildlife habitat (see Chapter 4, Biodiversity), would be expected. Vegetation (primarily trees) would be stunted and less vigorous because root volume (soil depth) would be reduced and soil horizons would be mixed. Further, it is not likely that spreading 21 inches of soil from the mill site area over all these disturbance areas to a depth of 11.4 inches would produce additional productivity increases to offset the impact of less soil at the mill site.

Soils along the transportation corridors (access roads, slurry line, powerline) would be stripped and stored adjacent to the disturbance. Soil from the waste water treatment disturbances would be stored on the 10-acre site.

Impacts resulting from soil salvage and handling would be moderate in the short term and moderate to minor in the long term for aesthetic considerations and comparable stability and utility determinations. The effects would be the most obvious on the reclaimed tailings impoundment area and the facilities and mine site areas. This is largely because soil depth would limit productivity and reclamation success especially on the south and west facing slopes of the tailings impoundment.

Vegetation Removal and Disposition. Sterling has not proposed any special plan to deal with vegetation removal and disposition. The lack of this plan could result in the loss of a source of native plant materials, less organic debris for BMPs, and loss of potential organic enrichment in stockpiled soils. Opportunities to enhance reclamation success could be lost.

Revegetation. The main issues relating to revegetation include scheduling of final revegetation, species selection, planting plans, establishment success, and growth rates to achieve cover and height objectives. These factors determine the speed and success of reclaiming the disturbed lands to comparable stability and utility.

The applicant would not implement final reclamation for most disturbances until the postoperational phase (after 31.5 to 35.5 years). Final reclamation would be done on some sites during the predevelopment period (years 1 through 3). These areas would include the borrow areas, the primary access road and new public road in the facilities area, and the mine and evaluation adit waste rock dumps. Final reclamation would be ongoing during predevelopment and operation (years 4 through 33) for soils stockpile sites, other roads, and the tailing impoundment dam face (ASARCO [now Sterling] Reclamation Plan *In* ASARCO Incorporated 1987-1997) (see Table 2-22).

Trees may be planted throughout the project life as areas are reclaimed. Sterling would plant trees at the end of operations on the facilities and mine areas and on the tailings impoundment face and top. Sterling predicts it would take 15 years for the tailings impoundment to be fully drained and for the entire tailings impoundment surface to be workable. Some areas would be workable within 1 year, as experience has shown at the Troy Mine. Reforestation of the transportation corridor and evaluation adit area would occur by natural regeneration. Foregoing or delaying tree planting may reduce success of establishment, and result in lower growth rates. Also, visual screening of and restoration of wildlife habitat on disturbed areas would be delayed (see Scenic Resources and Biodiversity).

The applicant has developed three final seeding/planting mixes to accommodate the differences in disturbance areas (see Table 2-22, Appendix J) (ASARCO's [now Sterling] Reclamation Plan, ASARCO Incorporated, 1987-1997). Grasses (primarily introduced species) and forbs are the same for all three mixes with the exception that alsike clover would not be planted on the road corridors or at the facilities and mine area until after operations to discourage wildlife use that could interfere with traffic and other operations.

Shrub revegetation would be done on some but not all reclaimed areas. In the tailings impoundment area, shrubs would be seeded except on the dam face where they would be planted at the end of operations. In the facilities and mine areas, shrubs would be seeded. In the transportation corridor, shrubs would be planted on road cut-and-fill slopes, only as necessary to enhance slope stability. Seeded shrubs would take longer to establish than planted shrubs so wildlife habitat and visual screening objectives would be delayed. For the remaining disturbance areas, the applicant is depending on natural invasion of shrubs from adjacent undisturbed areas. This practice would further slow attaining visual screening and wildlife habitat objectives.

Proposed revegetation of the evaluation adit includes seeding only grasses. Trees and shrubs would not be seeded or planted. Sterling would rely on invasion and establishment from surrounding undisturbed areas. This approach would increase the time needed to achieve a natural-looking setting, and provide screening and important wildlife habitat forage components in the short term. A well established grass cover in this area would likely retard the establishment of volunteer trees.

For the tailings impoundment area, the applicant has proposed two tree planting mixes. Douglas-fir and ponderosa pine would be planted (in a 50/50 proportion) on the dam faces. Douglas-fir, western white pine, western larch and lodgepole pine would be planted in a ratio of 40:20:20:20 on the impoundment surface and associated areas. Species selection and stocking rate (665 trees/acre) is appropriate for undisturbed site conditions attempting to meet stated reclamation goals for timber stands. The Agencies believe this species mix would not perform well on reclaimed areas due to the site conditions. The dam face would be a particularly harsh growing site because it would face west and south; a hot, dry exposure during the late spring and summer months. (pers. comm. M. Lincoln, USFS, D. Leavell, USFS, and L. Kuennen, USFS, with P. Plantenberg, DEQ, February 14, 2000).

The waste water treatment plant would be decommissioned and dismantled after mine discharge water met water quality standards without treatment. The site would be regraded and revegetated. Revegetation and planting plans would be similar to that proposed for the impoundment and associated disturbances.

Tree height growth rate and ultimate tree height is influenced by a number of factors, including species, site productivity and competition (Smith 1962). Under the most favorable conditions, it would take 15 to 30 years for planted trees on the dam face to reach heights of 20 to 40 feet. Even assuming good survival and establishment of seedlings, replaced soil would be deficient in physical and biological characteristics, discussed above, necessary for optimum growth conditions. Tree establishment on the impoundment surface would be successful initially because replacement soil and site conditions would be suitable for tree growth. However, without ripping of the tailings before soil placement, tree root growth would be hindered at the tailing-soil interface within 5 years. Overall growth rates likely would decline, in most part due to decreases in soil water availability and compaction. Root systems would continue to grow and even penetrate the substrate, but the mass of roots would be concentrated in the upper foot of soil, resulting in slow-growing, possibly stunted trees over time.

This shallow rooting could also affect reclamation success on the tailings impoundment dam face more than on the impoundment surface. Volunteer trees growing on the lower portion of the Troy Mine impoundment face have shallow root systems that spread along the contact between respread soil (3-12 inches deep) and the tailings. If similar conditions prevailed on the proposed Rock Creek impoundment face, trees would be likely to develop shallow root systems, resulting in possible stunted tree growth and blowdown during high wind events. This, combined with the hot, dry exposure would greatly limit planted tree growth rates. Trees at year 30 may be only 10 to 25 feet tall (pers. comm. M. Lincoln, USFS, D. Leavell, USFS, and L. Kuennen, USFS, with P. Plantenberg, DEQ, February 14, 2000).

For the facilities and mine sites and associated disturbances, the applicant proposes a tree planting mix of larch, spruce, lodgepole pine, and Douglas-fir in a proportion of 20:20:20:40. Stocking rate would be 665 trees per acre. Planting would occur at the end of operations. Although this mix may meet restocking goals for timber on less disturbed sites, it may not meet overall wildlife or scenic resource goals as identified by the Agencies (pers. comm. M. Lincoln, USFS, D. Leavell, USFS, and L. Kuennen, USFS, with P. Plantenberg, DEQ, February 14, 2000).

The proposed planting plan includes planting trees in 2-to- 4-foot wide strips (6-by-6-foot spacing) interspersed with strips of seeded grass. Trees would only be planted on slopes less than 3:1 (33 percent). This arrangement would not match surrounding landscape features and thus would not meet visual quality objectives (see Scenic Resources).

The applicant's proposed soil testing program to identify fertilizer and other possible soil amendment needs would minimize plant-nutrient deficiencies and would improve growth rates and, in turn, revegetation success. Results of the proposed revegetation program, especially the shrub and tree planting plan, would extend the time needed to meet visual screening and comparable stability and utility objectives in the short term. These impacts would decrease over time as soil redevelopment would overcome the restrictions imposed by limited soil quality and quantity.

Alternative III

Soil Impacts

Proposed changes to the applicant's Rock Creek mine plan would result in an overall increase in disturbance area of 24 acres to a total of 609 acres. Access road mileage in the transportation corridor, public road mileage in the facilities area, and soil stockpiles adjacent to the impoundment would increase but disturbance associated with the utility and tailings corridor would decrease. Although the overall disturbance acreage would increase under Alternative III, the proposed mitigation measures should result in less erosion overall. This, in turn, would result in less chance for sedimentation to Rock Creek.

Interim seeding would be conducted as soon as possible (regardless of season) after disturbance and on all soil stockpiles, as they were built and all other areas as they were completed. This would reduce erosion potential greatly (pers. comm. L. Kuennen, USFS, with P. Plantenberg, DEQ, February 14, 2000). Similarly, final seed mixtures would be planted as soon as possible after site preparation occurred. Stockpiles may require additional protection measures, such as mulching depending on erosiveness of salvaged soils.

Disturbances associated with the Miller Gulch siding would be minimal. Bridge replacement increases the chances for erosion and sedimentation in Engle and Rock creeks. However, the nearly perpendicular alignment would disturb less area and the bridge structure and fill slopes would be less susceptible to erosion and washout than with a skewed alignment. Additional BMPs and construction monitoring would be implemented and the extent and timing of construction would be required as part of the special use permit issued by KNF (see Transportation). To further minimize erosion, a vegetation management plan would be developed to reduce disturbance during clearing and construction and to maximize revegetation success on all cut-and-fill slopes and reclaimed road segments.

Other modifications of soil handling, reclamation, and revegetation plans discussed in Chapter 2 would preserve more of the native soil characteristics that have developed on the site over the last 10,000 years. Two-lift salvage in the impoundment area and mill site would help reduce the impacts of soil mixing to soil physical, biological, and chemical properties discussed in Alternative II.

Reclamation Impacts

The overall reclamation plan would be reassessed and updated with the Agencies' approval, to provide for a balance of resource needs, such as soil stabilization, reclamation success, biodiversity and scenic resources. Changes to the applicant's reclamation and revegetation plans are described in Appendix J and Chapter 2.

Vegetation Removal and Disposition. A vegetation removal and disposition plan would ensure the orderly removal and best use of existing vegetation for use as sources of native plant materials, organic debris for use in BMPs, and for use as organic amendment to stockpiled soil. This would enhance reclamation success over that predicted under Alternative II.

Soil Salvage and Handling. Reclamation would be enhanced by salvaging soils to greater depths (total additional volume about 767,000 cubic yards) and segregating/respreading soil based on quality of horizons. An additional 15 acres would be needed to store the additional soil. Increasing respread depths to at least 24 inches would increase tree growth rates by providing suitable soil volumes for root systems (Armson 1968; Berndt and Gibbons 1958; Cox, McConnell, and Matthew 1960; and McMinn 1963). Reclamation of the relocated waste rock dump into two smaller dumps adjacent to the facilities area would be more feasible. Soils would be salvaged to a greater depth (up to 36 inches) and in two lifts from the tailings impoundment and facilities areas and some soil would be salvaged from about 3 acres (slopes about 40 percent) of new dump locations and stored along the sides and bottom edge. Soil could be respread on the two relocated mine waste rock dumps more effectively and would make the sites more suitable for plant growth. Similarly, the proposed changes in the evaluation adit dump configuration would result in more effective use of salvaged soil. Soil salvage along new roads is recommended only where terrain is suitable and where salvage provided clear benefits for revegetation. All other soil salvage depths and volumes would be the same as for Alternative II.

Soil stockpiles would be amended with lime because forest vegetation debris would be incorporated into the piles. The lime would ensure that poor quality seeps do not develop and overall quality of soil is not additionally affected by coniferous forest debris stored in the piles.

Linear features, such as benches on waste rock dumps and the tailings impoundment crest, would be altered and other recontouring would be conducted to more closely resemble natural features. Reclamation and planting of the tailings impoundment face would begin in year 8, after the starter dam was completed. Interim mulching would reduce erosion from the lifts until regrading, soil respreading, and planting were accomplished. Every 3 or 4 years, as the tailings impoundment grew taller (e.g., every

25-30 vertical feet or whatever is practical for large machinery to maneuver for recontouring and planting), a new strip would be graded and planted (see Scenic Resources).

These changes to the reclamation plan would decrease concerns about plant root growth into compacted tailings and enhance tree and shrub growth rates. In turn, requirements for reclaiming the site to comparable stability and utility would be more closely achieved. The Agencies also would require monitoring of soil replacement depths, re-evaluation of soil handling to maximize direct-hauled soils, and identification of other techniques to minimize length of time soil was stored.

Revegetation. The overall revegetation plan would be updated to better meet the Agencies' concerns for rapid soil stabilization, restoration of soil productivity, early screening, and species establishment and diversity (see Appendix J). Grass and forb seed mixes and tree and shrub plantings would be reassessed to address site specific objectives. Modifications include:

- selecting species that consider plant succession and environmental conditions of recontoured areas to best achieve overall watershed and habitat conditions; for example, select a mix dominated by seral (tree) species adapted to harsh or disturbed sites;

- developing a vegetation management plan to specifically address disturbances and revegetation of the transportation corridor to enhance early screening and prevent redisturbance at closure;

- conducting interim seeding immediately, as discussed above, on all disturbances to decrease the potential for noxious weed invasion and, decrease erosion potential by quickly stabilizing disturbed sites;

- accelerating final revegetation by planting trees and shrubs as soon as final contours were reached; planting shrubs and trees in mosaics that resembled the surrounding visual landscape;

- testing substrate (tailings, waste rock) and stockpiled soil chemical and physical conditions to identify fertilizer, liming, and other soil amendments that may be necessary to ensure adequate plant growth;

- scarifying soil prior to seeding to reduce soil compaction and enhance soil-seed contact;

- choosing species that met short-term needs to stabilize soil but would not be attractive to wildlife (developed as a result of the bear problems at Troy);

- selecting species that met long-term needs for wildlife including browse, forage and cover, and arrangement of wildlife habitat components in the Rock Creek watershed (travel corridors, snags, winter range) to mitigate some potential impacts to biodiversity identified in this chapter;

- collecting seed from the permit area and propagating seeds and plantings to ensure locally adapted and genetically compatible stock and to meet Forest Service objectives of limiting impacts to biodiversity of plant species;

- choosing rapidly establishing grasses that would not hinder native colonization or that would spread off the reclaimed area (eliminate species such as timothy);
- choosing locally native pioneer species (such as fireweed and pearly everlasting) for rapid stabilization to limit biodiversity problems;
- hand planting trees and shrubs on slopes exceeding 33 percent due to operational constraints of planting equipment or steep slopes;
- protecting seedlings from wildlife browsing until trees grew above browsing height because of historic problems with wildlife foraging on shrub and tree plantings;
- using shade cards or other techniques to protect planted seedlings from weather extremes to enhance survival;
- using stockpiled slash (greater than 3 inches) to provide shading and precipitation catchments to enhance survival;
- using chips, sawdust, logging debris, or other organic amendments to help build soil organic matter; identifying and correcting carbon/nitrogen ratios;
- inoculating tree and shrub seedlings with appropriate mycorrhizal fungi to enhance survival and nutrient cycling;
- inoculating legume nitrogen-fixing species (clover and ceanothus) with appropriate bacteria to increase their nitrogen-fixing abilities;
- using drip irrigation April through early June only for 1 to 3 years to help establish trees and shrubs on the tailings impoundment face and to avoid the need for replanting; and
- a long-term reclamation monitoring plan documenting the effectiveness of the above mitigations and providing evidence needed to add or eliminate revegetation changes.

These changes in planting strategies and species selection would result in a marked improvement in revegetation success and in restoring soil productivity as quickly as possible. This, in turn, would better meet visual quality and habitat goals.

Alternative IV

Soil Impacts

Impacts to the soil resource would be similar to those identified under Alternative III, with the following exceptions. Relocation of the mill and adit site facilities and associated reductions in road, utility, and powerline corridor lengths would result in an overall decrease in the disturbance area to 542 acres compared to Alternatives II and III. Mine waste rock would be used for mill pad construction and starter dike material thus eliminating the need for a separate waste rock dump. Soil loss due to erosion would be greatly reduced since road length would be reduced. Where possible, a 300-foot vegetation buffer would be maintained between Rock Creek and the mill site, new construction in the transportation/utility corridor, and at borrow area 3 where a replacement wetland would be developed. If soil eroded off-site, this buffer would more effectively filter sediment before it could reach Rock Creek. All other soil impacts would be the same as under Alternative III.

Reclamation Impacts

Improvements to the reclamation plan would also be similar to those identified under Alternative III. Soil salvaged from the confluence mill site would total about 151,665 cubic yards. It would be salvaged in two lifts (lift 1 = 19 inches, lift 2 = 6 inches). Soil would be respread to no less than a total of 24 inches in two lifts. Soil salvage and respread would be easier and more efficient due to the site configuration and gentler slopes. In turn, revegetation is likely to be more successful and comparable stability and utility would be achieved.

Reclamation and planting on the mill pad faces would occur immediately after construction, so that screening would occur early in the project life.

Alternative V

Soil Impacts

Impacts to the soil resource would be similar to those identified under Alternatives II, III, and IV with the following exceptions. The total disturbance area listed in Table 2-2 has been reduced in Alternative V to 482 acres mainly by changes in borrow areas, soil stockpiles, powerline and mill facility disturbances. This is 102 acres less than Alternative II, 127 acres less than Alternative III, and 60 acres less than Alternative IV. In general, less disturbance equates with less soil impacts.

Soil Loss

Soil loss from the proposed project facilities would be essentially similar to Alternatives II, III, and IV except in the paste facility area. The potential for soil loss in Alternative V in the tailing paste facility area is reduced because less soil has to be stripped in advance as compared to a typical tailing impoundment soil stripping program. The tailings impoundment Alternatives II, III, and IV would require the entire footprint of 324 acres stripped in advance, leaving the disturbed areas and all soil stockpiles subject to erosion. This is potentially important because the most erosive soils in the area are the lacustrine soils found in the paste facility footprint. Less disturbance equates with less soil loss.

In addition, the applicant has proposed a concurrent reclamation plan as major stages of the paste facility are completed, beginning in year 7 of the project. As proposed, the Bottom-Up construction option would not have any portion of the paste facility at final grade until year 20. In contrast, the Top-Down construction option begins to have areas at final grade in Year 7. The Bottom-Up option has an area of maximum disturbance of 190 acres in Year 19 (pers. comm. Bill Thompson, Hydrometrics, with Nancy Johnson, DEQ, August 29, 1997). In contrast, the Top-Down option has a maximum area of active disturbance of 121 acres in Year 26. The combined option would have variable acreage depending on which method is being used at the time. As an Agency mitigation, Sterling would be required to reclaim any portions of the paste facility that are at final grade each year. The final engineering design plans for the paste facility should allow Sterling to deposit the paste to the approximate final grade and minimize regrading at a later date. This allows for more aggressive concurrent reclamation on an annual basis.

This reduction in acres disturbed at any one time limits soil losses operationally within the paste facility footprint. In addition, soil stockpiles are smaller. Soil losses after reclamation of the paste facility using the Bottom-Up option would be less than the tailings impoundment in Alternatives II, III, and IV even though the current conceptual design for the Bottom-Up option produces an ultimate configuration that is essentially the same as the impoundment with a 3H:1V outer slope and essentially the same number of sloped versus flat acres. Ultimate soil losses would be less because the concurrent reclamation schedule limits the acres of active disturbance and allows more acres to be reclaimed with direct haul soil which enhances reclamation success. Concurrent reclamation using the Top-Down option would limit soil losses even more because the ultimate slope is 5H:1V rather than 3H:1V. If the Bottom-Up option could be designed with flatter slopes to more closely resemble the final configuration of the Top-Down option, soil losses would be similar to the Top-Down option. The combined option would produce potential soil losses between the other two extremes.

In addition to reduced soil losses from less disturbed acres and more concurrent reclamation, Sterling would have to apply soils of varying quality on different slope angles. The lacustrine soils which are the most erosive, could only be placed on slopes less than 8 percent and that are not in drainageways. Colluvial, alluvial, and lacustrine soils mixed with specific rock contents would be used on slopes greater than 8 percent (see the Reclamation of Tailings Paste Facility section for Alternative V in Chapter 2). Sterling would need to conduct a detailed soil survey to ensure that enough soil materials exist to complete the reclamation with appropriate materials and to ensure there is enough materials available to construct the toe buttresses.

In summary, soil losses within the footprint of the disturbances proposed in Alternative V would be less than Alternatives II, III, or IV. The Agencies have concluded that enough soil exists within the footprint of the tailings impoundment site to complete the reclamation as proposed by the Agencies in the modified reclamation plan. Losses of soils within the footprint would be captured by sediment and erosion control BMPs reducing soil loss impacts to acceptable short-term limits. Long-term losses would be less than the 2 tons/acre/year threshold needed for successful reclamation. Impacts from any soil loss off the disturbance acreage is discussed in Hydrology and Aquatics/Fisheries.

Other Soil Impacts

The same factors listed above that reduce soil losses in Alternative V, also reduce impacts to physical characteristics, biological activity and nutrient levels. This would produce greater reclamation success as soil redevelopment would be accelerated as a result. Soil would not be in stockpiles as long as in Alternatives II, III and IV. The initial soil stockpiles should be used to reclaim the first acres of disturbance that reach final grade. Additional soil stockpiles needed operationally could be placed on the portions of the completed tailings deposit.

Reclamation Impacts

Reclamation impacts from soil salvage and handling and the revegetation plan would be similar to those identified in Alternatives III and IV with the following exceptions.

The pipeline corridor reclamation would be enhanced by covering the pipeline with 24 inches of soil. The majority of the pipeline would then remain in place at closure and reclamation would be considered final on the majority of the pipeline route. Redisturbance would be limited to removal of pipelines at stream crossings at mine closure or as soon as pipelines would no longer be required. This would enhance reclamation potential and allow trees to establish over the mine life enhancing the revegetation and therefore the aesthetics of the pipeline corridor. Double-walled pipe limits the chances of tree roots affecting pipeline performance over the 30 year mine life. Trees may have to be cleared under the powerline if they threaten powerline safety.

The reclamation of the tailings paste deposit would be enhanced by operational practices described in the soil impacts section above. Soil loss would be limited by less disturbance at any one time. Soil stockpiling would be limited; whenever possible the oldest stockpiled soil would be used first and more soil could be direct hauled. This would increase soil biological activity, minimize impacts to soil physical characteristics, and soil nutrients. Agency mitigations to place salvaged lacustrine soils on slopes less than 8 percent would replace these soils on flatter slopes similar to what they had been salvaged from. The rockier soils would be placed on slopes greater than 8 percent and in drainageways. These mitigations would limit long-term potential for erosion and sedimentation and recreate soil profiles that more closely resemble native soils on slopes and swales in the area. Reclamation and subsequent revegetation potential would be increased as a result over the other action alternatives.

The paste deposition process would allow for the addition of seed, fertilizer, organic amendments, cement and other additives as needed operationally to control erosion, enhance stability, or enhance reclamation as final design contours are reached. The Agencies would require that the reclamation plan contain provisions to include appropriate amendments to the tailings paste to adequately control erosion and facilitate interim and final reclamation. The paste deposition process also allows selective placement and regrading to create topographic variation in the final design features. Sterling would be required to submit updated regrading and more detailed revegetation plans containing mitigations described in Chapter 2 for Alternative V for all mine facilities for Agencies' approval. All of the features inherent in the paste deposition process would lead to better reclamation on the proposed disturbance areas improving the visual appearance and revegetation potential over the tailings impoundment Alternatives II, III, and IV.

Overall reclamation impacts to soils and revegetation would be minimized in Alternative V when compared to impacts in Alternatives II, III, and IV and the reclaimed sites would be stable and capable of supporting the post-mining landuse. The use of rocky soils on steep slopes would increase stability on those slopes compared with the other action alternatives.

Cumulative Impacts

Cumulative impacts to soils from other activities primarily would be associated with potential soil loss. Erosion would increase in the Rock Creek drainage by some unknown amount as a result of possible private timber harvests, new road construction, and possible commercial and residential development. Increased erosion may result in increased sediment rates to Rock Creek and the Clark Fork River. KNF requires the implementation of BMPs during logging and road-building operations. If these practices were properly implemented and maintained, on-site erosion and, in turn, potential increase in sedimentation to Rock Creek would be minimized. More acreage would become unproductive due to increases in roads and paved or graveled surfaces, however this additional loss is not expected to affect overall productivity in the region. Noxious weeds would continue to increase in the area (see Biodiversity).

Cumulative impacts to the soil resource from the Rock Creek project primarily would be associated with potential soil loss. On-site erosion within the disturbed areas would be controlled with BMPs. Off-site erosion would increase sediment to Rock Creek as discussed in the Hydrology and Aquatics/Fisheries sections. If proposed erosion mitigations are properly implemented and maintained, on-site erosion and, in turn, the potential increase in sedimentation to Rock Creek would be minimized. More acreage in the permit area would be unproductive due to the 481 acre increase in disturbances including roads and other paved or graveled surfaces, however this additional loss is not expected to affect the overall productivity in the region. When combined with other developments associated with private land development in the region as a result of population increases spurred by development of the proposed project, the Montanore project and the general increase in the population in the area could reduce the long-term productivity of the region in terms of timber production and wildlife habitat (see Biodiversity).

HYDROLOGY

Summary

The proposed adits, underground mine, mill facility, utility corridor, waste rock dump, and the tailings facility (impoundment or paste facility) and the underground storage reservoir would have the potential to affect surface and ground water resources under all action alternatives. Hydrologic effects would include changes in water availability and water quality.

Total ground water inflow to the evaluation adit is estimated to be about 168 gpm. Inflow to the conveyor and service adits would be about 228 gpm. Inflow to the underground mine is estimated to be about 1,650 gpm. Total inflow to the underground workings and adits would equal about 2,046 gpm. The quality of mine inflow would be affected by blasting activities increasing concentrations of nitrogen, ammonia, suspended solids, and metals. Excess mine water would be temporarily stored underground, and would be treated to remove suspended solids, metals, and nitrogen prior to discharge via a pipeline to the Clark Fork River. The impact of treated discharge on the quality of water in the Clark Fork River in Montana and Idaho would not be measurable due to the low concentration of constituents in the treated effluent and the relatively higher flow available for dilution. Under Alternative II (Sterling Project Proposal) at mine closure, water treatment would cease and the mine would be allowed to fill with water. Under Alternatives III and IV, at mine closure, excess mine water would continue to be treated until it eventually met MPDES effluent limits. Eventually the mine adits would be plugged and mine water would collect in the underground workings. Under Alternative V, mine water would continue to be treated until it met MPDES effluent limits without treatment. If the adits were not to be plugged then water meeting the MPDES limits with or without treatment would be discharged into the Clark Fork River in perpetuity unless the discharge eventually met standards for discharge into Rock Creek. If a decision was made to plug the adits, then only the water flowing into the adits would be treated for discharge until the appropriate standards or limits were achieved without treatment..

Several wilderness lakes in the CMW overlying mined-out portions of the mineral deposit could potentially be affected if faults or fractures acted as ground water conduits, and the pilot hole testing and grouting programs were ineffective. As a result, water levels in lakes and ground water inflow to the lakes might be reduced. The potential for this to occur depends on the geologic and hydrologic setting of each lake. Cliff Lake has a high likelihood of impact, Moran Basin has a moderate likelihood of impact, *and Copper Lake has a low likelihood of impact (MT DEQ 2001a). The Agencies' requirement for additional rock mechanics and hydrologic studies in Alternatives III through V and buffer zones near faults, lakes, and outcrops in Alternative V, would further reduce the risk of subsidence-related or hydraulically induced draining of these lakes. Water occupying fractures in rock above the operating level of the mine could be lost to mine inflow.*

After mining was complete and if the adits were sealed, the mine would fill with water until steady state conditions were reached. At steady state, inflow to the mine would equal outflow. The total volume of flow underground cannot be quantified, but should be relatively low due to low bedrock permeabilities. If there is outflow, the most likely discharge locations would be below the ore outcrops at the northeast and southeast ends of the deposit and in Copper Gulch. If access adits were not sealed, excess mine water could be discharged to surface waters only if it could meet effluent limits of the receiving waters; perpetual water treatment may be required prior to discharge to the Clark Fork River, unless the discharge could meet MPDES limits without treatment. In this case, hydraulic stresses on overlying lakes and streams could continue if present. Under Alternative V, the means of adit closure would depend upon the impacts, if any, to wilderness lakes that occurred during mining and the potential for the creation of down gradient springs and seeps from the underground body of water stored in the mine after the mine was sealed

Make-up water from a well located in the Clark Fork River alluvium would be required if mine adit and tailings reclaim water could not provide all water needed to maintain mill operations. The impact of the proposed withdrawal would not significantly affect existing instream flows or existing beneficial uses of the Clark Fork River or ground water.

Ruptures or breaks in either the proposed tailings slurry or return water lines, or an accidental rupture of a supply or tanker truck could result in short-term water quality impacts to Rock Creek. The potential of tailings pipeline ruptures and spills in the West Fork Rock Creek upstream of the stream crossing near the confluence are eliminated under Alternatives IV and V. The potential for pipeline rupture and spills to Rock Creek are greatly reduced by burying the pipeline under Alternative V. The effect that spills and ruptures would have on the overall water quality of Rock Creek cannot be predicted with certainty.

Depending on weather conditions and the efficiency of best management practices used, sediment and nitrogen loading to Rock Creek below the proposed mill site would temporarily increase during project construction. A detailed description of the R1-WATSED model and simulations is provided in Appendix N. The amount of sediment would be reduced under Alternatives III through V due to mitigations, including reduction of existing sediment sources in the drainage. The increase in the concentration of nitrogen in Rock Creek cannot be estimated with certainty, and would depend on several factors. Research suggests that the impacts of leaching soluble nitrogen in waste rock would be short lived. All nitrogen compounds would probably be leached out within one month to one year (British Columbia Ministry of the Environment 1983). Under Alternative V, seepage from the mill pad would be collected in an underdrain and routed to the mill for reuse. This action would reduce nitrate loading to Rock Creek.

Development of a tailings facility under all action alternatives would alter more than 300 acres of natural watershed in the Miller Gulch drainage. Surface water runoff in Miller Gulch would decrease *during the life of the project, and would likely return to near normal after reclamation if impoundment surface was graded to drain to previous drainage.*

Under Alternatives II, III, and IV, seepage from the proposed tailings impoundment to ground water within the ground water mixing zone could approach several hundred gpm by the end of the 30-year mine life. Seepage water would likely contain elevated concentrations of nitrate, metals, and total dissolved solids (TDS). Seepage water quality from the impoundment would likely be similar to impoundment seepage water quality at the Troy Mine, and would affect ground water quality within a ground water mixing zone permitted by DEQ (see ARM §17.30.502(6) for the definition of a mixing zone). An engineered perimeter drain and ground water extraction well system would pump seepage water back to the tailings impoundment, and would prevent changes in ground water quality outside of the mixing zone, and would prevent discharge of tailings impoundment seepage to Rock Creek, Miller Gulch, and the Clark Fork River. Continued monitoring of a series of tailings impoundment compliance wells would minimize or possibly eliminate the potential for seepage to migrate outside the mixing zone. Under Alternative V, seepage from the proposed paste facility would be approximately 20-30 gpm. An underdrain, seepage collection system, and an approved mixing zone would still be required.

Under Alternatives II, III, and IV, after the tailings impoundment was reclaimed, seepage from the impoundment would decrease, and the impoundment would dewater over several decades. Therefore, the perimeter seepage collection system would potentially need to be operated and maintained for Alternatives II through IV, and ground water would be monitored for several decades for all action alternatives. Under Alternative V, the 20-30 gpm seepage rate would decrease substantially after reclamation.

Under Alternatives II, III and IV, sediment and tailings leachate would be uncontrollably released to the environment in the unlikely event of catastrophic failure of the tailings dam. The volume of material released and the effect of this release on the environment cannot be predicted, and would depend on the type of failure, the size of the tailings impoundment at the time of failure, the volume of water associated with the failure, and the initial volume and character of the sediments. During a failure, sediment and tailings water could flush into Rock Creek, Miller Gulch, and the Clark Fork River. Portions of this sediment mass would probably remain in these stream channels for an undefined period of time following failure, while tailings water and the remaining sediment would be carried downstream. Subsequent to any such failure seasonal high flows would continue to wash most of the remaining sediment downstream, and eventually the sediment would be stored in Cabinet Gorge reservoir upstream of the dam. Fine sediments from any such catastrophic failure would probably persist in the Rock Creek system for decades. Tailings water and sediments would eventually enter Lake Pend Oreille. Because of the volume of lake water available for dilution, it is possible, but unlikely, that changes in concentrations of dissolved or total recoverable metals, or nutrients would be measurable in the long term. Short-term effects temporarily could impair some beneficial uses such as domestic water supply. Under Alternative V, the probability of catastrophic failure would be substantially reduced. Failure modes such as paste collapse would pose a maintenance problem that would require remediation to avoid potential environmental impacts to surface water resources.

Introduction

Water Quality Standards

Montana's surface water standards, shown in Table 4-13, for aquatic life and human health are found in Circular WQB-7, September 1999) and the prohibitions discussed in ARM §17.30.637. In implementing these standards, DEQ requires analysis of total recoverable metals. DEQ would base effluent limits and other conditions of the Rock Creek Mine Montana Pollutant Discharge Elimination System (MPDES) permit on both numeric and narrative water quality standards and Montana's nondegradation policy. Designated beneficial uses include potability for public water supply, growth and propagation of salmonid fish and associated aquatic life, wildlife, agriculture, recreation, and industrial supply. A Total Maximum Daily Load (TMDL) calculation would be required because Rock Creek is listed as a partial supporting-medium priority stream. The discharge permit would be submitted to EPA for approval as a partial TMDL for the Clark Fork River.

Ground water standards for human health are also found in WQB-7 (MT DEQ 1999), and are summarized in Table 4-13. In implementing these standards, the DEQ requires analysis of dissolved metals. Ground waters are designated Class I waters and must be maintained for human consumption, irrigation, livestock, wildlife, and commercial and industrial purposes with little or no treatment (ARM 17.30.1006).

Both surface and ground water in the vicinity of the project are considered high quality waters and are subject to Montana's Nondegradation Policy (75-5-303, MCA). Discharges to high-quality waters are allowed provided that all existing uses of state water are protected and the resultant change in quality is determined to be nonsignificant by the criteria of ARM §17.30.715. In this section, water quality impacts are calculated and compared to existing standards and trigger values (ARM §17.30.702[23]), for toxic parameters, which are used to determine if impacts are nonsignificant as per the Nondegradation Rules . Water quality impacts and comparison to existing standards, and trigger values (ARM §17.30.702 [23]) are used to determine whether or not a given increase in the concentration of parameters is significant or nonsignificant as per the nondegradation rules; that is, the maximum allowable increase in concentration. As per the nondegradation rules, increases in concentrations of parameters which are carcinogenic or have high bioconcentration factors are always significant, and can only be allowed via an "authorization to degrade." If this became the case, Sterling would have to request the authorization which would be evaluated at that time.

The Idaho Department of Health and Welfare, Division of Environmental Quality, administers Idaho's Water Quality Standards (see Table 4-13). These standards, along with newly adopted numeric toxics criteria based on the National Toxics Rule, effective August 24, 1994, have been used to evaluate the applicant's proposed discharge to the Clark Fork River and potential impacts to Idaho water resources. For substances that Idaho does not regulate by numeric criteria, the EPA 1986 Quality Criteria for Water (Gold Book) values are used, along with other methods, to determine impacts to designated beneficial uses. Designated beneficial uses of the Clark Fork River and Lake Pend Oreille include domestic and agricultural water supply, cold-water biota, salmonid spawning, and primary and secondary contact recreation.

TABLE 4-13
Montana and Idaho Water Quality Standards⊕ in Milligrams per Liter (mg/L)

	Montana Ground Water (Dissolved Analyses)			Montana Surface Water [h,+] (Total Recoverable Analyses)			Idaho Surface Water (Dissolved Analyses)
	Water Quality Standard	Trigger Value[t]	Revised draft MPDES Permit Ambient Standard	Water Quality Standard	Trigger Value[t]	Final MPDES Permit Average Monthly Limit[Q] (lbs/day)	Water Quality Standard
pH (SU)	N/A	N/A	NS	6.5-8.5	N/A	N/A	6.9-9.5
Hardness (as $CaCO_3$)	N/A	N/A	N/A	N	N/A	N/A	N
Alkalinity (as $CaCO_3$)	N/A	N/A	N/A	N	N/A	N/A	20.0S
Sulfate (SO_4)	N/A	N/A	N/A	N	N/A	N/A	N
Ammonia (NH_3 as N)[¶]	N/A	N/A	N/A	1.33	0.01	N/A	1.36[¶]
Kjeldahl Nitrogen (as N)	N/A	N/A	N/A	N/A	N/A	N/A	N
Nitrate and Nitrite (as N)	10	2.5	10	10	0.01	N/A	N
TIN	N/A	N/A	N/A	N	N/A	232	N
Orthophosphate (PO_4-P)	N/A	N/A	N/A	N/A	N/A	N/A	N
Total Phosphorus	N/A	N/A	N/A	N/A[⌀]	0.001	23.2	N
Arsenic	0.018	N/A	0.018	0.018	N/A	0.011	0.050
Cadmium[+]	0.005	0.0001	0.005	0.002[h]	0.0001	0.18	0.0019[h]
Chromium VI	0.10	0.005	N/A	0.011[h]	0.005	N/A	0.01045
Copper[+]	1.0	0.0005	1.0	0.008[h]	0.0005	0.91	0.0069[h]
Iron	0.3	N/A	N/A	0.3	N/A	N/A	N
Lead[+]	0.015	0.0001	0.015	0.0026[h]	0.0001	0.20	0.002[h]
Manganese	0.05	N/A	0.05	0.05	N/A	24	N
Mercury	0.00014	N/A	0.00014	0.000012	N/A	0.0002	0.000012
Selenium	0.05	0.0006	N/A	0.005	0.0006	1.08	0.005
Silver[+]	0.05	0.0002	N/A	0.003[h]	0.0002	N/A	0.003[h]
Zinc[+]	5.0	0.005	5.0	0.105[h]	0.005	7.7	0.089[h]

Source:
Circular WQB-7 (September 1999 edition); ARM 17.30, sub-chapters 6 and 10; and Idaho DEQ 1995.

SU = Standard pH Units N/A = Not Applicable TIN = Total Inorganic Nitrogen

t = Trigger values are used to determine whether or not a given increase in the concentration of parameters is significant or non-significant as per the non-degradation rules ARM §16.20.702(23)

¶ = pH and temperature dependent; value shown is calculated for 10°C and pH = 8.0. MT and ID standards are equivalent.

h = Standards based on Hardness = 85.7 mg/L and is the more restrictive of the human health or aquatic life standards. Values may differ from MPDES permit S.O.B. which used 100 mg/L hardness for calculations.

S = Minimal acceptable value except in waters which are naturally lower

N = Narrative standards (see Circular WQB-7 or State of Idaho regulations)

⊕ = Table values are based on chronic freshwater aquatic life criteria with the following exceptions: (MT and ID) Arsenic -human health criteria; Silver - acute freshwater aquatic life criteria; (MT) Manganese and Iron - human health criteria. Table values are the most restrictive standards of each state. Idaho standards for metals are dissolved concentrations; exceptions are mercury, selenium, and arsenic.

\+ = At a hardness value of 25 mg/L (hardness value for Rock Creek per WQB-7) the standards for identified metals are: cadmium - 0.0008 mg/L; copper - 0.0029 mg/L; lead - 0.0005 mg/L; silver - 0.00004 mg/L; zinc - 0.037 mg/L. Note that the 10 mg/L hardness value used in this footnote for calculating aquatic life standards for metals is lower than the minimum hardness value of 25 mg/L that appears in WQB-7. Therefore, calculations of the aquatic life standards using the 10 mg/L value are considered conservative, and protective of aquatic life.

⌀ = Clark Fork River Voluntary Nutrient Reduction Program (VNRP) targets for mainstem Clark Fork River is 0.039 mg/L (Tri-State Council, 1998)

Q Average monthly limits for Outfall 001 are flow dependent for cadmium, copper, lead, selenium, and zinc. Values presented in table are based on Clark Fork River flow equal to 3,610 CFS (default flow condition). Limits for these metals may be higher under high flow conditions subject to DEQ approval. For example, see tables under **Alternative II**, **Surface Water Quality**, *Water Treatment* in this section.

Idaho standards also designate the Clark Fork River in Idaho and Lake Pend Oreille as Special Resource Waters. This designation, requires that existing water quality cannot be lowered. Lowering of water quality is defined as a measurable adverse change in chemical, physical, or biological parameter relevant to a beneficial use. Finally, Section 402 of the Clean Water Act prohibits another state to authorize a discharge which violates a downstream state's water quality standards.

The draft MPDES discharge permit for the proposed project was issued for review in February 1996. The draft permit has been revised in response to agency and public comments. The final permit includes compliance limits for ground water and average monthly discharge limits for treated effluent reporting to surface water resources. These standards and effluent limits are provided in Table 4-13. A fact sheet and the statement of basis for the final MPDES permit is reproduced in its entirety as Appendix D of this EIS.

Other Hydrology Issues

TMDL status of Clark Fork River. The Tri-State Implementation Council has developed a TMDL for the upper Clark Fork River basin (headwaters down to the confluence with the Flathead River). Part of the TMDL strategy includes implementing a monitoring plan to sample water quality at key sites along the river. The Rock Creek Mine is not within the boundaries of the TMDL area for the upper basin. Idaho DEQ is developing a TMDL for Pend Oreille Lake and the Idaho portion of the Clark Fork River. After the Idaho TMDL is developed, the Tri-State Implementation Council would work with the two states to set a TMDL for the Montana/Idaho border, which would include any loading from the Rock Creek mine. The MPDES permit has a reopener provision which states that the permit may be reopened and modified to include appropriate effluent limitations if TMDL requirements or a waste load allocation is developed and approved by DEQ or the EPA.

303(d) Status of Rock Creek. Rock Creek was previously listed as threatened for aquatic life support and cold water fishery-trout due to metals and siltation from resource extraction and silviculture. The applicant petitioned to delist Rock Creek as threatened (Simonich 1998). The State of Montana determined that the applicant provided sufficient credible data to delist the mainstem of Rock Creek as threatened for aquatic life and cold water fisheries use. The information provided indicated that there was no adverse trend in metals contamination or siltation in Rock Creek; therefore, it did not fit the definition of a threatened water body. However, data submitted from the applicant suggest that the main stem of Rock Creek is partially supporting aquatic life and cold-water fisheries beneficial uses. The cause of the impairment is salmonid-fishery habitat degradation, while the probable source of the impairment is silviculture. Therefore, Rock Creek appeared on the year 2000 Section 303(d) list as partially supporting.

Alternative I

Under Alternative I, impacts to surface and ground water could result from land development activities in the Rock Creek drainage, such as timber harvest and home-building. Sediment-loading to Rock Creek could increase an unknown amount from the present due to road-building and land-clearing from timber harvest.

Watershed modeling completed by the Agencies was used to predict and evaluate the cumulative watershed effects of the existing harvest, roading and proposed mining alternatives within the Rock Creek watershed. The KNF uses the R1-WATSED model. The model predicts the highest 30-day average water yield increase and the annual sediment yield increase using naturally caused and human activities in the watershed as input. Water yield and sediment yield recovery is also predicted by the model. The predicted values generated by the model do not reflect rare or episodic weather events (such as the rain-on-snow events that have occurred in this area in the past), or the effects the predicted increases will have on water quality, fish or aquatic habitat. The volumes predicted for sediment generation reflect increases of suspended sediment only and do not include any in-channel generated sediment. The sediment values predicted are not exact amounts.

The model was run for each proposed alternative action to the year 2031 to review hydrologic and sediment recovery over the life of the mine. Results of the model for Alternative I, or no action, would result in a continuation of the existing conditions and recovery rates within the Rock Creek watershed. Appendix N gives a detailed description of the model and its predicted effects on the West Fork of Rock Creek, the East Fork of Rock Creek, and the Rock Creek watershed for all alternatives.

Alternative II

The proposed adits, underground mine, mill facility, utility corridor, waste rock dump, and the tailings impoundment would have the potential to affect surface and ground water resources. Hydrologic effects would include changes in water availability and water quality.

Ground Water Quantity

Under pre-mining conditions, ground water flow occurs mostly in local flow systems with recharge occurring by infiltration of snowmelt and rainfall, and discharge occurring in nearby streams, lakes, and wetlands. Water may reach discharge zones without ever leaving the shallow bedrock zone. Alternately, water may follow deeper flow paths through connected secondary openings until it is discharged. In the mine area, the ground water flow system is controlled entirely by fracture flow processes in secondary openings. The presence of permeability structures such as faults, joints, and fractures, modify ground water flow patterns. The shallow bedrock is more permeable than the deeper bedrock, contributes to the formation of upland springs, seeps, and streams, and supplies recharge to the regional bedrock aquifer below. As depth increases, permeability decreases because of pressure and a decrease in weathering and solution. Permeability is generally low under hilltops and higher under draws and valleys. Brittle fault zones are the primary permeability structures and control ground water flow because of the associated enhanced porosity and permeability. Because of high secondary porosity and permeability, the fault zones exhibit deeper ground water circulation, less seasonal water-table fluctuation, greater recharge, and higher stream and lake leakage rates.

Subsurface mine openings would serve as an additional sink but would be located at depth instead of at the surface. Mine openings produce an inward hydraulic gradient and function as a ground water drain. Water could flow toward the mine through transmissive fractures and faults. A downward hydraulic gradient could develop inducing shallow ground water or surface water to flow into the deeper aquifer. The application of a drainage stress to a fractured aquifer could also produce a measurable affect on ground water interactions with surface water features by either increasing seepage rates, or by lowering the potentiometric surface in the local fault and fracture systems reducing ground water contributions. Where surface water bodies are isolated from the underlying ground water system by low conductivity rock units at intervening depths, or are perched on low permeability unconsolidated materials at the surface, much of the recharge would continue to follow the pre-mining path flowing laterally to discharge in surface water sinks.

Evaluation adit. Most ground water in the vicinity of the evaluation adit probably moves through fractures and faults. Flow in fractures is controlled by secondary porosity (flow in fractures instead of rock) and the continuity of the fractures. Faults in the Cabinet Mountains generally act as conduits for ground water flow. Because aquifer tests could not be conducted under the CMW without causing significant surface disturbance, and there are no hydraulic conductivity data for the Copper Lake Fault within the ore body, the rate of adit water inflow from the fault cannot be estimated. The hydraulic conductivity of the Copper Lake fault at the surface in the vicinity of Cliff Lake was estimated at 5.0 x 10^{-3} centimeters per second. It is expected that the hydraulic conductivity decreases with depth. To reduce the potential risk of encountering unexpected inflows from the Copper Lake Fault, the evaluation adit would not intersect this fault (ASARCO Incorporated 1992).

During construction, pilot holes would be used to identify and characterize water bearing structures such as faults and fractures ahead of the advancing face of the adit so preparations could be made to handle expected inflows. If pilot drilling indicated the potential for large inflows of water, grouting would be used to control the water while advancing the face. If extreme amounts of water could not be controlled by grouting, a packer would be installed to seal the hole. At the end of the evaluation adit, Sterling would drill holes in a fan-like pattern to obtain information on characteristics of the fault.

Ground water inflow to the evaluation adit would increase as the adit is extended, and would reach a maximum of about 112 gpm. Cumulative inflow to the evaluation adit as a function of adit length is provided in Table 4-14. A safety factor of 1.5 was applied to this estimate to generate a reasonable case inflow of 168 gpm. The actual inflow may be higher or lower depending on the hydrogeologic characteristics encountered. Water requirements for driving the adit would average 30 gpm during the drilling cycle, and some additional water may be needed for dust control in the adit. A small amount of potable water would also be needed for the lavatory and lunchroom in the shop. Therefore, approximately 138 gpm of excess water would be produced during development of the evaluation adit.

Underground Mine. Ground water inflow into mine adits would be about 152 gpm. Cumulative inflow to the adits as a function of adit length is provided in Table 4-15. A safety factor of 1.5 was applied to this estimate to generate a reasonable case inflow of 228 gpm. Actual inflows may be higher or lower depending on local hydrogeologic conditions.

Ground water in the mine area occurs primarily in fractures (joints and faults) in bedrock. Assuming the mine workings were below the water table, ground water could eventually flow into the underground workings. Mine inflows would occur when a saturated fracture or saturated fracture system was encountered by the mine adit or workings. If not grouted, inflow from the fracture would soon decline as ground water stored in the fracture flowed in to the mine workings. Inflow would still continue from the fracture, but at a lesser rate. This rate would be equal to the rate of ground water recharge to the fracture or the same rate as steady state conditions. Inflow into the mine workings would increase as the size of the mine increased, and could reach a maximum of about 1,650 gpm (safety factor equal to 2.0) by the end of production. A larger safety factor was used to reflect a greater degree of uncertainty in the estimated inflow. Cumulative inflow to the mine as a function of time is provided in Table 4-16. Sterling would grout areas where water was flowing into the adits and mine workings. Grouting would be used as the primary mechanism to reduce adit and mine inflows. A summary of combined inflows to the evaluation adit, conveyor and service adits, and underground mine, including safety factors to account for uncertainty in the estimates, are provided in Table 4-17. Actual inflows may

TABLE 4-14
Ground Water Inflow to the Evaluation Adit

Adit Segment (ft)	Adit to Ground Surface (ft)	Hydraulic Head (ft)	Hydraulic Conductivity[1] (ft/min)	Calculated Inflow Per Foot (gpm/ft)	Segment Inflow (gpm)	Cumulative Inflow to Adit (gpm)
0 - 500	200	0	1.13×10^{-5}	0	0	0
500 - 1,000	400	0	1.13×10^{-5}	0	0	0
1,000 - 1,500	575	75	1.13×10^{-5}	0.0155	7.7	7.7
1,500 - 2,000	775	275	1.13×10^{-5}	0.0376	18.8	26.6
2,000 - 2,500	750	250	1.13×10^{-5}	0.0351	17.5	44.1
2,500 - 3,000	625	125	1.13×10^{-5}	0.0215	10.7	54.8
3,000 - 3,500	525	25	1.13×10^{-5}	0.0090	4.5	59.3
3,500 - 4,000	475	0	1.13×10^{-5}	0	0	59.3
4,000 - 4,500	675	175	1.13×10^{-5}	0.0271	13.6	72.9
4,500 - 5,000	875	375	1.13×10^{-5}	0.0475	23.8	96.7
5,000 - 5,500	1,025	525	1.13×10^{-6}	0.0062	3.1	99.7
5,500 - 6,000	1,200	700	1.13×10^{-6}	0.0077	3.9	103.6
6,000 - 6,700	1,750	1,250	1.13×10^{-6}	0.0123	8.6	112.2

Source: ASARCO Incorporated 1987-1997.
Note: [1]Based on field data.

TABLE 4-15
Ground Water Inflow to the Conveyor/Service Adits for Alternative II

Adit Segment/ (ft)	Adit to Ground Surface (ft)	Hydraulic Head (ft)	Hydraulic Conductivity[1] (ft/min)	Calculated Inflow Per Foot (gpm/ft)	Segment Inflow (gpm)	Cumulative Inflow (gpm)
0 - 1,000	463	0	0	0	0	0
1,000 - 2,000	756	256	1.13×10^{-5}	0.0403	40.3	40.3
2,000 - 3,000	869	369	1.13×10^{-5}	0.0524	52.4	92.7
3,000 - 4,000	1,022	522	1.13×10^{-6}	0.0068	6.8	99.5
4,000 - 5,000	1,295	795	1.13×10^{-6}	0.0094	9.4	108.9
5,000 - 6,000	1,428	928	1.13×10^{-6}	0.0106	10.6	119.5
6,000 - 7,000	1,301	801	1.13×10^{-6}	0.0094	9.4	128.9
7,000 - 8,000	1,534	1,034	1.13×10^{-6}	0.0115	11.5	140.4
8,000 - 9,000	1,507	1,007	1.13×10^{-6}	0.0113	11.3	151.7

Source: ASARCO Incorporated 1987-1997.
Note: [1]Based on field data.

TABLE 4-16
Ground Water Inflow to the Underground Mine for Alternative II

Production Year	Tons Mined	Percent of Ore Body	Area (ft^2)	Inflow to New Area (gpm)	Cumulative Inflow (gpm)
1	996,000	1.12	340,416	9.2	9.2
2	3,197,200	3.60	1,092,751	29.4	38.6
3	3,535,300	3.98	1,208,308	32.5	71.1
4	3,566,300	4.02	1,218,903	32.8	103.9
5	3,555,200	4.00	1,215,109	32.7	136.6
6	3,560,000	4.01	1,216,750	32.8	169.4
7	3,560,000	4.01	1,216,750	32.8	202.2
8	3,560,000	4.01	1,216,750	32.8	235.0
13	17,800,000	20.04	6,083,750	163.8	398.8
18	17,800,000	20.04	6,083,750	163.8	562.6
23	17,800,000	20.04	6,083,750	163.8	726.4
26	10,680,000	12.02	3,650,250	98.3	824.7

Source: ASARCO Incorporated 1987-1997.

TABLE 4-17
Estimated Ground Water Inflows for Alternative II

Proposed Project Portal Site	Inflow in gpm (no safety factor)	Inflow in gpm (safety factor applied)
Evaluation Adit	112	168
Conveyor and Service Adits	152	228
Ore Body Area	825	1,650
Total Inflow	1,089	2,046

Source: ASARCO Incorporated 1987-1997.
Note: Safety factors of 1.5 (for the adits) and 2.0 (for the ore body) were used. Flow rates and safety factors are estimated and may differ based on local and site-specific conditions.

be higher or lower depending on local hydrogeologic conditions. Variations in flow estimates ultimately would affect the size of treatment systems and the area required for siting treatment facilities, and the rate of ground water withdrawals for make-up water supplies.

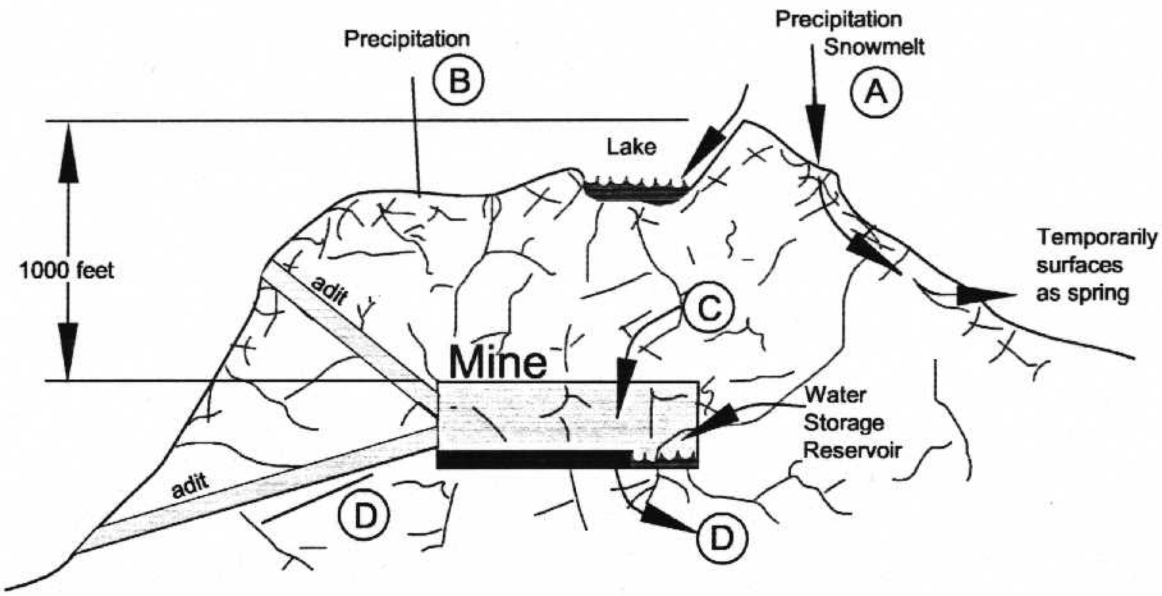
Excess Mine Water Storage. By year 30, up to a maximum of 207.7 million gallons of mine water could be stored in a reservoir in the underground mine as a method of managing excess water (see Figure 2-17). The maximum volume stored each year would vary. For example, during year 6, only 75.7 million gallons would be stored. Storage would have a seasonal component, with the largest volume being stored during late spring and early summer (ASARCO Incorporated 1995a). The reservoir would be developed in mined out sections of the ore body. Assuming that underground fractures or fracture systems intercepted the reservoir, the potential for seepage from the reservoir to ground water exists. However, most of the mine workings would be under an inward hydraulic gradient and water in mine pools would not flow out. If mine pools were located in areas of the mine not under an inward gradient, water would flow out. The rate of seepage cannot be determined, and would depend on the bedrock hydraulic conductivity and the degree and connection between fracturing. See Figure 4-3 for a conceptual model of ground water flow near the proposed underground mine. Seepage could either be retained in fractures or could migrate and possibly exit to the surface at undetermined locations in the Rock Creek, Copper Gulch, or East Fork Bull River watersheds in the form of springs or seeps.

Tailings Impoundment Seepage. Tailings slurry decant water would probably seep from the base of the tailings impoundment and enter the ground water system during the mine's operational life. The rate of seepage would be proportional to the impoundment area and the depth of water in the impoundment. The seepage rate would increase as the size of the impoundment increased (ASARCO Incorporated 1987-1997).

The maximum rate of seepage from the proposed tailings impoundment may be several hundred gpm (ASARCO Incorporated 1987-1997). The Agencies have used a value of 241 gpm in the ground water loading analysis. The actual value could be higher or lower depending on actual site geologic conditions and water transmitting properties of tailings materials and aquifers. This seepage rate was estimated based on the results of numerical computer modeling completed by Dames & Moore for the applicant, and which was subsequently reviewed and incorporated into the Agencies' analysis of impacts.

After reclamation of the tailings impoundment, seepage from the impoundment would decrease dramatically because tailings water would no longer be stored, and surface water runoff from precipitation would be rerouted off the reclaimed impoundment surface to minimize infiltration. At the end of operations, saturated water levels in the tailings impoundment would decrease until steady-state conditions were achieved. Seepage through the tailings dam and the bottom of the impoundment also would decrease as the saturated water levels dropped. Lower portions of the tailings mass would remain saturated after new steady-state conditions were established. Under these conditions, total seepage (seepage through the dam and the bottom of the impoundment) would decrease significantly.

The length of time necessary to completely dewater the tailings impoundment cannot be predicted with accuracy. Dewatering could occur in the impoundment over several decades, and would be limited due to the low permeability of the underlying lacustrine sediments. Therefore, the perimeter seepage collection system could potentially need to be operated and maintained for several decades.



CONCEPTUAL MODEL OF GROUNDWATER FLOW NEAR PROPOSED UNDERGROUND MINE

Ⓐ Melting snow recharges near surface fracture system. Water exits to surface as springs or seeps. Overland flow and spring flow recharge and fill wilderness lakes.

Ⓑ Melting snow recharges deeper fractures and fracture systems. Density and connectedness of fractures not high enough to create aquifer. Water held in storage for long periods of time. Some ground water may eventually make its way to surface, and exit as seep or spring, or may percolate into soil and be transpired.

Ⓒ Mine excavation creates void that collects stored water from deeper fractures. Discharge volume at end of mine life not expected to exceed 1,650 gpm. The Troy mine currently produces between 1,000 to 3,000 gpm.

Ⓓ Poorer quality water in mine exits fractures. The volume of discharge and location of fractures that could possibly convey water to surface are unknown. Water would exit adit upon cessation of mining.

Figure 4-3
Conceptual Model of Groundwater Flow Through Mine
Rock Creek Project

Mine Closure. Sterling would monitor inflow to underground workings during operations in order to predict whether the adits would discharge mine water following operations, and whether the expected flow would meet applicable water quality standards. If the discharge did not meet MPDES permit requirements, Sterling may seal the adits near the ore body following the cessation of operations. Adit sealing is a technique used to control and redirect mine water flow; it does not necessarily prevent mine water discharge. If the adits were successfully sealed, the mine water would rise until the outflow along natural pathways equaled the rate of mine water inflow. If the adit plugs leaked, the rise in mine water levels would be less. However, it is unknown what effect adit sealing would have on the discharge water quality. Adit plugs likely have an expected life ranging from several decades to centuries. Without periodic inspection and maintenance, the adit plugs may eventually fail. In this event, water under pressure would discharge to the surface, would cause erosion, and would increase flow in Rock Creek and its tributaries.

Once dewatering of the mine ceased, the mine would fill with ground water. The level of filling would depend on the closure option implemented. If the mine were completely plugged, the entire void space would fill and the potentiometric surface in the overlying rock mass would begin to rebound. Some ground water could migrate from the mine workings to discrete surface discharge points. The exact locations of preferred fracture flow paths cannot be identified. However, based on the structural geology of the area and the geometry of the deposits, higher probability discharge locations can be identified.

Likely locations for discharge of mine water from the Rock Creek deposit would be where the deposit outcrops. These locations would be in South Basin below 5,800-ft elevation and in North Basin below 5,200-ft elevation (Figure 3-2). Several small springs and substantial streamflow are present in South Basin and the large number of faults in the North Basin area make this a likely area for mine water discharge. Another location where mine water may discharge is in Copper Gulch below 5,200-ft elevation. Copper Gulch is eroded along a splay of the Copper Lake fault and, therefore, may contain fault-related permeability structures.

If, on the other hand, the mine were allowed to passively drain out the service adits, the void space would not completely fill and the potentiometric surface would not rebound in the overlying aquifer. The water level in the Rock Creek Mine could rise to an elevation of about 5,500 feet where it could drain out the service adit. Only those portions of the mine below 5,500 feet, mainly the north and west portions of the deposit, would flood. Seepage from these areas of the mine could discharge to the North Basin and Copper Gulch. The total discharge quantity would probably be less than under the previous scenario because of lower hydraulic gradients.

Depending on the actual impacts detected during mining, complete plugging of the mine at closure may be preferable or maintenance of mine dewatering after closure may be preferable. Complete plugging of the mine would help to reestablish the pre-mining static head in the bedrock aquifer and reduce ground water drainage stresses on overlying lakes and streams. Unfortunately, adit plugging would also increase hydraulic gradients and hydrofracturing potential, exacerbating post-closure leakage of mine water to the surface. Continued mine dewatering could reduce the potential of leakage to downgradient streams, but might maintain any mining-induced ground water drainage stresses on overlying lakes and streams.

Ground Water Quality

Tailings impoundment seepage would be diluted by ground water flow beneath the impoundment, and would be contained in a DEQ-approved ground water mixing zone using a system of perimeter trenches and recovery wells. Seepage impacts to ground water outside the mixing zone would be minor. The seepage collection and pump back system are discussed under the section heading Seepage Collection and Pump Back System.

Seepage Water Quality. The Agencies expect that the quality of the tailings slurry decant water for the proposed project would be similar to the Troy tailings water. The Troy tailings water characteristics are presented in Table 4-18 and Table 4-19. Leachate from the proposed Rock Creek tailings impoundment would probably percolate into ground water and change the quality of ground water below the tailings impoundment. Seepage would recycle back to the tailings impoundment via a perimeter seepage collection system. The Agencies are confident that a perimeter seepage collection system could be properly engineered to prevent degradation to ground water outside an established mixing zone, to Rock Creek, and to the Clark Fork River. After mining, the seepage from the impoundment would decrease and the resulting water quality would improve. Analysis of water quality is provided in Table 4-20. After mining, concentrations would decrease from these values and approach baseline. The time required for this is unknown.

After mine closure, the tailings impoundment would slowly dewater, thus lowering water levels and exposing any sulfide mineralization in the tailings to oxidation and bacterial action. Initial testing of the tailings material, however, indicates a net neutralizing potential (see Chapter 4, Geology and Table 4-12). The tailings also would have a low sulfide content (Timothy Hayes, U.S. Geological Survey, in a letter to Rebecca Miller, March 6, 1995). Although uncertainty exists, acid drainage from the tailings is not expected (see discussion in Chapter 4, Geology). Following operations, Sterling would monitor water quality in the vicinity of the tailings impoundment.

Seepage Collection and Pump Back System. Seepage to ground water from the impoundment would be intercepted by a tailings impoundment seepage collection system consisting of underdrains, seepage collection trenches, and ground water capture wells. The collection system would penetrate to bedrock in areas where bedrock was within approximately 20 feet of the surface. Where possible, the collection trenches would form a cutoff barrier for ground water migration that extended to bedrock.

Ground water capture wells would be located approximately 200 to 300 feet downgradient of the seepage collection ditches to minimize the potential for capture wells to induce or accelerate seepage from the impoundment and seepage collection ditches. Capture wells would intercept ground water coming from each of the impoundment sub-basins and would return it to the impoundment (see Figure 2-14). This also would potentially decrease static water levels in wells outside of Clark Fork alluvium and springs downgradient of Miller Gulch during mine operation.

Wells would be operated through the mine's operational life and until such time as seepage-contaminated ground water met water quality standards. The applicant's conceptual plan for the collection system consists of 11 capture wells. The actual number of wells required would need to be verified during final design. The perimeter recovery system could be designed to prevent migration of contaminated ground water from leaving an Agency-approved ground water mixing zone. Estimated ground water quality within the mixing zone is shown on Table 4-20. Nitrate and nitrite, and manganese

TABLE 4-18
Troy Tailings Impoundment Water Quality (Sterling Data)*

Parameter	Number of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	53	7.5	0.3	8.4	6.8
Total Suspended Solids	57	779	1,276	6,541	<1
Total Hardness (as $CaCO_3$)	57	72	35	300	21
Calcium	57	18.6	6	31	5.6
Magnesium	57	5.7	3.3	20	1.6
Sodium	55	20	9	46	1.7
Potassium	59	28.6	17.8	75	0.2
Bicarbonate	53	78.8	29.1	150	21
Sulfate (SO_4)	59	23	10	42	1
Chloride	55	6.0	4.1	24	<1
Ammonia (NH_3 as N)	58	7.2	3.3	14	0.05
Total Kjeldahl Nitrogen (as N)	52	8.1	4.1	20	0.03
Nitrate and Nitrite (as N)	60	15.9	7.0	30	2.3
Orthophosphate (PO_4-P)	53	0.031	0.038	0.23	0.009
Total Phosphorous	53	0.058	0.061	0.3	0.01
Arsenic (DIS)	4	<0005	0.0	<0.005	<0.005
Arsenic (TRC)	1	0.02	0.0	0.02	0.02
Cadmium (DIS)	8	0.002	0.002	<0.005	0.0001
Cadmium (TRC)	57	0.0017	0.0016	0.005	<0.0001
Chromium (DIS)	0	NC	NC	ND	ND
Chromium (TRC)	0	NC	NC	ND	ND
Copper (DIS)	10	0.037	0.034	0.09	0.003
Copper (TRC)	64	0.8	3.4	27	0.007
Iron (DIS)	1	0.050	0.0	0.050	0.050
Iron (TRC)	56	2.3	5.5	38	0.04
Lead (DIS)	10	0.015	0.019	<0.05	0.001
Lead (TRC)	65	0.126	0.327	2.2	<0.001
Manganese (DIS)	5	0.429	0.084	0.55	0.33
Manganese (TRC)	57	1.9	8.4	63	0.02
Mercury (DIS)	4	0.001	0.0	<0.001	<0.001
Mercury (TRC)	1	0.0005	0.0	0.0005	0.0005
Selenium (DIS)	0	NC	NC	ND	ND
Selenium (TRC)	0	NC	NC	ND	ND
Silver (DIS)	8	0.004	0.003	<0.01	<0.0002
Silver (TRC)	59	0.0042	0.0048	0.023	<0.0002
Zinc (DIS)	6	0.019	0.007	0.03	0.01
Zinc (TRC)	62	0.078	0.359	2.8	0.001

Source: ASARCO Incorporated 1987-1997.
Notes: *All units are in mg/L unless otherwise indicated.
SU =Standard pH Units; TRC =Total Recoverable Metals Analysis
NC =Not Calculated; ND =No Data
For purposes of statistical analyses, detection limit values were used for data reported as below detection.

TABLE 4-19
Troy Tailings Impoundment Water Quality (DHES Data)*

Parameter	Number Of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	1	7.7	NC	7.7	7.7
Total Suspended Solids	0	NC	NC	NC	NC
Total Hardness (as $CaCO_3$)	1	79	NC	79	79
Total Alkalinity (as $CaCO_3$)	1	111	NC	111	111
Sulfate (SO_4)	1	44.9	NC	44.9	44.9
Ammonia (NH_3 as N)	1	13.8	NC	13.8	13.8
Total Kjeldahl Nitrogen (as N)	0	NC	NC	NC	NC
Nitrate and Nitrite (as N)	1	29.8	NC	29.8	29.8
Orthophosphate (PO_4-P)	1	0.015	NC	0.015	0.015
Total Phosphorus	0	NC	NC	ND	ND
Arsenic (DIS)	2	0.004	NC	0.007	<0.001
Arsenic (TRC)	1	0.014	NC	0.014	0.014
Cadmium (DIS)	1	0.001	NC	<0.001	<0.001
Cadmium (TRC)	1	0.001	NC	<0.001	<0.001
Chromium (DIS)	1	0.001	NC	<0.001	<0.001
Chromium (TRC)	1	0.002	NC	0.002	0.002
Copper (DIS)	2	0.026	NC	0.036	0.016
Copper (TRC)	1	1.16	NC	1.16	1.16
Iron (DIS)	2	0.03	NC	0.05	<0.01
Iron (TRC)	1	1.17	NC	1.17	1.17
Lead (DIS)	2	0.0015	NC	0.002	<0.001
Lead (TRC)	1	0.028	NC	0.028	0.028
Manganese (DIS)	2	0.747	NC	1.03	0.464
Manganese (TRC)	1	1.16	NC	1.16	1.16
Mercury (DIS)	0	NC	NC	NC	NC
Mercury (TRC)	0	NC	NC	NC	NC
Selenium (DIS)	0	NC	NC	NC	NC
Selenium (TRC)	0	NC	NC	NC	NC
Silver (DIS)	1	0.001	NC	<0.001	<0.001
Silver (TRC)	1	0.001	NC	<0.001	<0.001
Zinc (DIS)	2	0.0395	NC	0.068	0.011
Zinc (TRC)	1	0.023	NC	0.023	0.023

Source: Department of Health and Environmental Sciences 1995.
Notes: *All units are in mg/L unless otherwise indicated.
SU = Standard pH Units
DIS = Dissolved Metals Analysis
NC = Not Calculated
TRC = Total Recoverable Metals Analysis
For purposes of statistical analyses, detection limit values were used for data reported as below detection.

TABLE 4-20
Estimated Ground Water Quality Resulting from Tailings Impoundment Seepage Beneath Tailings Impoundment*

Parameter	Ambient Ground Water Quality§	Estimated Tailings Seepage Water Quality	Resultant Ground Water Quality Alternatives II, III, and IV	Alternative V	Montana Water Quality Standard
pH (SU)	7.8313	7.5[a]	7.6	7.8	N/A
Total Hardness (as $CaCO_3$)	204.6875	72[a]	119	180	N/A
Total Alkalinity (as $CaCO_3$)	215.3333	111[b]	148	196	N/A
Sulfate (SO_4)	7.7583	23[a]	17.6	10.6	N/A
Ammonia (NH_3 as N)	<0.01[#]	7.2[a]	4.7	1.3	N/A
Total Kjeldahl Nitrogen (as N)	<0.01[#]	8.1[a]	5.2	1.5	N/A
Nitrate and Nitrite (as N)	0.2994	15.9[a]	10.4	3.2	10
Orthophosphate (PO_4-P)	0.0591	0.031[a]	0.04	0.05	N/A
Total Phosphorus	1.4885	0.058[a]	0.56	1.22	N/A
Arsenic (DIS)	0.0020	0.004[b]	0.0033	0.0024	0.018
Cadmium (DIS)	0.0009	0.002[a]	0.0016	0.0011	0.005
Chromium (DIS)	0.0170	<0.001[b]	0.0063	0.0139	0.1
Copper (DIS)	0.0013	0.037[a]	0.0244	0.0080	1.0
Iron (DIS)	0.0623	0.05[a]	0.0543	0.0600	0.3
Lead (DIS)	0.0015	0.015[a]	0.0102	0.0040	0.015
Manganese (DIS)	0.2895	0.747[b]	0.5859	0.3749	0.05
Mercury (DIS)	0.0004**	0.001[a]	0.0004**	0.0004**	0.00014
Selenium (DIS)	0.0028	ND	NC	NC	0.05
Silver (DIS)	0.0002	0.004[a]	0.0014	0.0005	0.05
Zinc (DIS)	0.0329	0.0019[a]	0.0485	0.0303	5.0

Source: (a) = ASARCO Incorporated 1987-1997 (see Table 4-18)
(b) = Department of Health and Environmental Sciences 1995 (see Table 4-19)

Notes: *All units are in mg/L unless otherwise indicated.

SU = Standard pH Units
DIS = Dissolved
¶ = pH and Temperature Dependent
ND = No Data collected
N/A = Not Applicable
Shading = Exceeds Standard (see Table 4-13)
§ = Uses "Average" from Table 3-12, except at noted.
# = Uses "Minimum Value" from Table 3-12 per request by EPA.
NC = Not Calculated

** Twelve samples were collected. All samples were below the laboratory detection limit value. Therefore, the conclusion that ambient ground water quality exceeds Montana water quality standards cannot be made.

would exceed ground water quality standards during mine operation and would likely return to pre-mine levels when the impoundment reached equilibrium. (Manganese already exceeds standards in ambient ground water.) The seepage collection system could be designed to eliminate the potential for migration of constituents to Miller Gulch outside the Agency-approved mixing zone, and to Rock Creek, Miller Gulch, and the Clark Fork River. Ground water pumping systems are a proven technology for containment of chemicals in ground water (U.S. Environmental Protection Agency 1985; U.S. Environmental Protection Agency 1988; Mercer et al. 1990). For example, systems have been designed to treat several thousand gpm, however it is expected that at this site, less than several hundred gpm would be treated.

In less than ideal settings, the efficiency of the technology may decrease. Therefore, continued monitoring of the pumping systems for potential bypass by seepage-contaminated ground water is essential. If monitoring indicated bypass of seepage, the pumping rates could be adjusted, or additional wells could be added to increase the efficiency of the pump-back system.

Geotechnical drilling to support the final design plans for the perimeter seepage collection system would determine final design and spacing of the impoundment capture wells. These wells would be designed to capture ground water from the basal gravel, shallow bedrock, and lacustrine aquifers. Beneficial uses of ground water within the mixing zone would be precluded.

Underground Storage Reservoir. The proposed underground storage reservoir could potentially discharge mine water if faults or fractures provide hydraulic connection between the reservoir and the ground surface. The volume of seepage from the reservoir cannot be predicted, but the potential for seepage is greatest towards the end of mine life when the reservoir is expected to be storing the largest volume of water. Generally, there is an inward gradient toward the mine workings. Where the underground workings approach the mountainside, external ground water pressure falls below that of the internal pressure and water will tend to flow out. Seepage from the reservoir, if present, would likely express itself as springs or seeps. The location of surface expression of these potential discharges, if present, cannot be predicted. Seepage water would likely contain elevated concentrations of nitrate, metals, and total dissolved solids. See Figure 4-3 for a conceptual model of ground water flow near the underground mine.

Surface Water Quantity

Evaluation adit. The proposed evaluation adit area lies adjacent to an unnamed tributary within the headwaters of the West Fork of Rock Creek drainage. The location is about 2,000 feet south and 500 feet vertically below the drainage divide that separates the West Fork of Rock Creek and Copper Gulch. The unnamed tributary is ephemeral near the proposed adit location and becomes perennial about 0.8 miles below the proposed adit location where two springs provide perennial flows between 20 and 100 gpm. The ephemeral section of the stream above the springs only flows for a brief period during the spring snowmelt period. In addition, one horizontal exploration 1,420-foot drillhole along the proposed adit alignment produced less than 5 gpm of water. It is not anticipated that the evaluation adit would affect existing spring flow, or tributary flow to Rock Creek.

Wilderness Lakes. There are several lakes located above or adjacent to the underground mine area in the Rock Creek and Copper Gulch watersheds, including Cliff, Copper, St. Paul, Moran Basin, and Rock lakes. Major faults such as the Copper Lake and Moran faults, and potential fracturing resulting from mining might possibly act as conduits for flow out of the lakes. For example, faults and fractures might provide a hydraulic connection between mine workings and the overlying surface or with ground water if Sterling's pilot hole testing and grouting programs were ineffective. Fractures would need to be continuously interconnected for impacts to occur (see Figure 4-3). The application of a drainage stress to a fractured aquifer could produce a measurable affect on ground water interactions with surface water features by either increasing seepage rates, or by lowering the potentiometric surface in the local fault and fracture systems reducing ground water contributions. Therefore, the potential for impacting the water balance in wilderness lakes is possible particularly if mitigations in the form of the purposed buffers are not applied (see Geology). Where surface water bodies are isolated from the underlying ground water system by low conductivity rock units at intervening depths, or are perched on low permeability unconsolidated materials at the surface, much of the recharge would continue to follow the pre-mining path flowing laterally to discharge in surface water sinks. See a DEQ technical report (MT DEQ 2001a) for a quantitative risk assessment to wilderness lakes and streams.

To further minimize the potential for impacts to surface water resources in the wilderness, Sterling would also maintain an adequate pillar size and spacing that would be based on rock mechanics data collected during construction of the evaluation adit. In addition, Sterling would maintain a barrier pillar (if necessary) near the Copper Lake Fault to isolate the mine workings from any potential water stored in the fault, and thus reduce the possibility of affecting lake water levels.

A buffer of 1,000 feet around Cliff Lake, ore outcrop zones, the Copper Lake fault, and the Moran Fault would remain unmined until the hydrogeology of this area is better characterized through the monitoring process. In the Copper Lake Fault area where ore thicknesses exceed 100 feet, Sterling proposes to leave a large barrier pillar between the fault zone and the active mine area. The function of the barrier pillar would be to provide stability in this area of large ore horizon thickness and potential poor ground conditions. The dimensions and location of the barrier pillar(s) would be determined after assessing local ground conditions.

Mill Facility and Makeup Water Requirements. The proposed mill facility would require up to 3,131 gpm of water during the project's operational phase. Mill makeup water would first come from excess water in the mine or from the tailings impoundment, if available as well as stormwater runoff collected from mine facilities. During the first few years of mining, sufficient makeup water may not be available from these sources. During this time, a well located in alluvial gravels adjacent to the Clark Fork River would supply the required makeup water. Maximum pumping rates would be expected to occur during project start-up or during extremely dry periods. Water balance estimates suggest the proposed mill would likely require makeup water from a supply well during the months of July, August, and September (ASARCO Incorporated 1987-1997).

Actual makeup water requirements from a production well would depend on the uncertain availability of mine water. Therefore, the timing and rate of discharge cannot be quantified. The flow in the Clark Fork River could be reduced by an amount equal to the discharge rate of Sterling's production well. The greatest impact to the Clark Fork River would occur during periods of low streamflow during the first few years of mining. Assuming low flow in the Clark Fork River is 3,610 CFS (the 7-day 10-year low flow [$Q_{7,10}$]), a withdrawal of 3,131 gpm would potentially decrease flows in the Clark Fork River by an equal amount, or only by 0.19 percent. Assuming the average flow is 21,460 cfs, a withdrawal of 3,131 gpm would potentially decrease the flow in the Clark Fork River by only 0.03 percent. These levels of flow reduction would only be expected if the underground mine did not intercept any ground water, and all make-up water came from the Sterling production well. The demand for make-up water from a well would most likely be the highest during the early phases of the project (when the size of the underground mine is too small to produce the required volume of water), or in abnormally dry climatic periods. Downstream mainstem senior appropriators on the Clark Fork River would not be affected due to flow available in the Clark Fork River and storage capacity of Cabinet Gorge Reservoir. Assuming flows in the Clark Fork River are reduced, the ability to generate hydroelectric power at Cabinet Gorge could also be reduced.

Drainage and Surface Water. Construction of the proposed tailings impoundment would alter the topography and drainage characteristics of about 324 acres in Miller Gulch. During the proposed project life, about 5 miles of ephemeral tributaries to Miller Gulch would be covered by fill material and tailings, and would essentially be removed from the natural hydrologic system. Therefore, surface water runoff to Miller Gulch would be expected to decrease for 35 years during the proposed mine life. In addition, one spring and several existing ground water monitoring wells would be covered by tailings material. The applicant's reclamation plan calls for grading the impoundment surface from the embankment crest to the head of the impoundment. Runoff from the reclaimed impoundment surface would be routed to a diversion ditch and transferred to the Rock Creek drainage and Miller Gulch. Flows into the West Fork of Rock Creek near the proposed mill site would be rerouted in culverts, and likely would impact existing wetlands and non-wetland waters of the U.S. (see Wetlands and Non-wetland Waters of the U.S.).

Surface flow from Miller Gulch is currently appropriated for power generation, irrigation, and domestic uses (Water rights P029428, W131977, and W131978). Sterling does not have water rights to appropriate surface water in Miller Gulch. The disruption of natural surface water runoff to the south fork of Miller Gulch during the proposed mine life would reduce flows for existing beneficial uses of surface water. The volume and timing of these impacts, however, cannot be quantified. In addition, under the Metal Mine Reclamation Act (82-4-355 MCA), Sterling would be required to repair or replace any existing use of surface or ground water that is affected by the proposed project.

Surface Water Quality

Adit and Mine Water. Drilling and blasting activities would contribute to high concentrations of suspended solids in the adit water and mine effluent. Suspended solids contribute nearly all of the total metals load to mine effluent and must be removed. Initial removal of suspended solids could be accomplished using settling sumps, with or without chemical flocculating agents and subsequent filtration. Although this treatment scheme would significantly improve water quality, some dissolved metals and most of the nitrogen compounds would remain in the water.

Underground mining is expected to influence mine discharge water quality mainly as a result of blasting activities. As much as 1 to 6 percent of the nitrogen in the explosives would be expected to remain in water discharged from the mine (British Columbia Ministry of the Environment 1983). Ammonium nitrate based explosives would leave residues of soluble nitrogen compounds to dissolve in mine inflow water. Wet blasting conditions in the mine and the use of slurry explosives appear to increase residual nitrogen. In general, the nitrogen discharged from the mine would be mainly nitrate, with relatively small amounts of more toxic ammonia and nitrite (British Columbia Ministry of the Environment 1983). BMPs would be employed during blasting operations when using explosives to limit use and minimize spillage of blasting agents.

During the latter stages of mining, the mine may at times discharge more than 2,000 gpm of water as a result of seepage from ground water into the mine workings. Discharge from the mine would be expected during the operational and postoperational periods of mining. Due to similarities in the geology of the ore bodies, mining methods, and type of explosives, it is assumed that mine adit water quality for the proposed project would be similar to mine adit water quality for the Troy Mine.

Troy Mine adit water quality during the operational period is provided in Table 4-21. The analysis of data indicates untreated mine water would contain elevated levels of TSS, nitrate, and total metals. The concentration of dissolved metals is generally lower than total metals concentrations. This suggests that most of the metals content in the mine water would be in the suspended solids. However, the dissolved copper concentration at the Troy Mine (0.1 mg/L) is above the surface water standard. Additional sampling would be needed to determine the actual concentrations of arsenic and mercury and ensure that there would be no increase in these metals in the discharge at any time.

Based on Troy adit water quality data collected by DEQ at a station near the Troy tailings impoundment, postoperational mine water quality is expected to be similar or better than what is shown in Table 4-22A (Sterling data) and Table 4-22B (DEQ data). The Troy Mine may be the best predictive model available for the proposed project. No acid mine drainage has been noted at this field site during its 13-year construction and operation. Postoperational mine water quality data for the Troy Mine suggest that concentrations of constituents decrease with time. The decrease is the result of the termination of mining, sediment production, and use of explosives.

Because recent data indicate some metals exceeded standards, continued adit water treatment is expected until such time that standards could be met without treatment. Based on the Troy Mine, the constituents of concern after mine closure would be dissolved lead, copper, and antimony.

Acid Drainage. The potential for acid mine drainage to develop is not anticipated based on available geochemical testing data (See Geology). In addition, post-operational mine water quality data for the geochemically similar Troy Mine suggest that the concentrations of constituents in adit discharges decrease with time. The decrease is likely the result of the termination of mining, sediment production, and use of explosives. Treatment of adit discharge water would be expected until such time that standards could be met without treatment. Regardless of actual flow rates or concentrations of constituents, the discharges associated with the proposed project would have to meet all load limitations specified in the MPDES permit issued by DEQ.

Waste Rock. Waste rock would be produced as a result of driving the evaluation adit and two access adits in predominantly nonmineralized rock in order to gain access to the ore body. Waste rock would be used in the construction of the mill pad, and would be stored on a hillside waste rock dump. Waste rock from the mineralized zone would be stored in underground workings.

Waste rock potentially containing residual nitrogen compounds from blasting and some fine grained material would be used in the construction of the proposed mill pad, and would potentially increase the load of nitrogen, TSS, and other non-toxic constituents in Rock Creek during the period of construction. Based on whole rock analysis (see Table 4-23), any sediment entering Rock Creek should not contain elevated concentrations of heavy metals. Resultant water quality impacts on Rock Creek cannot be estimated with certainty, and would depend on the explosive misfires or incomplete reactions, the relative use of slurry gels rather than ANFO, particle size distribution of the waste rock and the actual

TABLE 4-21
Operational Adit Water Quality for Troy Mine*

Parameter	Number of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	4	7.3	NC	7.4	7.1
Total Dissolved Solids	4	189	25	215	163
Total Suspended Solids	4	2,573	628	3,240	1,840
Total Hardness	4	83	8	89	73
Sulfate (SO4)	4	23.3	14.9	32.0	1.0
Ammonia (NH_3 as N)	4	8.2	2.6	10.2	4.4
Kjeldahl N	1	7.3	2.1	9.1	4.2
Nitrate	4	17.0	6.5	22.4	7.5
Nitrite	4	0.32	0.15	0.44	0.10
Ortho-Phosphate	4	<0.01	0	<0.01	<0.01
Phosphorous	1	0.02	0.01	0.03	0.01
Aluminum (DIS)	4	<0.1	0	<0.1	<0.1
Aluminum (TRC)	1	6.9	0	6.9	6.9
Arsenic (DIS)	4	<0.005	0	<0.005	<0.005
Arsenic (TRC)	1	0.027	0	0.027	0.027
Barium (DIS)	4	<0.1	0	<0.1	<0.1
Barium (TRC)	1	10.0	0	10.0	10.0
Cadmium (DIS)	4	<0.001	0	<0.001	<0.001
Cadmium (TRC)	1	0.002	0	0.002	0.002
Copper (DIS)	4	0.075	0.010	0.090	0.07
Copper (TRC)	1	30.9	0	30.9	30.9
Lead (DIS)	4	<0.01	0	<0.01	<0.01
Lead (TRC)	1	2.4	0	2.4	2.4
Manganese (DIS)	4	0.42	0.09	0.55	0.33
Manganese (TRC)	1	2.79	0	2.79	2.79
Mercury (DIS)	4	<0.001	0	<0.001	<0.001
Mercury (TRC)	1	<0.001	0	<0.001	<0.001
Silver (DIS)	4	<0.005	0	<0.005	<0.005
Silver (TRC)	1	0.011	0	0.011	0.011
Zinc (DIS)	4	0.018	0.005	0.020	0.010
Zinc (TRC)	1	0.13	0	0.13	0.13

Source: ASARCO Incorporated 1987-1997.
Notes: *All units are in mg/L unless otherwise noted.
SU =Standard pH Units
DIS =Dissolved Metals Analysis
TRC =Total Recoverable Metals Analysis
NC =Not calculated

TABLE 4-22A
Sterling Data: Postoperational Adit Water Quality for the Troy Mine*

Parameter	Number of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	10	7.3	0.3	7.9	6.9
Total Suspended Solids	10	2.4	2.4	7.2	< 1.0
Total Hardness (as $CaCO_3$)	10	98	26	133	61
Total Alkalinity (as $CaCO_3$)	0	NC	NC	NC	NC
Sulfate (SO_4)	10	28	7	38	18
Ammonia (NH_3 as N)	11	0.64	0.51	1.8	0.11
Total Kjeldahl Nitrogen (as N)	0	NC	NC	NC	NC
Nitrate and Nitrite (as N)	11	3.84	2.62	8.80	0.56
Orthophosphate (PO_4-P)	0	NC	NC	NC	NC
Total Phosphorus	0	NC	NC	NC	NC
Arsenic (DIS)	0	NC	NC	NC	NC
Arsenic (TOT)	0	NC	NC	NC	NC
Cadmium (DIS)	0	NC	NC	NC	NC
Cadmium (TOT)	0	NC	NC	NC	NC
Chromium (DIS)	0	NC	NC	NC	NC
Chromium (TOT)	0	NC	NC	NC	NC
Copper (DIS)	0	NC	NC	NC	NC
Copper (TOT)	10	0.21	0.09	0.38	0.11
Iron (DIS)	0	NC	NC	NC	NC
Iron (TOT)	10	0.153	0.086	0.320	0.041
Lead (DIS)	0	NC	NC	NC	NC
Lead (TOT)	10	0.011	0.006	0.023	0.005
Manganese (DIS)	0	NC	NC	NC	NC
Manganese (TOT)	10	0.27	0.13	0.47	0.12
Mercury (DIS)	0	NC	NC	NC	NC
Mercury (TOT)	0	NC	NC	NC	NC
Selenium (DIS)	0	NC	NC	NC	NC
Selenium (TOT)	0	NC	NC	NC	NC
Silver (DIS)	0	NC	NC	NC	NC
Silver (TOT)	10	<0.001	0.001	0.004	<0.001
Zinc (DIS)	0	NC	NC	NC	NC
Zinc (TOT)	10	0.026	0.025	0.100	0.010

Source: ASARCO Incorporated 1987-1997.
Notes: *All units are in mg/L unless otherwise noted. Period of record is from October 1992 to June 1994.
SU = Standard pH Units TOT = Total Metals Analysis
DIS = Dissolved Metals Analysis NC = Not calculated

TABLE 4-22B

DEQ DATA: Postoperational Adit (Decant Pond) Water Quality Data for the Troy Mine

Parameter	Units	7/26/1993	10/27/1993	3/30/1994	7/27/1994	10/26/1994	3/29/1995	7/25/1995	10/18/1995	4/24/1996	7/31/1996	10/16/1996	3/12/1997	7/30/1997	10/22/1997	4/1/1998	8/5/1998	10/21/1998	Number of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
Cond	umhos	190.0	182.0	153.0	172.0	146.0	176.0	159.0	105	141	160	180	45	148	169	134	156	163	17	152	34.3	190.0	45.0
Temp	deg.F	66.0	44.0	46.0	72.0	45.0	43.0							66			69		8	56.4	12.9	72.0	43.0
Turbidity	ntu	63.0	9.4	85.0	0.78	5.7	0.30	3.0	2.8	82.0	2.6	0.42	0.31	3.5	2.4	5.6	0.68	1.2	17	15.8	29.4	85.0	0.3
pH	s.u.	7.6	7.5	7.7	7.4	7.2	7.8	8.3	7.6	7.7	7.7	7.9	6.7	8.1	7.6	7.7	8.2	7.6	17	7.66	0.372	8.3	6.7
TDS	ppm							24.0	54	87	80	111	26	277	119	87	110	110	11	99	68	277	24
TSS	ppm	30.0	5.4	65.0	<1.0	1.8	<1.0	19.0	2.5	78	<1.0	<1.0	<1.0	14.0	<1.0	<1.7	2.3	1.5	17	13.4	23.4	78.0	1.0
Hardness	ppm	83.0	90.0	69.3	92.0	68.0	87.0	71.0	48	71	80	83	21	66	72	62	73	78	17	71.4	17.0	92.0	21.0
Alkalinity	ppm as CaCO3							52.0	31	42	52	60	14	50	56	39	54	56	11	46	13.6	60	14
CO3	ppm as CaCO3							<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10	1.0	0.0	1	1
HCO3	ppm as CaCO3							52.0	31	42	52	60	14	50	56	39	54	56	11	46.0	13.6	60	14
SO4	ppm	20.0	27.0	22.0	27.0	21.0	29.0	17.0	15	17.0	<2.0	20.0	<2.0	23.0	23	18	22.0	19	17	19.1	7.4	29.0	2.0
NO2/NO3	ppm	3.0	2.7	2.9	1.7	1.0	1.6	0.59	0.56	1.2	0.88	1.2	0.76	0.52	0.83	0.5	0.67	0.75	17	1.3	0.85	3.0	0.5
NH3/N	ppm	0.63	0.22	0.40	<0.10	<0.10	<0.10	0.32	0.30	0.06	0.06	0.10	0.20	<0.050	<0.05	<0.08	<0.050	<0.050	16	0.18	0.16	0.63	0.05
P	ppm							<0.10	<0.02	<0.10	<0.10	<0.10	<0.10	<0.050	<0.05	<0.10	<0.050	<0.10	10	<0.08	0.031	<0.10	<0.02
Ag	ppm	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	16	<0.002	0.001	<0.003	<0.001
Al	ppm							0.45	0.16	2.5	0.13	<0.05	<0.050	0.21	0.089	0.063	0.052	<0.050	10	0.375	0.76	2.5	0.05
As	ppm							0.011	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.005	<0.003	<0.003	<0.003	10	0.004	0.003	0.011	<0.003
Ba	ppm							0.30	0.043	0.092	0.057	0.048	0.021	0.067	0.061	0.049	0.045	0.044	11	0.075	0.077	0.3	0.021
Be	ppm							<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	10	<0.001	0	<0.001	<0.001
Ca	ppm	24	26	20	27				14	20	23	23	6	19	20	18	21	22	14	20.2	5.2	27.0	6
Cd	ppm							0.0004	<0.0002	0.0003	0.003	0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	10	0.001	0.001	0.003	<0.0002
Cl	ppm							<1.0	<1.0	1.5	<1.0	<2.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	10	1.16	0.33	2	1
Cr	ppm							0.001	<0.001	0.002	<0.001	0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	10	0.0012	0.0004	0.002	<0.001
Cu	ppm	0.34	0.19	0.49	0.064	0.15	0.13	0.18	0.13	0.31	0.089	0.065	0.023	0.10	0.056	0.062	0.063	0.050	17	0.15	0.13	0.49	0.023
F	ppm				<0.10			<0.10	<0.10	<0.10	0.055	<0.10	0.05	<0.050	0.05	0.054	0.050	<0.050	11	<0.074	<0.025	<0.1	<0.050
Fe	ppm	0.56	0.26	1.12	0.08	0.31	0.13	0.34	0.22	2.2	0.12	0.065	0.074	0.23	<0.050	<0.150	0.079	0.12	17	0.36	0.54	2.2	<0.050
Hg	ppb							<0.50	<0.5	<0.50	0.62	<0.20	<0.20	<0.50	<0.2	<0.50	<0.50	<0.20	10	0.42	0.16	0.62	<0.2
K	ppm	<2.0	4.4	2.0	1.4	1.5	<2.0	<2.0	<2	<2.0	<1.0	1.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	16	1.9688	0.73	<4.4	<1.0
Mg	ppm	5.7	6.0	4.6	6.0				2.9	5.4	5.3	6.3	1.4	4.4	5.0	4.2	4.9	5.4	14	4.8214	1.3	6.3	1.4
Mn	ppm	0.27	0.13	0.32	0.16	0.12	0.16	0.092	0.087	0.16	0.056	0.080	0.018	0.087	0.042	0.074	0.092	0.054	17	0.12	0.079	0.32	0.018
Ni	ppm							<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	10	<0.012	<0.004	<0.020	<0.010
Pb	ppm	0.011	0.018	0.037	<0.002	0.010	0.007	<0.002	0.009	0.037	0.002	<0.002	<0.002	0.006	0.002	0.003	0.006	0.005	17	0.0095	0.011	0.037	<0.002
Sb	ppm							0.004	0.004	0.006	0.009	0.006	0.011	0.008	0.006	0.006	0.005	0.009	11	0.0067	0.0022	0.011	0.004
Se	ppm							<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	10	<0.001	0.0000	<0.001	<0.001
Tl	ppm							<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.001	<0.001	<0.001	<0.001	<0.001	10	<0.002	<0.001	<0.003	<0.001
Zn	ppm	<0.008	0.010	<0.008	0.076	0.014	0.018	<0.010	0.019	0.023	0.011	<0.010	<0.010	<0.010	<0.010	<0.011	0.010	<0.010	16	0.0161	0.017	<0.076	<0.008

Source: Email from Wayne Jepson, August 26, 1999.

TABLE 4-23
Characteristics of Tailings Solids and Waste Rock

Parameter	Whole Rock Analysis For Tailing Solids and Waste Rock		E.P. Toxicity[2] Analysis For Tailing Solids and Waste Rock	
	Troy Tailings	Rock Creek Waste Rock[1]	Troy Tailings	Rock Creek Waste Rock[1]
Aluminum	34,500	4*	0.18	<1
Antimony	<25	1	<0.1	<1
Arsenic	3.8	12	<0.004	<0.5
Barium	1,410	295	0.26	<10
Beryllium	<1.0	7	<0.004	<0.05
Cadmium	<10	6	<0.004	<0.1
Calcium	3,950	3*	58	375
Chromium	31	33	<0.3	<0.5
Cobalt	<5.0	<1	<0.03	<0.1
Copper	630	9	0.15	15
Iron	7,600	1.21*	2.3	<1
Lead	120	13	0.04	<0.3
Magnesium	1,650	<1*	8.1	16.7
Manganese	540	1,324	9.4	<0.5
Mercury	ND	<0.1	<0.50	<0.02
Molybdenum	<10	<1	<0.04	<0.05
Nickel	<10	2	0.04	<0.3
Potassium	23,500	ND	2.4	ND
Selenium	<.50	<1	<0.004	<0.5
Silver	4.6	<1	<0.008	<0.1
Sodium	9,250	2*	1.3	ND
Zinc	10	52	0.04	12.4

Source: ASARCO Incorporated 1987-1997. (Additional data collected by the Agencies is presented in Table 4-12).

Notes: All values parts per million except where noted by an asterisk (*). The asterisk indicates that the value is in percent.

[1]Waste Rock values are the average of three samples. In cases where values are less than detection limit, the detection limit value was used in calculation of the average.
[2]Extraction Procedure Toxicity Test Method (EPA Method 1310). This procedure has been used to characterize the leaching potential and degree of hazard associated with solid wastes.
ND = No Data.

waste rock nitrogen content, rainfall and temperature conditions, infiltration capacity of the mill pad, potential for surface ponding, and actual streamflow during the period of construction. Research suggests that the impacts of leaching soluble nitrogen in waste rock would be short lived. Most nitrogen compounds could be leached out within 1 month to 1 year (British Columbia Ministry of the Environment 1983); the remainder would leach out within 5 years.

Milling Process. Reagents proposed by the applicant range from non-toxic to toxic to humans and fish (see Appendix I and Aquatics/Fisheries).

Water Treatment. A passive biotreatment system would be used to treat mine water. An ion exchange system also would be installed as a final polishing step to ensure the quality of water discharged to the Clark Fork River. While the proposed passive biotreatment cells have been used on a limited basis to treat mine waste water, the capability of passive biotreatment cells to treat mine waste similar to that anticipated at Rock Creek and under climatic conditions similar to that anticipated at Rock Creek has not been adequately delineated. The proposed passive biotreatment system has not been proven to be capable of providing the degree of nitrogen removal required to meet the limits in the MPDES discharge permit.

Because ion exchange resins are either cation or anion specific, a two step process would be required to remove both ammonia and nitrate-nitrogen. This increases the cost and complexity of the treatment process. Ion exchange systems have not been used extensively for nitrate removal from mine waste water. Therefore, the long-term reliability of ion exchange as a nitrate removal system has not been demonstrated.

MPDES permits do not require specific water treatment systems; they do require that the applicant provide whatever treatment is necessary to achieve the required permit limits. Although there is some doubt about the proposed waste water treatment system's ability to achieve sufficient levels of nitrate removal under Alternative II, the analysis that follows assumes that systems would be designed or modified such that they would remove dissolved solids, heavy metals, ammonia and nitrate/nitrite to comply with MPDES discharge requirements. Table 4-24 provides the applicant's estimate of untreated and treated water quality for the proposed project (ASARCO Incorporated 1997). The maximum concentrations of the treated effluent are carried forward into Tables 4-25A, 4-26A, and 4-27A to estimate the reasonable worst case impacts to surface water quality. The MPDES average monthly limits are carried forward into Tables 4-25B, 4-26B, and 4-27B.

The actual effects on Clark Fork River water quality due to discharge of adit water from the proposed project would vary both seasonally and annually for the proposed 30-year mine operational period. The actual water quality impacts would be a function of the volume of water discharged from the mine, the flow rate in the Clark Fork River, and the concentration of chemical constituents in both (see Tables 4-25A, 4-26A, and 4-27A). The degree of variation in the seasonal component of flow and water quality would be difficult to calculate for all possibilities using the available database (Windward Environmental 2000). Treated discharge would be piped to the Clark Fork River with a proposed outfall and underwater diffuser downstream of Noxon Reservoir.

TABLE 4-24

Estimated Untreated and Treated Discharge Water Quality*

Parameter	Effluent Prior to Treatment		Treated Effluent	
	Average Daily Concentration	**Maximum Daily Concentration**	**Average Daily Concentration**	**Maximum Daily Concentration**
pH (SU)	7.49	8.4	7.5	8.4
Total Suspended Solids	779	6,541	10	30
Total Hardness (as $CaCO_3$)	72	300	72	300
Total Alkalinity (as $CaCO_3$)	ND	ND	ND	ND
Sulfate SO_4	22.6	42	22.6	42
Ammonia (NH_3 as N)	7.2	14	1.43	2.8
Total Kjeldahl Nitrogen (as N)	8.1	20.0	1.6	4.0
Nitrate and Nitrite (as N)	15.9	30.0	3.2	6.0
TIN	24.4	124.0	4.61	8.8
Orthophosphate (PO_4-P)	0.031	0.23	0.1	0.1
Total Phosphorus	0.058	0.3	0.1	0.1
Arsenic (DIS)	<0.005	<0.005	<0.005	<0.005
Arsenic (TOT)	0.02	0.02	<0.005	<0.005
Cadmium (DIS)	0.002	<0.005	<0.001	<0.005
Cadmium (TRC)	0.0017	0.005	<0.001	<0.001
Chromium (DIS)	ND	ND	ND	ND
Chromium (TRC)	ND	ND	ND	ND
Copper (DIS)	0.037	0.09	0.037	0.09
Copper (TRC)	0.846	27	0.047	0.213
Iron (DIS)	0.05	0.05	0.05	0.05
Iron (TRC)	2.34	38.0	0.079	0.224
Lead (DIS)	0.015	<0.05	<0.01	<0.05
Lead (TRC)	0.126	2.2	0.017	0.06
Manganese (DIS)	0.43	0.55	0.43	0.55
Manganese (TRC)	1.95	63.0	0.448	0.836
Mercury (DIS)	<0.001	<0.001	<0.001	<0.001
Mercury (TOT)	<0.0005	<0.0005	<0.0005	<0.0005
Selenium (DIS)	ND	ND	ND	ND
Selenium (TRC)	ND	ND	ND	ND
Silver (DIS)	<0.004	<0.01	<0.004	<0.01
Silver (TRC)	0.004	0.023	<0.005	<0.005
Zinc (DIS)	0.019	0.03	0.019	0.03
Zinc (TRC)	0.078	2.80	0.019	0.043

Source: ASARCO Incorporated 1987-1997.

Notes: *All units are in mg/L unless otherwise indicated.
TRC = Total Recoverable Metals Analysis
SU = Standard pH Units ND = No Data TIN = Total Inorganic Nitrogen
DIS = Dissolved Metals Analysis TOT = Total Metals Analysis

TABLE 4-25A
Estimated Water Quality in the Clark Fork River at Average Flow (20,183 cfs) Resulting From Proposed Discharge*

Parameter	Ambient Clark Fork Water Quality	Estimated Water Quality of Proposed Discharge⊕	Calculated Load (lbs/day)	Resultant River Water Quality	Final MPDES Permit Average Monthly Limit[Q] (lbs/day)	Montana Water Quality Standard & Trigger Value
pH (SU)	8.1[b]	8.4	NC	8.10007608	N/A	6.5-8.5
Total Suspended Solids	<2.8[b]	30	829	<2.80689831	552.0	N/A
Hardness (as $CaCO_3$)	85[b]	300	8290	85.0545271	N/A	N/A
Alkalinity (as $CaCO_3$)	80.7[b,c]	ND	NC	NC	N/A	N/A
Sulfate (SO_4)	2.1667[a]	42	1161	2.1768023	N/A	N/A
Ammonia (NH_3 as N)	<0.013[b]	2.8	77	<0.01370682	N/A	1.33*; 0.01[t,&]
Kjeldahl Nitrogen (as N)	<0.171[b]	4.0	111	<0.17197109	N/A	N/A
Nitrate and Nitrite (as N)	<0.034[b]	6.0	166	<0.03551306	N/A	10; 0.01[t]
TIN	<0.047[b]	8.8	243	<0.04921989	232	N/A
Orthophosphate (PO_4-P)	<0.002[b]	0.1	2.76	<0.00202485	N/A	N/A
Total Phosphorus	<0.011[b]	0.1	2.76	<0.01102257	23.2	N/A; 0.001[t]
Arsenic	<0.0011[b]	<0.005	0.14	<0.00110099	0.011	0.018
Cadmium	<0.00023[b]	<0.001	0.03	<0.0002302	1.37	0.002; 0.0001[t]
Chromium	0.005[a]	ND	NC	NC	N/A	0.011; 0.005[t]
Copper	<0.0013[b]	0.213	5.89	<0.00135369	4.13	0.008; 0.0005[t]
Iron	0.082[b]	0.224	6.19	0.08203601	N/A	0.3
Lead	<0.0011[b]	0.06	1.66	<0.00111494	1.77	0.026; 0.0001[t]
Manganese	0.02[b]	0.836	23.10	0.02020695	24	0.05
Mercury	<0.0002[b]	<0.0005	0.01	<0.00020008**	0.0002	0.000012
Selenium	0.0025[a]	ND	NC	NC	10.3	0.005; 0.0006[t]
Silver	<0.0002[b]	<0.005	0.14	<0.00020122	N/A	0.003; 0.0002[t]
Zinc	<0.0036[b]	0.043	1.19	<0.00360999	20.6	0.105; 0.005[t]

Source: (a) = ASARCO Incorporated 1987-1997 (see Table 3-7). (b) = Statement of Basis (see Table 3-6).
Notes: *All units are in mg/L unless otherwise indicated. Calculations assume discharge rate equals 2,300 gpm (5.12 cfs).
SU = Standard pH Units
TIN = Total Inorganic Nitrogen
& = pH and Temperature Dependent
ND = No Data
NC = Not Calculated
t = Trigger Value
N/A = Not Applicable
c = As Alkalinity Increases, the Toxicity of Some Metals Decreases
** = The conclusion that the resultant concentrations exceed ambient cannot be made because the water quality criterion is lower than the detection limit.
⊕ = See "Maximum Concentration" listed in Table 4-24. Detection limit value used if maximum concentration was listed as less than detection.
Shading = Calculated load based on "Maximum Daily Concentration" value provided in Table 4-24, rather than "Average Daily Concentration," and may therefore exceed MPDES Average Monthly Limit.
Q = Wastewater limits for Outfall 001 as described in SOB (Appendix D, Tables 2 and 3).

TABLE 4-25B
Estimated Water Quality in the Clark Fork River at Average Flow (20,183 cfs) Resulting From MPDES Discharge Limits*

Parameter	Ambient Clark Fork Water Quality[a]	MPDES Average Monthly Limit ⊕ (mg/L)	Calculated Load (lbs/day)	Resultant River Water Quality (mg/L)	Final MPDES Permit Average Monthly Limit[Q] (lbs/day)	Montana Water Quality Standard & Trigger Value
TIN	<0.047	8.4	232	<0.04911844	232	N/A
Total Phosphorus	<0.011	0.84	23.2	<0.01121025	23.2	N/A; 0.001[t]
Arsenic	<0.0011	0.00041	0.011	<0.00109983	0.0011	0.018
Cadmium	<0.00023	0.05	1.37	<0.00024247	1.37	0.002; 0.0001[t]
Copper	<0.0013	0.15	4.13	<0.00133759	4.13	0.008; 0.0005[t]
Lead	<0.0011	0.064	1.77	<0.00111593	1.77	0.026; 0.0001[t]
Manganese	0.02	0.87	24	0.02021557	24	0.05
Mercury	<0.0002	0.000006	0.0002	<0.00019995**	0.0002	0.000012
Selenium	0.0025	0.37	10.3	0.00259384	10.3	0.005; 0.0006
Zinc	<0.0036	0.75	20.6	<0.00378854	20.6	0.105; 0.005[t]

Source: (a) = From Table 4-25A.
Notes: *All units are in mg/L unless otherwise indicated. Calculations assume discharge rate equals 2,300 gpm (5.12 cfs).

SU = Standard pH Units
TIN = Total Inorganic Nitrogen
& = pH and Temperature Dependent
ND = No Data
NC = Not Calculated
t = Trigger Value
N/A = Not Applicable
c = As Alkalinity Increases, the Toxicity of Some Metals Decreases
** = The conclusion that the resultant concentrations exceed the standard cannot be made because the water quality criterion is lower than the detection limit.
⊕ = See MPDES permit effluent limits for Outfall 001 in mg/L.
Q = Wastewater limits for Outfall 001 as described in SOB, Appendix D, Table 2 (Flow Nondependent) and Table 3 (High Flow).

TABLE 4-26A
Estimated Water Quality in the Clark Fork River at $Q_{7,10}$ Flow (3,610 cfs) Resulting From Proposed Discharge*

Parameter	Ambient Clark Fork Water Quality	Estimated Water Quality of Proposed Discharge⊕	Calculated Load (lbs/day)	Resultant River Water Quality	Final MPDES Permit Average Monthly Limit[Q] (lbs/day)	Montana Water Quality Standard & Trigger Value
pH (SU)	8.1[b]	8.4	NC	8.10042488	N/A	6.5-8.5
Total Suspended Solids	<2.8[b]	30	829	<2.83852265	552.0	N/A
Total Hardness (as $CaCO_3$)	85[b]	300	8290	85.3044989	N/A	N/A
Total Alkalinity (as $CaCO_3$)	80.7[b,c]	ND	NC	NC	N/A	N/A
Sulfate (SO_4)	2.1667[a]	42	1161	2.22311486	N/A	N/A
Ammonia (NH_3 as N)	<0.013[b]	2.8	77	<0.01694716	N/A	1.33*; 0.01[t,&]
Total Kjeldahl Nitrogen (as N)	<0.171[b]	4.0	111	<0.17642291	N/A	N/A
Nitrate and Nitrite (as N)	<0.034[b]	6.0	166	<0.04244949	N/A	10; 0.01[t]
TIN	<0.047[b]	8.8	243	<0.05939665	232	N/A
Orthophosphate (PO_4-P)	<0.002[b]	0.1	2.76	<0.00213879	N/A	N/A
Total Phosphorus	<0.011[b]	0.1	2.76	<0.01112605	23.2	N/A; 0.001[t]
Arsenic	<0.0011[b]	<0.005	0.14	<0.00110552	0.011	0.018
Cadmium	<0.00023[b]	<0.001	0.03	<0.00023109	0.18	0.002; 0.0001[t]
Chromium	0.005[a]	ND	NC	NC	N/A	0.011; 0.005[t]
Copper	<0.0013[b]	0.213	5.89	<0.00159983	0.91	0.008; 0.0005[t]
Iron	0.082[b]	0.224	6.19	0.08220111	N/A	0.3
Lead	<0.0011[b]	0.06	1.66	<0.00118342	0.20	0.026; 0.0001[t]
Manganese	0.02[b]	0.836	23.10	0.02115568	24	0.05
Mercury	<0.0002[b]	<0.0005	0.01	<0.00020042**	0.0002	0.000012
Selenium	0.0025[a]	ND	NC	NC	1.08	0.005; 0.0006[t]
Silver	<0.0002[b]	<0.005	0.14	<0.0002068	N/A	0.003; 0.0002[t]
Zinc	<0.0036[b]	0.043	1.19	<0.0036558	7.7	0.095; 0.005[t]

Source: (a) = ASARCO Incorporated 1987-1997 (see Table 3-7). (b) = Statement of Basis (see Table 3-6).

Notes: *All units are in mg/L unless otherwise indicated. Calculations assume discharge rate equals 2,300 gpm (5.12 cfs).

SU = Standard pH Units
TIN = Total Inorganic Nitrogen
& = pH and Temperature Dependent
ND = No Data
NC = Not Calculated
t = Trigger Value
N/A = Not Applicable
c = As Alkalinity Increases, the Toxicity of Some Metals Decreases
** = The conclusion that the resultant concentrations exceed the standard cannot be made because the water quality criterion is lower than the detection limit.
⊕ = See "Maximum Concentration" listed in Table 4-24. Detection limit value used if maximum concentration was listed as less than detection
Q = Wastewater limits for Outfall 001 as described in SOB, Appendix D, Table 2 (Flow Nondependent) and Table 3 (Default Flow Conditions).

Shading = Calculated load based on "Maximum Daily Concentration" from Table 4-24 and maximum discharge rate of 2,300 gpm. Allowable load based on MPDES discharge permit is less than Sterling's proposed maximum load. See Table 4-26B.

TABLE 4-26B
Estimated Water Quality in the Clark Fork River at $Q_{7,10}$ Flow (3,610 cfs) Resulting From MPDES Discharge Limits*

Parameter	Ambient Clark Fork Water Quality[a]	MPDES Average Monthly Limit ⊕	Calculated Load (lbs/day)	Resultant River Water Quality	Final MPDES Permit Average Monthly Limit[Q] (lbs/day)	Montana Water Quality Standard & Trigger Value
TIN	<0.047	8.4	232	<0.05883014	232	N/A
Total Phosphorus	<0.011	0.84	23.2	<0.01217409*	23.2	N/A; 0.001[t]
Arsenic	<0.0011	0.0004	0.011	<0.00109901	0.011	0.018
Cadmium	<0.00023	0.0066	0.18	<0.00023902	0.18	0.002; 0.0001[t]
Copper	<0.0013	0.033	0.91	<0.0013449	0.91	0.008; 0.0005[t]
Lead	<0.0011	0.0074	0.20	<0.00110892	0.20	0.026; 0.0001[t]
Manganese	0.02	0.87	24	0.02120383	24	0.05
Mercury	<0.0002	0.000006	0.0002	<0.00019973**	0.0002	0.000012
Selenium	0.0025	0.0039	1.08	0.00255169	1.08	0.005; 0.0006
Zinc	<0.0036	0.279	7.7	<0.00399004	7.7	0.105; 0.005[t]

Source: (a) = From Table 4-26A.

Notes: *All units are in mg/L unless otherwise indicated. Calculations assume discharge rate equals 2,300 gpm (5.12 cfs).

SU = Standard pH Units
TIN = Total Inorganic Nitrogen
& = pH and Temperature Dependent
ND = No Data
NC = Not Calculated
t = Trigger Value
N/A = Not Applicable
c = As Alkalinity Increases, the Toxicity of Some Metals Decreases
* = Considered non-significant based on MPDES permit.
** = The conclusion that the resultant concentrations exceed the standard cannot be made because the water quality criterion is lower than the detection limit.
⊕ = See MPDES permit effluent limits for Outfall 001.
Shading = Exceeds water quality standard or trigger value
Q = Wastewater limits for Outfall 001 as described in SOB, Appendix D, Table 2 (Flow Nondependent) and Table 3 (Default Flow Conditions).

TABLE 4-27A
Estimated Water Quality in the Clark Fork River at Lowest Flow (365 cfs) Resulting From Proposed Discharge*

Parameter	Ambient Clark Fork Water Quality	Estimated Water Quality of Proposed Discharge⊕	Calculated Load (lbs/day)	Resultant River Water Quality	Final MPDES Permit Average Monthly Limit[Q] (lbs/day)	Montana Water Quality Standard & Trigger Value
pH (SU)	8.1[b]	8.4	NC	8.10415001	N/A	6.5-8.5
Total Suspended Solids	<2.8[b]	30	829	<3.17626716	552.0	N/A
Total Hardness (as $CaCO_3$)	85[b]	300	8290	87.9741705	N/A	N/A
Total Alkalinity (as $CaCO_3$)	80.7[b,c]	ND	NC	NC	N/A	N/A
Sulfate (SO_4)	2.1667[a]	42	1161	2.71772803	N/A	N/A
Ammonia (NH_3 as N)	<0.013[b]	2.8	77	<0.05155355+	N/A	1.33*; 0.01[t,&]
Total Kjeldahl Nitrogen (as N)	<0.171[b]	4.0	111	<0.2239679	N/A	N/A
Nitrate and Nitrite (as N)	<0.034[b]	6.0	166	<0.11652977+	N/A	10; 0.01[t]
TIN	<0.047[b]	8.8	243	<0.16808332	232	N/A
Orthophosphate (PO_4-P)	<0.002[b]	0.1	2.76	<0.00335567	N/A	N/A
Total Phosphorus	<0.011[b]	0.1	2.76	<0.01223117+	23.2	N/A; 0.001[t]
Arsenic	<0.0011[b]	<0.005	0.14	<0.00115395	0.0011	0.018
Cadmium	<0.00023[b]	<0.001	0.03	<0.00024065	0.18	0.002; 0.0001[t]
Chromium	0.005[a]	ND	NC	NC	N/A	0.011; 0.005[t]
Copper	<0.0013[b]	0.213	5.89	<0.00422852+	0.91	0.008; 0.0005[t]
Iron	0.082[b]	0.224	6.19	0.08396434	N/A	0.3
Lead	<0.0011[b]	0.06	1.66	<0.00191478	0.20	0.026; 0.0001[t]
Manganese	0.02[b]	0.836	23.10	0.03128801	24	0.05
Mercury	<0.0002[b]	<0.0005	0.01	<0.00020415**	0.0002	0.000012
Selenium	0.0025[a]	ND	NC	NC	1.08	0.005; 0.0006[t]
Silver	<0.0002[b]	<0.005	0.14	<0.0002664	N/A	0.003; 0.0002[t]
Zinc	<0.0036[b]	0.043	1.19	<0.00414503	7.7	0.105; 0.005[t]

Source: (a) = ASARCO Incorporated 1987-1997 (see Table 3-7). (b) = Statement of Basis (see Table 3-6).

Notes: *All units are in mg/L unless otherwise indicated. Calculations assume discharge rate equals 2,300 gpm (5.12 cfs).

SU = Standard pH Units
TIN = Total Inorganic Nitrogen
& = pH and Temperature Dependent
ND = No Data
NC = Not Calculated
t = Trigger Value
N/A = Not Applicable
c = As Alkalinity Increases, the Toxicity of Some Metals Decreases
\+ = Meets water quality standards but exceeds trigger value.
** = The conclusion that the resultant concentrations exceed the standard cannot be made because the water quality criterion is lower than the detection limit.
⊕ = See "Maximum Concentration" listed in Table 4-24. Detection limit value used if maximum concentration was listed as less than detection
Shading = Exceeds water quality standard or trigger value
Q = Wastewater limits for Outfall 001 as described in SOB, Appendix D, Table 2 (Flow Nondependent) and Table 3 (Default Flow Conditions).

TABLE 4-27B
Estimated Water Quality in the Clark Fork River at Lowest Flow (365 cfs) Resulting From MPDES Discharge Limits*

Parameter	Ambient Clark Fork Water Quality[a]	MPDES Average Monthly Limit ⊕	Calculated Load (lbs/day)	Resultant River Water Quality	Final MPDES Permit Average Monthly Limit[Q] (lbs/day)	Montana Water Quality Standard & Trigger Value
TIN	<0.047	8.4	232	<0.16254998	232	N/A
Total Phosphorus	<0.011	0.84	23.2	<0.02246785**	23.2	N/A; 0.001[t]
Arsenic	<0.0011	0.0004	0.011	<0.00109032	0.011	0.018
Cadmium	<0.00023	0.0066	0.18	<0.00031812	0.18	0.002; 0.0001[t]
Copper	<0.0013	0.033	0.91	<0.00173852	0.91	0.008; 0.0005[t]
Lead	<0.0011	0.0074	0.20	<0.00118715	0.20	0.026; 0.0001[t]
Manganese	0.02	0.87	24	0.03175835	24	0.05
Mercury	<0.0002	0.000006	0.0002	<0.00019732**	0.0002	0.000012
Selenium	0.0025	0.039	1.08	0.00300492	1.08	0.005; 0.0006
Zinc	<0.0036	0.279	7.7	<0.0074097	7.7	0.105; 0.005[t]

Source: (a) = From Table 4-27A.

Notes: *All units are in mg/L unless otherwise indicated. Calculations assume discharge rate equals 2,300 gpm (5.12 cfs).

SU = Standard pH Units
TIN = Total Inorganic Nitrogen
& = pH and Temperature Dependent
ND = No Data
NC = Not Calculated
t = Trigger Value
N/A = Not Applicable
c = As Alkalinity Increases, the Toxicity of Some Metals Decreases
** = The conclusion that the resultant concentrations exceed the standard cannot be made because the water quality criterion is lower than the detection limit.
⊕ = See MPDES permit effluent limits for Outfall 001
+ = Meets water quality standards but exceeds trigger value.
* = Considered nonsignificant based on MPDES permit.
Shading = Exceeds water quality standard or trigger value

Q = Wastewater limits for Outfall 001 as described in SOB, Appendix D, Table 2 (Flow Nondependent) and Table 3 (Default Flow Conditions).

Tables 4-25A and 4-26A indicate that water quality standards are met during average flow (20,183 cfs) and low flow ($Q_{7,10}$ equal to 3,610 cfs) conditions in the Clark Fork River. Table 4-27 suggests that for night-time operations of Noxon Dam (assumed flow of 365 cfs), Sterling's maximum proposed discharge (2,300 gpm) at the highest predicted concentrations (Table 4-24) meet Montana water quality standards, but could possibly result in ammonia, nitrate + nitrite, phosphorus, copper, and lead exceeding the trigger values for nondegradation near the point of discharge, and prior to dilution and mixing effects in Cabinet Gorge reservoir reducing the overall impact. The trigger values, however, apply to a nondegradation determination for flows equal to or greater than the $Q_{7,10}$ rather than short-duration flows from the dam that are less than the $Q_{7,10}$. Therefore, trigger value exceedances occurring during these night-time periods are not relevant to the nondegradation determination. No exceedances would be allowed anywhere in the discharge for carcinogens and bioaccumulating metals.

Underwater Diffuser and Mixing Analysis. The effluent will contain several constituents that are expected to exceed acute aquatic life standards, primarily copper but also cadmium, lead and silver. Tailings wastewater from the Troy facility has also exhibited acute whole effluent toxicity (WET). Montana water quality standards require state surface waters to be free from substances which are toxic to plant or animal life [ARM 17.30.637(1)(d)] except that the department may allow a zone of initial mixing where acute standards are exceeded provided that this initial mixing will not threaten or impair existing beneficial uses [ARM 17.30.507(1)(b)]. All wastewater would be discharged from Outfall 001 to the Clark Fork River through an effluent diffuser. The diffuser will maximize initial dilution of the effluent and all applicable criteria, including nondegradation criteria will be met outside of the mixing zone. Potential exceedances of acute aquatic life standards would be minimized in the mixing zone through the imposition of acute toxicity WET testing of the effluent.

The proposed diffuser will consist of a perforated pipe running perpendicular to the flow of the river and extend the full width of the river (300 ft). Two inch diameter ports will be spaced every 10 feet resulting in an exit velocity from the diffuser of 2.7 feet per second. The momentum and buoyancy characteristics of the effluent will ensure rapid initial mixing of the effluent with the receiving water.

An analysis of the diffuser design was conducted by the agencies using the UM model under the control of EPA's PLUMES interface (Baumgarter, et al. 1994). Mixing rates and distances were evaluated for copper at both low and high flow conditions using this model. Copper was evaluated because of it's high toxicity to aquatic organisms and since the concentration in the effluent will exceed the acute water quality standard by a factor of 3.3 (235%) to 16 (1,500%). The results of this analysis are summarized in Table 4-28. The analysis predicts that effluent concentrations will be diluted to below potentially toxic levels within 2 meters (6.5 feet) of the discharge ports and will meet nondegradation criteria within 6 meters (20 feet) of the point of discharge during low flow and 74 meters (243 feet) at higher flows. Mixing will be more rapid, and completed within a shorter distance at low flow owning primarily to the reduced instream velocity during these periods. During high flow conditions, the velocity of the river (2 to 5 feet per second) will partially offset the exit velocity of the effluent. Under either flow condition, the individual plumes from the diffuser ports will initially merge laterally (horizontal) and the contact either the surface of bottom depending of temperature of the receiving water and effluent which will very seasonally.

TABLE 4-28
Summary of EPA PLUME Model Analysis
for Copper Mixing in Receiving Water

Parameter/Condition	Flow Condition	
	Low	High
River Flow, cfs	365	17,000
River Velocity, feet per second	0.05	2.5
Dilution Factor (S_a)	72	3,318
Effluent Limit (copper), µg/L	33	150
Distance (m) [(1)(2)] - nondegradation criteria	6	74
Distance (m) [(1)(3)] - horizon merge of plume	6	311
Distance (m) [(1)(4)] - vertical contact with bottom/surface	7	1,277/1,000
Distance (m) [(1)(5)] - complete mixing, meters	6	greater than 2,000
Distance (m) [(1)(6)] - fish avoidance criteria, meters	0.5	1.4

Notes:

(1) Distance in meters downstream from point of discharge to satisfy stated criteria.
(2) Nondegradation criteria is background concentration (1.3 µg/L) plus trigger values (0.5 µg/L), see Section I.A.1.
(3) Lateral mixing of plumes.
(4) Distance downstream for plume to contact either surface of bottom; low flow plume will contact surface, high flow plume distance given are summer/winter. During colder conditions when effluent is warmer it will contact surface first; during summer plume will contact bottom first.
(5) 100 percent dilution of effluent with receiving water.
(6) Total copper concentration (background plus effluent) less than 6 µg/L.

Accidental Spills and Ruptures. Significant ruptures or breaks in either the proposed tailings slurry or return water lines could result in short-term water quality degradation of Rock Creek. Both pipelines would be encased in larger pipes at stream crossings, and emergency dump stations would be provided in critical reaches along the utility corridor. Slurry lines would be continuously operated and monitored at the concentrator. In the event that pipeline leakage occurred, the system would be shut down and immediately repaired. Pin hole leaks in pipelines, while requiring maintenance or repair, would not likely result in measurable impacts to surface water resources. Impacts due to major ruptures would depend on the location of the rupture and the response time for cleanup. In addition, chemical spills at the concentrator would drain and be collected in a concrete sump located below grade.

The accidental rupture of a supply or tanker truck along the proposed utility corridor road could affect water resources in the Rock Creek drainage. The effect this event would have on the overall water quality of Rock Creek cannot be predicted, and would depend on (1) the response time for cleanup, (2) the toxicity of material(s) spilled, (3) the location of the spill relative to the creek, (4) the amount of material released into the environment, and (5) the quantity of flow available for dilution.

An accidental spill from a supply or tanker truck is considered to be an unlikely event. In the event of an accidental spill, Sterling would implement a spill contingency plan (ASARCO Incorporated 1987-1997).

Impacts to surface water from unlikely accidental spills or ruptures under Alternative II could be potentially significant.

Sterling has proposed to perpetually discharge adit water (meeting MPDES permit requirements) to the Clark Fork River. It is assumed that this discharge would be via pipeline. Unless the pipeline was perpetually maintained, eventual pipeline rupture would be probable, which would result in discharge of the water into Rock Creek near the point of rupture. Because of the lower hardness and less dilution capacity of Rock Creek, such a discharge may result in exceedence of standards in Rock Creek even though the same water would not violate standards in the Clark Fork River.

Sedimentation. Construction activities or mass failure of cuts, fills, embankments and soil stockpiles may temporarily increase sediment loading to Rock Creek and the Clark Fork River. Any increased sedimentation would be of short duration. See Table 4-29 for a summary of sediment impacts under various project alternatives. A complete discussion of sediment impacts is provided in Appendix N. See Aquatics/Fisheries for discussion on impacts from sedimentation to aquatic life.

Sediment yield was estimated by the Agencies using the R1-WATSED model. Actual sediment loading to Rock Creek would depend on weather conditions at the time of construction and the efficiency of BMPs used to control erosion. R1-WATSED modeling results for Alternative II actions showed a one percent increase in peak flows and a 80 percent increase in annual sediment yield during construction and operation of the mine. At the end of the life of mine, the peak flow value would decrease to the baseline value and the annual sediment increase is predicted to remain increased by one percent from baseline. Appendix N contains a detailed description of the R1-WATSED model and model simulations. Because this would result in a small overall increase in sediment yield within the watershed at the end of the project, it is expected that conditions would continue to remain the same or worsen with the implementation of this alternative. Potential increases in sediment loading to the Clark Fork River below Noxon Dam would be negligible because of the additional volume of flow available for dilution.

TABLE 4-29
Rock Creek - WATSED Summary

Alternative Number	WEST FORK (Rock Cr)					EAST FORK (Rock Cr)					ENTIRE (Rock Cr)				
	Peak Flow Change	Peak Flow Total	Sediment Changes	Sediment (mg/L)	Sediment Total	Peak Flow Change	Peak Flow Total	Sediment Changes	Sediment (mg/L)	Sediment Total	Peak Flow Change	Peak Flow Total	Sediment Changes	Sediment (mg/L)	Sediment Total
NATURAL CONDITIONS (Assumes no roads or other existing developments)															
NA	0%	0%	0%	10.2	0%	0%	0%	0%	11.1	0%	0%	0%	0%	10.4	0%
EXISTING 1998 (Pre-Construction) CONDITIONS															
NA	7%	7%	266%	34.8	266%	0%	0%	32%	14.3	32%	3%	3%	121%	22.3	121%
YEAR 2 (Construction) CONDITIONS DURING MINE OPERATION (2000)															
Alt. 2	1%	8%	277%	60.5	543%	0%	0%	13%	16.1	45%	1%	4%	80%	30.1	201%
Alt. 3	1%	8%	209%	54.1	475%	0%	0%	14%	16.2	46%	1%	4%	56%	27.6	177%
Alt. 4	0%	7%	76%	42	342%	0%	0%	24%	17.3	56%	0%	3%	44%	26.8	165%
Alt. 5	0%	7%	46%	39.2	312%	0%	0%	20%	16.8	52%	0%	3%	38%	26.2	159%
POST-MINING CONDITIONS (2031)															
Alt. 2	0%	7%	54%	39.9	320%	0%	0%	-3%	14	26%	0%	3%	1%	22.3	122%
Alt. 3	-1%	6%	28%	37.8	294%	0%	0%	-3%	14	26%	0%	3%	-7%	21.6	114%
Alt. 4	-2%	5%	-11%	34.4	255%	0%	0%	1%	14.4	30%	-1%	2%	-11%	21.4	110%
Alt. 5	-2%	5%	-21%	33.3	245%	0%	0%	-1%	14.2	28%	-1%	2%	-12%	21.2	109%

NA = Not Applicable

Tailings Impoundment Failure. The Agencies would institute a process to review and evaluate the applicant's final tailings impoundment design to ensure long-term stability, and minimize the probability of failure. Catastrophic failure of the tailings impoundment is considered a low-probability event (see Geotechnical Engineering). Should such a failure occur, sediment and tailings leachate would be uncontrollably released to the environment. The volume of material released and the effect of this release on the environment cannot be predicted, and would depend on the type of failure, size of the tailings impoundment at the time of failure, volume of water associated with the failure, and the initial volume and character of the sediments and the character of concurrent releases from other sources.

Under the worst case scenario, tailing liquids containing dissolved metals and reagent residues, and large masses of sediment would flush into stream channels associated with Rock Creek, Miller Gulch, and the Clark Fork River. Portions of this sediment mass would probably remain in these stream channels for an undefined period of time following failure, while the liquid and remaining solids would be carried downstream. (See Johns and Moore 1985, Workman 1985, Moore, Luoma, and Peters 1991, and Wright and Solero 1973 for discussion of heavy metals movement through natural and human-made impoundments).

Subsequent to any such failure, seasonal high flows would continue to wash most of the remaining sediment downstream, and this sediment would be deposited in Cabinet Gorge Reservoir upstream of the dam. Sediment and soluble metals and nutrients also would migrate downstream into Lake Pend Oreille. Most of the fine sediments from any such catastrophic failure would probably not persist in the Rock Creek system for many years. Suspended sediment also would move downstream and settle out in Lake Pend Oreille.

Impacts to Rock Creek and the Clark Fork River to Lake Pend Oreille from a tailings impoundment failure under Alternative II would be significant in the short term and potentially significant in the long term.

Lake Pend Oreille and Idaho's Clark Fork River. Chemicals in the proposed discharge, particularly nutrients, would undergo biological uptake and processing between the discharge near Noxon and the state line, a distance of approximately 18.5 miles. Because Lake Pend Oreille and the Clark Fork River are designated as Special Resource Waters, any increase in the concentration of pollutants due to the Rock Creek mine must be unmeasurable at the state border (see Appendix D). If this is not achievable, the Idaho Division of Environmental Quality (IDEQ) must approve the lowering of water quality or petition to the U.S. Environmental Protection Agency to deny the discharge permit. The approval process must include intergovernmental coordination and public participation, and must evaluate the discharge to see if it is necessary to provide important economic or social development in the area in which the waters (to be polluted) are located. Due to negligible economic or social benefits to Bonner County, IDEQ would have difficulty justifying a lowering of Montana effluent limits for the Rock Creek mine.

The Clark Fork River in Idaho is listed as water quality limited due to metals pollution. Lake Pend Oreille is listed as water quality "threatened" due to increasing development and other concerns. Both waters are scheduled for development of a problem assessment and a load allocation (TMDL) designed, respectively, to recover the impaired use, and to protect existing water quality. TMDLs are measured in loads (for example, lbs/day), not concentrations (for example, mg/L), to reveal the cumulative impacts of a discharge. On July 1, 1997, work was begun on developing a TMDL for Lake Pend Oreille and the Clark Fork River, with an anticipated completion date of Summer 2002. When the TMDLs become effective, Montana must meet these limits at the border. Idaho Technical Guidance proposes a total phosphorus target of 259,500 kilograms per year in the Clark Fork River at the Montana/Idaho state line, and a nitrogen to total phosphorus ratio greater than 15:1. However, the Montana and Idaho Border Nutrient Load Agreement has not yet been signed by all parties. This may or may not require a change to Sterling's discharge permit depending on the outcome of the problem assessments.

An analysis of water quality impacts was provided in the revised Fact Sheet/Statement of Basis (January 3, 2000) based on suggestions by the Idaho DEQ. This analysis estimates the concentration and load of nutrients and metals anticipated at the state line during high and low flow events, and compares these values to detection limits. The results of these analyses are provided in Table 4-30 (water quality impacts at low flow and Table 4-31 (change in load at low and high flow).

The projected increase in concentrations at the Idaho border using revised average monthly limits in the Statement of Basis would not be measurable. The proposed discharge would comply with Idaho water quality standards, including the Special Resource Water designation. This determination does not restrict Idaho officials from making an independent assessment of the discharge for compliance purposes. Should Idaho DEQ determine that the permit potentially violates state water quality standards, then Idaho would have authority under Sections 402(b) and (d) of the Federal Clean Water Act and 40 CFR Section 123.44 to administratively appeal the permit to EPA.

Alternative III

The Agencies' modifications to Sterling's proposal include measures to mitigate impacts and increase monitoring. In some cases, there is no residual impact to mitigate, but mitigation or additional monitoring has been proposed to address the uncertainties in the hydrologic or hydrogeologic analyses. In these cases, the intent of the mitigation is to either 1) reduce risk associated with the possibility of a potential impact occurring, or 2) collect additional data during the operation of the proposed project to verify the analyses and conclusions presented in the EIS. For example, estimates of surface or ground water flow, and results of mass balances may be under- or over-predicted. A mitigation is proposed to collect additional water balance data. These data could be used to verify the estimate of required underground storage. Based on these data, the size of the underground storage reservoir could be adjusted.

Ground Water Quantity

Operations of the tailings impoundment is expected to result in seepage to a ground water mixing zone. Reducing the total volume of seepage before it mixed with ground water would be more protective than capturing diluted seepage in the perimeter collection system. Under Alternative III, if soft foundation clays were excavated beneath the location of the proposed tailings impoundment embankment, then they could be used to seal the colluvium at the north end of the proposed tailings impoundment and other areas of the impoundment footprint that would be underlain by higher permeability materials. This mitigation would reduce tailings seepage and reduce the volume of water reaching the ground water mixing zone.

TABLE 4-30
Estimated Change in Water Quality for the Clark Fork River Below Cabinet Gorge Dam at the 7-day, 10-year Flow

Parameter	Background load[1] (lbs/day)	Rock Creek Projected Load (lbs/day)	Projected Concentration with Discharge (µg/L)	Net Increase at Border (µg/L)	ID Standard (µg/L)	Detection Criteria MDL/ML (µg/L)	EPA Method Number/Revision
Suspended Sediment	74,560	552	3,022	22.2	[5]	10/50	160.2[3]
Kjelhahl-N	4,970	NC	NC	NC	[5]	30/100	351.1[3]
Ammonia	497	NC	NC	NC	1,360	30/100	350.1[3]
Nitrite + Nitrate	1,267	NC	NC	NC	[5]	10/50	353.3[3]
Total Inorganic N	1,765	232	80	9.3	[5]	10/50	NA
Total Phosphorus	248	23	10.9	0.9	[5]	1/5	365.1[3]
Arsenic	25	0.0005	1.0	0.00	50	0.5/2	200.9/R2.2[4]
Cadmium	25	1.0	1.0	0.04	1.9	0.05/0.2	200.9/R2.2[4]
Copper	75	3.3	3.1	0.13	6.9	0.7.2	200.9/R2.2[4]
Lead	25	1.4	1.1	0.06	2.0	0.7/2	200.9/R2.2[4]
Manganese	50	20	2.8	0.80	[5]	0.3/1	200.9/R2.2[4]
Mercury[6]		0.000006		0.00002	0.012	0.2/0.5	245.1/R2.2[4]
Selenium	25	8	1.3	0.32	5	0.6/2	200.7/R4.4[4]
Zinc	275	17	11.7	0.70	89	1/5	200.9/R2.2[4]

Source: MPDES Permit, Appendix D

Notes:

(1) Based on estimated concentration (median, Table I.A.1.2 [page 7] of S.O.B.) and a flow of 4,611 cfs. Value given is an upper bound estimate due to presence of nondetects in data set used to developed loading estimates.

(2) Metal load based on 6 hours per day at base flow limits (Outfall 001B) and 18 hours per day at high flow limit (Outfall 001C).

(3) EPA 1983

(4) EPA 1994

(5) No numeric standard, narrative prohibition against toxic (IDAPA 250.01.02.02 and deleterious substances (IDAPA 250.01.02.03).

(6) All values less than detection limit.

NC Not calculated, impacts based on total inorganic nitrogen.

TABLE 4-31
Estimated Change in Load (lbs/day) at the Idaho Border Resulting From the Proposed Discharge

Parameter	Low Flow[1]			High Flow[1]		
	30-day Effluent Limit[2] (lbs/day)	Background Load[3] (lbs/day)	Percent Increase in Load @ Border[4] (%)	30-day Effluent Limit[2] (lbs/day)	Background Load[3] (lbs/day)	Percent Increase in Load @ Border [4] (%)
Kjelhahl-N	NC	9,530	NC	NC	26,411	NC
Ammonia	NC	953	NC	NC	2,641	NC
Nitrite + Nitrate	NC	2,430	NC	NC	6,735	NC
Total Inorganic N	232	3,383	6.9	232	9,376	2.5
Total Nitrogen (N)	NC	11,960	NC	NC	33,146	NC
Orthophosphate	NC	476	NC	NC	1,321	NC
Total Phosphorus	23	476	4.9	23	1,321	1.8
Arsenic	0.005	48	0.0	0.0005	132	0.00
Cadmium	1.1	48	2.2	1.4	132	1
Copper	3.3	405	0.8	4.1	1,142	0.4
Lead	1.4	95	1.5	1.8	264	0.7
Manganese	24	143	17	24	396	6
Mercury[5]			0.000			
Selenium	8	48	17	10	132	7.8
Zinc	17	881	2	21	2m443	0.8

Source: MPDES Permit, Appendix D

Notes:

(1) Based on flow statistics from station 1239200, 1962-1995 low flow is based on 8,840 cfs (90th percentile) and high flow is based on 24,500 cfs (25th percentile).

(2) Low flow discharge based on 6 hours at lower effluent limits per day and 18 hours per day at high limits; high flow estimates based on 24 hours per day at higher limits.

(3) Calculated as follows: lbs/day = concentration (µg/L) x flow (cfs) x conversion factor (0.00539). Value given is an upper bound estimate due to presence of nondetects in data set used to develop loading estimates.

(4) Calculated as ([total background]/background) x 100.

(5) All values less than detection limit.

NC Not calculated, impacts based on total inorganic nitrogen and total phosphorus.

Under Alternative III, the use of alternative mechanisms to reduce seepage would be investigated should field investigations of the disposal site or geochemical data of evaluation adit construction indicated the potential for seepage greater than predicted poorer water quality or ARD. An engineering study to assess the technical feasibility of the selected alternative would be conducted prior to the 30 percent design for the tailings impoundment. An alternative design could potentially eliminate seepage to the underlying ground water system, and the need to pump seepage for a lengthy period of time after mine closure. This mitigation would thereby provide options to reduce seepage.

Ground Water Quality

Operational data for predicting the potential for acid mine drainage could not be collected until mining commenced. Under Alternative III, acid-generating potential of the waste rock and tailings would be investigated during exploration and adit construction, and these materials would be monitored throughout mine life. If necessary, waste rock and/or tailings impoundment covers would be modified to prevent acid rock drainage prior to reclamation of these facilities. Such modifications may include increasing soil thicknesses or placing a barrier layer (clay or synthetic) beneath the soil to restrict infiltration.

The conceptual design for the perimeter collection system is based on preliminary hydrogeologic data. Data collected during additional site characterization would likely result in refinement of initial estimates of hydraulic conductivity and the hydraulic gradient. There is a risk associated with either under- or over-predicting hydraulic estimates. To reduce this risk, the perimeter collection system performance and efficiency would be modified as additional hydrogeologic data were collected. An "observational approach" would be used for the installation of the proposed seepage interception system. An initial set of wells would be installed, and additional wells would be installed as needed based on monitoring results and a program of aquifer testing. This mitigation would ensure the proper number of wells, well spacing, and discharge rates are used.

Surface Water Quantity

Limited data are available about the degree of fracturing and competency of rock in, and surrounding the mineralized zone. Therefore, predicting subsidence impacts, or predicting the impact of mining on surface water features using existing data would be difficult. Under Alternative III, Sterling would develop a plan to collect additional data that would be used to develop a plan to reduce the risk of subsidence (see Geology), and reduce the risk of impacting surface water features in the CMW. Rock mechanics and hydrogeologic data (rate of inflow, degree of fracturing, static water levels) collected during development of the evaluation adit would be used by Sterling and the Agencies to evaluate, and if necessary, modify the proposed mining plan to avoid potential impacts to lakes in the CMW. This mitigation would decrease the potential for surface subsidence and alteration of the flow regime.

Surface Water Quality

The use of passive biotreatment cells to treat mine discharge containing nitrates and metals is not a proven technology at the flow rates estimated for the proposed Rock Creek Project. Therefore, there is some risk associated with system treatment failure, and a contingency method of treatment is proposed under Alternative III. Sterling would develop a contingency for the treatment of excess project water. This contingency could include expanding an engineered water treatment plant or the ion exchange treatment facility proposed under Alternative II. This mitigation would ensure that proposed discharge limits for the proposed project would be met.

Elements of the proposed project water balance have been estimated. These estimates may be under- or over predicted. Therefore, descriptions of impacts that rely on these estimates also may be under- or over predicted. For example, if mine inflows were less than anticipated, more make-up water may be required. If mine inflows were more than anticipated, higher volumes of discharge to the Clark Fork River would be required, and resultant water quality could be poorer than estimated. If the rate of seepage from the impoundment has been underestimated, more water would require pump back from the perimeter collection system. Operational water balance data would be collected under Alternative III in order to verify the analyses provided in the EIS, and to modify components of the project, if necessary.

Long-term monitoring and water treatment likely would be required for the proposed project. There is risk that a funding mechanism would not be available. Under Alternative III, this risk would be eliminated. The Agencies would establish a mechanism for retaining financial assurance for long-term monitoring, maintenance, and possible perpetual water treatment. This mitigation would ensure that public funds such as EPA administered Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) funding or state abandoned mine program funding would not be needed for water treatment at this site.

The Agencies would need to review and approve the mine closure plan before the mine adits were plugged. Mine adit discharge would continue to be treated until it could meet MPDES effluent limits without treatment prior to plugging. The mine adits would be plugged near the ore body which would reduce the potential hydraulic head (water pressure) on the adit plug and decrease the risk of the adit plug blowing out. The adits would also be closed at the portal with non-mineralized rocks to prevent access. If continuous fractures from the mine to the surface are present under sufficient hydraulic head mine water could seep outward through bedrock creating or impacting springs and seeps. The location and amount of impact on these features cannot be reliably predicted, but the most likely discharge locations would be in basins on the northeast and southeast portion of the ore body and in Copper Gulch. Springs and small streams surrounding the ore body in the Rock Creek, Copper Gulch, and Bull River watersheds would be monitored, and if levels of impact warrant, measures could be taken prior to adit plugging (such as grouting or prevention of water accumulation in the mine) to reduce the impact.

Under Alternative III, Sterling and the Agencies would identify areas likely to contribute the highest sediment loading to the Rock Creek and Bull River drainages and prepare a sedimentation mitigation plan for lands that exhibit a high potential for soil erosion, slumping, and mass failure. Field surveys would be completed by Sterling and the Agencies. Sterling would then implement projects to reduce erosion, slumping, or mass failures from these areas prior to and during construction of the mine. Implementation of projects in these areas would have the effect of reducing existing sediment loading to Rock Creek and the Bull River. The reduction in sediment loading and subsequent impact on total suspended sediment cannot be quantified, and would vary depending on weather conditions and the degree and magnitude of precipitation.

There is concern that the proposed biotreatment system could result in waste that would be buried in place after the cells were no longer used. Under Alternative III, the design of the cells and options for reclamation would be reviewed and approved by the Agencies. The characteristics of the contents of the passive biotreatment cell, and whether the cell ultimately contained a hazardous waste would be identified and evaluated. Disposal options for the cell contents at the end of mine life would be evaluated and approved by the Agencies.

DEQ would require Sterling to test the biotreatment cell contents using EPA-1311 or EPA-1312 type extractable metals analyses to identify if leachable metals are a concern. If the tests indicated a potential problem then the agencies would require complete removal of the cell systems at the end of operations. The substrate removed from the cells at closure would be enclosed in a geomembrane lined cell in the paste facility. The substrate would be buried in the facility under a graded compacted layer of at least 6 feet of tailings near the embankment face. Topography in the area of the cell would be mounded to prevent excess water from potentially moving through the substrate. If no problem was indicated, then the cell contents could be either left in place and revegetated after being topsoiled with 24 inches of soil or removed and the site reclaimed as described above. In either case, Sterling would need to get approval from the Agencies.

Reclamation of the mounded tailings over the cell substrate would be completed by applying a minimum of 24 inches of soil, followed by revegetation. The biotreatment area would be backfilled with clean subsoils to a mounded configuration to produce a area which will limit infiltration through the old cell areas. Then the mounded subsoil area would be covered with a surface lift of soil and revegetated.

Monitoring

Under Alternative III, a "Monitoring Alert Levels and Contingency/Corrective Action Plan" would be developed by Sterling for the project. This plan would ensure early detection of potential environmental degradation or impairment, and would focus primarily on the protection of surface and ground water resources. Using this plan, early controls could be initiated to avoid development of nuisance or toxic conditions. The intent of the plan would be to prevent pollution and other problems before they occurred.

Sterling would finalize a comprehensive, long-term surface and ground water monitoring program. Data collected from the monitoring program would be reviewed to evaluate the extent and magnitude of impacts during the proposed project's construction, operation, and postoperational periods. The information from the monitoring would be used to guide subsequent operating and monitoring requirements. Operational monitoring would begin during the first quarter of construction of the evaluation adit and would be maintained during the life of the project. Postoperational monitoring would be carried out until water quality returned to required levels under water quality standards.

The Agencies would require extensive monitoring of operational flows and discharges because of uncertainties in the operational water balance and the discharge rates. If observed discharges were greater than currently estimated, a new loading analysis would be performed to determine if additional mitigations would be required.

R1-WATSED modeling results for Rock Creek under Alternative III actions result in a one percent increase in peakflows and a 56 percent increase in annual sediment yield in Table 4-29. At the end of the life of mine, the peakflow value would drop back to the existing value and the annual sediment increase is predicted to drop by 7 percent. Because this would result in a very small decrease within the watershed, it is expected that conditions at the end of the project would continue to remain the same with the implementation of this alternative.

Alternative IV

Surface water and ground water impacts associated with locating the mill site at the confluence of east and west forks of Rock Creek would be identical to impacts associated with Alternative III, with some exceptions. First, there would be less potential for supply truck spills or slurry and return water pipeline breaks because the hauling distance to the mill would be less, and the pipe between the mill and the tailings impoundment would be shorter. Second, because the mill would be located farther downstream, suspended sediment produced from the construction of the mill facility and residual nitrogen from blasting would not effect the West Fork of Rock Creek. In addition, the 300-foot buffer zone between the confluence mill site and both forks of Rock Creek would reduce sediment reaching surface waters, although the reduction cannot be quantified. Ground water inflow to the adit was evaluated and is presented in Table 4-32. Estimated inflow for the proposed project and the alternatives is provided in Table 4-33.

R1-WATSED modeling results for Rock Creek under Alternative IV actions result in no increase in peakflows and a 44 percent increase in annual sediment yield in Table 4-29. At the end of the life of mine, the peakflow value would decrease one percent below the existing value and the annual sediment increase is predicted to decrease by 11 percent. Because this would result in a small decrease within the watershed, it is expected that conditions at the end of the project would continue to remain the same or slightly improve with the implementation of this alternative.

Alternative V

The proposed adits, underground mine, mill facility utility corridor, waste rock dump, and tailings paste facility would have the potential to impact surface and ground water resources under the Alternative V action. However, the degree of impact is reduced compared to Alternatives II, III, and IV. Impacts to water availability and water quality are summarized below. A comparison of ground water impacts related to tailings facility seepage is presented in Table 4-20.

Alternative V includes measures to mitigate impacts and increase monitoring. In some cases, there was no residual impact to mitigate, but mitigation or additional monitoring has been proposed to address uncertainties in the hydrologic or hydrogeologic analyses. The intent of mitigation is to either reduce risk associated with the possibility of a potential impact or collect additional data during operation to verify the analyses and conclusions presented in the EIS process. A complete listing of the proposed additional mitigation and monitoring plans is presented in the Alternative V description in Chapter 2 (also see Appendix K).

Ground Water Quantity

Evaluation Adit, Underground Mine, and Excess Mine Water Storage. Evaluation activities would remain the same as described for Alternative II. Water use and supply for the evaluation and underground mining operations would remain the same as described for Alternatives II through IV. To address issues related to seepage of water from the underground mine, the final water resources monitoring program would be designed to detect changes in the distribution of flow. Mitigations such as additional grouting or handling of underground water could be applied. The Contingency/Corrective Action Plan would identify measures to be taken should monitoring identify potential water resources

TABLE 4-32
Ground Water Inflow to Conveyor/Service Adits - Confluence Mill Site Mine Portal

Adit Segment (ft)	Adit to Ground Surface (ft)	Hydraulic Head (ft)	Assumed Hydraulic Conductivity (ft/min)	Calculated Inflow Per Foot (gpm/ft)	Segment Inflow (gpm)	Cumulative Inflow (gpm)
0 - 1,000	175	0	1.13×10^{-5}	0	0.0	0.0
1,000 - 2,000	530	30	1.13×10^{-5}	0.0299	29.9	29.9
2,000 - 3,000	793	293	1.13×10^{-5}	0.0521	52.1	82.0
3,000 - 4,000	868	368	1.13×10^{-5}	0.0397	39.7	121.7
4,000 - 5,000	860	360	1.13×10^{-5}	0.0380	38.0	159.7
5,000 - 6,000	918	418	1.13×10^{-5}	0.0587	58.7	218.5
6,000 - 7,000	1,088	588	1.13×10^{-6}	0.0081	8.1	226.6
7,000 - 8,000	1,350	850	1.13×10^{-6}	0.0091	9.1	235.7
8,000 - 9,000	1,613	1,113	1.13×10^{-6}	0.0100	10.0	245.7
9,000 - 10,000	1,788	1,288	1.13×10^{-6}	0.0115	11.5	257.3
10,000 - 11,000	1,800	1,300	1.13×10^{-6}	0.0136	13.6	270.9
11,000 - 12,000	1,800	1,300	$1.13 \text{ X } 10^{-6}$	0.0138	13.8	289.8
12,000 - 13,000	1,963	1,463	$1.13 \text{ X } 10^{-6}$	0.0152	15.2	305.0
13,000 - 14,000	2,113	1,613	$1.13 \text{ X } 10^{-7}$	0.0016	1.6	306.6
14,000 - 15,000	2,125	1,625	$1.13 \text{ X } 10^{-7}$	0.0017	1.7	308.3
15,000 - 15,530	2,038	1,538	1.13×10^{-6}	0.0150	15.0	285.8

Source: ASARCO, Incorporated 1987-1997.

TABLE 4-33
Estimated Ground Water Inflows for Alternative IV

Rock Creek Forks Portal Site	Inflow in gpm (no safety factor)	Inflow in gpm (safety factor applied)
Evaluation Adit	112	168
Conveyor and Service Adits	286	429
Ore Body Area	825	1,650
Total Inflow	1,223	2,247

Source: ASARCO, Incorporated 1987-1997.

issues. Hydrogeologic information collected during evaluation adit construction would be used to develop these measures and evaluate their effectiveness. A conceptual model of ground water flow near the mine is presented in Figure 4-3.

Paste Facility Seepage. A tailing impoundment is not proposed under the Alternative V action. Alternative V would involve dewatering the tailings, to create a paste of a known consistency, adding a binder, if necessary, and placing the resulting paste on the ground surface. The volume of seepage from the paste would be significantly less than with alternatives involving deposition of the tailings as a slurry, since most of the excess water would be removed with paste placement. Sterling is preparing an underdrain design that would be included as part of the final paste design to collect drainage from the base of the paste facility. The proposed seepage collection system would assist in maintaining a minimal seepage rate to the existing ground water system. Proposed seepage collection is discussed below. Under the paste facility alternative, seepage lost to ground water is not expected to exceed 20-30 gallons per minute (gpm). The estimated seepage rate for Alternative V is an order of magnitude less than proposed under Alternatives II through IV. The 20 gpm seepage rate was calculated by the applicant. An independent estimate of the seepage rate was made by the Agencies' consultant (Klohn-Crippen). Their estimate of 30 gpm corroborates the applicant's estimate. The 30 gpm seepage rate was used in the analysis of impacts.

Mine Closure. Reclamation of the evaluation disturbances, mill site, and utility corridors would remain the same as described for Alternative IV. The Agencies would need to review and approve the mine closure plan before the mine adits were plugged. Under Alternative V, the means of mine adit closure would depend upon the impacts, if any, to wilderness lakes that occurred during mining and the potential for the creation of down gradient springs and seeps from the underground body of water stored in the mine after the mine was sealed Mine adit discharge would continue to be treated until it could meet MPDES effluent limits without treatment prior to adit closure.

If the decision was to plug the mine adits, they would be plugged near the ore body which would reduce the potential hydraulic head (water pressure) on the adit plug and decrease the risk of the adit plug blowing out. The adits would be also closed at the portal with non-mineralized rocks to prevent access. If continuous fractures from the mine to the surface are present, mine water could seep outward through the bedrock under sufficient hydraulic head creating or impacting springs and seeps. The magnitude of impact on these features cannot be reliably predicted. However, the most likely locations for seepage would be at the ore outcrops at the northeast and southeast portions of the ore body and in Copper Gulch. To reduce the potential of seepage to the surface to a low likelihood of occurrence (MT DEQ 2001a), a 1,000-foot buffer zone and a minimum of 450 feet of overburden would be maintained (see Figure 3-2). Springs and small streams surrounding the ore body in the Rock Creek, Copper Gulch, and Bull River watersheds would be monitored, and if levels of impact warrant, measures could be taken prior to adit plugging (such as grouting or prevention of water accumulation in the mine) to reduce the impact.

Installation of the paste facility underdrain system would result in a reduction of potential infiltration through the base of the paste facility to ground water. The collection system would continue to operate in conjunction with the waste water treatment facility until the seepage met Montana water quality standards. After mining ceases, water may either (1) seep into the local ground water system from the collection pond, or (2) be treated and routed to the Clark Fork River. Seepage water not entering the underdrain system would not exceed a maximum of 20-30 gpm and would decrease with time after mining ceases. All discharges would need to comply with the requirements of the MPDES permit.

Ground Water Quality

Seepage Water Quality. The quality of the paste seepage water would be similar to the quality of seepage predicted under Alternatives II through IV. Under Alternative V, additional geochemical testing including leach testing of tailings generated from evaluation adit bulk samples from ore including leach testing would be performed to ensure leachate water quality for constituents (particularly arsenic and mercury) are equal to or lower than ambient ground water quality. If the concentrations of arsenic or mercury in leachate are greater than ambient concentrations in ground water, then either (1) the paste facility would need to be modified, (2) the MPDES permit would need to be adjusted, or (3) Sterling would be required to apply for Authorization to Degrade. In all these situations, additional MEPA/NEPA analysis would be required at that time. Paste facility seepage would be diluted by ground water flow beneath the impoundment in a DEQ approved mixing zone. A seepage collection system, and downgradient monitoring wells would be used to monitor the quantity and quality of seepage from the paste facility area. In addition, a potential ground water recovery well system similar to that proposed for Alternatives II through IV would be installed if monitoring showed a violation of the MPDES permit limits and other measures were ineffective in resolving the situation. Impacts to ground water based on a seepage rate of 30 gpm (for Alternative V) were calculated by the agencies and compared to ground water seepage impacts for Alternatives II, III, and IV (Table 4-20). Data provided in Table 4-20 indicate that some constituents (for example, nitrate) in tailings seepage water are of poorer quality (higher concentration) than ambient ground water concentrations. In these cases, constituents contained in tailings seepage degrade water quality in the ground water mixing zone. In other cases, some constituents in tailings seepage (for example, phosphorus) are lower than ambient ground water concentrations. In these cases, adding tailings seepage to the aquifer has a diluting effect, and ground water quality for these constituents actually improves over baseline conditions. The degree to which resultant ground water quality either degrades or improves is directly proportional to the rate of seepage.

Data provided in Table 4-20 indicate ambient manganese concentrations already exceed Montana water quality standards. The standard for manganese is also exceeded under all action alternatives. In addition, Table 4-20 indicates the Montana water quality standard for nitrate would be exceeded for Alternatives II, III, and IV, but is not exceeded for Alternative V. There may be potential for a slight increase in arsenic or mercury, but that may be the result of too few samples and that the result of one sample was below detection limits. Additional geochemical testing of waste rock and tailings as defined in Appendix K would help to determine the actual levels. If the levels were greater, then additional mitigations would be necessary as no increases are allowed for these two metals. This increase could trigger the need for a liner and additional or greater levels of waste water treatment. Based on the Agencies' analysis, Alternative V is better able to meet Montana water quality standards compared to Alternatives II, III, and IV.

Seepage Monitoring, Collection, and Pump Back System. An underdrain system would be included in the final paste design to collect drainage from the base of the free-draining paste facility. Depending on the final construction technique selected for the paste facility (Top-Down, Bottom-Up, or Combination option) the underdrain system would consist of one or more of the following elements: (1) basin drains to maximize recovery of seepage of residual process water in the paste and storm water infiltration through the paste, (2) a blanket drain adjacent to the outer slopes and beneath the compacted structural zone to maintain a drainage of the structural zone under the Bottom-Up or the combined option, (3) a finger drain system constructed beneath the paste facility to collect and route drainage to a single collection pond outside the main buttress, and (4) collection ponds to collect water pumped back to the paste plant and, if not needed for paste production, returned to the mill for reuse.

The volume of seepage from the paste facility would be significantly less than with alternatives involving deposition of the tailings as a slurry (Alternatives II, III, and IV), since most of the excess water would be removed with the tailing paste process. Monitoring of discharge rates and seepage quality from the underdrain system would be included in the monitoring plan to confirm seepage conditions during operations.

The ground water monitoring plan would consist of the installation of three types of wells: (1) upgradient monitoring wells to establish a potentiometric surface across the paste disposal area, (2) downgradient proximal monitoring wells immediately outside of the paste pile footprint area, and (3) downgradient compliance monitoring wells which would be located at the boundary of the ground water mixing zone to ensure compliance with MPDES limits. Bedrock ridges divide the paste pile into three separate ground water basins. A downgradient monitoring well will be sited in the axis of each of these basins to provide early detection of water quality changes.

A system of pumpback wells (conceptually similar to the pumpback system proposed in Alternatives II, III, and IV) is included in Alternative V as a contingency. If operational monitoring data indicate MPDES discharge limits could not be met within the approved mixing zone, the pumpback system would be required by the Agencies to protect downgradient ground water quality.

Mine Closure. Under Alternative V, mine adit water would be collected and treated prior to discharge to the Clark Fork River. Treatment would continue until the discharge meets effluent limits set forth by DEQ in the MPDES discharge permit or other appropriate standards as determined by DEQ prior to mine closure. If the adits were to be plugged, then quality of mine water to collect in the mine workings would have to meet groundwater standards; water in the adits would continue to be treated until it met MPDES discharge limits without treatment and would be discharged into the Clark Fork River. If the adit discharge ever met standards applicable to Rock Creek and if the volume of flow was low enough such that it would not upset hydrologic stability and beneficial uses, it would be allowed to drain into the alluvium at the mine portal without treatment. However, DEQ has not yet evaluated this option for disposal of adit water as it is unlikely that the mine water would ever meet standards applicable to Rock Creek. Adit discharge would need to meet water quality regulations in place at the time of the proposed discharge. In addition, in order to discharge, Sterling would need to apply for a new MPDES discharge permit, and DEQ would first need to authorize the discharge under the new permit. Additional MEPA/NEPA analysis may be required at that time. If the adit was not to be plugged but only sealed to prevent access, the discharge might need to be discharged in perpetuity to the river with or without treatment, as long as it met the discharge limits; it is unlikely that the mine discharge would ever meet standards applicable to Rock Creek for discharge into that body of water without treatment. Treatment in perpetuity would require continued operation and maintenance of the water treatment facility as long as it was required as well as the pipeline between the mine and the point of discharge.

Seepage water collected in the paste facility underdrain system or captured in the pumpback system would also be treated until the discharge met effluent limits set forth in the MPDES permit. The project would require sufficient bonding to cover the possible need for long-term water treatment.

Surface Water Quantity

Evaluation Adit. Impacts from evaluation activities would remain the same as described for Alternative II.

Wilderness Lakes. Impacts to wilderness lakes related to fracturing and subsidence would be similar to those predicted for Alternatives III through IV. A long-term water monitoring plan is included for Alternative V and includes monitoring the water balance of Cliff, Copper, St. Paul and Moran Basin lakes. The subsidence control and monitoring plan would be coordinated with the fisheries/aquatics monitoring plans as presented under Alternative III. A 1,000-foot buffer zone around Cliff Lake would reduce the risk of impacting the lake. Also, a buffer around the Moran Fault would reduce risks to Moran Basin and the St. Paul Lake watershed (MT DEQ 2001a).

Compensating factors that could possibly reduce the risk to surface waters include monitoring of the lakes and streams for early detection of impacts; avoidance of high permeability geologic structures that intersect the ore body; avoidance of outcrops and areas underlying lakes; and grouting of mine inflows. Depending on the actual impacts detected during mining, complete plugging of the mine at closure may be preferable or maintenance of mine dewatering after closure may be preferable. Complete plugging of the mine would help to reestablish the pre-mining static head in the bedrock aquifer and reduce ground water drainage stresses on overlying lakes and streams. Unfortunately, adit plugging would also increase hydraulic gradients and hydrofracturing potential, exacerbating post-closure leakage of mine water to the surface. Continued mine dewatering would reduce the potential of leakage to downgradient streams, but would maintain any mining-induced ground water drainage stresses on overlying lakes and streams.

Mill Facility and Makeup Water Requirements. Under Alternative V, process water would remain in an essentially closed loop. Approximately 5 to 10 percent of the flow in the process loop would be diverted to the wastewater treatment system and fresh water added to the circuit on an ongoing basis to prevent buildup of excess constituents in the process water. Process water for the mill would come from five sources: reclaimed tailings slurry water, mine discharge water, reclaimed concentrate slurry water, mill site and tailings paste facility site storm water, and if needed, make-up well water. The demand for water from the proposed make-up water well under Alternative V would be reduced due to recycling of make-up-water from the paste plant and paste landfill seepage collection system.

Drainage and Surface Water. Construction of the tailings paste facility would alter the topography of about 325 to 330 acres in Miller Gulch, depending on the final construction technique used. The impact to surface water flow in Miller Gulch may vary depending upon the paste option implemented. A small tributary located to the south of the Miller Gulch would be impacted by the very top of paste impoundment thereby removing some watershed from draining into this tributary until after reclamation and water from the top of the embankment could be redirected to this tributary. The Top-Down option would reduce available flow sooner than the Bottom-Up option as embankment construction would start at the top and would temporarily remove surface water run-off from flowing into the tributary during construction, but as areas became reclaimed surface flow from those areas would be returned to Miller Gulch. The Bottom-Up option would reduce flows in the southern fork of Miller Gulch immediately after mining commences, but would not impact the upper drainage until much later. The combined option would impound water for a longer period of time compared to other options discussed above. The actual duration that runoff to Miller Gulch would be affected depends upon how fast the facility was constructed, which option was used, and how fast the completed portions of the facility were reclaimed.

Mine Closure. After the mine is shut down, ground water inflow to the mine would continue to be conveyed to the water treatment facility until the concentration of nitrogen and metals complies with discharge limits; the actual limits to be met would vary depending upon the type of adit closure selected and the final point of discharge. At that time water treatment would cease, the water treatment facility would be reclaimed, and the last stages of mine closure would commence. The actual period required for mine water quality to reach a point where treatment prior to discharge is no longer required would be based on water quality monitoring results and would be subject to agency review and approval. Based on post mine closure water quality monitoring at the Troy mine, it is anticipated that this probably would not occur within five years of mine shut down.

If the service and conveyor adits were to be plugged upon mine closure, they would be plugged with reinforced concrete at the elevation of the orebody. The adits would also be closed off at the adit portal. Ground water inflow into the adit would be allowed to drain through the adit portal plug. If adit water quality met MPDES discharge requirements, drainage from the adit portal would be allowed to infiltrate through a thick layer of unsaturated alluvium at the reclaimed mill site, if not then it would need to be treated to applicable MPDES limits to either Rock Creek or the Clark Fork River depending upon the point of discharge requested by Sterling. If the adits were not to be sealed, then the mine water would continue to be discharged into the Clark Fork River with or without treatment as long as the MPDES limits were met. If the quality ever met limits or standards for direct discharge into Rock Creek, then the waste water treatment facility would be decommissioned and the pipeline reclaimed. The increase in flow to Rock Creek would have the potential to restore perennial flow to the intermittent portions of the mainstem portion of the stream. However, it is not likely that the mine water would ever achieve that level of water quality, and so it is more likely that the mine water would continue to be discharged into the river in perpetuity if the adits were not plugged.

The evaluation adit would be plugged at the portal at mine closure. The purpose of this plug would be to close off access and to eliminate any potential for surface water inflow into the closed mine.

Because of the uncertainties or inability to accurately predict ground water movement associated with the mine, the Agencies have committed to developing a comprehensive monitoring program and contingency and Corrective Action Plan. Based on geology and topography of the area surrounding the ore body, the Agencies have selected recommended monitoring locations which would be most likely to be influenced by such seepage. The precise locations of these monitoring sites would be determined based upon stream surveys to determine gaining/losing reaches and sampling site accessibility. These studies would be required of Sterling, and the Agencies would require that a statistically representative number of samples at each location (e.g. monthly sampling during seasons when the sites are accessible for two or three years) be collected prior to commencement of mining.

Surface Water Quality

Adit and Mine Water, Waste Rock, and Milling Process. Mine water would receive treatment to remove suspended and dissolved solids, including ammonia nitrogen and nitrate/nitrite nitrogen, prior to discharge to the Clark Fork River through a submerged outfall located downstream of Noxon Dam. The mine water treatment system would include sedimentation, filtration, and nitrogen removal. Two different nitrate removal systems would be installed including an anoxic biotreatment system and a reverse osmosis treatment system. Although the agencies have not specified either system as the primary wastewater treatment system, the applicant expects that the biotreatment system would become the primary wastewater treatment system for most of the operating life of the mine water treatment system. However, the reverse osmosis system would be available to provide primary treatment during evaluation adit construction and the mine start up period, and to provide additional or backup treatment after the biotreatment system is up and operating.

Reverse osmosis technology and the proposed anoxic biotreatment technology have been proven to be capable of removing nitrate from water in a reliable manner. Reverse osmosis has been used for over 20 years throughout the world to successfully remove dissolved solids, including nitrate, from water flows comparable to that anticipated at the Rock Creek Mine. Reverse osmosis has been used in a Lead, South Dakota, mine since 1993 to remove nitrate from mine waste water on an intermittent basis at flow rates of approximately 200 gpm (pers. comm. with Wharf Resources personnel, August 21, 1997). In addition, reverse osmosis is currently being used to reduce nitrate concentrations (about 100 mg/L) from 100 gpm of mine water at the Kendall mine near Lewistown, Montana. Since a reverse osmosis system is constructed in cells, it is only a matter of having sufficient cells to handle the necessary volume of water.

Anoxic biotreatment utilizing methanol as a carbon source has been used to provide nitrate removal in large drinking water treatment facilities under low temperature conditions in Europe for many years at flows comparable to that anticipated at the Rock Creek mine. Anoxic biotreatment is commonly used to remove nitrate from domestic waste water in the United States. The proposed anoxic treatment system is presently being used at the Stillwater Mine in south-central Montana and the Wharf Mine in western South Dakota (Hydrometrics 1997a). At these mines, anoxic treatment systems have successfully removed nitrate from mine waste water with levels of dissolved nitrate similar to those anticipated at the proposed Rock Creek mine. In order to handle the necessary volume of water Sterling would need to construct sufficient anoxic biotreatment cells.

The proposed use of a dual technology system for nitrate removal at the Rock Creek mine appears to be both cost effective and environmentally acceptable. The proposed mine water treatment system would, if properly designed, constructed and operated, produce an effluent that meets the requirements of the revised draft MPDES discharge permit

The mine water treatment system would remove suspended solids, heavy metals, and ammonia nitrogen and nitrate/nitrite nitrogen so that the requirements of the MPDES discharge permit could be met. The estimated water quality for discharges under Alternative V must reflect concentration limits set in the MPDES permit. An analysis of impacts under Alternative V is presented in Tables 4-25B, 4-26B, and 4-27B under various flow conditions. It may be necessary to add phosphorus to the mine wastewater prior to anoxic biotreatment to promote growth of the de-nitrification bacteria. If this was determined to be necessary, the concentration of phosphorus in the treated effluent could increase over the untreated concentration. This increase is estimated to be less than 0.05 mg/L (pers. comm. Mark Reinsel, Hydrometrics, with Gary Sturm, September 12, 1997). In either case, the loading of phosphorus must meet limits set forth in the MPDES permit.

Following completion of mining operations and after ammonium nitrate blasting is discontinued, the quality of the water within the mine, especially in terms of the quantity of ammonia nitrogen and nitrate/nitrite nitrogen, would improve. The monitoring plan would include the collection of additional water quality data from the Troy Mine for comparison purposes. However, water treatment would continue for any surface discharge until such time as the quality of the mine water or collected seepage from the paste facility, if any, was acceptable for discharge to the Clark Fork River without treatment. If the adits were to be plugged at closure, the mine water would need to met applicable groundwater standards before treatment ceased and the adit was plugged. The long-term water quality from the underground workings is not known. Based on the Troy Mine, elevated copper would not meet surface water standards and it would require treatment prior to discharge. Monitoring data would be used to establish discharge requirements for this water.

Accidental Spills and Ruptures. Potential environmental consequences resulting from ruptures or breaks in pipelines and the accidental rupture of a supply or tanker truck are the same as presented for Alternative II. Alternative V includes several mitigations which reduce the potential for impacts from ruptures or breaks in pipelines and spills associated with transport of the ore concentrate.

Larger diameter pipelines (16- to 24-inch) between the mill and the paste plant are proposed to accommodate a higher water content in the tailings slurry. Because of the potential for tailings and concentrate to produce abrasion wear, dual wall steel/polyethylene (PE) pipe is proposed for Alternative V pipelines. With this type of pipe, the inner PE liner can be monitored and replaced as necessary if abrasion wear is a significant factor. High sensitivity leak detection would be utilized with this type of pipe, allowing detection of small amounts of seepage. In addition to leak detection, the proposed pipelines would have pressure monitoring which would automatically shut down pumps in the event of pipeline failure. All pipelines would be buried except at stream crossings and covered with 24 inches of soil. This would reduce the potential for breakage and rupture of the pipeline. In the remote case where both the inner liner and outer pipe were ruptured the soil surrounding the pipe would help to contain the spill until the monitoring system shuts the pipeline down. The pipe between the break and valve at the mill would continue to discharge until the pipe is empty.

Truck hauling of concentrate from the mill to the rail loadout facility would be replaced by pipeline transport of the concentrate. Concentrate would be sent from the mill to the rail loadout facility as a slurry in a 3-inch dual-walled steel pipe with leak detection sensors and buried in the same corridor as the tailings and water pipelines. This would eliminate eight trucks per day making the round trip between the mill and the loadout facility.

The rail loadout process including concentrate thickening, filtering, and storage and railcar loading would take place in an enclosed building to prevent contamination of the ground and surface runoff.

Sedimentation. Issues related to increased sedimentation would be the same as presented in the draft EIS for Alternative IV. The 300-foot buffer around the mill site, fewer miles of new road construction and reconstruction, as well as implementation of a sediment source identification and mitigation plan would help reduce sediment impacts.

Some aspects of the paste construction method help to minimize sediment losses. These include reduced surface disturbance prior to tailings paste deposition, modified storm water control features within and around the paste facility site, and smaller active working areas (unreclaimed). In addition, use of the paste facility rather than a tailings impoundment would allow concurrent reclamation of tailings paste as construction of the facility progresses, thus reducing the potential for sedimentation in comparison with other proposed alternatives. Depending on the method of deposition selected by the agencies the timing of reclamation activities varies (see Soils and Reclamation). In all three paste facility construction options, storm water controls and sedimentation mitigation BMPs are required and would be in place prior to initiation of construction activities to protect against sedimentation impacts to receiving waters.

R1-WATSED modeling results for Rock Creek under Alternative V actions show no increase in peak flows and a 38 percent increase in annual sediment yield during the life of the mine. Additional mitigations would further reduce sedimentation but WATSED does not take into account any instream sediment source reductions. Specific sediment reduction sites have not yet been identified but must result in 400 tons annual reduction over baseline levels. At the end of the life of mine, the peak flow value would drop one percent below the existing value and the annual sediment increase is predicted to drop by 12 percent from baseline conditions. Because this would result in a small overall decrease within the watershed, it is expected that conditions at the end of the project would continue to remain the same or slightly improve with the implementation of this alternative. Appendix N contains a detailed description of the R1-WATSED model and model simulations.

Tailings Paste Facility Failure. The agencies would institute a process to review and evaluate Sterling's final tailings facility design to ensure long-term stability and minimize the probability of failure similar to that required for impoundment design review under Alternatives III and IV. The proposed Alternative V paste facility eliminates the type of catastrophic failure potential discussed under Alternatives II, III, and IV (see Geotechnical Engineering). In addition, environmental consequences due to transport of material as a result of damage to the facility is essentially negligible due to the dewatered state of the paste. Inherent in the design of the placement of dewatered paste is the tendency for the material to be contained and able to be graded or re-worked if slumping or fracturing occurred. As discussed in Geotechnical Engineering, even if there was a mass failure of the paste facility, the relatively high viscosity of the paste would be sufficient to retard flow over any appreciable distance. Conditions which could change the character, and hence the behavior of the paste tailings include a change in moisture content of the paste. However, there would need to be a significant increase in moisture content throughout the entire paste deposit before overall stability would be compromised. This increase in moisture would not be expected with the strict quality control program that would be implemented by the Agencies.

Clark Fork River. The Priscu report (Priscu 1989) evaluated the potential impact of the Rock Creek Project on nutrient levels in the Clark Fork River assuming 2,000 gpm of adit water and 350 gpm of tailing seepage without any treatment discharged directly to the Clark Fork River. The report noted that existing algal biomass levels in the Clark Fork River at the time of the study exceeded conditions that were aesthetically acceptable, but because the Clark Fork River appears to be phosphorus limited, additional nitrogen loading from the Rock Creek Project was predicted to not have a major influence on the magnitude of the attached algal productivity and biomass in the Clark Fork River. However, the potential for minute increase in phosphorus and nitrates from the biotreatment process could increase algal mass in the Clark Fork River by an undetermined amount. Any increase in the loading of phosphorus would need to comply with the TMDL requirements of the MPDES permit, and must not degrade water quality in Idaho's Clark Fork River. Under Alternative V, the reverse osmosis treatment system may need to be used as a polishing step to ensure TMDL requirements could be met.

Lake Pend Oreille. The 1989 Priscu report noted that total nitrogen levels in Lake Pend Oreille would increase about 7.6 percent, and that chlorophyll would increase by about 1.5 percent under the conditions assumed above (no treatment). The report concluded that while this level of change could be calculated, it could not be measured given the intrinsic spatial and temporal variability of chlorophyll in the lake. Because Lake Pend Oreille is phosphorus limited, and because the greatest potential nutrient impact of the proposed project would be an increase in nitrogen, the report concluded that no significant algal blooms would be expected.

Any increase of phosphorus loading to Lake Pend Oreille must comply with the TMDL requirements of the MPDES permit and must not degrade water quality in Lake Pend Oreille. Algal blooms in Lake Pend Oreille are not expected under Alternative V loading conditions, particularly because river water mixes with the benthic portion of the lake. This conclusion is supported by a 1993 EPA report. As part of the 1993 EPA report a nutrient load-lake response computer model was used to aid in predicting the effect nutrient levels could have on the lake. Computer simulations indicate that the trophic state of the lake's pelagic waters would be little changed by small to moderate alterations in the amount of nitrogen and phosphorus entering the lake. Maintenance of open lake water quality is largely dependent upon maintaining nutrient discharges from the Clark Fork at or below their present levels.

Storm Water Control

Proposed storm water control measures for the Alternative V action have been modified from those presented for all other options. All detention and retention ponds would be lined with a 30-mil HPDE liner to provide primary seepage containment and reduce impacts to ground water underlying and adjacent to the proposed facility. All detention and retention ponds would be sized to contain the 100-year / 24-hour storm event, thus reducing impacts to surface waters in the area. The proposed paste facility would include an underdrain and collection system to provide secondary containment of storm water seepage through the tailings paste facility, again reducing potential impacts to ground water underlying and adjacent to the proposed facility.

Storm water collected at the adit portal and mill sites would be collected and recycled for mill use. Storm water collected from the outer slopes of the mill pad and the mill site underdrains would only be allowed to discharge as specified by the MPDES permit. Otherwise collected storm water would be pumped back to the mill for reuse.

Proposed surface water control structures associated with the paste facility would significantly reduce potential impacts of increased sedimentation to surface waters and drainages during the operational phase of the proposed activity. The proposed storm water control measures for the paste facility area would include two lined storm water ponds constructed at lower elevations in the tailings disposal site and sized to handle the runoff from the active portion of the landfill site during a 100-year/24-hour storm event. Settling ponds would be constructed on the upper portion of paste facility and lined to prevent seepage into paste. Limiting unreclaimed areas to the active disposal areas would minimize sediment and runoff. Water collected in the storm water pond could be pumped to the paste plant and then to the mill as process water or used to irrigate reclaimed portions of the paste facility. Storm water from undisturbed lands above the paste facility would be diverted around active portions of the paste facility, to north fork of Miller Gulch and to Rock Creek during mine operations. Runoff from reclaimed areas of the paste facility would be routed to settling basins before mixing with runoff from undisturbed areas.

Cumulative Impacts

Unknown private logging potentially may increase peak flows. The amount of these peak flow increases would depend on timing and site-specific information that are unknown at this time. Additional sediment could reach Rock Creek and the Clark Fork River from logging and road construction activities. The KNF and DNRC requires the implementation of BMPs during logging operations on federal and private lands respectively. BMPs would help minimize sediment transport into surface waters. Appendix H contains a discussion of the KNF BMP process. Proposed highway construction also may increase sediment reaching streams potentially affected by the Rock Creek Mine Project.

There may be impacts on Clark Fork River water quality from expansion of existing, near-capacity water treatment systems at Thompson Fall, Noxon, and Heron. However, without plans for those expansions it is impossible to determine what that impact would be. Any expansions with discharges to the river would have to be covered by an MPDES permit. The expansions would be necessary to handle increased populations resulting from mine employment, and would therefore apply to Alternatives II-V.

Also as part of the 1993 EPA report Idaho researchers concluded that phosphorus is the primary nutrient controlling algal and plant growth in Pend Oreille Lake. Phosphate in detergents is the source of much of the phosphorus discharged to municipal treatment plants, and approximately half of all soluble phosphorus loading to the Clark Fork River originates from wastewater discharges. Bans on the sale of phosphate detergents are already in effect in Montana in the Flathead River Basin, and in the communities of Missoula, Superior and Alberton as part of voluntary implementation of the Tri-State implementation's Proposed Plan. Bonner County, Idaho, has also adopted a phosphate detergent ban. These actions have been highly successful in reducing phosphorus discharges to the Clark Fork River from the respective municipal wastewater treatment facilities. For example, the phosphate detergent ban that was implemented by the City of Missoula in May 1989 resulted in greater than a 40 percent reduction in the phosphorus loading to the Clark Fork from the Missoula wastewater treatment plant. Concentrations of phosphorus in the river downstream of this facility have subsequently declined by a large margin. A modeling study conducted by the University of Montana predicted a reduction in algal standing crops in 110 miles of Clark Fork River as a direct result of this action. The increase of phosphorus loading from the Rock Creek discharge could minimally reduce these upstream efforts.

There is potential for additional nutrient loading to the Clark Fork River, from the expansion of water and waste water treatment facilities, both private and public, at nearby communities experiencing growth resulting from mine-related employment; however, the impact could not be quantified. Expansion of any such facilities would be subject to successful revision of its MPDES permit and compliance with Montana or Idaho water quality standards respectively depending upon where the facility was located.

No cumulative impacts would occur to ground water in the project area. The impacts of the proposed project would be limited to the vicinity of the project area, and the Rock Creek tailings impoundment site. No ground water effects would result from the proposed KNF timber sales. The Montanore Project includes underground mining and would affect bedrock ground water systems east of the proposed Rock Creek Project. However, it does not appear likely that the two operations would have any cumulative effects on ground water quantity or quality. In addition, no cumulative impacts are predicted as it related to TMDL requirements because these requirements would necessarily be equal to or more stringent than existing water quality standards. Cumulative impacts from Avista (formerly WWP) prelicensing are not expected because the operation of the dam is not expected to be significantly different than during the baseline period of measurement.

WETLANDS AND NON-WETLAND WATERS OF THE U.S.

<u>Summary</u>

None of the alternatives would directly affect more than 1.5 acres of non-wetland waters of the U.S. No more than 8.1 acres of wetlands would be directly and indirectly affected under any alternative.

Approximately 1 acre of wetlands associated with the proposed tailings impoundment/paste facility site for all action alternatives would be indirectly affected by the potential capture of surface water by the tailings impoundment and wet paste disposal system. The total drainage area contributing to wetlands would be reduced, potentially reducing the duration of saturation, inundation, and ponding of water in this area. Decreased surface and ground water flow, especially during the growing season or dry periods, would allow vegetative species more tolerant of drier sites to replace species requiring more moist site conditions.

Sediment would temporarily increase in wetlands and non-wetland waters of the U.S. during construction under all action alternatives. Proposed BMPs would help reduce sedimentation. Appendix H contains a discussion of the KNF BMP process. Mitigations under Alternatives III, IV, and V would further reduce sedimentation in Rock Creek.

The applicant has proposed mitigation plans (ASARCO Incorporated 1995b, 1997c, 1998a) to create wetland acres to compensate for the unavoidable loss of wetlands and non-wetland waters of the U.S. resulting from implementing the various action alternatives. Alternative II would result in approximately 12.3 acres of created wetlands for mitigation of the loss of about 8.1 acres of wetlands directly and indirectly affected. Under Alternative V, about 10 acres of wetlands would be created at three sites identified as (1) Miller Gulch Tributary, (2) Upper Rock Creek, and (3) Lower Rock Creek to compensate for the loss of about 6.6 acres of directly and indirectly affected wetlands and non-wetland waters of the U.S. In 1998, ASARCO identified six optional wetland mitigation sites that could be developed if the proposed sites prove to be less successful than anticipated for replacing the lost wetland functions and values.

The functions and values of the wetlands impacted by the Rock Creek mine would be destroyed or reduced. The U.S. Army Corps of Engineers (COE) has specified a wetland mitigation ratio of 1.5:1 (acres mitigated per acre destroyed). The applicant submitted revised specific wetland mitigation designs and locations to the COE in its revised 404(b) application (ASARCO Incorporated 1997) for Alternative V. The applicant has provided a revised wetlands mitigation plan to specifically address Alternative V (ASARCO Incorporated 1997a). The applicant submitted a 2-page letter to the COE (ASARCO; August 1998a) outlining six optional wetland mitigation areas that could be used to achieve a minimum ratio of 1.5:1. A total of 18.9 acres have been identified as suitable for development. Replacement (mitigated) wetland functions and values would be monitored during mining to evaluate the success of re-establishing functions and values of wetlands destroyed.

Introduction

The proposed project would affect wetlands and non-wetland waters of the U.S. in the mill site, waste rock dump, access roads, utility corridors, topsoil stockpiles, diversion ditches, and tailings impoundment areas (see Table 4-34).

In general, the functions and values of the wetlands and non-wetland waters of the U.S. impacted by the Rock Creek project may be considered limited for regional importance because they commonly occur throughout the region and their loss would not limit aquatic or wildlife habitat for the region. In addition, the proposed wetland mitigation would create wetlands that would re-establish similar wetland functions and values. Site-specific importance was rated high for aquatic diversity and abundance and wildlife diversity and abundance. Other wetlands and non-wetland waters of the U.S. functions and values discussed in Chapter 3 were rated as having only moderate to low importance.

Alternative I

Wetlands and non-wetland waters of the U.S. are located along Rock Creek, its tributaries, and along the ephemeral and intermittent drainages of Miller Gulch. These wetlands and non-wetland waters of the U.S. would be impacted under Alternative I as a result of possible timber harvests; potential land exchanges; probable increased recreational use, including hunting, fishing, camping, and recreational driving; and the Montanore Mine. These impacts may decrease the amount of wetlands and non-wetland waters of the U.S., increase erosion and sedimentation in the Rock Creek drainage by some amount, and reduce their ecological functions. The most important wetland functions are considered to be their role in providing aquatic and wildlife diversity and abundance.

Alternative II

Construction of Sterling's proposed mill site, mine waste rock dump, tailings impoundment, and associated facilities would affect a total of 5.8 acres of wetlands by the direct placement of fill, and an additional 2.3 acres of wetlands by modifying existing hydrology. Surface water flow would be reduced in wetlands downstream of both the proposed waste rock dump and mill site from the diversion of runoff.

About 1.1 acres of non-wetland waters of the U.S. would be directly affected by the construction of lined channels to route existing drainage flow through the mill site. Construction of utility corridors and of the new segment of FDR No. 150 from Montana Highway 200 would require filling 0.3 acres of wetlands (see Table 4-34) and would directly affect 0.4 acres of non-wetland waters of the U.S.

About 4.4 acres of wetlands located under the proposed tailings impoundment would be destroyed by direct filling with tailings materials. These wetland areas are associated primarily with ephemeral drainages of the south fork of Miller Gulch and occur in subtle surface depressions along the broad shallow grassy swales. Saturated soils are caused by shallow perched water in surficial clays. Static water levels in nearby monitoring wells indicate that the water table is about 20 feet beneath ground surface. Wetlands vegetation in this area is dominated by herbaceous species including sedge and rush species. The functions and values associated with these wetlands would be destroyed. Loss of these functions and values would be significant.

TABLE 4-34
Acreage of Wetlands and Non-Wetland Waters of the U.S. Affected by Proposed and Alternative Facilities

ALTERNATIVE IMPACTS	Wetlands (acres)		Non-Wetland Waters of the U.S. (acres)	
	Direct	Indirect	Direct	Indirect
ALTERNATIVE II				
Rock Creek Mine mill site area	0.3	0.0	1.1	0.0
Rock Creek Mine mill site waste rock dump	0.6	1.3	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1[1]	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	0.2	0.0	0.3	0.0
Rock Creek tailings impoundment	4.4	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative II Totals	**5.8**	**2.3**	**1.5**	**0.0**
ALTERNATIVE III				
Rock Creek Mine mill site area	0.3	0.0	1.1	0.0
Alternative mine waste rock dump	0.0	0.0	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	0.2	0.0	0.3	0.0
Rock Creek tailings impoundment	4.6	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative III Totals	**5.2**	**1.0**	**1.5**	**0.0**
ALTERNATIVE IV				
Confluence mill site and waste rock dump	<0.1	0.0	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	0.2	0.0	0.3	0.0
Rock Creek tailings impoundment	4.6	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative IV Totals	**5.2**	**1.0**	**0.4**	**0.0**
ALTERNATIVE V				
Confluence mill site and waste rock dump	<0.1	0.0	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	0.2	0.0	0.3	0.0
Wet paste tailing disposal	4.6	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative V Totals	**5.2**	**1.0**	**0.4**	**0.0**

[1] <0.1 acres rounded up to 0.1 acres for acreage totals

About 1 acre of wetlands, immediately downgradient of the proposed tailings impoundment, would be indirectly affected by the capture of surface water by the tailings impoundment, and the surface and ground water capture of the proposed tailings impoundment seepage collection system. The total drainage area contributing to downstream wetlands would be reduced under Alternative II, potentially reducing the frequency and duration of saturation, inundation, and ponding of water for some wetlands. Decreased surface and ground water flows, especially during the growing season or dry periods, may allow vegetative species more tolerant of drier sites to replace species requiring more moist site conditions. This may result in a reduction in wetlands functions, primarily from the loss of wildlife habitat diversity.

Wetlands Mitigation Plan

In compliance with Section 404(b)(1) of the Clean Water Act, the applicant has proposed a mitigation plan providing mitigation and compensation for the loss and potential diminishment of wetlands functions and values associated with development of the proposed project (ASARCO Incorporated 1993). A summary of the applicant's proposed wetlands mitigation plan is found in Chapter 2. In its wetlands mitigation plan, the applicant proposes to create 12.3 acres of wetlands to compensate for a wetlands loss of about 8.1 acres. About 1.5 acres of non-wetland waters of the U.S. (primarily without vegetated wetlands) would be affected by the proposed project and would be mitigated by creating 1.5 acres of non-wetland waters of the U.S. on site during final reclamation. The primary functions and values of the created wetlands would be to re-establish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek, and attenuate peak flows.

The applicant identified four possible wetland mitigation areas and one non-wetland waters of the U.S. mitigation site. The proposed acreages and mitigation schedules for the created wetlands and non-wetland waters of the U.S. are provided in Table 2-7. Detailed descriptions, including site development, design specifications, and schedules, are presented in the applicant's original wetlands mitigation plan (ASARCO Incorporated 1993). The proposed wetlands and non-wetland waters of the U.S. mitigation consists of creating: 1) 7.5 acres of wetlands at borrow area 3; 2) 1.8 acres of wetlands at the access road sites; 3) 1.2 acres of wetlands at the Miller Gulch sites; 4) 1.8 acres of wetlands at the Rock Creek sites; and 5) 1.5 acres of non-wetland waters of the U.S. at the proposed mill site. All proposed wetland and non-wetland waters of the U.S. mitigation sites are within the proposed permit boundary.

The technique of controlling wetland hydrology through elevated culverts and standpipes has been used successfully at numerous wetland construction projects. The proposed wetland mitigation, if successfully established, could provide wetland functions and values to compensate for the loss and potential diminishment of wetland functions and values associated with development of Alternative II. This could reduce the impact to wetlands and non-wetland waters of the U.S. below significance in the long-term.

<u>Alternative III</u>

The effects of Alternative III on wetland and non-wetland waters of the U.S. resources would be the same as those described under Alternative II, except for the following. The 1.5 acres of non-wetland waters of the U.S. would be diverted in channels constructed to retain their functions and values during mine operations. Relocation of the waste rock dump at the Rock Creek Mine mill site to a location with no delineated wetlands would result in 1.9 fewer acres of wetlands directly and indirectly impacted (see Table 4-34).

Wetlands Mitigation Plan

The wetlands mitigation plan for Alternative III would be essentially the same as for Alternative II although only 10.5 acres of wetland mitigations sites were identified. However, because the new segment of the lower portion of FDR No. 150 would be relocated to higher and drier terrain, the access road mitigation sites would either be eliminated or the methodology for creating wetland mitigation sites on the uphill side of the FDR No. 150 would need to be changed. The proposed wetland mitigation sites could still be located in the vicinity, however, small retention dikes across the drainageways would need to be constructed using alternative methods. Other locations within the riparian areas along Rock Creek and within the proposed permit area also may have the necessary wetland hydrologic characteristics to replace proposed access road mitigation sites.

Alternative IV

Implementation of Alternative IV would result in the loss of about 6.2 acres of wetlands and 0.4 acres of non-wetland waters of the U.S. This alternative would result in fewer impacts to wetlands and non-wetland waters of the U.S. than Alternatives II and III, and the same amount of impacts as Alternative V (see Table 4-34). The confluence mill site would be located on a relatively flat, upland area containing only three small wetlands (total < 0.1 acres) and no non-wetland waters of the U.S.

Surface runoff from undisturbed hillsides above the mill facilities and patio area would be diverted through the mill site and discharged into the natural channel that drains into the East Fork of Rock Creek. The diversion would be designed to handle the 100-year rain-on-snow event, but still retain premine functions and values. Relocation of the new segment of FDR No. 150 would result in the need to modify the mitigation methodology or relocate FDR No. 150 access road wetland mitigation sites.

The same 10.5 acres of wetland mitigation sites would be used. All other aspects of the mitigation plan would remain the same as for Alternative III, however, the mitigation for the 0.4 acres of non-wetland waters of the U.S. would be delayed until mining has been completed and the mill site and tailings slurry pipeline creek crossings have been reclaimed.

Alternative V

Implementation of Alternative V would result in the loss of about 6.2 acres of wetlands and 0.4 acres of non-wetland waters of the U.S. In the revised wetlands mitigation plan, the applicant proposes to create 10 acres of wetlands to compensate for a total loss of 6.6 acres of wetlands and non-wetland waters of the U.S. The 10 acres for mitigation would be selected from 18.9 acres identified at three main areas and six optional areas. The primary functions and values of the created wetlands would be to re-establish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek, and attenuate peak flows.

Alternative V would result in essentially the same impacts to wetlands and non-wetland waters of the U.S. as Alternatives III and IV. However, the main differences with Alternative V would be a time delay for the impacts to wetlands associated with tailings disposal and the elimination of a tailings impoundment seepage collection system (will be retained as a potential contingency measure).

Alternative V could result in up to a 25-year delay in the impacts to some wetland areas depending upon the paste construction option used compared to constructing the entire tailings impoundment at the start of the mining project. Successful re-contouring and reclamation of each completed paste tailings panel would also help minimize the cumulative amount of wetland areas that would be impacted during each phase of the mine project. The seepage collection system would not be needed under Alternative V and would reduce potential indirect impacts to wetlands by the collection of surface and ground water.

At the mill site, surface runoff from undisturbed hillsides above the mill facilities would be diverted around the mill site and discharged into the natural channel that drains into the East Fork of Rock Creek. The diversion would be designed to handle the 100-year rain-on-snow event.

Additional wetlands and non-wetland waters of the U.S. delineation work was performed in the Cabinet Mountain Wilderness Area to address potential impacts from mine dewatering and area-wide subsidence (Hydrometrics, 1997b). The wetland and non-wetland waters of the U.S. were delineated around Copper Lake, Cliff Lake, and four potential subsidence areas over the ore body by the applicant in August 1996. A total of 3.5 acres of wetlands and non-wetland waters of the U.S. (including the lake's surface area) were identified within the two lake areas. An additional 0.5 acres of wetland and non-wetland waters of the U.S. were identified within two of the four potential subsidence areas. The potential for impacts to these waters of the U.S. from the mine dewatering and area-wide subsidence was considered to be very unlikely because the lakes are located at least 900 feet above the ore body and are hydrologically separated from the regional water table by an unsaturated zone hundreds of feet thick. Also, Sterling does not plan to mine the pillars which will help reduce the potential for area-wide subsidence.

A buffer of 1,000 feet around Cliff Lake, ore outcrop zones, the Copper Lake fault, and the Moran Fault would remain unmined until the hydrogeology of this area is better characterized through the monitoring process. In the Copper Lake Fault area where ore thicknesses exceed 100 feet, Sterling proposes to leave a large barrier pillar between the fault zone and the active mine area. The function of the barrier pillar would be to provide stability in this area of large ore horizon thickness and potential poor ground conditions. The dimensions and location of the barrier pillar(s) would be determined after assessing local ground conditions.

Cumulative Impacts

The impacts of implementing any of the action alternatives, combined with impacts from the Montanore Mine, may decrease the amount of wetlands and non-wetland waters of the U.S. and their ecological functions in the vicinity of the CMW. However, the combined totals of approximately 20 acres of wetlands and 6 acres of nonwetland waters of the U.S. comprise a very small component of the wetlands and nonwetland waters of the U.S. within the 94,000 acres of the CMW in addition to the surrounds areas. Aquatic and wildlife diversity and abundance are the two most important functions of wetlands and non-wetland waters of the U.S. in the immediate area. The wetlands mitigation plans could create wetlands that would help re-establish wetland functions to compensate for the loss and potential diminishment of habitat diversity and abundance. Alternative V could result in an up to 25 year delay for some impacts to wetlands within the tailings disposal footprint area depending on the paste construction option used. In addition, successfully re-contouring and reclaiming of each successive paste panel should help minimize the total cumulative impacts to wetlands. Cumulative impacts under all action alternatives would be potentially significant in the short term until wetlands mitigation sites are successfully established.

AQUATICS/FISHERIES

Summary

Some impacts to water quality are possible as a result of mine construction and operation for all action alternatives. Impacts to water quality may affect fish and aquatic macroinvertebrates and plants. The impacts may include a reduction in numbers of individual organisms, a change in species composition, a reduction in species diversity, or a combination of the above. In general, all action alternatives could have these potential impacts depending upon the alternative. Alternative II tends to have the greatest impacts, and Alternative V the least.

Catastrophic failure of the tailings impoundment or paste facility would have potentially disastrous consequences for aquatic life in downstream water bodies under all action alternatives. Failure of the tailings paste facility under action Alternative V would have reduced risk of failure and reduced potential for tailings to reach the river because of the reduced mobility of the paste material (see Geotechnical Engineering).

Spills of fuels, chemicals, concentrate, or reagents could occur and have toxic effects on aquatic life if they reached water. Such events would be rare and impacts relatively short-lived. Long-term impacts would depend on the quantity and toxicity of spilled materials.

A slurry, waste water, or reclaim water pipeline rupture could result in tailings, mine adit waste water, or reclaimed water from the tailings impoundment polluting Rock Creek. The extent of harm depends on quantity and toxicity of tailings or waste water entering the stream, the flow of the stream at the time of the spill, and the spill's location. Risks to the Clark Fork River are somewhat less than to Rock Creek because of the dilution potential of the larger water body. The potential for tailings pipeline rupture and spills in the West Fork Rock Creek would be substantially reduced under Alternatives IV and V compared to Alternatives II and III. Burial of all pipelines under Alternative V would further reduce the risk of pipeline ruptures due to vandalism.

Clearing in the Rock Creek riparian zone for road, slurry line, and powerline construction could increase streambed sediments and water temperatures. Depending on the alternative, stream habitat could be directly altered by construction of the mill site, bridges, utility corridors, and pipeline crossings.

If mining results in reduced ground water inflow to the wilderness lakes (Cliff Lake and Moran Basin), amphibians and other aquatic life would be impacted. Moran Basin has a resident fish population while Cliff and Copper lakes are fisheries. Fishless mountain lakes are important for amphibian reproduction. The potential for subsidence-related impacts to water levels and aquatic life in these lakes would be reduced under Alternatives III, IV, and V.

Aquatic habitat degradation could result in non-native fish gaining a competitive advantage over the native species. Brook trout are the primary threat. They interbreed with bull trout and the offspring are sterile. It is generally believed that such a mating is detrimental to bull trout populations. Sediment mitigations in Rock Creek under Alternatives III, IV, and V could reduce project-related impacts to resident Rock Creek bull trout and westslope cutthroat trout and to Cabinet Gorge Reservoir bull trout.

Additional analysis of impacts to bull trout can be found in the Threatened and Endangered Species section and in Appendix B.

Increased recreational use and access in the area could result in increased fishing pressure. Potential impacts to Rock Creek from increased fishing pressure would be minimal.

Alternative I

Aquatic resources would change over time due to natural cycles. Road construction associated with future timber sales or development on private land in the drainage could impact fisheries resources by increasing sediment loads, changing flow patterns, and increasing water temperatures. Impacts to aquatics/fisheries resources in Rock Creek under Alternative I would have the potential to become significant if deposited sediments were increased.

The No Action alternative does have a minor risk of accidents and spills also (primarily of petrochemicals) because the area and its roads would still be used by the public, and a railroad which transports chemicals in tankers and containers passes through the Clark Fork Valley on a frequent basis. While the general public may not know what chemicals are being transported, the railroad and transport companies maintain manifests of the contents. There are rules and guidelines for the storage and transport of hazardous, toxic, flammable, corrosive, explosive, and otherwise dangerous chemicals and materials.

Pure strains of native westslope cutthroat trout are at risk from hybridization with non-native trout. Dilution of the pure strain is inevitable even in the absence of the mine, because there are no barriers preventing movement of the hybrids and non-native trout throughout Rock Creek.

Alternative II

Aquatic Habitat

Spills and Impoundment Failure. If the slurry, waste water, or reclaim water pipeline ruptured it could result in tailings, mine adit waste water, and/or reclaimed water from the tailings impoundment reaching surface waters (see Hydrology). The amount of harm this would cause depends on the amount and toxicity of material actually reaching the stream, and streamflow at the time of the spill. Location of the spill would also be important – the further upstream the spill, the greater portion of Rock Creek potentially impacted. The risks to the Clark Fork River are somewhat less because of the dilution potential of the large water body and higher hardness of the river water. Impacts to aquatics/fisheries resources in other water bodies from these improbable events would be minor.

The Troy Mine, located in a drainage approximately 12 miles northwest of Rock Creek, suffered a tailings slurry line spill in 1984, resulting in about 400 tons of mine tailings entering Lake Creek (Jones 1984). Macroinvertebrate data collected at the time of the spill were compared to baseline data collected seven years earlier (Hansen 1990). The differences in experimental design between the two survey periods did not allow a rigorous quantitative analysis to be made. However, it appeared that differences in species abundances were due to tailings contamination, although it was not possible to separate the effects of the tailings impoundment seepage from the tailings spill. None of the biotic changes in Lake Creek up to July 1985 appeared to be extreme enough to risk local extinction (Hansen 1990). Research on Lake Creek since 1986 indicates no major long-term impacts to macroinvertebrates from the tailings spill or tailings impoundment seepage (Parametrix 1997). The long-term impacts to Lake Creek from this accident appear to be negligible. Although the applicant is proposing several safety features to reduce the likelihood of spills (including emergency dump impoundments and pipeline sensors), the possibility of accidents cannot be eliminated.

Some of the reagents proposed for use in the milling process are known to be toxic to aquatic organisms. (Annual consumption of reagents is listed in Appendix I.) For example, 56 ppm of potassium amyl xanthate (PAX) was shown to kill 100 percent of the test fish under static conditions in a 96-h test (Webb et al. 1976). During flow-through toxicity tests conducted over a 28-day period, which better approach natural conditions, no mortality was observed in rainbow trout at a PAX concentration of 1.0 ppm. It is not known what concentration of PAX above 1.0 ppm would cause mortality in rainbow trout. For several related xanthates, toxicity was on the order of 100-fold greater than the level suggested by the static toxicity test results (ibid.). The results of these flow-through tests suggest that xanthates are potentially harmful to rainbow trout populations at concentrations that may be encountered in receiving waters near mining operations. Webb et al. (ibid.) cite research that found xanthates (not PAX specifically) in tailings effluent in the range of 0.2 - 4.0 ppm. Xanthate residues at this level in the tailings could be cause for concern if tailings were to leak or be spilled in Rock Creek. The potential adverse impacts to fish would likely be short-lived. Measured half-lives of PAX in aqueous solution ranged from 2.24 to 2.48 days (Xu et al. 1988). PAX has an extremely low partition coefficient, suggesting that this compound would not have a tendency to be associated with sediment particles or organism lipids.

Toxicity data are also available for the other proposed mining reagents. Under static conditions for a 96-hour test, a-terpineol (pine oil) killed 100 percent of the test fish (rainbow trout) at a concentration of 100 ppm (Webb et al. 1976). Dow 250 (polypropylene glycol) is relatively non-toxic to rainbow trout (LC_{50} > 10,000 ppm) (Webb et al. 1976). The toxicity to aquatic life of the other reagents to be used in the mill ranges from relatively non-toxic (Orzana A) to moderately toxic (Am Cy Superfloc S-5595) (see Appendix I).

The most likely, but still improbable, chemical accident would be a spill of one of the processing reagents into a stream while being hauled by truck to the mill site. It is possible that such an event could cause a fish kill and eliminate the aquatic macroinvertebrate and algae community in the vicinity of the spill. Such events would be rare and impacts relatively brief.

Concentrate would contain copper, silver, and residues from processing and would be shipped from the mill to the railroad in trucks. If a truck were to overturn, or a train derail, concentrate could spill into Rock Creek or the Clark Fork River. Both copper and silver are toxic to fish. Silver is one of the most toxic metals to aquatic life (Phillips and Russo 1978). Impacts to aquatics/fisheries from accidental spills could be potentially significant depending on the location of the spill and the quantity and characteristics of the material spilled. However, only a portion of the copper and silver present in the concentrate would be in a bioavailable form.

Of the several low-probability spill events that could have an impact on aquatic ecosystems, the least likely but most catastrophic would be a failure of the tailings impoundment (see Geotechnical Engineering and Hydrology). If this were to occur, sediment and tailings leachate would be uncontrollably released into Rock Creek, Miller Gulch, and the Clark Fork River. Water quality degradation associated with the unlikely event of an impoundment failure is discussed in Hydrology. The toxicity of ammonia, nitrate, copper, and lead (pollutants found in the tailings) to aquatic life depends on a number of variables including, but not limited to, concentration, temperature, hardness, and pH. Therefore, the impacts to aquatic life in the event of an impoundment failure cannot be accurately predicted.

At the Troy Mine, acute toxicity tests have been conducted with tailings pond water and *Daphnia magna* (an invertebrate test organism) during the mine operation and current shutdown. From the start of the operation to the summer of 1991, death of 50 percent or more *Daphnia* occurred in 9 of 29 tests. Since that time, the tailings decant water was similarly toxic (> 50% mortality) in 31 of 34 tests (Parametrix 1997). Toxicity during the latter part of the operation is believed to be caused primarily by elevated levels of ammonia, copper and other metals (Parametrix 1997). Based on the Troy toxicity data, it is likely that the Rock Creek impoundment tailings water would be toxic to aquatic life in the event of an impoundment failure, especially if the failure occurred a few years after the operation began.

In the event of a spill, the impact to the lower mile of Rock Creek would be the most severe because of the relatively low flow and soft water in Rock Creek. The Clark Fork River contains harder water and is therefore somewhat less sensitive to metals pollution. In addition, the substantially larger flow of the Clark Fork River provides significant potential for dilution of pollutants. The tailings liquid, which would have elevated levels of ammonia and nitrate, could impact aquatic life downstream to Lake Pend Oreille via direct toxic effects and/or by increasing algal growth. The tailings solids, which would have elevated levels of copper and lead, would tend to be transported along the bottom of Rock Creek, although finer particles could be transported in suspension. The spatial extent of the downstream effects are dependent on the creek flow rates and the particle size distribution of the tailing solids. Fine particles and their associated pollutants could impact aquatic life as far downstream as Lake Pend Oreille.

Impacts to aquatics/fisheries from an impoundment failure could be substantial and significant in the short term to the lower mile of Rock Creek and to the Clark Fork River, depending on seasonal, locational, operational variables and concurrent sediment releases from other sources. Long-term impacts from an impoundment failure would be less but potentially significant depending on the same variables. Aquatic systems downstream to Lake Pend Oreille could experience significant short-term impacts from the addition of nitrate and ammonia in solution. Long-term impacts to Lake Pend Oreille would depend on the rate and quantity of metals and sediments that passed Cabinet Gorge Dam, but could be potentially significant.

Sediment. Impacts can be evaluated for both suspended sediment (TSS) and deposited sediments. Assuming the implementation of BMPs, the estimated temporary increase in TSS in Rock Creek resulting from the project is between 38 and 121 percent during the exploration and construction phase (see Hydrology, Table 4-29). TSS is estimated to average 4 mg/L, which is considerably less than 20 mg/L, the level considered by the State of Montana to be "highly protective" of cold-water fisheries (Montana Department of Health and Environmental Sciences 1988). As disturbed areas are revegetated and stabilized, concentrations of suspended sediment would decrease. However, soil disturbed by construction activities would provide favorable sites for the spread of noxious weeds. Runoff and sediment yield are higher on sites infested with spotted knapweed (see Chapter 3, Biodiversity).

The impact of increased suspended sediments on fisheries resources is difficult to quantify. Data indicate that suspended sediment concentration alone is a relatively poor indicator of suspended sediment effects; concentration plus duration of exposure is a better indicator of effects (Newcombe and MacDonald 1991). Major impacts (decreased growth rate or increased mortality) to salmonids have occurred from exposure to suspended sediment concentrations of less than 20 mg/L (Slaney, Halsey, and

Tautz 1977; Sykora, Smith, and Synak 1972). The impacts of suspended sediment on fish in Rock Creek would depend on variables such as the concentration of sediment, duration of exposure, species and life stage of fish exposed, season, streamflow, and water temperature. Impacts would be greatest and potentially significant in the short-term and would dissipate over time.

The impact of deposited sediment is also difficult to quantify, because it is not possible to predict accurately the amount of sediment that would be deposited on the stream bottom. However, sediment could reduce the quantity and diversity of aquatic macroinvertebrates, which provide food for salmonids. Decreased aquatic insect populations have been noted below silt outflows (Nuttall and Bielby 1973). The distribution of aquatic macroinvertebrates inhabiting running water environments is highly dependent on substrate particle size (Cummins and Lauf 1969).[1] Increased levels of deposited sediment could reduce the quantity of aquatic macroinvertebrates (the food supply for fish) in Rock Creek in the short term. In addition, a change in species composition may occur, with increases in the abundance of sediment-tolerant species and decreases of abundance of sediment-intolerant species.

Sediment may adversely impact salmonid reproductive processes by modifying spawning time, place, and behavior. In addition, sediment deposition on the stream substrate can impair egg and larval growth, development, and survival (Weaver and Fraley 1993).

On the Flathead National Forest, an upper tolerance limit of 40 percent for fine sediment (less than 0.25 inches in diameter) in core samples from bull trout spawning areas has been established. Once the fine sediment fraction exceeds that threshold, no additional sediment loading from new land disturbances is allowed, and a program of sediment source reduction is undertaken. Very little spawning habitat is available in Rock Creek. The median percentage of fine sediment in spawning gravel located just downstream of Engle Creek was 43 percent in 1993, while the median percentage for the years 1988 to 1991 was 25 percent. Any increase in deposited sediment in these spawning substrates would further reduce survival-to-emergence of fry and potentially lead to reduction of fish populations due to reproductive failure (Weaver and Fraley 1991, 1993). Deposited sediment impacts to aquatics/fisheries in Rock Creek from Alternative II would be potentially significant in isolated areas where fine sediments in spawning gravels are high if deposited sediments were not flushed. Over time, sediment levels would decline as disturbed areas stabilized and revegetated.

Road construction and logging for roads, pipelines, and powerlines could potentially increase the percentage of fine sediments in Rock Creek. The applicant has committed to use BMPs when constructing roads and logging. However, BMPs may not eliminate all sediment production (Mathieus 1996). An audit of the implementation and effectiveness of BMPs (which included road construction) conducted in Montana in 1996 found that overall compliance with BMPs was high (92 percent of the practices rated on all sites were applied correctly and in the proper locations). High risk BMPs (those BMPs that are most important for protecting watersheds) were applied less consistently on federal lands - 85 percent met or exceeded minimum requirements. On federal lands, 83 percent of the sites examined had minor departures from BMP application guidelines, while 33 percent had major departures. The effectiveness of BMPs was also less than perfect. On federal lands, 84 percent of the high risk BMPs

[1]McClelland and Brusven (1980) found that increased quantities of sediment in laboratory streams filled substrate interstices (the cracks in between the rocks) and reduced the "effective" size of surface cobbles. The sediments effectively eliminated many of the critical static (calm) water areas around cobbles and boulders, reducing insect density. Fine sediments around cobbles produce a "gasket effect" by creating a seal, thereby restricting access to the undersurface of cobbles (Brusven and Prather 1974).

provided adequate protection for the watershed, 9 percent had minor or temporary impacts, and 7 percent had major and temporary or minor and prolonged impacts. Since 1990, when the BMP audit program in Montana began, the effectiveness and application rate of BMPs has increased steadily (Mathieus 1996). However, in view of the most recent audit results (Mathieus 1996), it is unreasonable to assume that all sediment impacts will be eliminated through the use of BMPs. Appendix H discusses specific BMP effectiveness for the Kootenai Forest for the years 1990 through 1997. In addition, these BMPs were developed specifically for soil and water resources; no long-term effectiveness monitoring has been conducted to assess the ability of BMPs to protect bull trout and other native fish species. Specific BMPs to be used for the project would be identified in the Plan of Operations. If on-site audits of BMPs identify shortcomings in application or effectiveness of any BMPs, immediate corrections will be made and mitigations employed as necessary.

The change in Rock Creek sediment loading attributable to the project was estimated using the Forest Service model R1-WATSED. This model predicted that annual sediment yield in the entire Rock Creek watershed during the initial stages of the project under Alternative II would be 80 percent greater than existing conditions. At the end of the life of the mine, annual sediment yield is predicted to return to existing conditions.

Any sediment that reached Cabinet Gorge Reservoir would likely settle out rapidly. Impacts to habitat in Cabinet Gorge Reservoir from sediment are expected to be insignificant. However, to the limited degree that migratory bull trout are present in Rock Creek, reduced spawning success in Rock Creek could affect fish populations in Cabinet Gorge Reservoir (see Fish section below).

Metals. The Clark Fork River would receive treated mine adit wastewater. The resulting metals loading is described in Hydrology. Metals levels would remain below Montana cold-water aquatic life standards. Impacts to aquatic life under Alternative II from metals loading into the Clark Fork River and Lake Pend Oreille would be negligible. In the unlikely event of a tailings slurry pipeline rupture, impacts to Rock Creek from metals loading could be significant, and are discussed earlier under Spills and Impoundment Failure.

Water Temperature. Clearing within riparian areas for construction of the road/utility corridors, four stream crossings, borrow areas, and catchment basins may expose some previously shaded portions of the stream channel to direct sunlight, possibly increasing water temperatures and plant growth in those areas. The minor rise in temperature and related impacts would likely be localized in the aquatic community. Impacts from temperature increases under Alternative II would primarily affect fish in the short term (see Fish below) and cannot be quantified in the long term.

Nutrients. Discharge of treated mine water would result in minor increases of nitrogen to the Clark Fork River. Resulting changes in water quality would be difficult to measure because the nitrogen load would be minor and a large volume of water in the Clark Fork River would be available for dilution (see Hydrology).

Since primary productivity in the system is limited by the availability of phosphorus (Woods 1991; EVS and Windward Environmental 2000), these minor increases in nitrogen are unlikely to change the productivity in Cabinet Gorge Reservoir, Clark Fork River, or Lake Pend Oreille. After reclamation was complete, the concentration of nitrates and other nitrogen compounds would return to near baseline conditions (see Hydrology).

Nitrogen loading to Rock Creek below the proposed evaluation adit waste rock dump, mill site, and mine waste rock dump could temporarily increase during construction (see Hydrology). The impact of this loading on aquatic plant communities cannot be quantified; however, the impact would be greatest and potentially significant in the short term (probably 1 to 5 years).

Aquatic invertebrate populations would respond to changes in the algal community. Aquatic invertebrates may increase in number, species diversity may decrease, and species composition may change. Species that are tolerant of pollution, such as excess nitrates, may replace sensitive species. The degree of change would depend on the amount and duration of nutrient loading. Impacts to macroinvertebrates from increased nutrients under Alternative II are expected to be significant in the short term.

Both the public and the agencies have expressed concerns as to the reliability of the proposed passive biotreatment technology and the use of an ion exchange system for nitrate removal. The proposed passive biotreatment technology has not been used extensively in mine waste water treatment, especially, under prolonged low temperature conditions as are anticipated at the Rock Creek site. There are also concerns about the complexity and reliability of the proposed ion exchange system.

Stream Habitat Alteration. There would be some direct disturbance of stream habitat of Rock Creek during mine facility construction. Construction of bridges, utility corridors, and pipeline crossings would involve heavy equipment operating in and adjacent to the stream channel, resulting in disturbance to the stream substrate and banks. The applicant's commitment to use BMPs, and the mitigations required under a 310 permit (required by the county conservation district for work in and around a stream), would minimize these impacts.

Two unnamed tributaries to the West Fork of Rock Creek would be routed around the proposed mill site in lined canals (see Wetlands and Non-wetland Waters of the U.S.). The conversion of these streams into ditches would result in a reduction of diversity and abundance of aquatic life currently inhabiting these streams. No baseline biological data are available on the upstream tributary (fed by spring SP-3). Aquatic macroinvertebrate sampling at site WRC-4 (the closest Rock Creek sampling station to the unnamed tributaries) had the overall highest abundance of macroinvertebrates of any sampling site in the Rock Creek drainage. No data on fisheries are available for either tributary. Degradation of the two unnamed tributaries should have a negligible impact on the diversity and abundance of aquatic life in the Rock Creek drainage as a whole. Mitigation for the loss of these streams during the construction/operation period would consist of constructing 1.5 acres of wetlands and non-wetland waters of the U.S. in this area during reclamation (see Wetlands and Non-wetland Waters of the U.S.).

The culvert extension on the West Fork of Rock Creek has the potential to be a barrier to fish passage if installed incorrectly. Inspections during construction should ensure that fish passage is maintained at this location.

Wilderness Lake Water Levels and Chemical Balance. Impacts to wilderness lakes are possible (see Geology and Hydrology). However, it should be noted that if a subsidence- or hydraulic stress-related reduction in surface water levels or ground water inflow did occur, the impact to aquatic resources would be significant and possibly irreversible.

Ground water plays an important role in the chemical regulation of lakes (Kenoyer and Anderson 1989; Sacks et al. 1992; Wentz et al. 1995). The importance of ground water is accentuated for dilute lakes, like those in the Cabinet Mountains, that rely on ground water inputs as their primary source of dissolved solids and nutrients. Ground water can be a major nutrient source for phytoplankton in lakes in temperate latitudes fed mainly by snowmelt (Hurley et al. 1985). Although the volume of ground water inflow to these lakes is a small fraction of the annual hydrologic budget, ground water inflow can contribute considerable amounts of water and solutes. This is particularly important in the summer when peak biological activity takes place. Mining induced changes in the volume of ground water inflow could have an effect on the chemical balance and, consequently, the biology of the lakes (MT DEQ 2001a).

Aquatic Invertebrates

The proposed project has the potential to reduce the abundance and diversity of aquatic invertebrates in Rock Creek and the Clark Fork River. Impacts from the project may produce conditions that favor species that are tolerant of sedimentation, nutrient enrichment, and/or metals. In Rock Creek, the primary threats are increases in sediment loading (primarily during project construction), direct loss of habitat (during construction and operation in unnamed tributaries to the West Fork of Rock Creek), nutrient increases (primarily during construction), and spills of toxic materials (primarily during operation). Impacts to aquatic invertebrates would be limited but somewhat greater in the short term than in the long term.

Fish

The proposed project has the potential to reduce the abundance and diversity of fish in Rock Creek. The primary threats are sediment and nutrient increases (during project construction), spills (primarily during operation), and temperature increases.

Rock Creek is unusual in that several sections of the stream still possess a native fish species complex (westslope cutthroat and bull trout),[2] although the subpopulation of westslope cutthroat trout should not be considered unique over the long-term because of the increasing trend toward hybridization. Westslope cutthroat are sensitive to habitat degradation. Brook trout (a non-native species) are generally considered to be more tolerant of sediment and increases in temperatures than westslope cutthroat. Habitat degradation could result in non-native species gaining a competitive advantage over native species. Habitat degradation from the project may be sufficient to cause the loss of resident westslope cutthroat trout in Rock Creek.

Effluent discharged to Cabinet Gorge Reservoir may potentially affect the movement of trout in the vicinity of the outfall. Previous studies conducted in the laboratory (e.g., Woodward et al. 1995, 1997) and the field (e.g., Sprague et al. 1965, Saunders and Sprague 1967) suggest that the trout may avoid water containing copper and zinc at concentrations which may occur at the end of the discharge pipe (see Hydrology and Appendix D). A critical area for trout, particularly the migratory form of bull trout, is the mouth of Rock Creek. This area serves as a cold-water refuge for trout in the reservoir. The proposed outfall location is approximately 800 feet upstream of the mouth of Rock Creek. Given the fact

[2]The final rule to list the Columbia River distinct population segment of bull trout as a threatened species was published in the federal register on June 10, 1998. Consequently, a Biological Assessment for this species was prepared (see Appendix B).

that instantaneous mixing (defined by DEQ as within 2 river widths) of the effluent is predicted (see Appendix D), metal concentrations above ambient are not expected to occur at the mouth of Rock Creek.

Human population changes and improved recreational access in the area (see Socioeconomics) would increase the number of recreationists and anglers near Rock Creek and the Clark Fork area near Noxon. The increased numbers of anglers would primarily focus on Noxon and Cabinet Gorge reservoirs (see Recreation). During construction, Sterling workers could temporarily increase fishing pressure in Rock Creek, but the expected increase is very small. Therefore, adverse impacts to fish in Rock Creek from increased fishing pressure are expected to be negligible.

The Forest Service has developed guidelines for evaluating potential impacts to inland native fish (INFS) (USFS 1995). Alternative II complies with INFS standards and guidelines. Standard TM-1b refers to application of silvicultural (timber harvest) practices in a manner that does not retard attainment of Riparian Management Objectives (RMOs) and that avoids adverse effects on inland native fish. As indicated above in the temperature subsection, timber harvest within the riparian zone (see Figure 4-4) could result in localized increases in temperature. One of the RMOs specified in INFS specifies that there would be no measurable increase in water temperature. Water temperature would be periodically monitored during mine construction and operation (see Appendix K).

Standard MM-2 specifies that adverse impacts to riparian zones and fish from the construction of roads and facilities should be avoided. As noted above in the sediment subsection, it is likely that some sediment would be deposited in Rock Creek from construction activities within the riparian zone (see Figure 4-4). Because sediment fines are already relatively high in some Rock Creek spawning gravels, increased sediment loading could adversely affect inland native fish. Specific mitigations proposed as part of the road construction design would satisfy the overall goals and objectives of INFS even if this specific standard was not met.

Alternative III

Aquatic Habitat

Spills and Impoundment Failure. Routing the slurry line along a major travel corridor would reduce the risk that a pipeline leak would go undetected but would not affect the impacts if a spill occurred. The magnitude of impacts to aquatic habitat from spills and accidents under Alternative III would vary and could be potentially significant depending on a variety of variables discussed under Alternative II.

Risk of an impoundment failure would be reduced because of additional design factors (see Geotechnical Engineering). Impacts to aquatics/fisheries in Rock Creek and the Clark Fork River from an impoundment failure could be greatest and significant in the short term; the magnitude of impacts could vary greatly but might remain potentially significant over the long term depending on seasonal, locational, and operational variables.

Sediment. Under this alternative, several mitigations are proposed to reduce the quantity of sediment reaching reach Rock Creek. Eliminating Sterling's proposed mine portal access road would minimize or eliminate slumping potential, in turn reducing sediment impacts to aquatic resources in Rock Creek. Overall impacts from bridge replacement and construction would be reduced (see Transportation).

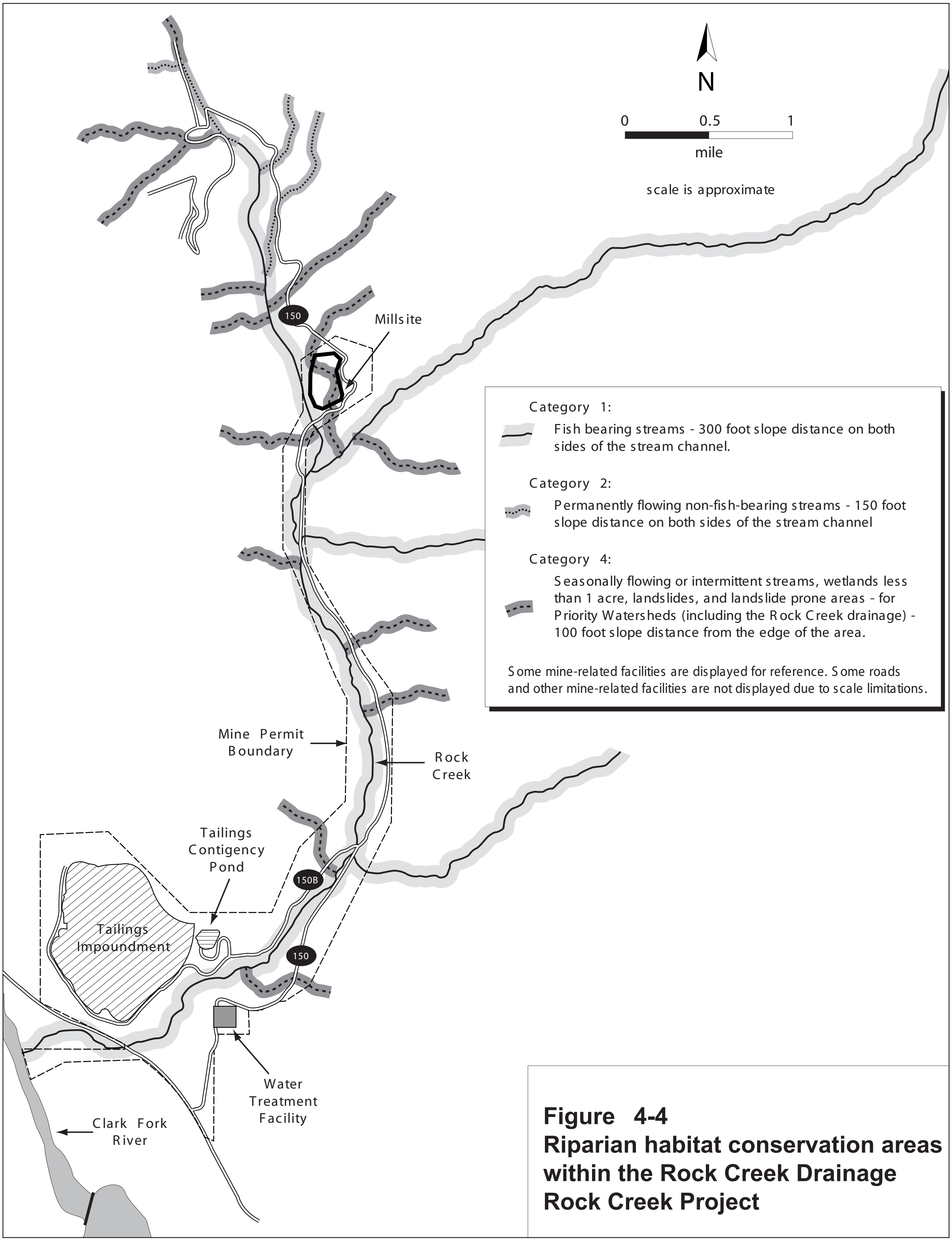


Figure 4-4
Riparian habitat conservation areas within the Rock Creek Drainage
Rock Creek Project

FDR No. 150's new location would be farther away from Rock Creek on a bench with more stable soils, minimizing impacts to the stream. Restricting the extent of road construction/ reconstruction along Rock Creek would minimize the amount of unreclaimed and ungraveled surface subject to erosion.

Locating the tailings slurry line along FDR No. 150 could reduce associated disturbed acres. Reducing transportation and utility corridor construction should result in minor sediment-related impacts to Rock Creek under Alternative III.

Construction-phase BMP audits, followed by corrective measures, would help reduce new sediment impacts. In addition, a sediment source identification and mitigation program is proposed on NFS lands in the Rock Creek and Bull River drainages equivalent to 130 acres of disturbed land under Alternative III. This program should reduce the existing sediment sources in the drainages as well as reduce the impacts of new sediment sources on resident and migratory bull and westslope cutthroat trout.

The change in Rock Creek sediment loading and composition attributable to the project was estimated using the Forest Service model R1-WATSED. This model predicted that annual yield to the entire Rock Creek watershed during the initial stages of the project would be 56 percent greater than existing conditions. At the end of the life of the mine, annual sediment yield is predicted to be slightly lower than existing conditions. Appendix N has a detailed discussion on how the model works and its results.

It is clear that impacts from sediment would be less under this alternative compared to Alternative II. However, since very little spawning habitat is available, and some of the spawning gravel in mainstem Rock Creek already contains a high level of fine sediment, any increase in the percentage of deposited fine sediment in these spawning substrates would further reduce survival to emergence. To the limited extent that migratory bull trout are present in Rock Creek, reduction in spawning success in Rock Creek could impact fish populations in Cabinet Gorge Reservoir. Therefore, under Alternative III, impacts from sediment to Rock Creek would be minor but potentially significant in localized areas where fine sediment in spawning gravels is at relatively high levels.

Water Temperature. Less disturbance would be required along utility and pipeline corridors, resulting in fewer impacts to the aquatic resources as a result of riparian zone disturbance. One detour bridge would not be required reducing the disturbance to streamside vegetation.

Stream Habitat Alteration. Modified road locations and timing of one bridge replacement would reduce direct stream habitat alterations. Streams at the mill site would be placed in constructed streams channels rather than concrete-lined ditches. This would reduce impacts to aquatic life in these streams.

Wilderness Lake Water Levels and Chemical Balance. Increasing the level of rock mechanic analysis and hydraulic testing, and mine plan reviews to reduce the risk of subsidence or ground water inflow disruption would also reduce the risk that wilderness lakes would be affected by the mine (see a DEQ technical report [MT DEQ 2001a] for a quantitative risk assessment for wilderness lakes). Therefore, impacts to wilderness lake water levels and the lake's chemical balance under Alternative III would be unlikely. If lake levels were reduced as a result of mining activities, a contingency plan would be implemented to curtail the flow to underground workings and to mitigate impacts to wetlands and aquatic life. If a reduction in wilderness lake water levels should occur under Alternative III the impact would be significant and possibly irreversible.

Aquatic Invertebrates

Under Alternative III, nutrient levels would remain the same as Alternative II. The potential for erosion and sedimentation and spills would be reduced by mitigations and modifications to the project. Impacts to aquatic invertebrates would be mitigated in the unnamed tributaries of the West Fork of Rock Creek through the use of constructed channels (see Wetlands and Non-wetland Waters of the U.S.).

Fish

Alternative III complies with INFS standards and guidelines. Standard MM-2 specifies that adverse impacts to riparian zones and fish from the construction of roads and facilities should be avoided. It is likely that some sediment would be deposited in Rock Creek from construction activities within the riparian zone (see Figure 4-4). Because the percentage of sediment fines is already relatively high in Rock Creek spawning gravels, increased sediment loading could adversely affect inland native fish. Specific mitigations proposed as part of the road construction design would satisfy the overall goals and objectives of INFS even if this specific standard was not met.

Impacts to westslope cutthroat trout would be reduced under this alternative by mitigation measures discussed above. Measures proposed to mitigate potential water quality impacts would also benefit threatened, endangered, and sensitive species. Despite mitigation measures, impacts to these species would be significant under Alternative III.

Alternative IV

Aquatic Habitat

Spill and Impoundment Failure. Moving the mill site to the confluence location would result in a shorter slurry pipeline and haul distance for trucks carrying mill reagents and ore. The headwaters of the West Fork of Rock Creek would no longer be at risk from a spill.

Sediment. This alternative should result in a substantial reduction of sediment reaching Rock Creek. The disturbed acreage would be smaller, and the length of the utility corridor shorter. In addition, a 300-foot buffer between the mill site and the east and west forks of Rock Creek would further reduce the quantity of sediment that actually reached Rock Creek.

This alternative requires less new road construction and reconstruction compared to Alternatives II and III. Since road construction is a major source of sediment, reducing the road construction should reduce sediment impacts to Rock Creek. Although an additional overpass bridge would be required, a new bypass road around the mill site near the West Fork of Rock Creek would not be required.

The change in Rock Creek sediment loading and composition attributable to the project was estimated using the Forest Service model R1-WATSED. This model predicted that annual yield to the entire Rock Creek watershed during the initial stages of the project would be 44 percent greater than existing conditions. At the end of the life of the mine, annual sediment yield is predicted to be 11 percent lower than existing conditions. In spite of the mitigation measures discussed above, impacts from sediment deposited in Rock Creek would still be minor and potentially significant in localized areas under Alternative IV. Over the entire Rock Creek drainage, the impacts are expected to be minimal. Appendix N has a detailed discussion on how the model works and its results.

Stream Habitat Alteration. By moving the mill site to the confluence area, direct habitat impacts to the West Fork of Rock Creek and its unnamed tributaries would be reduced or eliminated.

Aquatic Invertebrates

Under Alternative IV, the potential for erosion, sedimentation, and spills would be reduced by mitigations and modifications to the project. Impacts to aquatic invertebrates in the unnamed tributaries of the West Fork of Rock Creek would be eliminated by siting the mill downstream of the west fork.

Fish

Development in West Fork of Rock Creek would be limited to exploration activities. Since the upper reaches of West Fork of Rock Creek support an apparently self-sustaining population of westslope cutthroat trout, it would be less detrimental to those fisheries resources to locate the mill site and mine portal downstream. Fish populations in the headwater portions of the West Fork of Rock Creek would remain relatively undisturbed over the long-term because activities which could adversely impact fish habitat (i.e., evaluation adit) will be short-lived. Impacts to bull and westslope cutthroat trout in Rock Creek would be further reduced under this alternative by establishing a 300-foot buffer zone around the confluence mill site.

Alternative IV complies with INFS standards and guidelines except where noted below. Standard MM-2 specifies that adverse impacts to riparian zones and fish from the construction of roads and facilities should be avoided. It is likely that some sediment would be deposited in Rock Creek from construction activities within the riparian zone (see Figure 4-4). Because the percentage of sediment fines is already relatively high in some Rock Creek spawning gravels, increased sediment loading could adversely affect inland native fish. Specific mitigations proposed as part of the road construction design could satisfy the overall goals and objectives of INFS even if this specific standard was not met.

<u>**Alternative V**</u>

Aquatic Habitat

Spill and Tailings Paste Facility Failure. The risk of accidents and spills has been minimized in Alternative V by requiring burial of all pipelines (except at stream crossings), use of dikes between the stream and the pipelines, construction of emergency spill ponds near stream crossings to contain pipeline ruptures, installation of pipeline monitoring equipment that detects leaks, a requirement for a dewatered viscous tailings deposit with no standing water, busing of employees within the drainage, transport of concentrate (refined ore from the milling process) via a pipeline rather than a vehicle, widening of roads and speed restrictions, and other associated measures. A road risk assessment was conducted (USFS 2001) to identify potential high risk sites and develop an appropriate mitigation to reduce the likelihood of spills or adverse impacts. Impacts to aquatics/fisheries in Rock Creek and the Clark Fork River from such catastrophic events could be potentially significant in both the short and long term depending on seasonal, locational, and operational variables.

Sediment. This alternative should result in a reduction of sediment reaching Rock Creek over the long term. Alternative V would have the least amount of disturbed acreage of any action alternative. Eliminating the proposed mine portal access road (Alternative II) would minimize or eliminate slumping potential, in turn reducing sediment impacts to aquatic resources in Rock Creek. Overall impacts from bridge replacement and construction would be reduced (see Transportation). The new location and paving of FDR No. 150 would be farther away from Rock Creek on a bench with more stable soils, minimizing impacts to the stream. Restricting the extent of road construction or reconstruction along Rock Creek would minimize the amount of unreclaimed and ungraveled surface subject to erosion. Locating the tailings slurry line along FDR No. 150 could reduce associated disturbed acres. Under Alternative V, the length of the utility corridor would be shorter. In addition, a 300-foot buffer between the mill site and the east and west forks of Rock Creek would further reduce the quantity of sediment that actually reached Rock Creek.

Sediment mitigation measures specified in Alternative V were derived using the following steps. The actual tonnage of sediment resulting from construction and operation of the mining facilities was estimated using the Forest Service model R1-WATSED. Based on preliminary validation monitoring for this model, the predicted effects were inflated by a factor of six to arrive at a real-world estimate of effects. The cumulative annual (inflated) tons of sediment resulting from the proposed action were then specified as a mandatory mitigation requirement in Rock Creek only, to be performed concurrent with reconstruction of roads, utilities, and exploratory adit development. The mitigation (sediment reductions) would exceed estimated impacts.

Construction-phase BMP audits, followed by corrective measures, would help reduce new sediment impacts. In addition, a sediment source identification and mitigation program is proposed on NFS lands in the Rock Creek drainage. Mitigations would include, but not be limited to, stabilizing an eroding cutbank where Engle Creek joins Rock Creek and completion of an inventory and mitigation plan for the Orr Creek and Snort Creek (tributaries to the West Fork of Rock Creek) basins to identify additional sediment mitigation opportunities. If significant sediment sources are identified in either of these basins, they would be mitigated. These programs would reduce the existing sediment sources in the drainage and reduce the impacts of new sediment sources on Cabinet Gorge bull trout.

The change in Rock Creek sediment loading and composition attributable to Alternative V was estimated using R1-WATSED. This model predicted that annual sediment yield in the entire Rock Creek watershed during the initial stages of the project (without considering mitigations) would be 38 percent greater than existing conditions. At the end of the mine life, annual sediment yield is predicted to be 12 percent lower than existing conditions. It is anticipated that implementation of sediment source mitigations in the Rock Creek watershed would reduce the amount of sediment generated during mine operation and further reduce post-mining sediment yields. These mitigations were not incorporated into the model as all the details and locations of the sediment mitigations are not known. Appendix N has a detailed discussion of how the WATSED model works and its results.

It is clear that the amounts of suspended sediment would be potentially less in the long term under this alternative. Sediment abatement measures that will be implemented before and during the project construction period should both offset expected increases in deposited sediments and minimize any unavoidable short-term increase in fugitive sediment. Although fine sediment levels in some spawning gravels are at or above critical thresholds, fine sediment levels in most of the Rock Creek drainage are very low. Unmeasurable degradation of habitat due to sediment effects could occur in some critical areas over the short-term, but mitigation described above should result in a measurable improvement in sediment conditions over the long-term.

Water Temperature. Potential temperature impacts are minimized by consolidating the road and utilities (power and pipelines) into one corridor, eliminating several stream crossings by the utility lines, and by reducing the length of corridor within the riparian zone. At several stream crossings there will be a marginal loss of shade trees (well below 1 percent of stream length), but this impact will be offset by a natural increase in shade resulting from 30 years of growth in undisturbed stream reaches.

Nutrients. Discharge of treated mine water would result in minor increases of nitrogen to the Clark Fork River. The proposed dual nitrate removal system, consisting of anoxic biotreatment and reverse osmosis, appears to be capable of reliably removing dissolved nitrate from the mine waste water. The proposed anoxic treatment system has been demonstrated to be effective at removing nitrate from similar mine waste water under Montana climatic conditions. Reverse osmosis is a proven technology for removing dissolved solids, including nitrate, from water under conditions and at flow rates similar to that anticipated at the Rock Creek mine. The outfall and diffuser proposed under Alternative V would result in effluent dilution across the entire width of the river (see Hydrology). Limited impacts from nutrients to aquatic life in the Clark Fork River and Lake Pend Oreille are anticipated.

Stream Habitat Alteration. By moving the mill site to the confluence area, direct habitat impacts to the West Fork of Rock Creek and its unnamed tributaries would be reduced. There would be some direct disturbance of stream habitat of Rock Creek during mine facility construction. The joining of pipelines and utilities within the same corridor would reduce the impacts to stream habitat compared to Alternative II. BMPs applied during construction and the mitigations required under a 310 permit would further minimize these impacts. There would be some limited impacts to stream habitat in Rock Creek under Alternative V in the short term.

Wilderness Lake Levels and Chemical Balance. The additional hydraulic testing and 1,000-foot buffers around Cliff Lake, the southern part of Copper Lake Fault, Moran Fault, and the ore outcrop zones at the north and south basins should greatly reduce the risk of altering the hydrostatic gradients in the bedrock and fracture systems that maintain ground water flows into wilderness lakes. If the flows are not interrupted or altered, then there would be no mining-induced changes to the lake's chemical balance.

Aquatic Invertebrates

Under Alternative V, the potential for erosion, sedimentation, and spills would be reduced by mitigations and modifications to the project. Impacts to aquatic invertebrates in the unnamed tributaries of the West Fork of Rock Creek would be reduced by moving the mill site to the confluence of the west and east forks.

Fish

Alternative V would comply with INFS standards and guidelines. Through a combination of relocation of some activities and additional sediment mitigation, Standard MM-2 would be met (see Figure 4-3).

The Biological Assessment for bull trout (see Appendix B) concluded that implementation of Alternative V is likely to adversely affect bull trout because of unavoidable fugitive sediment loading during project construction. Given the fact that this species is the most sensitive fish species located in the Rock Creek drainage, this conclusion may not hold for all other fish species. There may be short-term, minor impacts associated with bridge construction, improvement of the exploration adit access road, and construction of the exploration adit patio and waste rock dump. None of the potentially adverse project-related effects on fish habitat are measurable. The net effect determination indicates that unmeasurable degradation for several habitat types is expected in the short term. Measurable improvement is expected over the long-term for surficial and streambed sediments. None of the project-related impacts to fish are measurable. Overall, individual fish are likely to be adversely affected, but there should be negligible effects on fish stocks. Impacts to fish populations would be assessed during periodic monitoring throughout the life of the project (see Appendix K).

The USFWS biological opinion (BO) provided in response to the US Forest Service's biological assessment (BA) of project affects to bull trout concurred that Alternative V would likely adversely affect bull trout. The opinion cited sediment, potential affects to water chemistry in Rock Creek and the lower Clark Fork River, and actual harm to individuals as reasons for the determination. The BO provided direction for mitigation to reduce impacts as well as direction for monitoring. The BO requires that a watershed baseline, including bull trout population information, be developed prior to surface disturbance activity not associated with the exploration adit. Some of this information is presently being collected as part of the Native Salmonid Restoration Plan developed by the Lower Clark Fork Collaborative during the Avista Relicensing of the Lower Clark Fork Projects, FERC number P-2058. The BO specifically identified the Rock Creek bull trout population, water temperatures, sediment, metals, and groundwater changes as items to monitor with regards to effects to bull trout. The BO further recommends that Sterling participate in the Rock Creek Watershed Council.

Cumulative Impacts

There are 16 separate watersheds which are interrelated with respect to aquatic resources. In addition to the project described in this document, there are many other projects occurring in these watersheds (Table 4-35). Considering all the projects in Table 4-35 together, approximately 2 percent of the 650,000 acres in these watersheds will be disturbed. Approximately 80 percent of the 800-plus miles of linear disturbance is road reconstruction that will upgrade roads to present design standards or road decommissioning. The improvement of these roads should have the net effect of decreasing sediment loading.

Management actions in the Lower Clark Fork River could impact aquatic resources. The Tri-State Implementation Council's management plan (see Description of Reasonably Foreseeable Activities in Chapter 2) includes water quality management objectives pertaining to the control of nutrient loading and algae growth. The achievement of these objectives should benefit aquatic resources in Cabinet Gorge Reservoir by reducing algae blooms.

The cumulative effect of these projects on bull trout was evaluated in the Biological Assessment for this species (see Appendix B). The conclusion reached in that document was that these projects, when considered together, would maintain the function of the bull trout meta-population. Since bull trout is most sensitive aquatic species found in the Rock Creek drainage, such a conclusion is also protective of all less sensitive aquatic species. The USFWS BO supports this determination.

TABLE 4-35
Ongoing or Foreseeable Projects for Lower Clark Fork River Watersheds[1]

Watershed	Number[2]	Amount[3]	Projects of Note
Elk	31	1318/57	Smead Rice timber sale - 766 ac; habitat burn - 450 ac; road maintenance - 11 mi; road constr/reconstr - 23 mi
Blue	6	65/2	none
Pilgrim	23	167/37	road maintenance - 21 mi; road constr/reconstr - 4 mi
Bull	60	1345/65	Berray Mountain timber sale - 800+ ac; road maintenance - 28 mi; private roads and water systems - 22; road constr/reconstr - 3 mi; Bull River campground fishing
Clark	61	1793/42	burning - 1000 ac; road maintenance - 18 mi; road reconstruction - 4 mi; public/private water systems - 17; North Shore/Big Eddy campground fishing; guided fishing
Trout	22	331/31	road maintenance - 11 mi
Rock	9	175/17	none (other than Rock Creek mine)
Marten	18	471/34	salvage timber sales - 270+ ac; road maintenance - 16 mi; road constr/reconstr - 13 mi; Marten Creek campground fishing; electrofishing
McKay	8	16/9	none
White	19	432/131	Grey Woodchuck timber sale - 235 ac; habitat burn - 195 ac; road maintenance - 47 mi
Swamp	14	1220/8	burning - 518 ac; private water systems - 4; grazing - 700 ac; Green Mountain irrigation ditch
Beaver	26	2096/227	Burnt Lion timber sale - 1535 ac; road constr/reconstr - 109 mi; road maintenance - 100 mi; grazing - 100 ac
Vermillion	28	94/65	road constr/reconstr - 8 mi; road maintenance - 21 mi; electrofishing
Prospect	158	1101/84	parts of 5 timber sales - 1090 ac; pipeline maintenance - 3 mi; powerline maintenance - 4 mi; stream restoration - 2 mi; road reconstruction - 4 mi
Graves	14	2/9	road maintenance - 9 mi; washout repair 1/8 mi
Squaw	13	1/3	none

Notes
1 project descriptions are preliminary estimates subject to revision
2 number of discrete projects underway (each project typically involves multiple activities)
3 acres/miles of "disturbance" authorized, funded or conducted (acres or miles may be disturbed one or multiple times by sequential or concurrent activities)

BIODIVERSITY OF WILDLIFE HABITAT/VEGETATION AND WILDLIFE SPECIES (BIODIVERSITY)

Summary

The proposed project could have a significant effect on components of biodiversity under all action alternatives except Alternative V. The proposed project could result in a decline of project area plant and animal species diversity and numbers, although mitigation and design features would reduce project area impacts from moderate to minor levels under Alternative V. These are potentially long-term effects.

Potential adverse effects result from mine-related impacts such as increases in disturbance, direct loss of habitat or a decline of habitat effectiveness, and increases in mortality risks. It would be the combination of indirect and cumulative impacts that would cause the most detrimental effects to most animal species.

The analysis of sensitive animal species in the draft EIS was based on limited information. Additional studies were completed or started after the draft EIS. Based on the information available at the time of the draft EIS, it was determined that Alternatives II, III and IV could cause potentially significant impacts to three Forest Service sensitive species (harlequin duck, fisher, and wolverine) and/or their habitats, two management indicator species (pileated woodpecker and mountain goat), and old growth habitat. Impacts to two sensitive species (fisher and wolverine) have been determined to be much lower than expected at the time of the draft EIS under Alternatives II through IV and would be further reduced under Alternative V, based on forest-wide habitat and viability analyses. Impacts to harlequin duck would be the potentially most serious of the effects to wildlife other than federally-listed threatened or endangered species. Impacts to harlequin ducks would be substantially reduced by Alternative V mitigations. All these species would be affected to some degree by loss, alteration, and degradation of habitat, and increased human disturbance and activities.

Other wildlife species in general could be displaced, restricted in use of habitat and travel corridors, and suffer higher stress and mortality levels. A decline in animal numbers could result.

The proposed project would affect habitat by physical alteration or destruction, fragmentation, and decreasing effectiveness or usability. The loss and degradation of old growth habitat, potentially significant under all action alternatives except Alternative V, would result in a decline in abundance and occurrence of various old growth associated species in Compartment 711.

Eleven populations of five Montana Natural Heritage Program (MTNHP) plant species of special concern or KNF sensitive species would be partially or totally destroyed under the action alternatives if they cannot be avoided. If KNF sensitive plant species cannot be avoided, study, conservation, or mitigation would be required under the National Forest Management Act. A reduction of plant community diversity on reclaimed sites compared with similar undisturbed lands would result. In addition, the proposed project would result in an increased rate of noxious weed spread over current conditions requiring implementation of a noxious weed management plan to control weeds.

Alternative I would have the least impact on biodiversity, including wildlife and vegetation resources, except for impacts resulting from the potential sale of Sterling lands and subsequent change in land use. Alternatives II to IV would likely have significant short- and long-term adverse impacts for many aspects of biodiversity. Alternative V would likely have significant to less than significant short- and long-term adverse impacts.

Introduction

Aspects of biodiversity that are discussed in this section include plant species of special concern, noxious weeds, wildlife habitat/vegetation communities, old growth forests, and wildlife species including Forest Service sensitive wildlife species and management indicator species. Other sections that tie closely to this discussion are Wetlands and Non-wetland Waters of the U.S., and Threatened and Endangered Species.

Alternative I

Wildlife Habitat/Vegetation

Plant Species of Special Concern. The populations of Yerba buena have been impacted to an unknown degree in the study area because the Applicant logged their private lands in the proposed impoundment area since the baseline studies were completed. Future disturbance impacts to other plant species of special concern are difficult to predict under Alternative I. Site-specific activities are unknown and surveys continue as time and budgets permit. Activities on KNF lands would have surveys completed. Private land surveys are not required unless a permit is required such as a mining or water quality permit. No other major disturbances have occurred since the baseline studies were conducted in the area.

Noxious Weeds. Noxious weeds would continue to spread in the area in spite of the limited control efforts being applied by federal, state, county, municipal and private land managers. This is true in all parts of Montana, not just in the proposed project area. Noxious weeds could eventually reach the CMW area, carried by the limited human users of the area as well as by wildlife vectors.

Wildlife Habitat/Vegetation Communities. Wildlife habitat and vegetation communities would continue to change due to logging activities, human developments, fire and natural succession. Forest fragmentation would increase or decrease with logging and natural succession of logged areas. Human caused habitat impacts are expected to rise as human population and demands increase, although at a slower rate than would occur with the action alternatives. Wildlife would be affected to varying degrees by the expected changes in habitat.

Sterling has indicated they probably would not maintain their property ownership in Rock Creek if the project was not approved (Sterling 2001). If their acreages in lower Rock Creek drainage (approximately 700 acres) were sold, significant changes could occur to wildlife habitat within the drainage (see Socioeconomics). The upper elevation lands probably would not change in habitat value from current conditions unless land use changes significantly. The lower elevation lands have gentle topography with relatively easy access to the highway, so it would be reasonable to expect that they would either continue to be managed for timber management or sold and developed as homesites. This is particularly important because more than half of Rock Creek from the highway to the confluence of the east and west forks (2.4 miles of 4.7 miles total) is currently owned by Sterling.

Loss of wildlife habitat would occur if the lands currently managed for timber harvesting or awaiting minerals development would be sold for homesites or shorter term timber values. An increase in fragmentation of wildlife habitat would occur because of the conversion of habitat to housing developments, roads, and septic systems. This type of fragmentation is more impactive to forest-adapted wildlife than is timber harvesting for several reasons (see Wildlife Species below). It would be a permanent loss of habitat to houses, outbuildings, and low diversity pastures.

If Sterling did choose to maintain their holdings in the Rock Creek drainage, timber harvest on their lands could be expected and perhaps accelerated, based on past activities. This would reduce cover along Rock Creek and possibly affect the water quality. Because of the proximity of their lower elevation lands to Rock Creek, some degree of impacts to harlequin ducks and other riparian-associated species could be expected.

Effective Old Growth Habitat. Forest Service management of old growth as Management Area (MA) 13 is discussed in the Forest Plan section.

Old growth habitat on NFS lands in MA 13 would remain primarily undisturbed. Existing amounts of effective old growth (7.4 percent) would remain below the recommended minimum until other forest stands (such as replacement old growth managed as MA 13) grew into old growth habitat.

Table 4-36 displays acreage of effective old growth and effective replacement old growth affected by each alternative. Effective old growth habitat would remain at the current level of 867 acres of 1,032 acres total old growth (6.2 percent) because of the effects of existing roads and the small size of some blocks. Under current conditions, the long-term maintenance of old growth dependent species would be difficult under Alternative I.

Wildlife Species

Wildlife Species in General. Human-caused wildlife disturbance and habitat impacts are expected to rise as human population and demands increase, although at a slower rate than would occur with the action alternatives. Mortality risks likely would increase as human presence and use of the area increases.

Forest Service Sensitive Wildlife Species. The occurrence of breeding harlequin ducks on Rock Creek likely would continue but would remain vulnerable if land uses remain similar to current uses. The stability of the lower Clark Fork subpopulation of harlequin ducks would remain tenuous due to low duck populations, habitat loss, and mortality risks. Modest changes in land uses along any of the streams currently used may have significant consequences to the subpopulation.

TABLE 4-36
Changes to Effective Old Growth Habitat by Alternative

Effective Old Growth Component	Alternative				
	I	II	III	IV	V
Effective Old Growth (OG):					
Change in Acres of Effective OG (difference from existing)		-122	-47	-30	+1
Direct Loss	0	-28	-17	-11	0
Ineffective	0	-94	-30	-19	+1
Remaining Effective OG Acreage*	867	745	820	837	868
Percent Effective OG in Comp. 711**	6.2	5.3	5.9	6.0	6.2
Replacement Old Growth (ROG):					
Change in Acres of ROG (difference from existing)		-5	-3	+6	+6
Direct Loss	0	-2	-2	0	0
Ineffective	0	-3	-1	+6	+6
Remaining Effective ROG Acreage*	644	639	641	644	644
Percent Effective ROG in Comp. 711**	4.6	4.6	4.6	4.6	4.6

Source: USFS Kootenai National Forest GIS database 1997

Note: 1032 = Total MA acres of OG
650 = Total MA acres of ROG
14,029 = Total acres in Rock Creek Compartment 711.

Acreage affected by roads is calculated differently for Forest Plan (MA 13) old growth (see Table 4-1) and effective old growth (Table 4-36) above. In the Forest Plan, roads are considered as part of the old growth acres (MA 13) (see Table 4-1). For effective old growth, roads are not considered as part of effective old growth acreages and are subtracted.

* 165 acres of MA 13 (1032-867 = 165) are considered currently ineffective habitat due to road corridors, small size of stands (less than 25 acres), or fragmentation.

** Percent effective old growth = acres of effective old growth/ acres in compartment

If Sterling were to sell its lands, and land use changed from current uses, several important changes have the potential to occur. The most important possible change would be in the use of land from timberlands to homesite development. This would be particularly significant for the sensitive species most at risk, harlequin duck, for the following reasons. The location of FDR No. 150B, currently adjacent to the creek in an important area for harlequins, would probably remain in its location without the large economic incentive for the change in location and subsequent closure included under Alternative V. The configuration of Sterling's lands places them along the riparian areas, along the most important portions of stream for harlequin ducks (as well as fishers). An increase in homesites would likely be accompanied by some aspects of development incompatible with nesting or rearing of ducklings, including continuous close proximity of people, livestock or carnivorous pets. Clearing of land near the stream, either for homesites, pastures or timber harvesting, would remove the sight buffer from the road and could lead to increased disturbance. An increase in homesites would increase the amount of traffic on the road from current levels, although this increase would be a small to moderate fraction of the increase proposed under any action alternative.

Other species affected if the Sterling lands converted to homesites would be those noted under indirect effects of increased human development in the Lower Clark Fork and Bull River valleys.

The no action alternative would continue the present condition of habitat and disturbance patterns in the compartment for northern goshawks. Currently younger stands would trend towards the older trees preferred for nesting, which would ultimately provide a greater amount of nesting habitat. Concurrently, some younger stands now available for foraging would be likely to close in and become less available for foraging. Overall the net result would be an increase in usable habitat. Disturbance patterns would remain approximately as at present. Several stands are currently so close to roads that their utility as nesting habitat is doubtful, and the status of these would not change.

The long-term viability of the fisher, wolverine, and harlequin duck are directly and indirectly dependent on the extent of the impacts from human population increase in the region. Many of the most serious adverse impacts are due to increased human presence. The no action alternative allows a much longer period of time between the existing human population condition and a human population increase similar in size to that predicted as a result of mine-related growth. This time period may allow for the development of solutions to some of the factors working against long-term viability, including habitat loss, highway mortality, incidental trapping or hunting mortality, and disturbance from pet dogs and snowmobiles.

Peregrine falcon use along the Clark Fork River drainage would remain a possibility. The suitable nesting habitat would still be available. The likelihood of a nesting pair moving into the area remains only fair. The use of the area by migrating peregrines could still occur. Alternative I would have no effect on the peregrine falcon or its habitat.

Forest Service Management Indicator Species. Increased use by mountain goats of the Rock Creek area may be expected if goats are displaced by the Montanore project. Elk and other wildlife security could improve as open road densities are reduced to meet Forest Plan standards. The downward trend of amphibian abundance and occurrence is expected to continue.

Other Species of Interest. Current land uses would not be expected to affect most of the species in this group substantially differently than in most other similar drainages.

If Sterling were to sell its lands for homesite development, several important impacts could occur to groups of species in this section. Homesites and associated features such as livestock and domestic animals generally support species not adapted to forest habitat. Such species as starlings, house sparrows, pigeons, and brown-headed cowbirds each can directly or indirectly impact native species. Starlings are aggressive cavity-nesters that outcompete native species for nesting sites, affecting tree swallows and others. Pigeons are implicated in the deaths of northern goshawks from a communicable disease transmitted during ingestion (Beebe 1974, p.62). Brown-headed cowbirds are aggressive and prolific brood parasites (birds which lay their eggs in others' nests) and are implicated in a number of species' declines. Brown-headed cowbirds are strongly associated with agricultural sites, which can be as small as a corral with waste grain, and would be expected to increase substantially over existing levels if new homesites were built in the lower elevations of Rock Creek. Their presence could then be expected to reduce the diversity and numbers of several species of open-cup nesting songbirds. This is particularly important for willow flycatchers, a species recorded in the vicinity during the baseline study (Farmer and Heath 1987).

Alternative II

Wildlife Habitat/Vegetation

Plant Species of Special Concern. Under Alternative II, all 11 populations of plant species of special concern (five different species) identified in the permit area would be affected. Suitable habitat for all species identified in the study area could also be lost or affected.

The local population of Yerba buena in the area is rather extensive. Much of this large local population would be destroyed by construction of the tailings impoundment but some of the population does occur outside the areas proposed for disturbance. It is anticipated that implementation of the project would not affect either the local or regional viability of this species. Construction of the impoundment and soil stockpiles could impact a mousemoss population. Construction and/or reconstruction of the roads, slurry pipeline and powerline corridor along Rock Creek could destroy the known populations of pointed broom sedge, tarpaper lichen, mousemoss, and possibly habitat for wavy moonworts if siting for these facilities were not modified to avoid these populations. If wavy moonworts or other KNF sensitive species or MNHP plant species of special concern listed in Chapter 3 or subsequently added to either list in the future were found in subsequent surveys and they could not be avoided, study, conservation, or mitigation would be required under the National Forest Management Act. Crested shield fern (a.k.a. Buckler fern) populations that were thought to be in the area were misidentified and would not be affected by the proposed project. Impacts to plant species of special concern would be important in the short term under Alternative II.

More information would be needed about the distribution of each species to determine long term impacts to species viability. A conservation easement for the crested shield fern which was identified in the draft EIS would not be required for the final EIS because the plant thought to be crested shield fern was misidentified.

Plant Species Changes at Springs and Seeps. Plant species and communities have evolved and adapted to certain habitat characteristics found across the landscape. Fine-scale, aquatic-related habitats include bogs, fens, springs, and seeps. Certain plant species and communities will be found at various abundances within these water-related habitats. Certain species may be unique to these habitats and to no other. A spring is a flow of water above ground level that occurs where the water table intercepts the ground surface. Where the flow from a spring is not distinct but tends to be somewhat dispersed, the flow is more correctly termed a "seep" (Allaby 1994). Springs and seeps are found throughout the Rock Creek study area. There are many reasons for ground water levels to be lowered below the ground surface. Climatic change inducing drought, seismic shifts, natural or human-caused disturbance, even over-use by wildlife can alter the spring/seep habitat and may change the habitat altogether. Plant species presence, absence, and/or abundance can also be altered when this happens. Some species will cease to exist in the area as a result of significant spring/seep habitat change. The proposed mining activity is a disturbance activity that may or may not alter the water table and therefore the habitat surrounding a spring or seep.

The question of whether or not plant species would be affected by a change in water level and spring or seep habitat as influenced by the Rock Creek mining activity is best answered by relating plant species with water abundance and quality for monitoring and evaluation. However, Alternative II does not include additional baseline survey of plant species abundance (all species) prior to activity and subsequent plant species abundance and water monitoring. Without this type of monitoring, it would be possible for mining-induced changes in water level or quality to result in a loss of species associated with the impacted springs or seeps.

Noxious Weeds. Noxious weeds are spreading across Montana. On areas proposed for disturbance, such as this project, the goal is to keep weeds in check during operations such that the rate of spread is comparable to the rate of spread on adjacent undisturbed lands. The disturbed soil created by construction activities would provide favorable sites for several noxious weed species. The spread of weeds is unavoidable and can only be limited by aggressive weed control activities. Noxious weed seed would likely be spread by vehicles moving from infested areas to newly disturbed areas and along roads and utility corridors. Potential introduction and spread of weeds from the evaluation adit site and increased traffic on the Chicago Peak Road increases the likelihood of noxious weed introduction into the CMW over Alternative I.

The applicant has committed to developing an effective weed control plan in cooperation with the Sanders County Weed Board and the Agencies. Implementation of the revegetation plan and early detection of new infestations and treatment would be key elements of Sterling's weed monitoring and control program. Any necessary herbicide applications, biological control agent releases, mechanical controls or other aspects of the integrated weed control program would be made in accordance with approved materials and methods under the supervision of licensed applicators as required by law. An effective weed control program would minimize weed infestations on lands disturbed by the proposed disturbances.

Wildlife Habitat/Vegetative Communities. Direct impacts from Alternative II of the proposed project would occur to wildlife habitat by physical alteration. Indirect impacts would be a decrease in habitat effectiveness (usability) from disturbance or fragmentation. New habitat for species that prefer openings would be created.

A total of 584 acres of wildlife habitat would be degraded, lost or altered under Alternative II including about 293 acres of forested habitat, 273 acres of riparian habitat, 8 acres of wetlands, and 10 acres of subalpine habitat. Impacts to water resources are described in Aquatics/Fisheries and Hydrology. Habitat that is altered or destroyed can have a short- or long-term effect. Long-term habitat loss outside of the project area due to mine-related home building and recreational demands would also occur.

Some additional wildlife habitat would become less effective because of mine related noises and activities, increased road traffic and increased human presence. The acreage affected varies with species and types and durations of disturbances. The greatest reduction of habitat effectiveness would occur during mine construction. Disturbance caused by traffic would occur throughout mine life. A portion of this less effective habitat would likely return to usable habitat upon closure of the mine and completion of reclamation.

Usable habitat would be fragmented by construction of mine facilities. Habitat may be bisected by roads or isolated from other similar habitat. The proposed project would fragment old growth and riparian habitat, travel corridors, and other important habitat. The significance of fragmentation from road building is variable depending on wildlife species or ecological community. However, in general, increased fragmentation would be undesirable for key wildlife and biological communities on KNF.

The proposed project would eliminate forested cover along the utility corridors. This change from forested to open grass/shrub communities would provide additional habitat for those species preferring open areas (such as juncos and bluebirds).

The revegetation plan proposed by the applicant would result in extensive areas seeded to grass and forb cover during the life of the operation. These areas would likely be attractive foraging areas for some species such as big game and bear. Overall plant community diversity for sites directly impacted would be reduced in the short term and succession would be slow due to changes in soil materials and vegetation species established (see Soils and Reclamation).

Effective Old Growth Habitat. Alternative II would result in the direct loss of 28 acres of effective old growth habitat, (see Table 4-36). Effectiveness of the remaining old growth would decrease by 94 acres due to increased fragmentation and edge effect. Effectiveness of travel and dispersal corridors along Rock Creek and the West Fork of Rock Creek would be severely reduced due to the presence of the mine facility and roads. If loss of effectiveness is considered, the percentage of old growth habitat in Compartment 711 would decline to 5.3 percent, well below the recommended 8 to 10 percent needed to support old growth dependent species. Loss of effective old growth habitat would decrease abundance and diversity of old growth associated species and lead to a decline in biodiversity in Compartment 711 for the short-term and possibly long-term. Impacts to effective old growth habitat under Alternative II would be significant.

Wildlife Species

Wildlife Species in General. Alternative II would negatively impact wildlife by displacement, restriction in use of habitat and travel corridors, increased disturbance and mortality, and direct habitat loss.

Mine-related noises and activities, increased road traffic, and increased human presence would cause some wildlife to leave the area. Displaced animals could suffer reduced vigor due to the stress associated with being displaced or if the animals were displaced into less suitable habitat. Where unoccupied suitable replacement habitat was not available, eventual mortality could occur. Most wildlife populations are habitat-limited. Thus, mortality is the typical fate of displaced animals because they are at a competitive disadvantage with individuals already occupying suitable habitat.

Rock Creek is a travel corridor for numerous species. The mill site, increased road widths, new utility corridors, and increased traffic levels would decrease effectiveness of Rock Creek drainage as a travel corridor and could inhibit movement.

The proposed project would result in a higher occurrence of wildlife-vehicular collisions. Under the proposed project, FDR No. 150 would be paved and upgraded. Traffic would increase 22 to 28 times the existing level on FDR No. 150 and 30 percent on Montana Highway 200 (see Transportation).

Several key indirect impacts to wildlife would occur. The most significant effect on all wildlife species as a whole is the increase in human developments as a result of mine-related employment. The loss of wildlife habitat effectiveness in the Bull River and Lower Clark Fork valleys as housing increases, commercial establishments grow, access roads increase, and pets, especially dogs, roam, will amount to far more than the direct loss of habitat within the project area. Increased hunting pressure, poaching and disturbance to wildlife would result from the increased access and human population associated with the proposed project. More hunters and recreationists would be able to access areas currently difficult to reach because FDR No. 150 would be upgraded and maintained for year-round use (see Recreation). As a result, more human activity would occur during all seasons. This human-caused disturbance could decrease wildlife health and vitality, which may decrease reproduction. Wintering animals would be especially sensitive to increased human presence.

The amount of any illegal taking of wildlife is difficult to determine and predict. Recent mine-related poaching occurrences in Libby provide some insight into potential problems. In 1990, a total of 14 separate charges were brought against five subcontractors of Noranda Mineral Company for poaching 11 big game animals on the Montanore project site (pers. comm. MacLong, MFWP with Al Bratkovich, USFS, 1990). While measures would be taken to reduce poaching potential, some poaching would inevitably occur.

Impacts to wildlife species in general under Alternative II could be significant for some species.

Forest Service Sensitive Wildlife Species. Alternative II would impact five sensitive species. Of these, the harlequin duck would be the most directly and significantly affected. Alternative II would have minor to less than significant effects on four sensitive species: wolverine, fisher, boreal owl and Coeur d'Alene salamander. The remaining sensitive species (flammulated owl, black-backed woodpecker, Townsend's big-eared bat, northern bog lemming) would not be affected.

The draft EIS determined that harlequin duck, fisher, lynx, wolverine, Townsend's big-eared bats, and black-backed woodpeckers would be significantly to slightly affected by Alternative II; new information is included below in the species accounts. Lynx has been moved to the Threatened and Endangered Species section. Potential effects on the boreal and flammulated owls could not be determined at the writing of the draft EIS. These two species have been included in the individual species account below.

Forest Service sensitive species generally would be affected by the proposed project in a similar manner as previously described in Wildlife Species in General.

Harlequin Duck. Harlequin ducks, especially breeding females, avoid areas with human activities (Reel, Schassberger, and Ruediger 1989). Increased mine-related noise levels and activity, such as the greatly increased traffic along FDR No. 150, and increase of human use on Rock Creek likely would create intolerable levels of disturbance for the harlequin duck. Noise studies completed by the applicant after publication of the draft EIS indicate that noise from a single large ore truck passing along the road, even attempting to make noise for study purposes, is not likely to be heard above ambient stream noise in vegetated areas (Parker 1996). The majority of the noise disturbance pertinent to harlequins would be from the portion of FDR No. 150B where the road is very close to the creek in sections 27 and 28. The creek is visible from FDR No. 150B at several locations, which would be a visual disturbance even if noise was minimally heard. This area has been shown by monitoring to be key harlequin duck breeding habitat, so the greatest disturbance for this species would be in their most important habitat.

Noise may not be a major concern for harlequin ducks because of their tendency to occupy habitats with high ambient noise levels, such as turbulent mountain streams or crashing surfs. Some researchers believe noise is not an issue for this reason (pers. comm. Francis Cassirer, IDFG, and Beth MacCallum, Bighorn Environmental Design, with Sandy Jacobson, July 9, 1998), but that the presence of people along streams is a greater disturbance. Noise as disturbance includes vibration, which probably transmits differently through stream substrates than noise itself. MacCallum (ibid 1998) reports that vibration is not likely a concern based on banded harlequins using culverts under bridges even while traffic is on the bridges.

Disturbance from mine-related activity could result in harlequin ducks abandoning Rock Creek as a breeding area. The ducks may not successfully relocate or be displaced to adjacent streams because of their strong fidelity to traditional areas. Indeed, only one incidence of long-distance (i.e. 50 km) movement of a female from her natal stream has been documented; this occurred on one of the drainages used by the Lower Clark Fork subpopulation with a hen banded near Lake Pend Oreille, Idaho (Reichel 1997).

Some harlequin habitat near or in the riparian zone could be altered or destroyed. Short-term reduction of water quality would occur during construction. Should this affect aquatic insect populations (see Aquatics/Fisheries), the main food base for harlequins could be reduced for short durations.

Although the probability of a spill of mill reagents or petroleum products or a pipeline rupture is remote, it has the potential to be extremely damaging to harlequin ducks. The applicant has developed a spill plan (Hydrometrics 1997a) to manage the risk of this occurrence. Harlequin ducks would be affected by some types of materials more than others. These would be any that affected the long-term productivity of Rock Creek, or short-term toxicity during the breeding season. There are four risk factors to consider for harlequins: (1) the risk that a spill would contain either of the hazardous materials types noted above, (2) the risk of a spill entering Rock Creek, (3) the risk that it would be during the time of year that harlequins are present (approximately April through August) or that the effect would remain through that period, and (4) the risk that cleanup procedures would be ineffective. The joint probability of these occurring is extremely remote.

Should one of these spills occur, a loss of at least one breeding season's productivity or possibly the adult females may occur. Loss of the adult breeding females would be significant primarily because of the site fidelity noted above. If stream productivity was not compromised for more than one breeding season, or only the young were affected, the loss may depress the Lower Clark Fork subpopulation in a similar way as a normal non-productive breeding season. It is unknown how many poor production years the Lower Clark Fork subpopulation can tolerate and remain viable, but it is not likely to be many because of the low numbers. Combined with the disturbance factors, the Rock Creek breeders would probably experience significant loss of vigor. The proximity of FDR No. 150B would increase the probability of a spill or pipeline rupture affecting harlequin ducks.

Disturbance and the subsequent loss of some effective harlequin habitat along Rock Creek would last for 35 years (from mine construction through operation and reclamation). While effective harlequin habitat may occur after mine-related disturbances end, harlequins probably would not return to or recolonize Rock Creek without extraordinary measures to reintroduce them. This is because the knowledge of Rock Creek as a breeding area would end with the last successful brood of harlequins raised in Rock Creek and colonization of unoccupied streams is likely a rare event (Reichel and Genter 1995).

The indirect effect of increased human population around the Lower Clark Fork and Bull River valleys is likely to affect the continued viability of harlequins as well. Streams that presently support nesting or foraging harlequins may become more desirable for human development. Similar disturbances on any drainage supporting harlequins are likely to have the same effect as disturbance on Rock Creek, particularly if the disturbance is permanent as in the case of homesite development.

Loss of one of the four breeding areas and the associated decline in recruitment of harlequin ducks could be significant to the lower Clark Fork subpopulation. This would result in the decline and possible elimination of this subpopulation. The loss of the Lower Clark Fork subpopulation would be considered a reduction in range, thus resulting in a trend towards federal listing of harlequin ducks under the Endangered Species Act (pers. comm. Jim Reichel, Montana Natural Heritage Program, Francis Cassirer, IDFG, and Robert Jarvis, Univ. of Oregon, with Sandy Jacobson, December 7, 1996). Impacts to harlequin ducks under Alternative II could be significant.

Fisher. Alternative II would result in a loss of fisher habitat and would increase mortality risks. This could result in a decline of population numbers.

The proposed project would result in a loss of fisher habitat through physical destruction, fragmentation, and a decrease in effectiveness. Loss and degradation of key habitat such as old growth forests, riparian areas, and travel corridors would occur. Habitat reduction would occur for both the short and long terms. Some riparian habitat in the drainage would be effectively lost, and wetlands mitigation for Alternative II would itself destroy some fisher habitat at Borrow Area 3. New analysis indicates that fisher habitat is currently disjunct along Rock Creek, and that a concentration of habitat occurs to the west of the permit area boundary. The direct habitat loss of 28 acres of old growth, by itself, is probably insufficient to significantly reduce fisher numbers in the Rock Creek drainage. This is because it is not the only habitat fishers use, although it is disproportionately important for the habitat components it provides. The numbers of fishers present in the Cabinet Mountains are probably not limited by habitat, based on the amount of habitat available (Johnsen 1996). Suitable fisher habitat in Compartment 711 would increase over time as the large number of younger stands age, such as those managed for replacement old growth.

Rock Creek would likely become a less effective or an ineffective travel corridor because of the increased traffic on FDR No. 150 and direct reduction of fisher habitat. This would reduce movement between drainages to the east and west around the CMW. Reducing fisher movement between drainages is undesirable (Heinemeyer and Jones 1994) and counter-productive to recovery efforts in the Cabinet Mountains. The increase of traffic along FDR No. 150 would primarily affect fisher movement around the base of the CMW, because most of the CMW is too high elevation to provide suitable habitat. The higher elevations tend to be devoid of the continuous mature and older forest that fishers prefer, and the CMW is a barrier to east and west travel. As fisher attempt to travel to other suitable habitat, FDR No. 150 could be a barrier because of disturbance and risk of mortality. Alternative II reduces some riparian habitat useful for travel as well as foraging and denning.

The proposed project might increase mortality risk due to slightly increased direct or incidental trapping from mine-related increased local human population (see Recreation). Because the fisher population is small, loss of individuals could be significant.

Fishers have demonstrated tolerance to moderate degrees of human activity (Heinemeyer and Jones 1994); however, Alternative II would cause high levels of human activity. As a result, fishers could be displaced out of Rock Creek drainage and/or suffer high stress levels that could result in reduced reproductive success.

If fishers were to be displaced from the Rock Creek drainage, they would probably re-establish after mine closure because suitable habitat is widespread around the Rock Creek vicinity and adequate fisher habitat would remain in the drainage. However, low fisher population levels would decrease the opportunity for this re-establishment to occur in the short term. Disturbance would substantially decrease after mine closure, but habitat loss, primarily old growth, would remain over the short term. This habitat loss would be replaced within several decades because the majority of the compartment is either mature or immature sawtimber which will grow into mature and older stands (barring a stand-replacing wildfire).

The indirect effects of the project would cause increased habitat loss for fishers because of the increase in human populations in the Lower Clark Fork and Bull River valleys. Fishers tend to occur in lower elevation, gentle gradient habitat near water, which is desirable for human homesites as well. While fishers may tolerate human activity to some degree, dogs and snowmobile activity associated with otherwise good habitat may reduce population levels.

Alternative II would reduce fisher habitat, increase human disturbance, and increase mortality risks. Alternative II may impact individual fishers, but would not result in a trend towards federal listing under the Endangered Species Act.

Northern Goshawk. Alternative II would produce the greatest amount of direct nesting habitat loss of the action alternatives, at 25 acres, or 4% of the currently suitable stands. All of these acres are in stands that are adjacent to or very near currently open roads, including one stand that follows FDR No. 150B. Therefore, the loss in functional habitat is somewhat less than if the same loss would occur to undisturbed stands, but it remains an impact. This is primarily because the increase in traffic would be considerably more than currently occurs. The type of traffic in Alternative II would be louder than currently, increasing the disturbance level.

Foraging habitat loss occurs as well, generally from the direct loss of habitat as a result of facility construction. The majority of this would be concentrated under the tailings or paste facility. This reduces the effects of habitat fragmentation on loss of foraging habitat because it is all in one location. However, because nesting habitat appears to be limiting in Compartment 211, foraging habitat is not as great an issue as the loss of nesting habitat, and the amount of direct habitat loss in unlikely to be a factor that would render the compartment unsuitable.

The greatest direct and indirect habitat loss in this alternative would be to a large stand at the mill site. The construction of the mill would not only fragment a suitable stand into too small a size to function as a nest stand, but would also expose the remaining portion of the stand to significantly louder disturbance from the mill than it currently experiences. Although foraging habitat would be lost in this alternative, the greatest indirect impact would be from the loss of nesting habitat and the disturbance tot he remaining stands.

Blasting disturbance is not likely to be a major concern in any of the action alternatives because of the distance from suitable habitat and because the majority of the blasting would be muted underground. Blasting noise would probably be responded to similarly to thunderstorm noise as long as the blasters were not visible to the birds.

The evaluation adit is not a concern in any alternative because no currently suitable nesting habitat is nearby.

A possible additional impact to goshawks would be the installation of utility and electrical wires. Direct mortality as a result of goshawks flying into wires is possible. Additional traffic on the paved road could result in greater direct mortality as well because goshawks are known to forage in openings in the trees, which a roadway would provide.

Wolverine. Alternative II has the most impacts to wolverines of all action alternatives. Impacts from Alternative II would be caused by disturbance at the mill site, an increase in disturbance in the CMW, and the increase of human development in the Lower Clark Fork and Bull River valleys causing a loss of remote habitat. Mortality risks from incidental trapping and increased human development would increase due to increased human use and accessibility to habitat.

Most wolverine habitat in Compartment 711 is higher elevation than the area disturbed by the project. Direct habitat loss would only occur at the evaluation adit (maximum of 10 acres). Wolverines are habitat generalists and this quantity of habitat loss is minor. Wolverines are highly mobile, and have occurred in the project area at times in lower elevations, as well as many other areas. These individuals are likely to be transient wolverines. Transient wolverines may be disrupted in travel because of Alternative II mine activities; the two features primarily affecting wolverine travel are activity at the mill site because it is close to wolverine habitat, and the increased number of vehicles on FDR No. 150. A higher risk of highway mortality may occur with FDR No. 150 at these times. Over a broader area, the increased human development in the Bull River and Lower Clark Fork valleys may cause a more important impediment to travel. Human development is hazardous to wolverines because of the mortality risk associated with dogs, snowmobiles, and increased traffic.

Wolverines are very easily disturbed during the denning period (Copeland 1996: p.2). Denning habitat studied in Idaho was in high snowy cirque basins, similar to many locations in the CMW. Disturbance in late winter and early spring has the most impact. Disturbance is unlikely to increase during the denning season in the CMW because of the inaccessibility of suitable denning habitat. Disturbance from recreationists at other seasons in the CMW may increase, and the effect of increased non-motorized disturbance is unknown. Wolverines occur in areas, such as Glacier National Park, that have a much higher human presence than is expected in the CMW. The response of Glacier's wolverines, or other animals, to human presence should be viewed carefully when compared to that in the CMW because Glacier's wolverines are not exposed to trapping or the potential for shooting. After mine closure, disturbance would substantially decrease from mine operation levels.

The increase in human development as a result of the proposed project is likely to result in an increased risk of mortality from trapping losses or illegal shooting. Trapping mortality is under greater management control than illegal shooting, and can be regulated if numbers reach unacceptable figures. Illegal shooting is probably a rare event, but because wolverine numbers are very low, it can be an important contributor to population declines.

Direct impacts to the wolverine under Alternative II would be minor. Indirect impacts could be potentially moderately significant. Together, Alternative II may impact individual wolverines, but it is not likely to result in a trend towards federal listing under the Endangered Species Act.

Townsend's Big-eared Bat. Alternative II would destroy 584 acres of potential summer roosting and foraging habitat. Additional similar habitat is present in the area making this loss of habitat less than significant. Winter habitat is not expected to be affected. It is not known how mine-related disturbance would affect bats. Because bat winter habitat would not be affected and loss of summer habitat is considered minimal, the proposed project would not be expected to result in the decline of local bat populations. For bats, this determination was based on the loss of summer foraging and possible tree cavity roosting habitat as a direct result of mine development. These biological components are not considered limiting factors, thus the ability for the species to occur in the project area is not considered limited. The Conservation Strategy (Pierson et al. 1999) for Townsend's big-eared bats confirms that tree cavities are rarely used, and that they use a wide variety of habitat for foraging, so direct habitat loss would not affect this species. Potential to create wintering habitat for the Townsend's big-eared bat could occur upon closure of the mine if adit closures were designed to accommodate bats and would benefit bats in general. The proposed project would have no impact on Townsend's big-eared bats or their habitat.

Northern Bog Lemming. Bog lemming habitat occurs only in the East Fork Rock Creek drainage at Rock Creek Meadows and would not be affected by the proposed project. There would be little increased mortality risk. The proposed project would have no impact on northern bog lemmings or their habitat.

Black-backed Woodpecker. The proposed project would not affect the preferred habitat of the black-backed woodpecker, so there would be no impact on this species or its habitat.

Coeur d'Alene Salamander. The proposed project would be required to minimize effects to drainages, which represent the majority of suitable habitat for Coeur d'Alene salamanders. Microsites along FDR No. 150 that may provide limited habitat could potentially be temporarily affected by road reconstruction, although all of the identified suitable habitat is outside of the road base. This species commonly occurs along roadside ditches and cutbanks with suitable habitat on both the Idaho Panhandle and Kootenai National Forests, so road reconstruction does not necessarily mean complete loss of habitat. Some additional mortality may rarely occur due to increased traffic. The proposed project may impact individuals but would not result in a trend towards federal listing under the Endangered Species Act.

Flammulated Owl. None of the action alternatives would affect flammulated owl habitat. Since there is a scarcity of suitable habitat for this species in Compartment 711, it is unlikely that any disturbance effects would occur. Thus, there would be no impact to the flammulated owl from the proposed project.

Boreal Toad. Wetland habitat that boreal toads might use for breeding habitat would be destroyed under Alternative II. However, this species has a broad tolerance for wetland types to use as breeding habitat, and it is likely that the wetlands mitigation would adequately replace breeding habitat. An increase in road mortality is likely to occur with increased traffic, and a loss of nearly all types of habitat would affect individuals to some extent. Assuming that toads are approximately evenly distributed around the general forest at the same elevation, it is likely that the proportion killed on the road, or the habitat lost due to the project's effects, would not result in a trend towards federal listing under the Endangered Species Act.

Northern Leopard Frog. Northern leopard frogs would not be directly affected by habitat loss due to the project, because their habitat occurs outside of the permit area. Indirect effects would be limited to any change in water quality in the Cabinet Gorge Reservoir, which is not expected to occur in measurable quantities (see the hydrologic effects analysis). The project would have no impacts to northern leopard frogs or their habitat.

Peregrine Falcon. Peregrine falcon use along the Clark Fork River drainage would remain a possibility. The suitable nesting habitat would still be available. Since bald eagles and peregrine falcons generally do not co-habit the same nesting territory, and since there is an existing bald eagle nest site within 1/3 mile of suitable peregrine falcon nesting habitat, the likelihood of a nesting pair moving into the area remains only fair. The use of the area by migrating peregrines could still occur. Indirect impacts to the peregrine from heavy metals found in prey (fish-eating waterfowl) would be a low risk. Alternative II is not likely to adversely affect the peregrine falcon because all potential nesting habitat is kept intact, potential food sources remain available, and there is no known use in the project area.

Forest Service Management Indicator Species. Four of the eight management indicator species (mountain goat, white-tailed deer, elk, and pileated woodpecker) are discussed below; the others are discussed under Threatened and Endangered Species. The four management indicator species would be affected by the proposed project in a similar manner as that previously described in General Impacts to Wildlife. Alternative II could have substantial impacts to pileated woodpeckers and mountain goats. As indicators of old growth, snag, or cavity habitat and alpine habitat, respectively, the effects on these species could be used to gauge effects on those habitats.

Mountain Goats. The overall effect of Alternative II could be a decline of the Rock Peak goat herd. The only direct impact of the mine would be a minor habitat loss at the evaluation adit and ventilation adit. Indirect effects would have a much greater impact. Indirect effects include disturbance from mine activities, primarily during the construction phase, that displaces goats from suitable habitat or reduces their ability to effectively use the available habitat. This could decrease reproductive rate and increase mortality. The most important mine-related impact to mountain goats would be disturbance resulting from increasing human use in the Rock Creek drainage and the CMW. Because mountain goats have a relatively low reproductive rate, disturbance and increased mortality from increased poaching and hunting could have negative impacts on the goat population.

Direct habitat removal would be minor. Eight acres of mountain goat Situation 1 summer/ transitory habitat would be lost, (less than 1 acre at the wilderness ventilation adit and about 7 acres at the evaluation adit site). Development of the mill site and transportation/facilities corridor would result in the destruction of about 14 acres of mountain goat Situation 3 range, most of which is not currently used by goats.

Alternative II of the proposed project would result overall in the greatest habitat effectiveness loss of the action alternatives. Table 4-37 portrays impacts to goat habitat from mine-related noise disturbance. During the relatively short period of construction, 495 acres of Situation 1 summer/transition habitat and 393 acres of Situation 3 summer/transition habitat would become less effective because of mine-related disturbance. Joslin (1980) recommended that activities in Situation 1 mountain goat habitat should not occur longer than one year in order to avoid disruption of traditional use patterns. The construction phase is expected to take approximately one year, thus it is at the outer edge of the longest recommended duration for intensive activities. During operation, 29 acres of Situation 1 and 501 acres of Situation 3 habitat would become less effective because of mine-related disturbance. No winter habitat would be affected by mine-related disturbance for any alternative. Goats likely would suffer increased stress levels from disturbance during construction and operation that could result in a decline in reproductive rates.

Increased human population growth attributable to the mine in the Lower Clark Fork and Bull River valleys would result in more disturbances due to increased recreation and increased mortality from hunting and poaching. Disturbance would be facilitated by the proposed road improvements and year-round access. The disturbance would be greatest during the one year evaluation adit construction period when both the FDR No. 150 and 2741 would remain open year round. These indirect effects, which would extend beyond Rock Creek drainage, could have great impact on goat populations (Geist 1975; Joslin 1980; Joslin 1986; Rice and Benson 1984).

Displacement from suitable habitat is one likely result of increased disturbance. It is not known if suitable habitat exists to accommodate displaced goats. The larger historic population numbers of goats implies that at one time suitable habitat existed to support more goats than now exists. The reasons for unoccupied habitat today may be the same reasons the proposed project may impact goats, that is, disturbance and increased mortality resulting from an increase in human population.

After mine closure, recolonization of habitat likely would take a long time. Displacing goats from traditional habitat for 30-to-35-years could result in habitat use information not being passed on to new generations. The long-term effects of displacement could be the loss of goat herd occurrence or abundance in Rock Creek, Copper Lake Basin, and adjacent areas for greater than 35 years unless reintroduction efforts are made. Reintroduction efforts with mountain goats have been successful, particularly if overhunting has ceased (pers. comm. Dave Spicer, IDFG, with Sandy Jacobson, July 29, 1997).

TABLE 4-37
Alternative Effects on Mountain Goat Habitat From Road and Construction Activities

Habitat	Total Acres	Existing Condition	Alt. II			Alt. III			Alt. IV			Alt.V		
		Eff Acres (%)	Eff Acres (%)	Ac Aff	Change	Eff Acre (%)	Ac Aff	Change	Eff Acres (%)	Ac Aff	Change	Eff Acres (%)	Ac Aff	Change
Summer Transition 1	8,652	7,869 (91)												
Construction Phase			7,374 (85)	1,278	-495	7,475 (86)	1,177	-394	7,500 (87)	1,152	-369	7,396 (86)	1,256	-473
Operations Phase			7,840 (91)	812	-29	8,075 (93)	577	+206	7,960 (92)	692	+91	7,811 (90)	841	-58
Summer Transition 3	18,892	12,806 (68)												
Construction Phase			12,441 (66)	6,451	-393	12,886 (68)	6,006	+80	12,185 (64)	6,707	-621	12,658 (67)	6,234	-148
Operations Phase			12,313 (65)	6,579	-493	12,838 (68)	6,054	+32	12,743 (67)	6,149	-63	13,264 (70)	5,628	+458
Winter 1	669	669 (100)	No Change			No Change			No Change			No Change		
Winter 2	173	173 (100)	No Change			No Change			No Change			No Change		
TOTAL CHANGE FROM EXISTING			Construction Phase		-888	Construction Phase		-314	Construction Phase		-990	Construction Phase		-621
			Operations Phase		-522	Operations Phase		+238	Operations Phase		+28	Operations Phase		+549

Notes: Construction Phase conditions - open roads buffered by 1/4 mile; sites buffered by 1 mile; ventilation adit buffered by 1,200 feet for Alternative II and 100 feet for Alternatives III, IV, and V.
Operations phase conditions - open roads buffered by 1/4 mile; sites buffered by ½ mile; ventilation adit buffered by 1,200 feet for Alternative II and 100 feet for Alternatives III, IV, and V.
Ac - Acres
Eff - Effective/Effectiveness
Aff - Affected
Total Acres - Mountain goat analysis area includes Compartments 710, 711, & 744.
Change - A negative change in acres from existing conditions indicates a reduction in the number of effective acres because of project effects; whereas a positive change indicates an addition of effective acres.
Total Change From Existing - Total change in acres from existing conditions combines all habitats during either construction or operation phases.

Mortality risks from poaching and legal harvest of goats would probably increase with the greater human accessibility and use of the area. In other goat herds, this has resulted in a marked decline or elimination of goat herds (Foster 1987; Joslin 1986; Phelps, Jamieson and Demarchi 1975). Goats wintering near Rock Creek Meadows would be especially vulnerable to disturbance and increased mortality. Legal harvest of goats is under management control by the Montana Department of Fish, Wildlife and Parks, and could be reduced if goat herd populations indicated a significant decline.

Alternative II could affect the Rock Peak goat herd by direct habitat loss, increased disturbance leading to decreased habitat effectiveness, and increased mortality risks, resulting in a decline in goat numbers.

Elk. The proposed project would result in some elk habitat loss through physical alteration and a decrease in effectiveness. The main elk winter range and the Green Mountain/McKay Creek range would not be directly affected by the proposed project. However, increased mine-related disturbance would reduce habitat effectiveness on several small bull elk wintering areas located near the tailings impoundment, between Miller and Rock Creek, and in scattered areas along Rock Creek. Some elk summer habitat would be made less effective due to increased open road densities, and greater disturbance (see Threatened and Endangered Species section). Open road density would be greatest in Alternative II, and higher than recommended (Thomas 1979). Some elk could be displaced out of the vicinity for 35 years. The proposed project would increase elk mortality risk due to increased traffic and human access and use. Poaching frequency and hunting likely would increase.

White-tailed deer. Direct effects as a result of the proposed project would include physical loss of habitat, displacement, and loss of individuals from the population. The proposed project would increase mortality risk from increased traffic, human use and access, and poaching. The anticipated increases in mortality and habitat loss would not affect white-tailed populations.

Pileated Woodpecker. Alternative II would have a potentially significant effect on the local population of pileated woodpeckers because the relatively low amount of existing old growth in the compartment indicates a marginal amount of habitat is currently present. Fewer acres of old growth would decrease the available effective habitat for this species. This loss of 122 acres of effective old growth may reduce the local habitat threshold for Compartment 711 such that pileated woodpeckers may have a difficult time finding adequate foraging or nesting trees within a spatial area compatible with efficient metabolic requirements. Proportionately, the loss of these acres is small. Pileated woodpeckers are known to commonly forage and successfully reproduce in the compartment (Farmer and Heath, 1987), so the habitat quality is implied to be quite good, if not abundant. This suggests that factors, such as annual weather patterns or wildfire, may have a greater effect on, or conversely may additively affect, the viability of the local population. Impacts to the pileated woodpecker under Alternative II would be potentially the most significant of the action alternatives.

Other Species of Interest. Other species of interest could be affected by the proposed project in a manner similar to that described under Wildlife Species in General. Effects to some species are described below.

Boreal Owl. A maximum of 4 acres of marginally suitable boreal owl habitat would be directly impacted at the evaluation adit. Since there is a scarcity of suitable habitat for this species in Compartment 711, it is unlikely that any disturbance effects would occur. It is unlikely that the loss of 4 acres of marginal habitat would be a determining factor in the presence of owls within the compartment and would not measurably impact this species.

Black Bears. Black bears would be affected by the proposed project by direct habitat loss, disturbance, and an increase in mortality risk. Alternative II would alter or destroy 584 acres of black bear habitat. Additional habitat would be rendered less effective, in approximately the same manner as for grizzly bear (see Threatened and Endangered Species). Black bears respond to road influences less than grizzly bears in spring, and about the same as grizzly bears in fall (Kasworm and Manley 1994), so the use of the grizzly bear Cumulative Effects Model displacement guidelines provides a conservative approach to loss of habitat effectiveness. Habitat lost or rendered ineffective includes key areas such as riparian areas and travel corridors. The proposed project would increase mortality risk from increased traffic, human use and access, hunting, and poaching.

Mule Deer. The proposed project would cause a general loss of mule deer habitat. Critical habitat such as winter ranges would not be affected.

Moose. Moose habitat loss would most prominently occur in the slurry pipeline and road corridor along Rock Creek. Noise and activity disturbance could displace moose out of the area. It is unknown how this could affect the local population.

Mountain Lion. Fluctuations in big game populations affect mountain lions because of their dependence on a prey base such as deer. The proposed project could cause a displacement of some local big game populations and a related mountain lion displacement. If deer are displaced into areas occupied by humans (such as housing development) or if mine-related home building occurred in areas with concentrations of big game, an increase in human-lion encounters could occur. Mortality risks to mountain lions could result from increased potential for vehicle-lion collisions and increased hunting. Increased mortality is not expected to affect mountain lion populations.

Selected Wildlife Groups.

Furbearers and Small Mammals. Furbearers and small mammals would be affected similar to impacts described under General Impacts to Wildlife and other sections such as Forest Service Sensitive Wildlife Species. Impacts to furbearers and small mammals under Alternative II are variable depending on species.

Birds. A variety of songbirds and neotropical migrants would be affected by habitat loss and mortality. Those species associated with old growth would be the most adversely affected. Fragmentation of forested habitats and the increase in open grass-shrub habitats would result in higher populations of those birds preferring open habitats and loss of individuals preferring forested environments. The indirect effect of building mine-related housing would be to eliminate bird habitat.

Raptors would experience a loss of habitat. Primary habitat for great gray owls would remain unchanged. Those raptors associated with specialized habitat, such as old growth and riparian zones, would be negatively affected (see Old Growth). Potential for raptor mortality by powerline electrocution would be minimized by proposed raptor-proofing (Olendorff, Miller and Lehman 1981).

Two of the four game species found by Farmer and Heath (1987) would be affected by the project. The ruffed grouse and blue grouse would suffer habitat loss and increased mortality. Some ruffed grouse habitat would be eliminated during construction of slurry lines and road widening. Hunting pressure of grouse could increase, resulting in a higher mortality. Hunting seasons and bag limits are set by the state, and if declines are high enough to affect population levels, hunting mortality could be adjusted to compensate.

Amphibians and Reptiles. The species in this group most affected by the action alternatives are those associated with the riparian areas, either for breeding or for their entire life cycles. Of these four species (long-toed salamander, Pacific tree frog, tailed frog, boreal toad), the tailed frog is most narrowly tied to riparian areas while the others can breed in small wetlands over a range of elevations and habitat types.

Loss of habitat within the riparian zones would affect individuals of these species by reducing available breeding habitat. Direct mortality may occur during construction activities. Acid rock drainage potential does not appear to be a likely potential impact to amphibians from any action alternative (see Geology). Acidification is implicated in the global decline of amphibians. Siltation of Rock Creek from Alternatives II and III of the project is likely to cause the greatest impact to tailed frogs because of their feeding habits in clear streams (Nussbaum et al. 1983: pg. 150). In the worst case scenario, complete disappearance of tailed frogs from the lower reaches of Rock Creek would not be likely to lead to loss of species viability because the species is widespread. However, it would reduce the biodiversity of Rock Creek.

Species that would be affected by a general loss of habitat would be long-toed salamander, boreal toad, Pacific tree frog, western skink, racer, rubber boa and the two species of garter snakes. All of these species are widespread with habitat requirements found commonly in western Montana forests.

Species not affected by the project would be bull frog, northern leopard frog, rattlesnake, and painted turtles. Three of these species are associated with the Cabinet Gorge Reservoir rather than the permit area. According to the hydrologic effects analysis, the water quality in the reservoir would not be measurably changed from existing condition. The decline of the northern leopard frog may be associated with the presence of the introduced bullfrog in the vicinity, since related frogs have disappeared from similar areas (Nussbaum et al. 1983: pg. 187).

Alternative III

Impacts to biodiversity under Alternative III would be similar to Alternative II with the following exceptions.

Wildlife Habitat/Vegetation

Plant Species of Special Concern. Under Alternative III, all 11 plant populations identified in the permit area could be eliminated (five different species). Suitable habitat for all species of special concern identified in the study area could be destroyed. Impacts would be the same as Alternative II. On site verification studies would be performed during development of preliminary designs to precisely locate KNF sensitive plant populations as well as populations of MNHP plant species of special concern for avoidance. Sterling would be required to do a conservation assessment if wavy moonwort or other sensitive species located during final site surveys and preparation could not be avoided. Whenever the KNF sensitive species list is updated, Sterling would be required to revisit the various surveys conducted within the project area to determine whether or not those species as well as any new MNHP plant species of special concern had been identified and to determine whether or not suitable habitat for any of those species was located within the project area and sites scheduled for disturbance but not yet disturbed. If species were found or if suitable habitat exists, Sterling would need to conduct additional surveys to either relocate the populations previously identified in the surveys or determine whether or not these new species were to be found within the project area and if they would be disturbed. These reports would be submitted to the agencies along with plans, if necessary, for changes to the operating permit needed to avoid disturbance of these species. If avoidance could not be achieved, then a conservation assessment may be required by the Forest Service.

Impacts to plant species of special concern under Alternative III would be greatest in the short term unless known populations could be avoided. If avoidance is not possible more information would be needed to determine long term impacts.

Springs and Seep Habitat/Vegetation. The impacts to habitat and vegetation associated with springs and seeps that may be potentially affected by the proposed action under this alternative is the same as described in Alternative II.

Noxious Weeds. Impacts are similar to Alternative II, except under Alternative III, more acres would be disturbed but revegetation efforts would be improved which would reduce the spread of weeds in affected areas. Risk of increased weed introduction into the CMW would be likely.

Wildlife Habitat/Vegetative Communities. A total of 609 acres would be disturbed under Alternative III which is 24 acres more than Alternative II. Less riparian habitat would be physically lost because pipelines would remain on the east side of Rock Creek until the crossing of FDR No. 150 near Engle Creek. A similar amount of riparian habitat would be rendered ineffective due to noise and activity.

Revegetation plan changes detailed in Chapter 2 would help meet the Agencies' goal for reclamation success, wildlife habitat, and scenic resources (see Chapter 4, Soils and Reclamation and Appendix K). These changes would result in less acreage being in grass and forb cover during the operation of the mine. Less acreage would be highly attractive to species such as big game and bears. Community diversity and successional relationships would be more closely maintained since a wider variety of trees and shrubs would be planted and native grass and forbs would be seeded. Plant succession would begin earlier. The use of locally collected seed and plants would tend to maintain the ecological integrity of the ecosystem.

Effective Old Growth Habitat. Alternative III would result in the direct loss of 17 acres of old growth habitat, and an additional loss of effectiveness of 30 acres. The percentage of effective old growth in Compartment 711 would decline to 5.9 percent. While less old growth would be lost under Alternative III, the same type of effects would occur as described under Alternative II. Impacts to effective old growth habitat under Alternative III would be significant.

Wildlife Species

Wildlife Species in General. Noise impacts from the wilderness adit would be reduced (see Sound).

Animal-vehicle collisions could be reduced by eliminating the use of road salt and by daily removal of road-killed animals (thus removing scavenging opportunities). Sterling's funding of increased law enforcement would reduce impacts to wildlife in general from illegal activities affecting wildlife. This would be particularly important to species such as mountain goats and grizzly bears (refer to those sections for details on impacts from illegal activities such as poaching).

Road closures mitigating effects to grizzly bears would reduce impacts to those species affected by either road-related disturbances or vehicle mortality under Alternative III.

Forest Service Sensitive Wildlife Species.

Fisher. Alternative III would reduce the amount of old growth habitat directly lost to 17 acres. Alternative III may impact individuals, but is unlikely to result in a trend towards federal listing.

Northern Goshawk. Alternative III has only a minor improvement over Alternative II for northern goshawk habitat because the water treatment facility in Alternative II does not remove 6 acres of suitable habitat in Alternative III. Nineteen acres (3% of currently suitable habitat) would be lost in Alternative III. Other impacts would remain as Alternative II.

Peregrine Falcon. Peregrine falcon use along the Clark Fork River drainage would remain a possibility. The suitable nesting habitat would still be available. The likelihood of a nesting pair moving into the area remains only fair. The use of the area by migrating peregrines could still occur. The other effects are the same as Alternative II. Alternative III is not likely to adversely affect the peregrine falcon or its habitat.

Forest Service Management Indicator Species.

Mountain Goats. Reducing fan noise of the ventilation adit in the wilderness would reduce the loss of effectiveness of Situation 1 habitat. The configuration of the mill site under Alternative III (i.e., the noise produced by the mill site would overlap the noise produced by the road) would result in the smallest loss of effectiveness from road and mill disturbance of Situation 1 and Situation 3 habitat during construction. A loss of 394 acres of Situation 1, the most important habitat, is offset somewhat by an increase in effectiveness of Situation 3 habitat by 80 acres because of road closures. During operation, road closures increase effectiveness over existing conditions by 206 acres in Situation 1 and 32 acres in Situation 3 (see Table 4-37). Other indirect effects described in Alternative II remain.

Pileated Woodpecker. Impacts to pileated woodpeckers would be similar to Alternative II although less old growth habitat would be lost (17 acres). The impacts to pileated woodpeckers under Alternative III would be potentially significant.

Alternative IV

Impacts to biodiversity under Alternative IV would be the same as under Alternative III with the following exceptions. Probably the largest difference in impacts result from the change in mill site location to lower down the drainage. This change reduces the amount of FDR No. 150 that would support greatly increased traffic. Acreage disturbed would be lower than the acreage in Alternatives II and III, with a roughly proportional reduction of impact for several species.

Wildlife Habitat/Vegetation

Plant Species of Special Concern. Under Alternative IV, all 11 plant populations identified in the permit area could be lost or affected. Any impacts to KNF sensitive plant species would require study, conservation, or mitigation. Suitable habitat for all species of special concern identified in the study area could be destroyed. The impact would be the same as Alternatives II and III but the mitigations described under Alternative III would help minimize the impact on these plant species.

Springs and Seep Habitat/Vegetation. The impacts to habitat and vegetation associated with springs and seeps that may be potentially affected by the proposed action under this alternative is the same as described in Alternative II.

Noxious Weeds. Under Alternative IV, the mill site relocation would result in 542 acres of disturbance (Table 2-2). This is 42 and 66 acres less disturbance than Alternatives II and III respectively. This reduction in acreage would somewhat limit the spread of noxious weeds. The elimination of traffic to the upper mill site could help limit the introduction of weeds into the CMW.

Wildlife Habitat/Vegetative Communities. The alternative mill site would shift some mill site-related effects (such as habitat loss and noise) from the upper West Fork of Rock Creek to an area near the confluence of the east and west forks of Rock Creek. Proposed vegetation screens at the mill site would reduce the noise impacts to wildlife.

Effective Old Growth Habitat. Alternative IV would result in the direct loss of 11 acres of old growth habitat, and an additional loss of effectiveness of 19 acres. The percentage of effective old growth habitat in Rock Creek Compartment would decline to 6.0 percent. Impacts to old growth habitat under Alternative IV would be moderate.

Wildlife Species

Forest Service Sensitive Wildlife Species

Harlequin Duck. The 300-foot buffer at the mill site would reduce the likelihood of disturbance to harlequin ducks, although this reach of stream is not the most key habitat along Rock Creek. Impacts would remain similar to those described for Alternatives II and III. Alternative IV would be likely to impact individuals and result in a trend towards federal listing under the Endangered Species Act.

Fisher. The loss of less old growth than under Alternatives II and III would result in less impact to this species. Moving the mill site lower in the drainage reduces the disturbance to suitable travel corridors between Rock Creek and the north. Buffers at the mill site reduce disturbance to the travel corridor along the creek. The indirect effect of increased human population, specifically the increase in trapping mortality risk and loss of habitat in the Lower Clark Fork and Bull River valleys, would remain the most important impact. Alternative IV may impact individuals but would not result in a trend towards federal listing under the Endangered Species Act.

Northern Goshawk. Alternative IV has a reduced direct loss of suitable nesting habitat from the previous action alternatives to 1 acre (0.001% of currently suitable habitat). The move of the mill site to a lower location in the drainage retains the value of the stand directly lost in Alternatives II and III to more closely resembling its no action status. The new mill site location does not directly impact habitat, but it is within 0.25 miles of suitable habitat, thus probably increasing the disturbance in this stand to a level unacceptable to nesting goshawks. This stand would be affected by road traffic in Alternatives II and III also, but the presence of the mill site is a larger impact than traffic alone would be. Indirect impacts from disturbance continue to reduce habitat effectiveness at the same stands affected by the previous alternatives.

Peregrine Falcon. Peregrine falcon use along the Clark Fork River drainage would remain a possibility. The suitable nesting habitat would still be available. The likelihood of a nesting pair moving into the area remains only fair. The other affects are the same as Alternative II. The effects determination is the same as Alternative III - not likely to adversely effect.

Forest Service Management Indicator Species.

Mountain Goats. The confluence mill site would be further from summer habitat in the Chicago Peak area. Under Alternative IV, 369 acres of Situation 1 and approximately 621 acres of Situation 3 summer habitat would be affected from mine-related disturbance during the construction phase. During mine operation, proposed closures on FDR No. 2741 would result in an increased habitat effectiveness of 91 acres of Situation 1 from current levels. The proposed closure would decrease mortality risk as well. Alternative IV would result in reduced effectiveness on 63 acres of Situation 3 habitat (see Table 4-37). Other impacts described in Alternative II would remain for Alternative IV.

Elk. The proposed closure of FDR Nos. 2741 and 2285 would reduce open road densities, reducing disturbance to elk.

Pileated Woodpecker. The loss of less old growth than in Alternatives II and III would result in less significant impact to this species. However, the loss still results in an amount of old growth less than minimum Forest Plan standards, which means the threshold for continuation of a local population in Rock Creek may be reached.

Alternative V

Impacts to biodiversity under Alternative V would be the same as Alternative IV with the following exceptions. The largest change would be due to the busing of employees, piping of the concentrate, and closing of FDR No. 150B.

Wildlife Habitat/Vegetation

Plant Species of Special Concern. Impacts to plant species of special concern would be essentially the same as described under Alternatives II through IV. Under Alternative V, all 11 populations of plant species of special concern (five different species) identified in the permit area could be potentially destroyed. Any impacts to the one KNF sensitive plant species would require study, conservation, or mitigation.

Because of the reduction in disturbance acreage in Alternative V over the other action alternatives, as summarized in Table 2-2, the chances of avoidance of several populations is increased. Suitable habitat for all species of special concern identified in the study area could be destroyed. The mitigations described under Alternative III would help to minimize the impacts to these species in the short and long term.

Springs and Seep Habitat/Vegetation. The proposed action under this alternative would have the same affect to springs and seeps as Alternatives II, III, and IV. Because of the added length of the development adits under this alternative would have the potential to affect a greater area in which springs and seeps could be affected if present. The proposed activity may or may not alter the water table and therefore the habitat surrounding a spring or seep. The question of whether or not plant species will be affected by a change in water level and consequent spring or seep habitat as influenced by the Rock Creek mining activity is best answered by relating plant species with water abundance and quality for monitoring and evaluation. The following monitoring plan would be established to evaluate potential impacts to the plant community encompassing the springs and seeps that are in the project area. This mitigation will not directly change the cause of the impact but would assist in determining if such an impact is occurring and scale of such impact.

1. Initiate a survey to identify, document, monitor and evaluate wetland plant communities in non-surface disturbance areas (i.e., high/mid elevation springs and seeps) prior to the construction of the development adits. These wetland plant communities should be identified and monitored for their persistence in relation to ground water diversions associated with mining activities. Surveyed areas, should incorporate the identification of facultative and obligate wetland plants and associated hydrophilic sensitive, threatened and endangered plant species. This information would be related to and coincide with the water quality quantity sampling of springs as discussed in the Water Quality Monitoring Plan, Chapter 4 and Appendix K.
2. A professional botanist/plant ecologist would design survey methodology and protocols.
3. Initial surveys should be semi-permanent and contain site photo points and GPS site locations.
4. Initial surveys should contain basic site descriptors, hydrophilic plant species (facultative and/or obligate) and their relative frequency.

5. One or two indicator hydrophilic plants (obligate) and their relative frequency should be chosen from the initial survey information - trigger plants.
6. A botanist/plant ecologist would gauge observable increases should use trigger plants and associated rapid observational percentage/frequency information or decreases in obligate plant species.
7. Trigger plants will serve as a basic "trigger" to begin additional monitoring in a particular site. Other water quantity and quality information will be used to facilitate or strengthen monitoring decisions.
8. If a change in flow or water quality is noted outside the baseline data for an individual site or set of sites, then a re-evaluation of those potentially affected plant communities would be conducted and documented for comparison against initial survey information. If water quality or flow remain within baseline parameters, then on a five year cycle a survey in areas of current development would be conducted and compared to the initial survey.
9. If, as a result of the proposed action, trigger plant percentages are declining to a level where population numbers may affect reproduction of the species for that site, then the agencies may require additional monitoring effort for the following year. Dependent on a combination of biological variables and/or the severity of plant indicator decline, the agencies can insist on a more in-depth monitoring effort. If a "trigger" plant declines two years in a row, then additional monitoring may be required for the following year.

Noxious Weeds. Impacts from noxious weeds are similar to Alternative II, except under Alternative V fewer acres would be disturbed and revegetation efforts would be improved. The reduction of mine-related traffic would also reduce the transport of weed seed to the mine. These features would reduce the spread of weeds in affected areas. Impacts from noxious weeds under Alternative V would be limited in the short term.

Wildlife Habitat/Vegetation Communities. Under Alternative V, 482 acres (Table 2-2) of wildlife habitat would be physically altered compared with 584 acres in Alternative II. The lower amount of direct habitat loss from Alternative V than for the other action alternatives is a good measure of overall effect, especially when combined with the reduced effect of decreased traffic on FDR No. 150, closure of FDR No. 150B, and decreased loss of old growth. Some riparian habitat loss would continue to reduce the amount and value of this vegetative community important to many species of wildlife. Fragmentation is reduced with Alternative V over the other action alternatives, particularly with respect to old growth, and in the effect of a busy travelway (FDR No. 150). The placement of the evaluation adit support facilities near the tailing paste facility site instead of along FDR No. 150 further up stream and busing of evaluation adit construction workers from the support facilities site to the evaluation adit would reduce disturbance along the reach of Rock Creek closest to the road (FDR No. 150B), because it would reduce the number of vehicles traveling the route. This would reduce disturbance effects to wildlife species in that area compared to the other alternatives. The realignment of the adits with the mill and elimination of the portal site east of FDR No. 150 would have little effect on any wildlife species over the other positions.

Pumping of the concentrate to the rail loadout facility would reduce disturbance effects to wildlife in general.

Effective Old Growth Habitat. The direct loss of old growth habitat in Alternative V of less than 1 acre along FDR No. 150 would minimize the loss of effective old growth; the portion of old growth removed is already marginally effective. The loss of effective old growth occurs when the size or shape of a stand of old growth can no longer function as old growth. Many of the old growth stands in Compartment 711 are currently in this situation. Alternative V does not significantly alter the existing condition. The reduction of traffic along FDR No. 150B increases the effectiveness of the old growth parcel along lower Rock Creek compared with Alternatives II through IV. Closure of a short spur road under Alternative V accounts for the additional acreage of effective old growth.

Wildlife Species

Wildlife Species in General. The effects from Alternative V varies, but generally would be similar to the effect of Alternative IV. Direct habitat loss is least with Alternative V, thus impacts associated with direct habitat loss would be the least of the action alternatives. Disturbance and traffic mortality would be decreased from Alternative IV, and would be the least of the action alternatives. Mitigation proposed for grizzly bear and harlequin ducks would benefit many species. Alternative V is not expected to affect the long-term viability of any of the species in this group.

Monitoring for several species is included in Alternative V (see Appendix K). This includes harlequin ducks, mountain goats, birds, and the effectiveness of road closures.

Forest Service Sensitive Wildlife Species

Harlequin Duck. Alternative V has several features designed to avoid effects of disturbance on harlequin ducks. Disturbance could occur in several forms, including noise, sight, and presence of humans or dogs. The location of disturbance is important as well.

As noted for Alternative II, the presence of increased traffic on the lowest reaches of Rock Creek along FDR No. 150B is in a very sensitive location because of the close proximity of the creek to the road. Alternative V reduces this disturbance to less than existing levels by a considerable amount. The reduction of traffic along this stretch is also important because it is the portion of the road, along with the upper bridge, that road noise would be most likely to cause disturbance to harlequins. The sound disturbance from buses is probably reduced from that of ore trucks, particularly with the required mufflers. The reduction of disturbance along this stretch of road is the single most important factor in avoiding impacts to harlequin ducks from the proposed project. Other design features avoiding impact along this section are the timing restrictions on construction of the pipeline across lower Rock Creek and hauling of waste rock to the paste facility site, vegetation and topographic screening at the paste facility, relocation of the support facilities site within the paste facility footprint, and busing of evaluation construction, and operation workers from this lower location.

Disturbance to harlequins would be possible from activities at the tailings paste facility without mitigation. Vegetative and topographic screening would reduce the impact of this activity both in sight and sound. The construction activities on the paste facility would eventually reach a point where activity is not visible from the creek because of the topography of the paste pile. At this point, no disturbance would be expected regardless of screening.

The busing of mine workers would reduce the effects of disturbance compared to the other action alternatives in several ways. It would funnel people away from FDR No. 150B, and lower Rock Creek, to a parking area where access to the creek is more difficult. It would reduce traffic disturbance along FDR No. 150 and the upper bridge. It would avoid the possibility of some workers stopping along FDR No. 150 for easier access to the creek. Busing of workers would reduce traffic disturbance to a level near what some other harlequin duck populations have successfully tolerated (pers. comm. Jim Reichel, Montana Natural Heritage Program; Francis Cassirer, IDFG, and Robert Jarvis, Univ. of Oregon, with Sandy Jacobson, December 7, 1996).

While busing mine workers would reduce impacts relative to the other action alternatives, the paving of FDR No. 150 would still enable an increased number of recreational visitors to access the road and creek. To mitigate the possible disturbance from this group of people, the road would be designed to discourage stopping (except for emergency purposes) at locations in line of sight of the creek. An additional mitigation item would include vegetation screening for areas of the creek that may become visible from the road from future management actions. Screening of the traffic on the bridge itself during breeding season is proposed as an experimental measure to decrease visibility of vehicles and reduce the possibility of disturbance from vehicle or foot traffic.

If monitoring indicated a mining-related impact to harlequin ducks, then the agencies may consider a temporary closure during harlequin duck breeding season of the area around the upper bridge as a measure to reduce possible disturbance from foot traffic along the creek in this area. The area at the upper bridge is currently a popular camping location. Disturbance during the time overlap of the breeding season and huckleberry picking and camping may have contributed to lack of past breeding success in this reach. Another possible explanation is the typical drying of the creek prior to the end of the breeding season in some stretches. If disturbance is the primary cause of unsuccessful breeding in this area, an area closure could encourage harlequins to use the area more than it is currently used.

Construction disturbance could occur at some locations of the proposed project. To avoid impacts during the construction phase, a limited operating season (from August 1 through March 31) would be imposed on those activities that have the potential to disturb nesting harlequin ducks. This includes road and bridge construction/reconstruction, pipeline and powerline construction, hauling of waste rock from the mine to the paste facility site within line of sight of Rock Creek, mine traffic during reconstruction of FDR 2741, and construction at the paste facility and spill contingency pond.

The risk of a spill of mill reagents, petroleum products or pipeline rupture directly affecting harlequin ducks is discussed in the effects analysis section of Alternative II (see also Aquatics/Fisheries). For Alternative V, the discussion remains valid except that the probability of a spill reaching Rock Creek, particularly the lower section where the majority of harlequin duck use occurs, is much lower. This would result because of the closure of a portion of FDR No. 150B above the paste facility access road, the section of road both closest to the creek and habitat most important to harlequins. The busing of mine employees and the subsequent reduced number of vehicles reduces the risk of a spill from non-freight vehicles from entering Rock Creek. With the presence of a hazardous materials spill plan to rapidly respond to an occurrence, the risk of a spill adversely affecting harlequin ducks is probably lower than the risk faced by other populations near travelways, such as those along the Lochsa River in Idaho. Nevertheless, if all the risk factors combined in a joint probability of occurrence and a spill did occur that adversely affected harlequins, their loss would be extremely damaging to the viability of the subpopulation.

Direct toxicity to harlequins from a spill of mill reagents into Rock Creek is an extremely remote risk because of the few occasions when spills would be likely to occur. Less than one trip of mill reagents per month would cross any portion of Rock Creek (pers. comm. Dave Parker, ASARCO, with Sandy Jacobson, October 23, 1997), or an average of fewer than 4 trips during the harlequin duck breeding season. The risk of a spill in the creek could be managed by special transportation restrictions during the crossings.

Water quality concerns for harlequins are of most concern in terms of direct toxicity or toxicity to their primary invertebrate food source. Project impacts from Alternative V appear to have a low probability of affecting invertebrates over the long term (see Aquatics/Fisheries), thus the impact to harlequin ducks from this concern is probably low risk as well. Short term impacts to invertebrates would primarily be a concern to harlequins during breeding season if the depression in numbers was large enough to affect the ability of young harlequins to forage effectively. Since some impacts have the greatest potential to affect invertebrate productivity during the construction phase, and since impacts would be generally of short duration, the breeding season timing restrictions on some construction phase activities would reduce the likelihood of a reduction in invertebrates impacting harlequins.

Changes in surface water flow are an issue for harlequin ducks because Rock Creek has segments that may dry up prior to the end of breeding season. This adversely affects the productivity of this stream because some otherwise suitable reaches are fragmented by dry stretches that ducklings have great difficulty crossing. Thus, any decrease in water flow during the latter portion of the breeding season, or substantial increases in water flow during the peak spring run-off, would adversely affect the ability of Rock Creek to produce young harlequins for the year in which the effect occurred. The effects analysis for Alternative V determined that water flow in Rock Creek would not change to an extent that is likely to adversely impact harlequin ducks.

Indirect effects to harlequin ducks are extremely important because of the very low numbers of breeding pairs in the Lower Clark Fork subpopulation. The indirect effects explored for Alternative II apply to Alternative V as well. The importance of maintaining breeding groups at all four streams in the Lower Clark Fork subpopulation is that each stream can provide a reservoir for individuals to repopulate any of the other streams. The total number of young produced during any given year in the subpopulation is low enough that stochastic events, such as a 100-year storm event could quite readily destroy an entire season's production of young birds. If the Rock Creek breeding harlequins were removed (amounting to approximately 25% of the subpopulation's breeding harlequins), it would affect the ability of the other streams to maintain adequate numbers because it would reduce the buffer of both young produced and experienced breeders. Likewise, if any of the other streams became unable to support breeding harlequins, it would affect not only their ability to contribute to the subpopulation but would also affect their ability to serve as a long-term reservoir in the event that design features and mitigations of Alternative V were unsuccessful at maintaining a short- or long-term breeding presence on Rock Creek. Thus, it is critical that all four breeding streams in the Lower Clark Fork subpopulation be maintained at sufficient habitat quality and quantity to ensure continued breeding at each.

It is possible that the number of individuals currently breeding in the subpopulation is below the minimum necessary to maintain a long-term subpopulation, regardless of any effects of the proposed project. However, because the subpopulation has had stable, if very low, numbers over several years of monitoring (Cassirer et al. 1996), it appears the subpopulation is on the lower edge of viability rather than below minimum, at least for the present.

With the implementation of the above design features and mitigations of Alternative V, the direct effects of the proposed project would be reduced or mitigated to the extent that Alternative V is not likely to adversely impact harlequin ducks or their habitat, either in the short or long term. If mitigation as described in the Wildlife Mitigation Plan for Alternative V in Chapter 2 is implemented, the indirect effects of a mine-related increase in human development would be adequately mitigated such that the project may impact individuals but would not be likely to result in a trend towards federal listing of harlequin ducks under the Endangered Species Act.

Fisher. The direct loss of less than 1 acre of old growth in Alternative V would be essentially unmeasurable in its effect on fisher. As with Alternative IV, the loss of other habitat would likely affect fisher somewhat less than the loss of old growth because most of this species' habitat component needs are present in old growth. The loss of some fisher habitat would remain with Alternative V, but as stated for the other alternatives this amount would not be enough to limit fisher recovery. The reduced amount of total direct habitat loss would have less effect under Alternative V than under the other action alternatives.

The considerable decrease in traffic along FDR No. 150 due to busing of mine employees decreases the risk of mortality from vehicle collisions and decreases the effect of the road as a barrier to fisher movement, particularly if suitable crossings were designed into the road (see Wildlife Mitigation Plan in Chapter 2, Alternative V). Reduced traffic along FDR No. 150B would reduce possible disturbance along the riparian corridor. Other mitigation items designed to reduce disturbance to the creek would likely benefit fisher as well.

The indirect effect of increased human population, specifically the increase in trapping mortality risk and loss of habitat in the Lower Clark Fork and Bull River valleys, would remain the most important impact. That portion of this effect directly attributable to the Rock Creek mine would likely be mitigated by the land acquisition or easements proposed as mitigation for harlequin ducks and grizzly bears. With the proposed mitigation, Alternative V may impact individual fishers but would not result in a trend towards federal listing under the Endangered Species Act.

Direct habitat loss for wolverines remains minimal at the evaluation adit; this amount is not substantial in proportion to the amount of area wolverines normally cover in an average home range. Mitigation for grizzly bear would more than compensate for this loss through an increased security for suitable wolverine habitat.

The lower mill site location of Alternative V combined with a considerably reduced number of vehicle trips for mine employees reduces the risk of disturbance to wolverines in their primary high elevation habitat. If employees are bused to the mill site instead of using their own vehicles, it is possible that the amount of incidental visits by mine workers to the CMW would be reduced over the number of visits possible otherwise. This may slightly reduce the risk of illegal mortality or disturbance in the wilderness. The greatly reduced number of vehicles reduces the risk of mortality along FDR No. 150 as well. Recreational use in the CMW would continue to be a potential disturbance in this alternative.

Alternative V may impact individual wolverines but is not likely to result in a trend towards federal listing under the Endangered Species Act. This is because the indirect effects above are largely mitigated for, but not completely, and it is conceivable that a transient wolverine would encounter a fatal situation because of the mine's indirect effects.

Northern Goshawk. Alternative V has the least amount of direct nesting habitat loss, with a virtually unmeasurable 0.04 acres removed. This amount of nesting habitat loss would be unnoticeable to a species that prefers large stands of suitable habitat. Foraging habitat loss would be the least of the action alternatives as well because of the least amount of general habitat loss in this alternative.

The indirect effects of disturbance are the least of the action alternatives because of several mitigating design features. The closure of FDR No. 150B would effectively eliminate the disturbance to the west side of one stand of suitable habitat, however, the new paved road on the east side would not be far enough away to completely eliminate any indirect effects. Seasonal closures designed to protect nesting harlequin ducks would also reduce disturbance to nesting goshawks in the important early nesting period. The traffic management plan for Alternative V would reduce the amount of disturbance for three nesting stands below the disturbance level of Alternative IV, but it would remain higher then the no action alternative. Although it is impossible to predict at what level traffic disturbance becomes intolerable to nesting goshawks, it is likely that the amount of traffic in Alternative V would continue to impact the effectiveness of these stands to provide undisturbed nesting conditions. The mill site effects would remain as Alternative IV. The temporary evaluation adit support site would not be present for Alternative V; while this is probably not a great amount of disturbance, the activity would be more impactive than if it were not present.

Utility wire mitigation would reduce the risk of direct mortality from impact with wires.

The level of impact associated with Alternative V may affect individuals but would not be likely to trend the species towards listing under the Endangered Species Act. This is because the direct loss of nesting habitat is very small. Loss of foraging habitat above the existing condition would be measurable but would not be significant, because the number of territories Compartment 211 would be able to support is more likely limited by the number of suitable nesting stands. The loss of foraging habitat under the paste pile would affect probably only one nesting stand cluster because of its concentrated affected area. This nesting stand cluster is near enough to the existing road to have reduced effectiveness at present, and would have disturbance impacts from Alternative V as well. The additional impacts of disturbance attributable to the project would be most pronounced in one nesting stand, at the mill site. In a worst-case scenario, the complete loss of this stand as nesting habitat would not reduce the ability of the compartment to continue to provide habitat for a minimum of five pairs of goshawks (at 150 acres of nesting habitat each considering the configuration of suitable habitat stands in the compartment). Mitigation provided for other species would also reduce disturbance effects in the areas that are mitigated, thus compensating to some degree for the increased disturbance associated with the increased traffic in Compartment 211.

Peregrine Falcon. Peregrine falcon use along the Clark Fork river drainage would remain a possibility. The effects would be the same as Alternative II. Alternative V is not likely to adversely affect the peregrine falcon or its habitat.

Forest Service Management Indicator Species

Mountain Goat. With respect to impacts on mountain goats, Alternative V would primarily differ from Alternative IV in the closure of FDR No. 150 on Government Mountain instead of closure of the upper 1.88 miles of FDR No. 2741, Chicago Peak Road. During mine operation, this would result in an increase in habitat effectiveness from security closures in Situation 3 Summer Transition habitat. During the relatively short construction phase, Alternative V has the greatest impact from disturbance in Situation 1 Summer Transition habitat of the action alternatives except for Alternative II, with effectiveness reduced on 473 acres, or 5% effectiveness. Direct habitat loss at the evaluation adit remains, and as noted for the other alternatives, a minor loss relative to habitat remaining. Mitigation would reduce the mortality risks associated with increased mine-related human development by providing increased law enforcement and monitoring designed to detect possible herd declines in a timely manner.

Situation 1 summer transitional range is not as limited or as critical as winter range, and the disturbance impact is at the outer edge of both the summer transitional range as well as the outer perimeter of the sound effect from the mine's operations. Thus the disturbance from mine operations may impact the movements of individual goats and decrease the reproductive vigor of those individuals, but the majority of the herd is unlikely to be affected by the sound disturbance. Mountain goats are known to habituate to recurrent noise and may eventually reoccur in the area at some point during the operational phase if disturbance initially displaces individuals. The acreage affected during operations is approximately 58 acres more than existing condition or less than a 1 percent change in habitat effectiveness.

Situation 3 summer transitional ranges are important to goats primarily by providing travel corridors. Along with the other action alternatives, Alternative V may impact the ability of suitable travel habitat in the Rock Creek drainage to be effectively used for travel because of the greatly increased use along FDR No. 150 over current levels. FDR Nos. 150 and 2741 are probably affecting the ability of the drainage to be used for travel at the current level. The impact from Alternative V would be considerably less than for the other action alternatives because of the busing of employees and consequent reduction of number of trips. The majority of the project area used by goats would be in the upper elevations, which would be closed after the exploration phase.

Road closures in the Government Mountain area planned for grizzly bear security habitat are entirely within Situation (summer transition) 3 habitat and would produce a moderate amount of security benefit to mountain goats because of the low use of that area by goats. During the operations phase of the project, habitat security is estimated to increase by 458 acres, an increase in habitat effectiveness over existing of 2% (Table 4-37).

Overall, the habitat effectiveness is increased by Alternative V more than the other alternatives (including the no action alternative) during the operations phase, but the majority of the increase is in moderate to low quality summer transition habitat. As with the other alternatives, no change in habitat quality or effectiveness is expected in the more important and restricted winter range.

The increased use of the area accessed by FDR No. 2741 that is expected from recreation traffic (see the Recreation section) would likely affect some of the movements of mountain goats in the vicinity of the trailhead, and use of the area by goats. FDR No. 2741 would be able to be used a short period of time each summer depending on snowpack and temperature, because of the elevation and gradient. The kidding season from mid-May to mid-June would be avoided in most years because of snowpack, however, the trailhead would be accessible when kids were only a month or two old. Most of the observed current goat use is not in the vicinity of the road itself (pers. comm. Wayne Johnson, USFS, with Sandy Jacobson, July 1998), so the road itself would probably not seriously reduce the availability of habitat for goat use. Increased recreation use as a result of increased human population, and as a result of increased knowledge of the area because of the mine construction, may result in displacement of individual mountain goats within the CMW. The increased recreation use of the CMW, including hunting use, would be present at both trailheads in the Rock Creek drainage, and thus may decrease overall use within the portion of the CMW that increased use occurs.

Increased mortality risk from indirect increases in human use of the CMW and other areas goats occupy would continue to occur in Alternative V. In order to mitigate for this effect, increased law enforcement, to reduce the risk of increased illegal mortality on the mountain goat herd, would be provided. (See Wildlife Mitigation Plan for Alternative V in Chapter 2).

Increased legal harvest as an indirect effect of increased human development has the potential to affect population numbers as well. In order to mitigate this possibility, increased monitoring to determine population trends would be funded by Sterling. Projected increased human recreational use of the CMW is another potential impact to goats that would be noted by monitoring. Monitoring would enable the appropriate agencies to determine if management actions, such as implementation of wilderness permit systems, hunting bag limit adjustments, or mountain goat reintroductions, are warranted.

Elk. Alternative V would have the least effect on elk of the action alternatives because of the reduction in open road densities through road closures and reduction of direct habitat loss. The mitigation proposed for grizzly bear would benefit elk, and would substantially mitigate impacts to elk except for the loss of winter range.

White-tailed Deer. Reduced traffic on FDR No. 150 would result in the most important reduction of impact to white-tailed deer because it would reduce traffic mortality.

Pileated Woodpecker. The loss of less than one acre of old growth habitat, representing 0.1% of the current habitat, is probably immeasurable in its effect on pileated woodpeckers. As noted in earlier sections, the amount of old growth in Compartment 711 is already low enough that continued breeding presence of this species is probably marginal. Thus, Alternative V is very similar to the no action alternative in its effect on this species. There may be some increased disturbance from the additional expected traffic associated with the proposed project, which may be partially compensated by the closure of FDR No. 150B. Some of the affected habitat is currently reduced in effectiveness, so this additional possible reduction would probably not be substantial in its effect on this species.

Other Species of Interest. Other species of interest could be affected by the proposed project in a manner similar to that described under Wildlife Species in General. Effects to some species are described below.

Black Bear. The effects of Alternative V on black bear would be similar to, but less than, the effects on grizzly bear (see Threatened and Endangered Species). As with other game species, the expected increased legal harvest is under management control and is expected to remain within limits designed to maintain a harvestable population. The effects of increased illegal mortality would be partially compensable because of these legal harvest limit controls, and additional enforcement personnel provided as mitigation by Sterling should help reduce the number of illegal incidents. The habitat mitigation proposed for grizzly bears would benefit black bears as well. Thus, the effects of Alternative V on black bear would be greater than the no action alternative but the least of the action alternatives.

Mule Deer. Alternative V would have similar effects to the other action alternatives, except that the reduced traffic from busing would reduce the mortality risk associated with increased traffic on FDR No. 150.

Moose. Compared to the other action alternatives, Alternative V would result in the least amount of direct habitat loss. The closure of FDR No. 150B would be a benefit over current conditions because the habitat present along lower Rock Creek would have a reduction in disturbance. This benefit might be offset by the general increase in activity for the proposed project in general.

Selected Wildlife Groups.

Furbearers and Small Mammals. The effects to this group of species from Alternative V would vary, but generally would be similar to the effect of Alternative IV. Direct habitat loss is least with Alternative V, thus impacts associated with direct habitat loss to this group would be the least of the action alternatives. Disturbance and traffic mortality would be decreased from Alternative IV, and would be the least of the action alternatives. Mitigation proposed for grizzly bear and harlequin ducks would benefit small mammals. The proposed project is not expected to affect the long-term viability of any of the species in this group.

Birds. Resident and neotropical songbirds would be most affected by habitat loss of old growth, the most limiting of the habitats within the project area (other than wetlands, which are discussed in Wetlands and Non-wetland Waters of the U.S.). Alternative V would have the least impact on old growth of the action alternatives, and would be substantially similar to the no action alternative on this group of species. Alternative V would result in the least amount of direct habitat loss between the action alternatives. Night migrating birds may be at risk for collision mortalities with the mill site because of attraction to lights, but this risk is readily mitigable with appropriate mill site design (see Wildlife Mitigation Plan in Chapter 2).

Raptors would be least affected by Alternative V of the action alternatives. The loss of less than 1 acre of old growth is not likely measurable in its effect on raptors associated with older seral stages (such as goshawks). The reduction of disturbance along the lower FDR No. 150B would be a benefit over current conditions, possibly counteracted by the smaller increase in traffic along the remainder of FDR No. 150 between Montana Highway 200 and the confluence mill site compared to Alternatives II through IV.

Grouse would not be affected by Alternative V substantially differently than the other action alternatives, except for the lower amount of habitat loss. Birds would continue to be monitored under existing monitoring programs.

Amphibians and Reptiles. A lower amount of direct habitat loss would occur for Alternative V than for the other action alternatives. The magnitude of the effect on this group of species is unknown, however, the mitigation of wetlands is probably the most important factor in the effects of the alternatives. The species most likely adversely affected by the project would be tailed frog, because of its sensitivity to stream sedimentation and specialized dependence on riparian habitat. Alternative V has the least potential for increasing sedimentation of the action alternatives, so it would have the least impact on this species. Although the status of this widespread species is not well understood, the change from existing conditions under Alternative V would be unlikely to affect the species as a whole while still possibly impacting individuals. Fishless Copper and Cliff provide habitat for long-toed salamander reproduction. Alternative V incorporates mitigation for wetlands and requires development of a contingency plan for wilderness lakes and wetlands which would reduce any impact to amphibians as a group.

Reptiles are likely to be less affected than amphibians because their habitat, by and large, is not as restricted as the mesic habitats favored by amphibians. However, a reduction in salamanders would affect garter snakes, their main food source. No special habitats are affected by the project that are not widely present elsewhere in the compartment. Alternative V is not expected to affect the viability of any reptile species in the project area.

Cumulative Impacts

Cumulative effects are those which are greater when considered together with other impacts than when considered alone. Activities or factors that would have a greater impact to wildlife and plant species when considered together than alone are the increased human development beyond normal regional growth, the Montanore mine, timber sales within Compartment 711, and the loss of old growth on private and public lands. Increased human development also leads to loss of elk winter range, loss of habitat, increased traffic mortality and travel barriers.

Increased Regional Growth

This is by far the most important cumulative effect because it affects the most number of plant and animal species and is the most difficult to control. The intermountain west is a growing region, and human population will continue to reduce wildlife habitat in many locations, such as the Bull River Valley, that are now nearly pristine and relatively undeveloped. The effects of the proposed project and other regional activities to increase economic growth are likely to increase the rate of this growth many years before it would normally occur. It is probable that effects to wildlife and plants would occur at any point the regional human population reaches a certain point, regardless of whether that increase is created by the mine or not. Many animal species would find it difficult to coexist in locations with noisy houses, carnivorous pets such as cats and dogs (especially allowed to run untethered), and winter snowmobiling. The land used by houses is an irreversible and irretrievable commitment of wildlife habitat resources except in rare cases. Plant species of special concern as well as general plant species diversity could be cumulatively affected due to loss of plant populations or suitable habitat from construction of houses, roads, and other human developments. The increase in disturbed lands would also allow for the increased spread of noxious weeds in the region.

Loss of elk winter range. Loss of winter range is occurring throughout the range of elk, through increased human development, increased livestock use, or direct habitat loss. Although several organizations, including the US Forest Service, are attempting to improve winter range in an effort to counteract the trend, the loss is an important population limiter. Cumulatively, the loss of winter range would not affect the species' viability but it may limit hunter opportunities. Noxious weeds would increase and reduce forage potential on winter range as well.

Direct habitat loss. The loss of habitat to mine development is cumulatively added to the loss of wildlife habitat throughout the area from other human developments such as parking lots, dams or buildings. There is no unique habitat in Compartment 711 that would indicate any particular animal or plant species is cumulatively at risk because of the loss of habitat for mine development.

Highway traffic mortality. An overall increase in human population is accompanied by increased highway traffic. The cumulative effect of this increased traffic along with the proposed project's expected traffic increase would be to make highway crossings by wildlife a more hazardous situation. Probably more important would be the inevitable increase in width and standards with highway reconstruction which would facilitate faster auto travel, which would lead to even fewer safe crossing opportunities. The wildlife species most adversely affected by this would be the rare but wide-ranging ones such as wolverine, lynx and fisher, and the large ungulates.

Highway travel barriers. Increased highway and road widths provide a physical barrier to many species, which decreases their dispersal capability. This affects non-mobile species such as small mammals, reptiles and amphibians. Techniques are available to reduce the effect of roads and highways as barriers to wildlife movement, but they are not universally applied.

Montanore Mine

The Montanore mine would have the most direct cumulative effect on mountain goats, because individual goats use areas on both sides of the Cabinet Mountains near the mines. Part of the Rock Peak mountain goat herd uses the head of Libby and Ramsey creeks during the summer, habitat near Rock Creek Meadows in winter, and habitat between these locations. Thirty-five years of disturbance caused by two mines could result in a decline of herd abundance, health and occurrence in some traditional ranges. Wolverine, fisher and lynx would be the other species most likely cumulatively affected by the Montanore mine operation. Lynx and wolverine would be cumulatively affected by a reduction in travel and dispersal capabilities because of a reduction in remote areas and a constriction of the CMW. An increased trapping risk from both mines' increase in local human populations would cumulatively increase the risk that trapping could exceed the ability of the three species to maintain population numbers. Although trapping is under management control, the effects on sensitive species may not be noticed until well after the populations have been suppressed. The construction of both mines would increase the opportunity for noxious weeds to invade the CMW from the east and west. There may be some cumulative loss of habitat for some populations of plant species of special concern as well as for general plant species diversity.

Timber Sales

Although timber sales alter habitat for several wildlife species analyzed in this biodiversity section, fisher is the only species likely to be cumulatively affected by the reasonably foreseeable timber sale activity in Compartment 711 (but see loss of old growth section below). Some of the indirect effects of timber sales, such as increased traffic on FDR No. 150, would be insignificant compared to the mine's effects. This cumulative effect would be in the form of loss of current or future suitable habitat. Based on the KNF's forestwide habitat analysis, suitable habitat is probably not limiting fisher. Fishers are slow to recover from extirpated areas even with suitable habitat (Ruggiero et al. 1994). Timber sales within the Rock Creek drainage could cumulatively impact habitats for and populations of plant species of special concern as well as increase the potential for the spread of noxious weeds in the drainage. Overall, this could affect general plant species diversity.

Loss of Old Growth

Alternatives II through V would directly remove 47 to 1 acres of old growth, respectively. The Montanore project is estimated to disturb approximately 192 acres of protected old growth (MA 13) (U.S. Forest Service et al. 1992). Because the occurrence of old growth habitat is considered to be limited and declining, and is an important habitat component for several sensitive species, the cumulative loss of old growth habitat is an important cumulative effect. Old growth habitat on private lands is at an economic premium and can not be expected to be retained, so the cumulative effect of old growth lost on private and public lands can adversely affect several old growth dependent species, including pileated woodpeckers. This loss can be accumulated if the remnants are too disjunct for recolonization to occur.

Habitat for northern goshawks is being reduced over its range, with nesting habitat being lost on private land at a greater rate than foraging habitat. As a Forest Service sensitive species associated with older stands, goshawks are at minimal risk for loss of nesting or foraging habitat trending towards federal listing. Other mining projects listed as reasonably foreseeable future actions are likely to reduce some habitat indirectly or directly for goshawks, with an unknown total effect. However, the amount of habitat available across the planning unit (the Kootenai National Forest) indicates that the amount of nesting habitat lost would not be significant. Foraging habitat loss is more readily mitigable because it comprises more age classes and structures than does nesting habitat, and so it is unlikely to result in a significant loss.

THREATENED AND ENDANGERED SPECIES

Summary

There is the potential to increase bald eagle mortality along roads used to access the mine or to haul ore. Increased vehicle traffic would result in more animals killed on the roads. Bald eagles would scavenge on the road kill. Eagles would gorge themselves and be unable to gain elevation rapidly when disturbed by an approaching vehicle. Their flight path would be along the road corridor, thus increasing the likelihood of being struck by vehicles. Mortality risk would also increase indirectly for grizzly bear, gray wolf, and bald eagles due to increases in the number of people in the area and the time people are present.

Transient gray wolves, and resident grizzly bear could be displaced, from areas presently or potentially used, by the increased human activity level. With the potential for a large number of people moving into the area to work on the mine, habitat loss for threatened and endangered species could occur due to the need to build new residences. The actual number and locations of these homes are not known but they are likely to be along the Clark Fork and Bull Rivers. These areas are classified as Management Situation 3 habitat for grizzly bear (defined in IGBC 1986 pg. 4). Loss of this habitat may affect corridors between larger blocks of suitable habitat (i.e. East and West Cabinets) within the Cabinet ecosystem. It could also affect the linkage between the Cabinet and Bitterroot ecosystems, however the USFWS has determined that while linkage zones are desirable, they are not essential for delisting at this time (USFWS 1993 pgs. 24-25).

The areas along the Clark Fork and Bull rivers also provide the best bald eagle nesting, foraging, and wintering habitat. Residences may be built close to active nests, resulting in disruption of nesting activity. They could also be built near feeding or wintering sites, which could displace eagles from traditional use areas.

Spring grizzly bear habitat would be reduced by the physical changes required to operate the mine. Grizzly bear habitat effectiveness would be reduced due to the increase in human activity. Planned road closures on federal lands would increase habitat effectiveness for gray wolf and grizzly bear in areas previously open to public use for part or all of the year. The operation of this project, and the associated indirect increase in recreation activity widens the fracture zones in the southern Cabinet Mountains portion of the Cabinet/Yaak grizzly bear recovery zone. This, along with the project sites, increases the mortality risk to grizzly bear. The additional human activity could impact a third of the known grizzlies in the CYE.

Threatened and endangered mitigations would be phased in over the construction period and be in place by the start up of full operations. Grizzly bear mitigation may not prevent incidental taking, therefore all action alternatives may adversely affect the grizzly bear.

There is the potential for sediment produced during mine facilities construction to enter Rock Creek and decrease available spawning habitat. This would reduce current levels of reproduction. Increased sediment levels could also affect eggs and fry survival prior to emergence. There is also a potential for the mine to affect surface water chemistry. Increased metals concentrations could impact bull trout in Rock Creek. Toxicity would be more likely given the soft water condition in Rock Creek.

Additional impacts to Rock Creek and lower Clark Fork River bull trout could be caused by the diffuser, which would be positioned in the lower Clark Fork River directly above Rock Creek. There would be the potential for effluent metals concentrations to deter migratory bull trout from entering Rock Creek or passing upstream beyond the diffuser. This would further affect connectivity and reproduction if water chemistry conditions impede access up Rock Creek or upstream to proposed fish collection facilities adjacent and directly downstream of Noxon Dam.

Though mitigations to reduce project related impacts to bull trout would be implemented with each action alternative, adverse effects to bull trout cannot be totally eliminated. Therefore each action alternative may affect bull trout and would likely adversely affect them. Monitoring would be implemented with each action alternative to track impacts to bull trout and allow for timely operations changes to further reduce impacts to bull trout.

Introduction

Construction and operation of the Rock Creek Mine and associated activities would have direct, indirect and cumulative impacts on some wildlife species that are Federally listed as threatened or endangered. The lynx is proposed for listing as threatened under the ESA and is discussed here. Direct impacts result from on site activities that alter habitat, displace individual animals from habitat they normally use, or affect the productivity, survival, or mortality of the species impacted. Indirect impacts result from those activities that occur off site or at a later time, and are not directly a part of the mine operation. Indirect impacts can also affect productivity, survival, and mortality.

The analysis process used for each species discussed is documented in the Rock Creek Analysis File, which is available at the Kootenai National Forest Supervisor's Office, and summarized in the Biological Assessment and the Lynx Amendment (Appendix B). There are new numbers generated for original models and new models have been used and are included in this final EIS.

The environmental effects displayed in this section are given in detail under the first alternative which caused the impact. Once the effect has been disclosed it is not discussed in subsequent alternatives unless there is a change in the impact.

Alternative I

Bald Eagle. Under the No Action Alternative, bald eagle use along the lower Clark Fork River would continue to increase, as evidenced by the increase in number of nesting pairs found over the past eight years (1988: 0 pairs; 1996: 5 pairs). Mortality risk, due to increased traffic levels, could increase slightly. This is based on average daily traffic (ADT) trends that show a 3.6 percent annual increase in traffic over the past ten years and the potential associated increase (4 percent) in deer and elk mortality. Since there is no suitable nesting or winter roosting habitat in the project area, there would be no change in available habitat conditions. Alternative I would have no adverse effect on the bald eagle or its habitat.

Gray Wolf. Movement of wolves through the project area would still be possible. Since there are no known den or rendezvous sites in the project area and the FDR No. 150 would still be open to public access, there would be no change in the availability of these two components of wolf habitat. Like the bald eagle, a slight increase in mortality risk, associated with increased availability of vehicular killed deer, could occur. The risk to the wolf is low due to very low numbers of wolves in the area. Alternative I would have no effect on the gray wolf or its habitat.

Grizzly Bear. The project area would continue to provide the present amount of spring and fall grizzly habitat. There would be a slight increase in habitat effectiveness (percent of BMU freely available or “uninfluenced”), due to completion of other projects in the BMUs where the Rock Creek Project is proposed. Bear Analysis Area (BAA) 7-4-7 would retain an open road density (ORD) of 0.62 miles per square mile. BAA 7-5-2 would retain a 0.86 mi./sq.mile open road density. BAA 7-6-1 would retain a 0.77 mi./sq.mi. open road density. BMU 4 (62.5 percent in 2000 due to Berray Mountain timber sale), BMU 5 (64.8 percent in 2000 due to Noranda), and BMU 6 (68.0 percent in 2000 due to access of private lands) would not meet the Forest Plan habitat effectiveness standard (70 percent). There would be no increase in total motorized access route density and no decrease in core habitat, thus there would be no incidental take (McMaster 1995). There would be no change in the mortality risk to grizzly bear

(MRI = 163.0). The 'normal' human population growth rate would result in slow recreational use increases in areas like the East Fork Rock Creek trail. This slow rate of increase in human activity is likely to allow grizzly bears to adjust their habitat use patterns, thus avoiding conflict and resulting mortality. Alternative I is not likely to adversely affect the grizzly bear or its habitat.

Bull Trout. Resident bull trout in Rock Creek could be harmed if deposited sediment in spawning areas increased. Migratory bull trout, although probably rare in Rock Creek, could also be adversely impacted by deposited sediments in spawning areas. The rarity of the migratory form of bull trout puts the resident bull trout population at greater risk of extinction from random events.

Lynx. Lynx movement through the permit area would still be possible. Foraging habitat would continue to decline as timber stands continue to age and the structure, that provides prey habitat in combination with conditions suitable for lynx hunting, changes. Natural disturbances, such as wild fire, would restore early successional forage habitat, should they occur. Alternative I would have no adverse effect on the lynx or its habitat.

Foraging habitat is less common than denning habitat for the CMW portion nearest the project boundary. Because only a small amount of denning habitat is needed for denning, foraging habitat is likely the limiting factor for lynx in the adjacent CMW as well as for other areas on the forest. Linkages to adjacent national forests and drainages do not appear to be limiting because travel habitat is well represented. Roads have an effect on the ability of animals to use otherwise suitable habitat for travel. In the Rock Creek drainage, suitable habitat is well-connected with a very large tract of habitat along the CMW. The portion of the LMU nearest the Noxon connectivity corridor is primarily travel habitat rather than denning or foraging habitat.

Alternative II

Bald Eagle. No activity is planned within 3.0 air miles of known bald eagle nest sites. Potential perching habitat (larger standing trees or snags) would be removed at the tailings impoundment site. Only a portion of this area is in the USFWS defined (Harms 1992) suitable bald eagle habitat area. Since the tailings impoundment perching habitat is outside the nearest known pair territory, there is no evidence of eagle use in the proposed impoundment area, and there are many acres of this habitat component available in the area, the loss of perching habitat is not significant. The known hunting perch site is within the tailings impoundment disturbance influence zone (½ mile). The increased noise level may cause the eagles to abandon this hunting perch. The likelihood of this happening is low, as evidenced by the use of this site which is adjacent to Highway 200. Many other potential perch trees exist along the river.

Bald eagle foraging is done primarily in the Clark Fork River and associated reservoirs. The degree to which the project could affect the eagle is related to the predicted downstream effects on fish, the primary prey species. Eagles, as the top of the food chain, would be susceptible to accumulation of heavy metals (primarily arsenic and mercury). Based in part on data from the Troy mine, a minor increase in some toxic metals could occur, which can increase stress in aquatic life (see Hydrology and Aquatics/ Fisheries). The likelihood of this happening is low due to negligible potential to form acid (near neutral pH of adit water) and low levels of dissolved metals. This suggests that metal mobility is not a concern (Schafer & Associates 1997). Metal levels would remain below Montana cold-water aquatic life standards.

The main source of heavy metals would come from a tailings impoundment failure. While the likelihood of failure is low, the proposed design only adequately addresses 3 out of 4 failure modes. The level of failure risk from earthquake-induced liquification was not acceptable to reviewing agencies. In the event of failure, the lower one mile of Rock Creek would be impacted the most, due to low flows. The Clark Fork River contains harder water which is less sensitive to metals pollution. In addition the substantially larger flow of the Clark Fork River provides significant potential for dilution of metals. The downstream impacts to aquatic life, from metals loading into the Clark Fork River and Lake Pend Oreille, would be negligible. Therefore, impacts (due to heavy metals) to the bald eagle would be negligible in both the short and long term.

A reduction in prey (e.g., fish) abundance could indirectly affect bald eagles. Sediment and nitrogen loads would temporarily increase, thus impacting aquatic invertebrates which could impact fish (see Hydrology and Aquatics/Fisheries). The downstream impact is negligible. While nitrogen loads will increase (actual level too small to measure), the state has established maximum discharge levels which will be met, with the result that nitrogen levels would remain below Montana cold-water aquatic life standards. The resultant indirect effect to bald eagles would also be negligible.

Since there is no suitable nesting or winter roost habitat in the project area, there would be no change in these habitat components. Foraging habitat along Highway 200, FDR 150, and the train tracks would potentially increase due to an expected increase in deer mortality (potential 86% increase) from vehicle (minimum 30% increase on Highway 200 and 2800% on FDR 150) and train traffic needed for the proposed project. The increased food source could result in an increase in mortality risk to bald eagles scavenging on road kill. The likelihood of this happening is low.

An indirect effect results from additional housing needs for mine employees. In general, housing development occurs within one mile of the Clark Fork and Bull Rivers. Since this area is potential bald eagle habitat, new housing construction could physically alter bald eagle habitat. An estimated 150 acres (see Socioeconomic) could be developed, thus reducing bald eagle habitat on a portion of these acres. Because the actual level of hiring residents verses nonresidents in unknown and the site specific locations of construction activities are also unknown, the actual impacts from housing construction on bald eagle habitat are unquantified. No mitigation is planned for this indirect effect. This is because the recovery goals for Zone 7 are being met, and even exceeded by the present zone eagle population. Therefore, this potential minor habitat loss would not adversely affect the population.

Based on the low likelihood of adverse impacts, bald eagle use along the Clark Fork River is expected to remain stable or continue increasing as evidenced by the increase in nesting pairs over the past 8 years (from none to 6), until all 10 of the potential breeding areas are occupied.

Alternative II is not likely to adversely effect the bald eagle or its habitat based on: (1) distance to nearest nest site is greater than 2.5 miles (nesting territory radius), (2) lack of winter roost or nesting habitat impacted by the project, (3) low risk of long term effects from metals, (4) low risk of catastrophic collapse of tailing impoundment, and (5) existing population is meeting recovery goals and is expected to show a continuing upward trend.

Gray Wolf. The increase in human activity (continuous mine operations 7 days a week for up to 35.5 years) would effectively eliminate the suitability of the stream bottom portion of Rock Creek for use by wolves. The increased potential for human/wolf encounters would result in a greater mortality risk for wolves entering the Rock Creek drainage. Mortality risk could also be increased due to the potential availability of a greater number of vehicle killed deer or elk (see discussion in Bald Eagle analysis).

Prey base habitat and population potential would remain essentially the same. As there are no known den or rendezvous sites in the planning area and the likelihood of a pack establishing a site is low due to the presence of FDR No. 150, the proposed project would not affect this habitat component. Should wolves attempt to hunt in the area during operations, they would be displaced by mining activities (i.e. mill site, hauling, tailings impoundment work). Displacement habitat would be available (see section on Grizzly Bear). Corridors connecting the project area to displacement habitat would be impacted by the increased traffic levels and perhaps by housing developments (see discussion in Grizzly Bear and Bald Eagle analyses). The reduced corridor effectiveness would primarily be in the corridor between bear analysis areas 7-6-1, 7-5-2 and 7-4-7.

While overall habitat effectiveness for wolf may drop slightly, this alternative is not likely to adversely affect the gray wolf or its habitat. This determination is primarily based on: (1) absence of confirmed wolf sightings in the area, and (2) no known den or rendezvous sites in the area and low potential for their existence in the future.

Grizzly Bear. Habitat would be physically changed by the construction of the mill site, waste water treatment plant, tailings impoundment, utility and road corridors, and placement of excavated material at waste and storage sites. There would be a direct, physical loss of 585 acres of grizzly bear habitat under Alternative II (see Table 4-38). The increased level of human activity would further displace bears using the Rock Creek riparian area on additional habitat within 0.25 to 0.5 miles of the physically disturbed sites and the human travel routes. Habitat effectiveness would be reduced on an estimated 8,196 acres during construction and 7,308 acres during operations (Table 4-39). A portion of the area influenced by the proposed project presently experiences some human disturbance. Disturbance would generally be much greater with the proposal because of the increased intensity (24 hours/day, 7 days a week). Denning habitat, as described by Kasworm and Thier (1992, pgs. 40 and 1993, pg.44), would not be disturbed by the proposed project.

Changes in habitat effectiveness caused by this alternative are all negative (Table 4-40).

Alternative II would involve new road construction and existing road reconstruction (some existing roads are currently closed). This activity, in conjunction with planned road closures would result in modified ORD that would not meet Forest Plan standards in two BAAs (Table 4-41).

Additional mitigation would be needed to close 5.28 miles of road (1.88 miles of FDR No. 2741, 0.18 miles of FDR No. 2741x, 0.51 miles of FDR No. 2741A, and 2.71 miles of FDR No. 2285) in order to meet the Forest Plan ORD standard in all BAAs. There would be an increase in total motorized access route density in all three BMUs. There would be a 321 acre reduction in core habitat across the three affected BMUs (BMU 4: -25 ac.; BMU 5: -135 ac; BMU 6: -161 ac.) (Table 4-42: shown for alternative comparison only). Incidental take, as defined in the USFWS Incidental Take Statement for grizzly bear on the KNF Forest Plan (McMaster 1995), would occur.

TABLE 4-38
Acreage of Habitat Components Physically Altered by Rock Creek Project

Feature	Component	Alt. I	Alt. II	Alt. III	Alt. IV	Alt.V
Tailings Impound and AF	Conifer Forest	0	381	396	396	360
	Graminoid Park	0	5	5	5	5
	Shrub field	0	2	2	2	2
	Bareground	0	2	1	1	1
Mine and AF	Conifer Forest	0	30	38	*	*
Evaluation adit	Conifer Forest	0	9	9	9	9
	Rock	0	1	1	1	1
Transportation Corridor	Conifer Forest	0	93	86	65	53
	Forb Field	0	0	1	1	1
	Grassy (disturbed)	0	1	1	1	1
	Shrub/forb field	0	0	3	3	9
	Huckleberry field	0	1	0	0	0
	Bareground	0	1	0	0	0
Facilities (includes Mill and water treatment sites	Conifer Forest	0	59	65	57	40
	Forb Field	0	0	1	1	1
TOTAL PHYSICAL DISTURBANCE **		0	585	609	542	483

Note: Physical changes are approximately 67% on National Forest lands and 33% on Private lands
AF = Associated Features
* = Mine and Facilities on same location, acre shown under Facilities. Acres rounded to nearest whole acre (when component less than one acre, one acre used)
** = Acres off by 1-2 acres compared to Table 2-2 due to rounding methodology.

TABLE 4-39
Total Space Influenced During Construction and Operation Phases

Rock Creek Mine	Construction Phase Acres *	Operation Phase Acres **
Alternative I	0	0
Alternative II	8,196	7,308
Alternative III	7,625	7,001
Alternative IV	7,259	6,635
Alternative V	7,044	6,428

* = 1/4 to ½ mile or ridge line depending on activity (includes acres from Table 4-38)
** = Evaluation and air intake ventilation adits dropped

TABLE 4-40
Percent Habitat Effectiveness Change Due to the Rock Creek Project

Alternative	BMU 4 (%)	BMU 5 (%)	BMU 6 (%)
I	0.0	0.0	0.0
II	- 0.2	- 2.2	- 0.9
III	- 0.2	- 1.7	- 0.6
IV	- 0.2	- 1.1	- 0.6
V	+ 1.0	- 1.1	- 0.3

TABLE 4-41
Open Road Density (mi./sq.mi.) Projections (MS-1 lands) with Rock Creek Project Alternative

B.A.A.*	Alt. I	Alt. II	Alt. III	Alt. IV	Alt. V
7-4-7	0.62	0.62	0.62	0.62	0.59
7-5-2	0.86	1.05	0.81	0.74	0.79
7-5-3	0.00	0.00	0.00	0.00	0.00
7-6-1	0.77	0.80	0.66	0.66	0.62

* Bear Analysis Area
Open Road Density standard is 0.75 mi./sq. mile.
BAA 7-4-7: all new roads in MS 3 lands. Assumes closure of 2.0 mi. FDR 150.
BAA 7-5-2: Assumes Sterling mitigation for grizzly bear habitat: Alt. 2 (none); Alts. 3, 4 (1.88 mi. FDR No. 2741, 0.18 mi. FDR No. 2741x, 0.51 mi. FDR 2741A); Alt. 5 (0.9 mi. FDR 150 + 2741A & X from Alt 3)
BAA 7-6-1: Assumes Sterling mitigation for grizzly bear habitat: Alt. 2 (none); Alts. 3-5 (1.61 mi. FDR No. 2285)

TABLE 4-42
Core Habitat Percent by BMU by Alternative

Alternative #	BMU 4			BMU 5			BMU 6		
	1998	1999	2000	1998	1999	2000	1998	1999	2000
I	60.2	60.2	60.2	60.7	60.2	60.2	52.0	50.6	50.6
II	60.2	60.2	60.0	60.7	60.2	60.0	52.0	50.6	50.4
III	60.2	60.2	60.1	60.7	60.2	60.8	52.0	50.6	51.2
IV	60.2	60.2	60.1	60.7	60.2	60.8	52.0	50.6	51.5
V	60.2	60.2	60.9	60.7	60.2	60.2	52.0	50.6	51.5

Core changes in 1999 due to Noranda Montanore mine; Skranak and Harpole mine; and Cedar Gulch Timber Sale.
Core changes in 2000 due to Rock Creek mine.
Changes in core for 1999 are due to new road construction on private company lands.

The summary of the moving windows open and total route density analysis is shown in Table 4-43. There are no standards for moving windows route densities in the Cabinet/Yaak ecosystem (CYE) but figures in Table 4-43 are provided for relative comparisons of alternatives.

TABLE 4-43
Moving Windows Route Densities (% BMU by Route Density Category*)

BMU 4	**Open Routes**				**Total Routes ***			
Alt.	**0 miles**	**0-1 miles**	**1-2 miles**	**> 2 miles**	**0 miles**	**0-1 miles**	**1-2 miles**	**> 2 miles**
1	46.9	14.1	15.0	24.0	43.9	13.7	14.3	28.1
2	46.7	14.3	14.9	24.1	43.8	13.8	14.2	28.2
3	46.7	14.3	15.0	24.0	43.9	13.8	14.2	28.1
4	46.7	14.3	15.0	24.0	43.9	13.8	14.2	28.1
5	47.9	14.9	15.7	21.5	44.3	14.2	15.8	25.7
BMU 5	**Open Routes**				**Total Routes ****			
Alt.	**0 miles**	**0-1 miles**	**1-2 miles**	**> 2 miles**	**0 miles**	**0-1 miles**	**1-2 miles**	**> 2 miles**
1	55.0	14.9	14.0	16.1	43.5	15.8	16.7	24.0
2	54.8	14.7	13.4	17.1	43.2	15.7	16.1	25.0
3	55.5	14.9	13.5	16.1	55.5	14.9	13.5	16.1
4	55.9	14.6	13.8	15.7	44.3	15.6	16.5	23.6
5	55.0	14.9	14.1	16.0	43.5	15.8	16.6	24.1
BMU 6	**Open Routes**				**Total Routes ****			
Alt.	**0 miles**	**0-1 miles**	**1-2 miles**	**> 2 miles**	**0 miles**	**0-1 miles**	**1-2 miles**	**> 2 miles**
1	52.6	15.6	14.3	17.5	35.5	13.9	15.8	34.8
2	49.1	17.0	14.6	19.3	33.4	14.7	16.2	35.7
3	49.7	16.6	14.9	18.8	34.4	14.7	16.2	34.7
4	49.7	16.6	14.9	18.8	34.4	14.8	16.3	34.5
5	49.7	16.6	14.9	18.8	34.4	14.7	16.3	34.6
All Alts.	**Open Routes**				**Total Routes ****			
BMU.	**0 miles**	**0-1 miles**	**1-2 miles**	**> 2 miles**	**0 miles**	**0-1 miles**	**1-2 miles**	**> 2 miles**
7	63.2	12.6	10.7	13.5	46.8	16.2	15.2	21.8
8	40.4	17.2	21.8	20.7	36.4	19.5	21.9	22.2
22	45.0	13.0	15.0	27.0	31.0	13.0	14.0	42.0

Alt. 1 values are for 1999.
* Route density categories are in units of "miles of road per square mile."
** Does not include barriered roads (per IGBC Grizzly Bear Access Committee notes 2/97)

The possibility of direct mortality to grizzly bear from the mine and associated activities exists. Grizzlies could be struck by vehicles accessing the mine or hauling ore (ADT increases 2730% during construction), or be shot illegally. The presence of the mine could create an attractant that may result in a nuisance bear. Nuisance bears often are destroyed because they cannot adapt to areas without human influence (i.e. garbage). The grizzly bear mortality risk index would increase 1.2% (to 164.9) over the existing situation.

Sterling's mitigation, as specified in Chapter 2 under Alternative II would reduce the increased mortality risk caused by the mine operation but the net result would still be an increase in mortality risk from present conditions. This is based on the risks of vehicle and nuisance bear mortality still existing. In addition, no replacement habitat is provided. A minimum of 3,074 acres would be needed to assure maintaining the present carrying capacity.

Additional habitat loss would occur as a result of the increased human population. Increased population requires increased housing, and increased housing would result in habitat modification (up to 150 acres, most likely in MS-3 lands). Also, more people would mean greater recreational use of grizzly habitat. This increases the likelihood of displacement or human/bear encounters. Increased encounters often result in increased grizzly mortality. The operation of this project, and the associated indirect increase in recreation activity widens the fracture zones in the southern Cabinet Mountains portion of the Cabinet/Yaak grizzly bear recovery zone (see Appendix B). Increased human activity in the north to south movement corridor could impact a third of the known grizzlies in the CYE. The rate of increase in human activity is higher than projected 'normal' human population growth rates for this area, thus reducing the opportunity for grizzly bears to adjust their habitat use patterns. This is likely to result in more bear/human encounters that often end in bear mortality.

Habitat potential is reduced based on direct physical loss of suitable habitat, reduced habitat effectiveness (below 70 percent minimum), reduced core area, and habitat fragmentation. These factors combine to result in a reduction in habitat carrying capacity. This reduced carrying capacity may result in disruption of normal grizzly behavioral patterns, including breeding, feeding or sheltering. In addition, the mortality risk is increased. Since the adverse effects to grizzly bear and its habitat would not be fully mitigated, the biological assessment determination for Alternative II is "may adversely affect" the grizzly bear.

Bull Trout. Bull trout are sensitive to habitat degradation, particularly elevated fine sediment concentrations and water temperature. Brook trout (a non-native species) are generally considered to be more tolerant of sediment and increases in temperatures than are bull trout. Habitat degradation could result in non-native species gaining a competitive advantage over bull trout. See the Aquatics/Fisheries for additional analyses of impacts to aquatic habitat.

Brook trout interbreed with bull trout, resulting in sterile offspring. It is generally believed that such a mating is detrimental to bull trout populations (Leary, Allendorf, and Knudsen 1983). Therefore, habitat degradation may give brook trout a competitive advantage over bull trout. If this occurred, a significant loss of native species and biodiversity in Rock Creek would result.

Migratory bull trout populations in the Cabinet Gorge Reservoir/lower Clark Fork River ecosystem are low and are at a very high risk of elimination (Thomas 1992, WWP 1995). The available data suggest that migratory bull trout in Rock Creek are very rare, if present. Given the precarious state of the fish in this system, the loss of Rock Creek as a spawning and rearing tributary could push the bull trout further towards elimination in this drainage.

Alternative II is likely to significantly and adversely affect bull trout in the Rock Creek drainage.

Lynx. Alternative II would have the most impact of the action alternatives on lynx, because it has the most activity in the higher elevations lynx prefer. Direct impacts to lynx from Alternative II would be from habitat loss at the evaluation adit, and disturbance at the mill site and mine portal. Indirect impacts would be from possible increased mortality from trapping, and from increased traffic in lower elevation travel corridors.

The direct habitat lost from Alternative II would be denning habitat (3 acres) and travel habitat (7 acres) at the evaluation adit, and any foraging habitat rendered less usable due to disturbance from the road to the evaluation adit. Denning habitat at the evaluation adit would remain unusable for an indefinite period after the construction phase. However, because lynx can use small areas of suitable denning habitat if adequate foraging habitat is present, this loss is not likely to be damaging to lynx populations. After the evaluation adit construction phase, the reduction in use of Chicago Peak Road would probably be adequate to allow use of the area during lynx foraging time periods, and also because of the proximity of the CMW with its larger areas of foraging habitat.

Mortality risks would increase due to increased human use and accessibility to habitat. Mortality from additional trapping or poaching likely would be low, primarily because the likelihood of lynx occurring in the area is low. However, because lynx are highly susceptible to trapping and populations are very low, loss of individuals could be significant. Any trapped lynx would probably be transient individuals rather than residents, based on the low availability of habitat to support a resident population. Montana Dept. of Fish, Wildlife and Parks has the responsibility of ensuring trapping mortality does not exceed levels injurious to the population, so trapping regulations could be modified if mortality is excessive.

Another form of indirect mortality is from highway mortality. Traffic levels on Montana Highway 200 are expected to increase as a result of mine operation. The Kootenai National Forest has identified a lynx travel corridor at the narrowest crossing of the Clark Fork River near Noxon (Johnson et al. 1997). This area would be where much of the traffic increase would be along the highway, so roadkills of lynx are possible. This impact is of concern primarily from a genetic interchange perspective, and has a very low likelihood of occurrence because of the very few individuals potentially involved. After mine closure, trapping and mortality risks would decrease but could remain higher than pre-mine levels, because some of the increase in human population would remain in the Lower Clark Fork Valley.

Direct impacts to the lynx under Alternative II would be minor, based on lack of suitable habitat within the Lynx Habitat Unit. Indirect impacts would be greater but not potentially significant, with highway mortality being a low risk but the most long-term and uncontrollable impact. Alternative II is not likely to jeopardize the continued existence of lynx or result in the adverse destruction or modification of critical lynx habitat.

The Kootenai Cumulative Effects Model (CEM) for lynx is considered to be the most accurate model for predicting lynx habitat suitability within the project area. While the TSMRS is more accurate where a high proportion of an area has stand examinations, the CEM is considered most accurate where these exams are lacking, as in the Rock Creek project area. Using the CEM, the project area has only 3 acres of denning habitat, and 17 acres of travel habitat at the evaluation adit. Travel habitat is much less specific than either foraging or denning habitat. The low amount of habitat within the project area suggests that the reason for few lynx observations (including trapping records) within the project area and vicinity is probably lack of suitable habitat.

Alternative III

Bald Eagle. Bald eagle use along the Clark Fork River would continue to increase, as evidenced by the increase in number of nesting pairs found over the past five years. The increase in road killed deer and the associated risk of bald eagle mortality, as shown under Alternative II, would be less if increased truck traffic used the Miller Gulch rail siding on improved FDR No. 150 rather than the highway. Also, FDR No. 150 traffic levels would be 33% less than Alternative II (Transportation). In addition, mitigation is planned that would remove dead animals from the road corridor which would further reduce the mortality risk.

Sediment and nitrogen loads would temporarily increase and this would impact aquatic invertebrates which could impact fish. Mitigation is planned to reduce sediment from existing sources so that the net result becomes a reduction in sediment (see Hydrology and Aquatics/Fisheries). The down stream impact is negligible. While nitrogen loads will increase (actual level too small to measure), the state has established maximum discharge levels which will be met, with the result that nitrogen levels would remain below Montana cold-water aquatic life standards. The resultant indirect effect to bald eagles would also be negligible. The water resources and aquatics/fisheries monitoring plans are an integral part of the proposed action, and would be used to detect any adverse changes in the food chain used by bald eagles.

The potential effects of metals would be further reduced by water treatment that would remove suspended solids, metals and nitrogen prior to discharge to the Clark Fork River. The resulting metal levels would remain below Montana cold-water aquatic life standards. The risk of impoundment failure is less than Alternative II due to changes in design, so the potential for downstream metal impact to bald eagles is reduced.

Mortality risk from potential electrocution would be mitigated by the requirements to construct powerlines using the standards in Olendorff et.al. (1981: p. 19-43).

Based on the low likelihood of adverse impacts and implementation of proposed mitigation to reduce mortality risk from the proposed project, bald eagle use along the Clark Fork River is expected to continue increasing. This is evidenced by the increase in nesting pairs over the past 8 years (from none to 6) until all 10 of the potential breeding areas are occupied.

Alternative III is not likely to adversely effect the bald eagle or its habitat based on the same reasons as Alternative II. Plus the implementation of effective mitigation and project designs reduce the risk of impoundment failure and reduce mortality risk.

Gray Wolf. The planned road closures to meet ORD standards for grizzly bear would benefit big game and thus benefit wolves. There would be no change in the availability of denning or rendezvous habitat. Space, with limited exposure to humans, would be slightly reduced due to the increase in disturbance caused by increased human activity (continuous mine operations 7 days a week for up to 35.5 years). The potential acres affected are shown in the section on grizzly bear. The improved habitat effectiveness in areas where roads are closed may not compensate for reduced effectiveness on the influence area acres. This is due to the lower elevation of the influence acres, which makes them more suitable for big game winter range (wolf foraging habitat). Mitigation (designed to protect the grizzly, but also benefitting the wolf) through the approved Sterling Traffic Management Plan, and the requirement to not allow firearms in employees vehicles should be relatively effective at offsetting the increase in mortality risk (professional judgement).

While the overall habitat effectiveness for wolf may drop slightly, this alternative is not likely to adversely affect the gray wolf. This determination is based on the same reasons identified in Alternative II as well as implementation of effective mitigation.

Grizzly Bear. There would be a direct, physical loss of 609 acres of grizzly bear habitat due to the mine proposal. The increased level of human activity would further displace bears using the Rock Creek riparian area.

Habitat effectiveness would be reduced on an estimated 7,625 acres during construction, and 7,001 during operations (Table 4-39). Changes in habitat effectiveness caused by this alternative are BMU 4 is -0.2%, BMU 5 is -1.7%, and BMU 6 is -0.6% (Table 4-40).

Mitigation for physical habitat loss and reduced habitat effectiveness is planned in the form of replacement habitat. Sterling would be required to provide 2,692 acres through conservation easements, acquisition, or other means.

The open road density would change as displayed in Table 4-41. With planned mitigation to close 4.18 miles of road year long (1.88 miles on FDR No. 2741, 0.18 miles of FDR No. 2741x, 0.51 miles of FDR No. 2741A, and 1.61 miles on FDR No. 2285), this alternative would meet the ORD standard in all affected bear analysis areas except 7-5-2. There would be an increase in total motorized access route density, and no decrease in core habitat (Table 4-42). Planned closure of portions of the Chicago Peak and Orr Creek roads may cause the public to resent the grizzly and could result in increased mortality risk.

The possibility of direct mortality to grizzly bear from the mine and associated activities exists. Grizzlies could be struck by vehicles accessing the mine or hauling ore (but ADT level is less than Alternative II - see Transportation), or be shot illegally. The presence of the mine could create an attractant that may result in a nuisance bear. Nuisance bears often are destroyed because they cannot adapt to areas without human influence (i.e. garbage). Mitigation for these effects include an approved Traffic Management plan that reduces mine related traffic, no firearms in employee vehicles, bear proof containers for attractants, an information and education program on grizzly bears, and removing vehicular killed animals from road right-of-way on a daily basis. Even with these mitigation measures, the grizzly mortality risk index increases 1.2% (to 164.9).

Additional habitat loss (unquantified) would occur as a result of the increased human population. Increased population requires increased housing, and increased housing would result in habitat modification. Also, more people would mean greater recreational use of grizzly habitat. This increases the likelihood of displacement or human/bear encounters. Increased encounters often result in increased grizzly mortality.

The operation of this project, and the associated indirect increase in recreation activity widens the fracture zones in the southern Cabinet Mountains portion of the Cabinet/Yaak grizzly bear recovery zone (see Appendix B). Increased human activity in the north to south movement corridor could impact a third of the known grizzlies in the CYE. The rate of increase in human activity is higher than projected 'normal' human population growth rates for this area, thus reducing the opportunity for grizzly bear to adjust their habitat use patterns. This is likely to result in more bear/human encounters that often end in bear mortality.

Since the adverse effects to grizzly bear and its habitat can not be fully mitigated, the biological assessment determination is that Alternative III may adversely affect the grizzly bear.

Bull Trout. Impacts to bull trout would be reduced under this alternative by mitigation measures discussed in Chapter 2 (Table 2-8). Despite mitigation measures, Alternative III is still likely to significantly and adversely affect bull trout in the Rock Creek drainage.

Lynx. Alternative III would reduce a minor source of disturbance due to the relocation of the ventilation shaft in the CMW. This change does not affect the determination that effects to the lynx would be minor, and that Alternative III would be unlikely to adversely impact lynx or its habitat.

<u>**Alternative IV**</u>

Bald Eagle. The increase in road killed deer and the associated risk of bald eagle mortality would be same as Alternative III. The water resources and aquatics/fisheries monitoring plans (Appendix K) are an integral part of Alternative IV. They would be used to detect any adverse effects in the food chain used by bald eagles. The effects determination is the same as Alternative III - not likely to adversely affect.

Gray Wolf. Space, with limited exposure to humans, would be slightly reduced due to the increase in disturbance caused by increased human activity (continuous mine operations 7 days a week for up to 37 years). The potential acres affected are shown in the section on grizzly bear. The other effects are the same as Alternative III. The biological assessment determination is the same as Alternative III - not likely to adversely affect the gray wolf.

Grizzly Bear. There would be a direct, physical loss of 542 acres of grizzly bear habitat due to the mine proposal. The increased level of human activity would further displace bears using the Rock Creek riparian area.

Habitat effectiveness would be reduced on an estimated 7,044 acres during construction and 6,420 during operations (Table 4-39). Changes in habitat effectiveness caused by this alternative are: BMU 4 is -0.2%, BMU 5 is -1.1%, and BMU 6 is -0.6% (Table 4-40).

Mitigation for physical habitat loss and reduced habitat effectiveness is planned in the form of replacement habitat. Sterling would be required to provide 2,536 acres through conservation easements, acquisition, or other means.

The open road density would change as displayed in Table 4-41. With planned mitigation to close 4.18 miles of road year long (1.88 miles FDR No. 2741, 0.18 miles of FDR No. 2741x, 0.51 miles of FDR No. 2741A, and 1.61 miles of FDR No. 2285), this alternative would meet the ORD standard in all affected BAAs. There would be no increase in total motorized access route density, and no decrease in core habitat (Table 4-42). Planned closure of portions of the Chicago Peak and Orr Creek roads may cause the public to resent the grizzly and could result in increased mortality risk. The summary of the moving windows open and total route density analysis is shown on Table 4-43.

Habitat enhancement would be conducted on about 480 acres. Enhancements would improve the quality of grizzly bear habitat by providing high quality food (produced through prescribed burning) such as whitebark pine and huckleberry or improve habitat effectiveness (by obliterating all or portions of roads that are already closed).

The mitigation to reduce grizzly mortality risk caused by the proposed project would be the same as Alternative III. The mortality risk index still increases, but only 0.9% (to 164.5).

All of the above affects combine to result in a reduced habitat carrying capacity. This reduced carrying capacity may result in disruption of normal grizzly behavioral patterns, including breeding, feeding or sheltering. Since the adverse effects to grizzly bear and its habitat can not be fully mitigated, the biological assessment determination is may adversely affect the grizzly bear.

Bull Trout. Impacts to bull trout would be further reduced under this alternative by mitigation measures discussed in Chapter 2 (Table 2-9). Despite mitigation measures, Alternative IV is still likely to significantly and adversely affect bull trout in the Rock Creek drainage.

Lynx. The move of the mill site to lower in the drainage would reduce the likelihood of disturbance to dispersing lynx. The impacts of Alternative IV would be similar to those for Alternative III and the determination would be the same as Alternative II.

Alternative V

Bald Eagle. The increase in mortality risk to bald eagles scavenging on road kill is further reduced in Alternative V. This is due to a reduced traffic level caused by piping the ore slurry rather than hauling it down the FDR No. 150 road. Also, mitigation is planned that would remove dead animals from the right-of-way clearings of FDR No. 150 (between Highway 200 junction and the mill site) on a daily basis. In addition, Sterling would implement an Agency approved traffic management plan (including bussing employees to the mill site) to reduce traffic levels on FDR No. 150. Mitigation should reduce the increased mortality risk (37% less traffic than Alternatives III and IV), but it will still be greater than the present level due to the increase in ADT (operation phase) on FDR No. 150 (see Transportation). Bald eagle use along the Clark Fork River is expected to continue increasing, as evidenced by the increase in nesting pairs over the past 8 years (from none to 6), until all 10 of the potential breeding areas are occupied.

The main source of heavy metals would still come from tailings impoundment failure, but the likelihood of failure is lower than the other action alternatives (less than 1 in 1,000,000) (Klohn-Crippen 1997).

Alternative V is not likely to adversely effect the bald eagle or its habitat based on the same reasons as Alternative III, plus the lower likelihood of metal contamination from a tailings failure.

Gray Wolf. Space, with limited exposure to humans, would be slightly reduced due to the increase in disturbance caused by increased human activity (continuous mine operations 7 days a week for up to 37 years). The potential acres affected are shown in the section on grizzly bear. The other effects would be the same as Alternative III. The biological assessment determination is the same as Alternative III.

Grizzly Bear. There would be a direct, physical loss of 483 acres of grizzly bear habitat due to the mine proposal. The increased level of human activity would further displace bears using the Rock creek riparian area.

Habitat effectiveness would be reduced on an estimated 7,044 acres during construction and 6,428 during operations (Table 4-39). Changes in habitat effectiveness caused by this alternative are: BMU 4 is +1.0%, BMU 5 is -1.1%, and BMU 6 is -0.6% (Table 4-40).

Mitigation for physical habitat loss and reduced habitat effectiveness is planned in the form of replacement habitat. Sterling would be required to provide 2,350 acres through conservation easements, acquisition, or other means.

The open road density would change as displayed in Table 4-41. With planned mitigation to close 5.22 miles of road year long (2.92 miles FDR No. 150, 0.18 miles FDR No. 2741X, 0.51 miles FDR No. 2741A, and 1.61 miles FDR No. 2285), still does not meet the ORD standard in one BAA (7-5-2). However, the ORDs in all BMUs (as a whole) are well below 0.75 (BMU 4 = 0.27, BMU 5 = 0.58, BMU 6 = 0.62). To meet the ORD in BAA 7-5-2 would require closing a portion of the Chicago Peak road (FDR No. 2741), which would not occur for Alternative V. Not meeting the ORD in this BAA was mitigated by improving the overall habitat effectiveness in the southern half of the Cabinet Mountains with the closure of a portion of FDR No. 150. This closure provides an undisturbed east to west movement area across the top of Government Mountain and provides better security to bears using the huckleberry fields in that area. There would be no increase in total motorized access road density, and no decrease in core habitat (Table 4-42). The summary of the moving windows open and total route density analysis is shown in Table 4-43.

The possibility of direct mortality to grizzly bear from the mine and associated activities would be less than the other action alternatives due to fewer impacted acres, lower traffic levels, and additional mitigation. The resulting grizzly mortality risk index is up only 0.2% (1.63.4) over the existing situation.

All of the above affects combine to result in a reduced habitat carrying capacity. This reduced carrying capacity may result in disruption of normal grizzly behavioral patterns, including breeding, feeding or sheltering. Since the adverse effects to grizzly bear and its habitat can not be fully mitigated, the biological assessment determination is may adversely affect the grizzly bear.

Bull Trout. The Biological Assessment for bull trout (see Appendix B) concluded that implementation of Alternative V is likely to adversely affect bull trout because of unavoidable fugitive sediment loading during project construction. See the Aquatics/Fisheries section for additional discussion on the impacts of sediment loading on fish. However, the implementation of this project would not result in jeopardy for the Columbia River distinct population segment of bull trout.

The USFWS Biological Opinion agreed with the conclusions of the Biological Assessment in that the project would likely adversely affect bull trout but does not constitute a jeopardy situation. The USFWS further developed Terms and Conditions to reduce potential impacts associated with implementation of the project.

The applicant would complete a watershed assessment that will include information to define bull trout population parameters for the Rock Creek population, fish habitat conditions, and sediment sources in the Rock Creek drainage.

The diffuser would be installed so as to provide unimpeded upstream access along the North shore of the Clark Fork River for migratory bull trout. Monitoring would be developed to verify mixing zones and determine whether fish movement is indeed affected by effluent concentrations in the lower Clark Fork River over the life of the project.

Additional monitoring plans would be developed by the applicant some of which would meet obligations of other environmental requirements such as compliance with the MPDES Discharge Permit. Specific monitoring includes plans to monitor the Rock Creek bull trout population, habitat condition, sediment levels, metals concentrations, and impacts to groundwater. A risk assessment for haul routes, traffic and potential for spill has been completed and included in this EIS. Mitigation to reduce the potential for effects to bull trout and their habitat has been developed in consultation with the USFWS and is included in the Roads Risk Assessment for this project.

Lynx. Busing employees and incorporation of animal-friendly crossings along FDR No. 150 would reduce the mortality risk to any dispersing lynx. Mitigation proposed for grizzly bear would also function as mitigation for the minor direct loss of habitat at the evaluation adit. Alternative V is not likely to jeopardize the continued existence of lynx or result in the adverse destruction or modification of critical lynx habitat.

Biological Assessment Lynx Amendment (as quoted from Appendix B)

> On March 24, 2000, the U.S. Fish and Wildlife Service published its determination on the status for the contiguous U.S. distinct population segment of the Canada lynx (*Lynx Canadensis*) (USFWS 2000). The determination was to list the lynx as Threatened. This constitutes a change in conditions for the Rock Creek Mine.
>
> The final Biological Assessment of Threatened, Endangered, and Proposed species for the proposed Rock Creek Mine was completed on July 31, 1998 and submitted to the U.S. Fish and Wildlife Service for formal consultation on the same date. At that time the lynx was a proposed species and the determination in the BA was that the project is "not likely to jeopardize the continued existence of lynx or result in the destruction or adverse modification of critical lynx habitat."

Now that the lynx is listed, in order to comply with the Endangered Species Act, a new determination of either "likely to adversely affect" or "may affect, but is not likely to adversely affect" the lynx is required. This BA amendment documents the new determination and the supporting information used in making it.

The U.S. Fish and Wildlife Service and the U.S. Forest Service signed a Canada Lynx Conservation Agreement (CA) (USFS Agreement # 00-MU-11015600-013: 2/7/2000) that establishes the use of the (1) Lynx Conservation Assessment and Strategy (LCAS) (USFS and USFWS 2000), (2) local conditions and activities, and (3) modifications (if any) made to proposed projects that reduce or eliminate potential adverse effects to lynx, in all determinations of effect for lynx.

Assessment

The description of the lynx population status is documented in the original BA (pg. 36) and in the final lynx listing rule (USFWS 2000). Both are incorporated in this amendment by reference.

The LCAS establishes conservation measures that are intended to conserve the lynx, and to reduce or eliminate adverse effects from management activities on federal lands. Under the CA, the Forest Service is to review and consider these recommended measures, which apply only to lynx habitat within lynx analysis units (LCAS pg 76 and 77). The conservation measures are displayed in three forms: objectives (measures of desired resource condition); guidelines (ways to meet objectives); and standards (required management actions). The following analysis includes those conservation measures that apply to activities proposed for this specific project, measures outlined in the LCAS for other types of activities not anticipated (i.e. livestock grazing) are not analyzed.

I. <u>Conservation Measures Applicable to - All Programs and Activities:</u>

Delineation of Lynx Analysis Units (LAUs) (LCAS pg. 77)
The Kootenai National Forest has delineated LAUs. Most of the Rock Creek project is nearest to, but falls outside of LAU 14702 (formerly 7.2.1, see pg 37 of original BA). A small portion (evaluation adit) is in the LAU. This LAU covers approximately 23,000 acres which meets the size guideline for LAUs (LCAS pg. 77).

Mapping Lynx Habitat (LCAS pg. 77)
Lynx habitat has been mapped using the criteria for the Northern Rock Mountains Geographic Area (Montana portion - LCAS pp 46-47). Based on satellite image data, a total of 20 acres of lynx habitat (3 acres of denning habitat) would be impacted by the project. Less the 30% of the potential lynx habitat within the LAU is currently classified as unsuitable (LCAS pg. 101). The proposed activity on 20 acres of lynx habitat will not result in more that 30% of potential habitat in the LAU to be classified as unsuitable, or result in a permanent loss of habitat. This meets the LCAS standard (pg. 77).

Maintain at least 10% of potential lynx habitat acres in denning habitat (LCAS pg. 78)
Currently only 8.3% (4.9% of the LAU) of the potential lynx habitat provides denning habitat. The loss of 3 acres of denning habitat is less the one tenth of one percent of existing denning habitat. The proposed project will delay achievement of denning habitat structure on an estimated 17 acres. These acres are in the same condition as most forested habitat in the LAU. That is, that they are younger stands that currently do not have an adequate down log component to provide denning habitat. Since there are many acres moving toward denning habitat, the delay on 17 acres is not significant.

II. Conservation Measures to Address Risk Factors Affecting Lynx Productivity

Timber Management:

Management actions shall not change more than 15% of lynx habitat within a LAU to an unsuitable condition with a 10 year period. (LCAS pg. 79)
The majority of LAU 14702 is in wilderness and areas without roads, so far less than 15% of the LAU has been changed in the last 10 years by management activities. The 20-acre change proposed with this project meets the standard.

The project does not propose salvage harvest following a disturbance nor precommercial thinning.

Recreation Management:

The project is not proposing changes in recreation management during the winter season, therefore LCAS standards for recreation management (pg. 82 and 83) are met.

Other human developments (including mines) (LCAS pg. 85):

To access the miss site, FDR No. 150 would be plowed for approximately the first 5 miles. This segment is not in lynx habitat, nor in any LAU. With the high traffic level to the mill site, it is unlikely that the road would become an access point for snowmobile use into lynx habitat at higher elevations. There would be no increase in groomed or designated over-the-snow routes or snowmobile play areas.

There are no new roads being constructed in lynx habitat. The existing access route to the exploration adit (road 2741) goes through lynx habitat. The project proposes to close the portion of this road that currently extends beyond the adit. This minimizes disturbance around some potential denning habitat, which is important from May to August. The standards and guidelines are met.

III. Conservation Measures to address mortality risk factors

The project proposes to provide funding for a position with the Montana Department of Fish, Wildlife, and Parks as part of the mitigation for grizzly bear. Part of the duties of that position is information and education on grizzly bear, but lynx would be included as well (LCAS standard pg. 86). The proposed project includes busing employees to the mill site, which reduces the projected traffic increase and thus keeps mortality risk to any dispersing lynx at a minimum.

IV. Conservation Measures to address Movement and Dispersal (LCAS pp 87-89)

The project does propose paving an existing dirt (# 150), however the segment planned for paving is not in lynx habitat. The potential to increase mortality risk, due to higher traffic levels and increased speeds, was mitigated by busing employees to the mill site (see measure III above).

The project does include the possibility of land ownership changes as part of the mitigation package for grizzly bear. Most lands identified as possible mitigation for grizzly bear would also provide habitat for lynx, thus acquiring ownership or conservation easements would maintain or in some cases improve habitat conditions for movement and dispersal.

Determination

The determination of effect is that the proposed Rock Creek Mine is **not likely to adversely affect** the lynx or its habitat. This is based on: (1) The majority of the project is outside of lynx habitat and lynx analysis units; (2) direct impacts to habitat are minimal (20 acres maximum); (3) no recent sightings of lynx in the Rock Creek drainage; and (4) with the mitigation already included, the project complies with all standards and guidelines of the lynx conservation assessment and strategy.

Cumulative Impacts

There are no foreseeable cumulative effects to bald eagles.

With the Montanore project active in two of the three same BMUs, there would be very little available displacement habitat available for grizzly bears or wolves (see the revised Biological Assessment - Appendix B). The cumulative habitat effectiveness in BMUs 4 and 5 would be below the minimum 70 percent level for all alternatives (see Table 4-44). In addition, when the two mines are operating, the north-south corridor along the crest of the Cabinet Mountains becomes extremely narrow and could limit grizzly bear and wolf movements between the southern and northern portions of the Cabinet Mountains. Elimination of movement along the ecosystem is not likely, but changes in individual bear behavior is likely. Changes in behavior could result in increased competition for habitat or territory in the restricted area. It could also result in mortality to bears that are forced to move through the disturbed areas.

The BA indicates that a north to south movement corridor in the Cabinet Mountain portion of the CYE would be fragmented by having two large mining operations active at the same time. Additional analysis of the indirect recreational impacts and corridor assessment (see Appendix B) shows that complete fragmentation is not likely to occur. However, any grizzly bear with an established home range in the south half of the Cabinet Mountains would be impacted and may respond with changes in movement patterns and behaviors. At a minimum, this fracture zone (linear area of human activity that bisects grizzly habitat) would affect 31% (5 of 16) of the known grizzly bears in the CYE. The rate of increase in human activity is higher than projected 'normal' human population growth rates for this area, thus reducing the opportunity for grizzly bear to adjust their habitat use patterns. This is likely to result in more bear/human encounters that often end in bear mortality. Mitigation provides proportional displacement habitat (see mitigation plan). The north to south movement patterns of bears would be further impacted by fracture zones created with the proposed access to three private parcels (Way-UP, Fourth of July, and Bear Lakes properties).

Future timber sales would physically change additional grizzly habitat components, especially by removing conifer forest and creating shrub/forb openings. This type of activity also has the potential to decrease the percent of the BMU(s) available for undisturbed use by grizzly bear (reduce habitat effectiveness) (see Table 4-44). Timber sales can also result in increased road densities, which contribute to increased human/bear encounters, that lead to more bear mortalities.

The cumulative effects evaluation for bull trout must consider the factors currently limiting the recovery of the bull trout meta-population. The six primary factors are:

1. Reservoir temperatures preclude any significant habitat value except as a travel corridor.
2. Meta-population has been fragmented due to the presence of three dams and unsuitable reservoir conditions.
3. Dewatering at the lower end of many tributaries.
4. Historic stream cleaning (i.e., loss of woody debris and deep pools) and stream sedimentation (i.e., road and channel erosion).
5. Channel instability in some powerline, pipeline, and road corridors that parallel the stream network.
6. Exceptionally low numbers of adfluvial and fluvial migrants.

TABLE 4-44
Cumulative Habitat Effectiveness by BMU by Alternative
(Lowest % HE reached during project period)

Alternative	BMU 4 (%)	BMU 5 (%)	BMU 6 (%)
I[1]	62.5	64.8	68.1
II	61.5	63.4	65.5
III	61.5	63.7	65.7
IV	61.5	64.1	65.7
V	62.3	64.1	66.0

Notes:

Minimum Acceptable Habitat Effectiveness is 70%
Assumes Noranda Montanore project part of existing condition and road closures in place.
[1] Changes from existing condition shown for Alternative 1 are the result of cumulative effects from other projects.

Passage of fish from the Cabinet Gorge system to Lake Pend Oreille was discussed as part of the relicensing of Noxon Rapids and Cabinet Gorge hydroelectric dams. A specific proposal has not been put forth, so it is impossible to accurately predict the impacts from a fish passage facility. However, the facility could potentially improve the status of bull trout by reversing the trend of habitat fragmentation initiated by the construction of the dams. Sediment mitigations in the Rock Creek drainage would result in long-term reductions in sediment, which could eventually improve fisheries habitat in Rock Creek and aid in bull trout recovery.

The USFWS is currently preparing a conservation plan for bull trout. The effect of this plan will be to establish principles and guidelines under which all projects can be evaluated. Although specific details of the plan have not been released, its implementation should benefit bull trout.

Ultimately, the prospect of recovery for the meta-population is good if connectivity to Lake Pend Oreille is restored. On a more local scale, recovery prospects are better for tributaries of Noxon Reservoir compared to tributaries of Cabinet Gorge Reservoir because of the larger foodbase and more stable water levels. In summary, although the meta-population is functioning at unacceptable risk in all the Lower Clark Fork watersheds which contain bull trout, the cumulative effect of all foreseeable projects in these watersheds is to maintain function.

SOCIOECONOMICS

Summary

The socioeconomic effects associated with the Rock Creek project would occur primarily in a "local area" consisting of western Sanders County, southern Lincoln County, and the portion of Bonner County, Idaho, in the vicinity of the town of Clark Fork.

Under Alternative I, existing demographic and economic trends would be expected to continue. Between 1999 and 2020, Sanders County would experience 32 percent population growth and between 1998 and 2020 a 27 percent increase in employment (1,279 jobs) driven by the immigration of retirees and others attracted by the amenities of the area. Lincoln County would see 15 percent population increase and 28 percent employment growth, while population in Bonner County would be expected to increase 47 percent and employment 63 percent. In all three counties the resource commodity production and goods production sectors of the economy would show little-or-no growth, with most new employment being derived from the services and finance/education/government sectors. The trend of land use conversion from timber, agricultural, and open space use to residential subdivisions and ranchettes also would continue. Some community service providers would see the demands for their services expand more rapidly than their resources.

Mine development under the Alternative II or III schedule would add 531 jobs (mostly construction) to the local economy in the first year of mine construction. A year later employment would dip to 143 before climbing again to 497 jobs at full mine production. This sudden influx of workers would cause a scarcity of housing and possibly other boom town effects in the communities nearest the mine. Mine operations, lasting up to 30 years, would support roughly 500 local area jobs providing $14 million in annual personal income. For Lincoln County this mine related employment and income would reflect net increases over the Alternative I baseline, but in western Sanders County housing scarcity and other effects could discourage enough retirement and amenity immigration to largely offset the mine related gains. Eventual mine closure would cause a sudden loss to the area of the related jobs and

income. The local area impacts would be similar to those which occurred when the nearby Troy Mine closed in 1993. Some community service providers in western Sanders County would have difficulty responding to the sudden population influx and exodus during mine construction, but they would at least have the financial assistance provided through Hard-Rock Impact program funding.

The long-term effects of mine operation and closure under Alternative IV or V would not differ significantly from those of Alternatives II or III. Production operations would support about 476 jobs providing annual personal income of $13.4 million for a period of up to 28 years. The employment and population fluctuation during mine construction would be slightly less severe and community service providers would have more time following the start of mine construction to prepare for the arrival of the major influx of construction workers.

If the Rock Creek Mine were to be developed while two other local area mine projects, Troy and Montanore, were in development or operation, the socioeconomic effects would differ substantially from those projected for the Rock Creek project alone. Under this scenario the other two facilities would absorb the labor pool, housing, and community service capacities of the communities in southern Lincoln County. Western Sanders County would receive almost the entire effect of the Rock Creek project demand for workers, housing, and community services. The small pool of western Sanders County available labor would quickly be exhausted and non-local hiring would be extensive. Immigration into western Sanders County during both contract construction and production operations would be nearly double the levels projected under Alternatives IV or V. An extreme shortage of housing would occur unless local government and Sterling pre-built substantial housing (both temporary and long-term). Careful planning would be required to avoid critical shortages of both private and public community services. The costs of housing and other basic services would be likely to escalate. The housing situation and other boom effects would cause prospective amenity immigrants to settle elsewhere and could drive out some who already reside in the area.

Alternative I (No Action)

The impact analysis for Alternative I, the no-action alternative under which the proposed mine would not be developed, assumes that existing patterns and trends would continue to drive the social structure and economy of the area. Since standard demographic and economic projections are based on the same assumption, those projections can be used for the Alternative I analysis of impacts.

Local Population and Economy

Sanders County. The population of Sanders County is projected to grow from 10,233 persons (in 1999) to 13,540 persons in 2020 (NPA DATA Services, Inc. 2001) (Table 4-45 and Figure 4-5). This 32 percent increase would be greater than the expected 26 percent Montana population increase over the same period. The school-age population is expected to rise by 42 percent during this period. The retirement-age population would increase by 1,400 persons from 15.7 percent of county population in 1999 to 22.5 percent in 2020. The county economy also is expected to grow at rates above Montana projections and to experience a slight shift away from resource commodity and goods production toward more services and trade (Table 4-46). Sanders County employment is expected to increase by almost 1,300 jobs, from 4,711 in 1998 to 5,990 in the year 2020. All sectors would expand, but the rate of growth would be somewhat higher in services than in the other categories. As is typical in rural areas, per capita incomes are projected to remain below statewide averages (U.S. Bureau of Economic Analysis

1997). The portion of total county individual income derived from employment earnings would continue to decline as the population ages.

Lincoln County. Lincoln County population is projected to grow more slowly than statewide averages, increasing from 18,819 persons in 1999 to 21,640 persons in year 2020 (15 percent overall increase). The school-age population is expected to increase slightly by 2010, stabilizing at the 1,200 level. Retirement-age population, however, is projected to almost double from 2,818 persons in 1999 to 5510 in 2020 (Table 4-45 and Figure 4-5). Lincoln County employment is expected to increase to 11,450 persons (2,500 additional jobs or 28 percent increase) through the year 2020 (Table 4-46). All of this growth would take place in the finance/education/government and service sectors (40 percent growth), while the resource commodity and goods production sectors are expected to lose over 50 jobs. Wood products manufacturing would remain a vital part of the Lincoln County economy, but the historic dominance of the resource commodity and goods production sectors would be a thing of the past. Per capita income is projected to remain below statewide averages (U.S. Bureau of Economic Analysis 1997).

Bonner County. Bonner County, Idaho, is expected to continue its rapid population growth from 36,071 persons in 1999 to 53,130 persons in year 2020, a 47 percent increase (Table 4-45 and Figure 4-5). The school-age population would grow by 20 percent, while the retirement-age population would increase from 4,801 persons in 1999 to 10,630 in 2020. County employment is expected to increase to 29,490 persons (11,400 jobs or 63 percent growth) through the year 2020 (Table 4-46). Retirement immigration and recreation/tourism would continue to shape the economy with all sectors except resource commodity production experiencing substantial growth. In particular, the construction industry would prosper as it responds to the demand caused by rapid population growth.

Overview. The picture that emerges from these projections is that migration of retired persons to the area (expected to accelerate as the Baby Boom generation begins to retire), combined with immigration of persons whose employment allows them to live where they choose, is expected to be the most significant factor underlying social and economic developments in the region over the next quarter of a century. The ongoing national and regional growth of recreation and tourism would also be a factor. Bonner County's population and economy are expected to grow at rates that would make growth management a more significant concern than economic development. Sanders County (particularly its western portion) would benefit from and move toward what is happening in Bonner County. Sanders County's growth rate is expected to be more modest on average, but is likely to pose some land use issues and challenges for social service providers. Lincoln County is expected to see minimal impact from the regional pattern and to continue its slow pace of growth and change. What growth it does see would come from the finance/education/government and service sectors of the economy.

Land Use and Housing

The land use implications of rapid population growth associated with retirement, amenity, and recreation/tourism development have become familiar based on the experience of areas like Montana's Bitterroot and Flathead valleys, and Idaho's Coeur d'Alene region. The typical development pattern is very dispersed. Lands in private ownership which have supported timber or agricultural production and provided open space are converted to residential subdivisions and ranchettes. During the transition, land use conflicts often arise from the incompatibilities between timber or agricultural production activities and residential use. In some areas domestic water supply and waste treatment pose significant problems.

TABLE 4-45
Rock Creek Mine Area Alternative I Population Projections

County/Sector	1999 (Estimate)	2000 (Projected)	2010 (Projected)	2020 (Projected)
SANDERS COUNTY				
Age 0 to 4	556	580	730	790
Age 5 to 19	2,392	2,380	2,080	2,510
Age 20 to 64	5,681	5,850	7,040	7,190
Age 65 and Above	1,604	1,630	2,080	3,050
ALL PERSONS	10,233	10,440	11,930	13,540
LINCOLN COUNTY				
Age 0 to 4	1,072	1,050	1,200	1,200
Age 5 to 19	4,312	4,180	3,390	3,850
Age 20 to 64	10,617	10,560	11,730	11,090
Age 65 and Above	2,818	2,740	3,460	5,510
ALL PERSONS	18,819	18,530	19,770	21,640
BONNER COUNTY, IDAHO				
Age 0 to 4	2,348	2,370	2,630	3,140
Age 5 to 19	7,874	8,060	8,600	9,420
Age 20 to 64	21,048	21,800	27,120	29,940
Age 65 and Above	4,801	4,680	6,580	10,630
ALL PERSONS	36,071	36,910	44,930	53,130

Sources: Montana Data: NPA Data Services Inc., 2000 Regional Economic Projections Services, Demographic Database, Revised February 2001.

Idaho Data: Woods & Poole Economics, Inc., 2000 State Profile.
Idaho Data Center, Idaho Department of Commerce, Idaho County and State Populations, 1990 to 1999, http:www.idoc.state.id.us/data/county.xls - March 9, 2000.

Note: Numbers may not add to totals due to rounding.

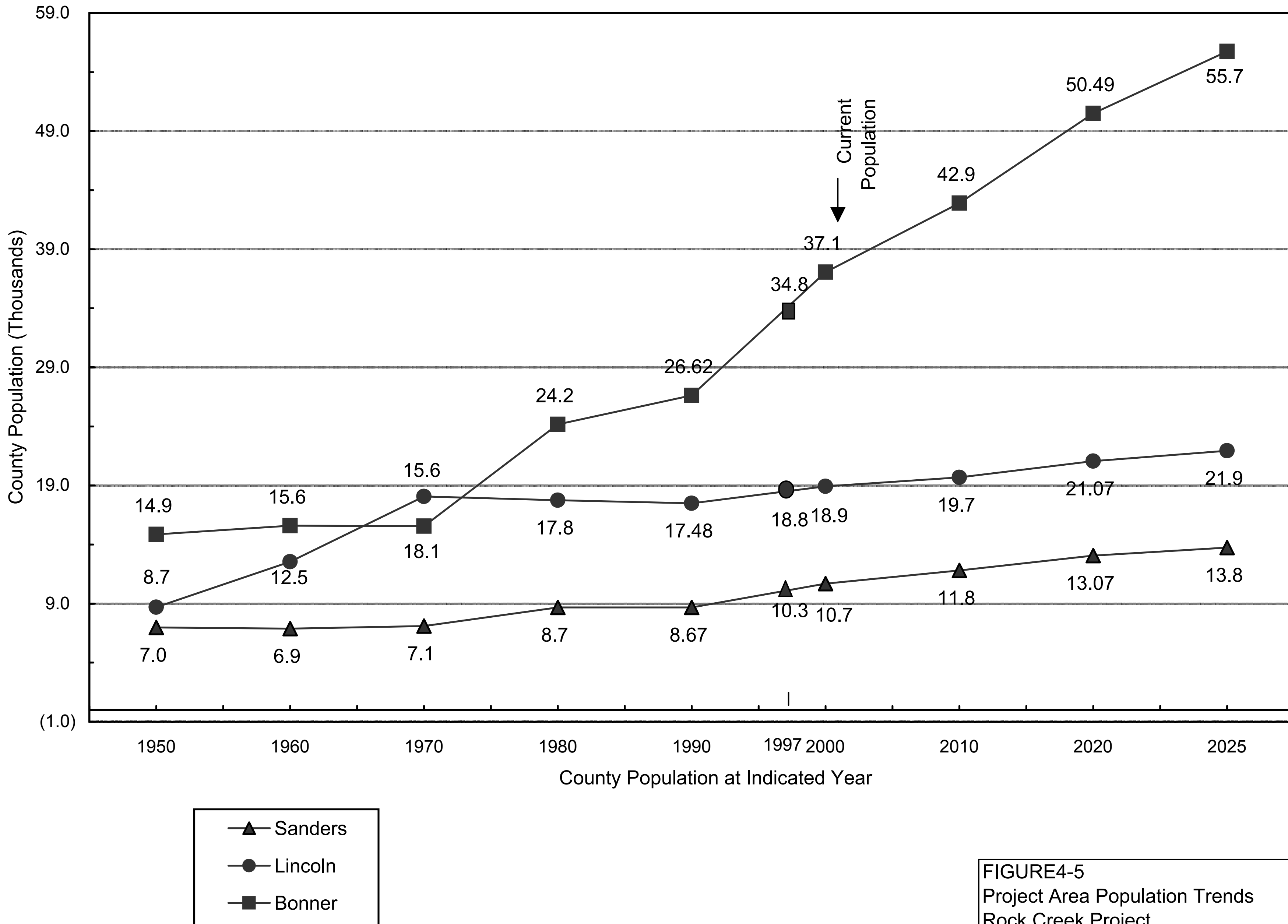


FIGURE4-5
Project Area Population Trends
Rock Creek Project

TABLE 4-46
Alternative I (No Action) Employment Projections

Employment By Sector	1998 (Estimate)		2000 (Projected)		2010 (Projected)		2020 (Projected)	
SANDERS COUNTY								
Resource Commodity (Agriculture, Forestry, Mining)	657	13.9%	640	13.2%	730	13.3%	780	13.0%
Goods Production (Construction, Manufacturing)	781	16.6%	810	16.7%	880	16.1%	920	15.4%
Service Production (Trade, Service, Utilities, Tran.)	2,301	48.8%	2,350	48.6%	2,700	49.3%	3,000	50.2%
Finance/Government/Education	972	20.6%	1,040	21.5%	1,170	21.4%	1,280	21.4%
TOTAL EMPLOYMENT	**4,711**	**100.0%**	**4,820**	**100.0%**	**5,460**	**100.0%**	**5,990**	**100.0%**
PERCENTAGE OF POPULATION EMPLOYED	46.3%		46.2%		45.8%		44.2%	
LINCOLN COUNTY								
Resource Commodity (Agriculture, Forestry, Mining)	567	6.3%	590	6.5%	730	7.0%	820	7.2%
Goods Production (Construction, Manufacturing)	2,059	23.0%	1,940	21.3%	1,820	17.6%	1,750	15.3%
Service Production (Trade, Service, Utilities, Tran.)	4,272	47.7%	4,420	48.5%	5,350	51.6%	6,150	53.7%
Finance/Government/Education	2,064	23.0%	2,170	23.8%	2,460	23.7%	2,730	23.8%
TOTAL EMPLOYMENT	**8,962**	**100.0%**	**9,110**	**100.0%**	**10,340**	**100.0%**	**11,450**	**100.0%**
PERCENTAGE OF POPULATION EMPLOYED	47.9%		49.2%		52.3%		52.9%	
BONNER COUNTY, IDAHO								
Resource Commodity (Agriculture, Forestry, Mining)	1,110	6.1%	1,060	5.3%	1,120	4.5%	1,090	4.0%
Goods Production (Construction, Manufacturing)	4,013	22.2%	4,520	22.7%	5,300	21.4%	5,920	20.1%
Service Production (Trade, Service, Utilities, Tran.)	9,556	52.8%	10,850	54.5%	14,150	57.2%	17,640	59.8%
Finance/Government/Education	3,406	18.8%	3,490	17.5%	4,160	16.8%	4,750	16.1%
TOTAL EMPLOYMENT	**18,085**	**100.0%**	**19,920**	**100.0%**	**24,730**	**100.0%**	**29,490**	**100.0%**
PERCENTAGE OF POPULATION EMPLOYED	51.2%		54.0%		55.0%		55.5%	

Source: Montana Data: NPA Data Service, Inc., 2000 Regional Economic Projections Series, Economic Database, Revised February 2001.
Idaho Data: Woods & Poole Economics, 2000 State Profile, 2000.

Note: Numbers may not add to totals due to rounding.

The demands on public lands and their managers shift dramatically. Traditional large scale resource commodity activities meet with increasing opposition, while the demand for aesthetic and recreational resources expands substantially (USFS 1995a).

The severity of the problems associated with these land use changes depends mostly on their pace and extent. Bonner County already has substantial experience with these growth related issues. To date, land use change in western Sanders County has caused few problems, but private lands along the Clark Fork and the Bull River would continue to be developed for residential and recreational uses in the next 25 years (estimated 400 to 500 new residences in western Sanders County). The Rock Creek drainage is expected to receive reduced timber cutting over the next few decades. If Sterling were to determine that its lands along Rock Creek were no longer needed, these lands (approximately 700 acres) could be sold and the more accessible parcels would most likely be developed for residential use.

Population growth in Bonner County and western Sanders County has increased the price of housing and building sites (see Table 3-38). Median land and home prices have risen dramatically in recent years (ASARCO Incorporated 1997b). Projections for population growth and the continued strength of the area's construction industry suggest that this trend would continue. In this market, affordable housing for low-income and fixed-income households is apt to become scarce or be available only in less attractive areas. In communities or locations lacking public water supply or sewer systems, the cost of a private well and septic system could add significantly to the cost of basic housing.

Community Services

The region's population is expected to show little or no growth in the school-age population and rapid growth in the retirement-age sector over the next quarter century. This pattern has particular implications for community services. It creates little or no demand for expansion of school facilities and services, but it also produces a voting population which may not be supportive of tax measures needed to maintain existing facilities and cover operating costs. An aging population has fewer people likely to be involved in criminal activity, but a high proportion who may become crime victims. It also is a population that has a high need for medical and emergency response services and community transportation.

The three counties in the project study area present three patterns of growth combined with an aging population structure (see Table 4-45). Bonner County is expected to grow so rapidly that, while the senior sector of the population would show the most growth, school enrollments would also increase. Lincoln County is expected to experience a substantial reduction in school-age population and enrollment paired with a dramatic increase in the retirement-age sector. Sanders County is expected to see modest school enrollment declines combined with slightly less retirement-age sector growth than has been predicted for its neighbors.

Because it is anticipated that the effects of the proposed Rock Creek Mine on community services would be minimal in Bonner County, the primary area of community services concern is western Sanders County and southern Lincoln County. The implications of the Alternative I population and economic projections for Sanders County community services can be summarized as follows:

- In Sanders County total school-age population is not expected to exceed its 1995 level at any time during the next 25 years. School enrollments would probably decrease over the first half of the period and then return to approximate 1995 levels by 2020. In Lincoln County school age population is expected to decrease by 21 percent over the next 25 years, and school enrollment would follow suit. A generally older population with a smaller proportion of voters with school-aged children may reduce local support for school operations and maintenance tax levies.

- Given the widely dispersed pattern of expected residential development and the limited public water systems available, most new domestic water supply would be private wells or small private water systems. Individual septic tank/drainfield systems would be used for sewage treatment. In some areas heavy clay soils may limit the use of such systems or make them very costly to install and operate.

- Population growth may make it necessary to expand Sanders County law enforcement staff and to increase the staff and upgrade the equipment of the fire protection and ambulance services. Volunteer staffing of the fire and ambulance services should continue to provide adequate service.

- Existing medical services in western Sanders County are very basic and limited. In most areas the travel time to the nearest hospital or source of specialized services is at least an hour. A growing senior population may support some upgrading of local clinic and visiting physician services, but the limited availability of medical services in the area is unlikely to change significantly.

A number of studies have examined the effects of different residential development patterns on local communities in terms of the cost of providing local government services versus the revenue generated (Frank 1989). The most relevant of these studies found that in Montana's Gallatin and Broadwater counties, the cost of services for residential development was between $1.45 and $3.25 per dollar of revenue produced (Hagerty 1997). On the other hand commercial, industrial, agricultural and open space property typically requires from $.18 to $.31 in services per dollar of revenue produced. The expectation that school enrollment would not increase, the substantial dependence on private water and sewer systems, and the reliance on volunteer emergency service providers suggest that community service costs in the Rock Creek project area may not exceed increased revenue from new development by such a large margin. Even so, revenue received from rural area residential growth in Sanders County would be unlikely to pay the increased community services costs generated.

Alternatives II and III

Because the mine development schedule, the employment levels, and the placement of mine facilities would be essentially identical under Alternatives II and III, the social and economic effects of the two alternatives would be the same and could be addressed with a single analysis.

Project Employment, Income, and Immigration Projections

During the life of the mine, activity would go through four phases: evaluation adit construction, mine construction and startup, mine operation, and closure/reclamation. Each phase would have a distinct employment pattern (Table 4-47 and Figure 4-6). The evaluation adit construction phase would last about a year with mine employment peaking during the last quarter of the year at 73 workers. Adit construction could lead directly to mine construction, or it could be followed by a period of inactivity lasting from a few months up to several years. Mine construction and start-up would last about

TABLE 4-47
Alternative II & III Direct & Secondary Employment Projections

		ASARCO Employment	Contract Employment	Direct Employment	Secondary Employment	Total Employment	Employment Increment
Evaluation Adit Construction							
Yr. 1	1st. Qtr.	39	--	39	--	39	39
	2nd. Qtr.	52	--	52	12	64	25
	3rd. Qtr.	70	--	70	14	84	20
	4th. Qtr.	73	--	73	18	91	7
Yr. 2	Indefinite	20	--	20	8	28	-63
Mine Construction and Startup							
Yr. 1	1st. Qtr.	34	235	269	8	277	249
	2nd. Qtr.	50	260	310	61	371	94
	3rd. Qtr.	78	300	378	72	450	79
	4th. Qtr.	84	320	404	91	495	45
Yr. 2	1st. Qtr.	88	345	433	98	531	35
	2nd. Qtr.	92	210	302	104	406	-124
	3rd. Qtr.	92	--	92	79	171	-235
	4th. Qtr.	106	--	106	37	143	-28
Yr. 3	1st. Qtr.	120	--	120	42	162	20
	2nd. Qtr.	144	--	144	48	192	30
	3rd. Qtr.	219	--	219	58	277	85
	4th. Qtr.	260	--	260	88	348	71
Yr. 4	1st. Qtr.	305	--	305	104	409	61
	2nd. Qtr.	340	--	340	122	462	53
	3rd. Qtr.	355	--	355	136	491	29
Mine Operations							
Up to 30 Years		355	--	355	142	497	6
Mine Closure							
Approx. 2 Yrs.		35	--	35	10	45	-452

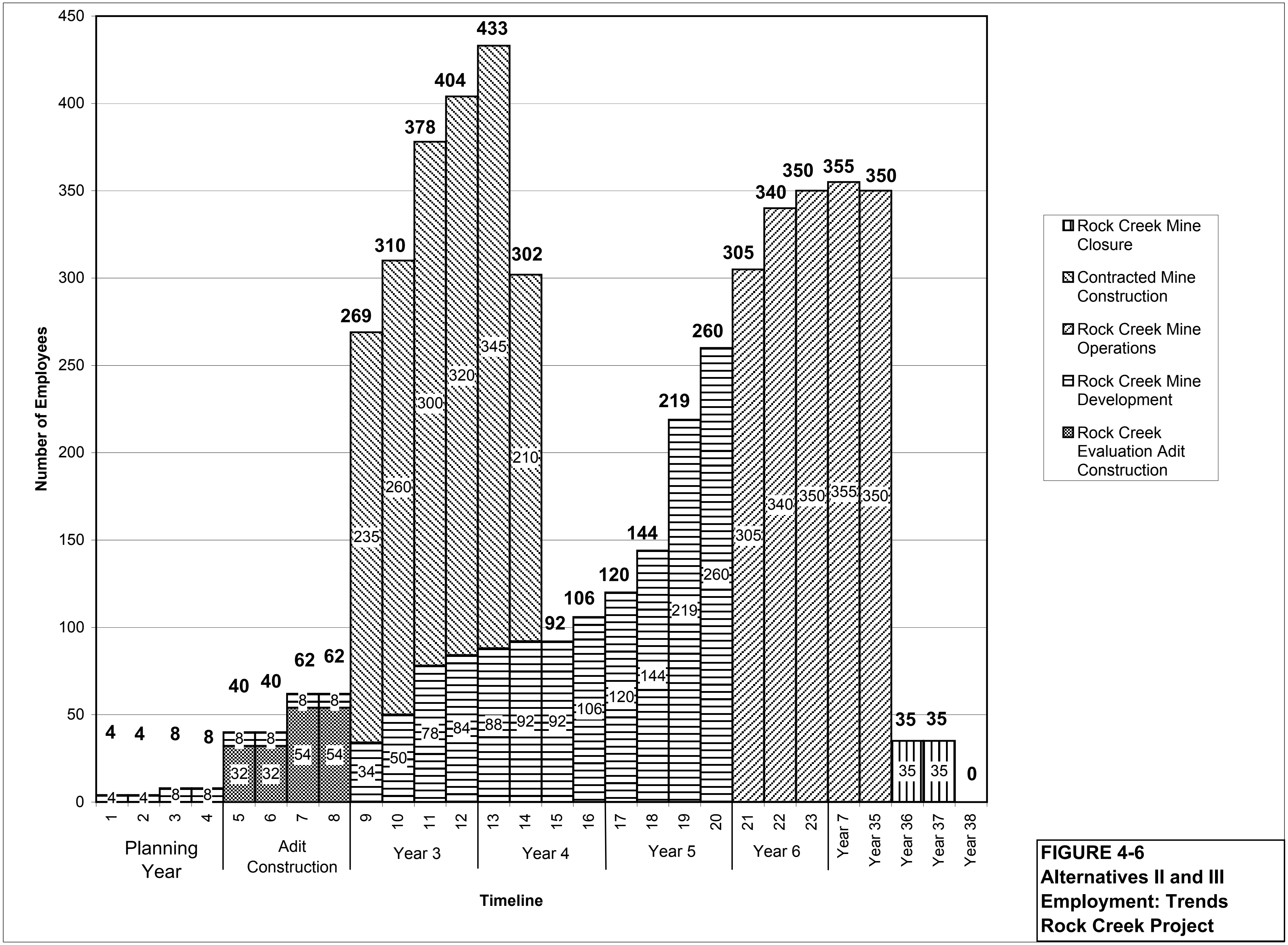


FIGURE 4-6
Alternatives II and III
Employment: Trends
Rock Creek Project

three-and-a-half years with employment peaking at 433 workers during the first quarter of the second year, dropping to 92 workers six months later, and then climbing to 355 as the mine approached full production. The full employment level for the mine operations phase, which could last up to 30 years, would remain at 355 employees. Mine closure and reclamation activities would require about 35 workers for two years. Actual project employment and the duration of the mine-life phases would vary from these projections, depending upon construction progress and the resources applied by Sterling toward full-scale operations. Mineral market conditions also could cause operations to be curtailed or shut down on short notice at any point during projected mine life.

Mine activity would stimulate new jobs (secondary employment) in the local economy. The short duration of the contract construction jobs, combined with the normal delay between direct employment changes and secondary employment development, would produce very low levels of indirect job creation. Only about 0.2 secondary jobs per contract construction job would be expected. On the other hand, long-term mine activity would be expected to generate an average of 0.4 secondary jobs per mine employee. These indirect employment multipliers are based on recent Montana mine development experience, adjusted to reflect the high leakage rates of the area economy.

Table 4-47 and Figure 4-6 show that the combined total of direct and secondary employment associated with the project would begin with 91 jobs during exploration adit construction. During mine construction it would go from a handful of employees to 531 jobs in just over a year, drop precipitously to 143 jobs nine months later, and then build again to 497 jobs as the mine reached full production.

The potential increment to total personal income from these 497 operating phase jobs could be estimated using industry earnings statistics. In 1995 the average annual wage paid in the Montana metal mining industry (adjusted for personal contribution for social security insurance to be compatible with baseline data) was $33,100, while the average wage for all non-agricultural employment was $15,980. Multiplying these averages by expected project direct and secondary employment, provides an estimate of $14 million per year as the total project-generated annual personal income. It should be noted that this estimated income would be reached only when average employment for a year equaled 355 mine workers and 142 secondary employees.

The number of people who would immigrate to the local area because of the project could be estimated based on experience with other mines in the region. This experience indicates that mining and construction workers will tolerate one-way commuting times of about an hour. Beyond that distance the incidence of relocation to live closer to the work site increases quickly. For the Rock Creek project this implies a local employment area that would include the Clark Fork Valley from a few miles east of Thompson Falls to west of Clark Fork, Idaho. Southern Lincoln County around Troy would be included as would the portion near Libby (unless another major project in that area provided better employment opportunities). On the other hand, it is unlikely that mine workers would reside in the Sandpoint area. The distance to Sandpoint from the project site, the strong Bonner County economy, and the proximity of the Coeur d'Alene-Spokane employment market would make Rock Creek Mine employment relatively unattractive. Even so, some workers might commute from Sandpoint during the brief period of contract construction.

TABLE 4-48
Alternatives II & III Local Area Immigration Projections

		Cumulative Local Area Immigration				Migration Increment			
		Workers	Spouses	Children	Total	Workers	Spouses	Children	Total
Evaluation Adit Construction									
Yr. 1	1st. Qtr.	19	15	25	59	19	15	25	59
	2nd. Qtr.	24	19	30	73	5	4	5	14
	3rd. Qtr.	33	25	40	98	9	6	10	25
	4th. Qtr.	39	30	46	115	6	5	6	17
Yr. 2	Indefinite	24	18	27	69	-15	-12	-19	-46
Mine Construction and Startup									
Yr. 1	1st. Qtr.	169	106	103	378	145	88	76	309
	2nd. Qtr.	236	151	164	551	67	45	61	173
	3rd. Qtr.	306	200	226	732	70	49	62	181
	4th. Qtr.	346	227	261	834	40	27	35	102
Yr. 2	1st. Qtr.	377	247	285	909	31	20	24	75
	2nd. Qtr.	304	204	253	761	-73	-43	-32	-148
	3rd. Qtr.	171	123	183	477	-133	-81	-70	-284
	4th. Qtr.	167	121	179	467	-4	-2	-4	-10
Yr. 3	1st. Qtr.	168	122	181	471	1	1	2	4
	2nd. Qtr.	179	130	193	502	11	8	12	31
	3rd. Qtr.	201	147	219	567	22	17	26	65
	4th. Qtr.	236	172	258	666	35	25	39	99
Yr. 4	1st Qtr.	272	199	298	769	36	27	40	103
	2nd Qtr.	310	227	340	877	38	28	42	108
	3rd Qtr.	335	245	367	947	25	18	27	70
Mine Operations									
Yr. 1	1st Qtr.	346	253	378	977	11	8	11	30
	2nd Qtr.	348	254	380	982	2	1	2	5
Up to 30 Years		348	254	380	982	--	--	--	0

Local hire rates for permanent employees at mines in Montana over the last 15 to 20 years have ranged from about 40 percent to above 90 percent. The high end of this range has been observed where a large local population or high rate of unemployment in the relevant skill areas provided a large pool of available labor. The low end examples came from projects located in areas with a small population base and labor pool. Conditions in the vicinity of the Rock Creek project suggest that local hiring in the 70 percent range should be achievable during most project phases but would probably drop somewhat in the tight labor market expected during contract construction.

Local hire for short-term contract construction could range from less than 20 percent to more than 80 percent, with 40 percent being commonly observed when out-of-area contractors are involved. Secondary employment usually goes to local residents who typically are hired into 80 to 90 percent of the jobs created. Replacement hiring, an often overlooked factor, brings immigrants to a local area when the new jobs created by a new source of employment cause a chain reaction of vacancies as employed individuals move into better jobs. If project startup occurs during a period of local labor shortage, or if it creates a shortage, out-of-area replacement hiring could be substantial.

The numbers of anticipated Sterling, contract construction, and secondary employees were factored together with the expected local-hire ratios to estimate the number of non-local workers that would be hired for primary, secondary, or replacement vacancies. The combined estimate is displayed by the "Workers" column under "Cumulative Local Area Immigration" in Table 4-48.

Many of these in-migrating workers would bring families with them. Experience from other mineral and energy developments in the region indicates that family size would vary depending on the type of employment. Table 4-49 shows expected family sizes for long-term mine employees, contract construction workers, and secondary and replacement employees. Eighty percent of the long-term mine employees are expected to be married with families present and, on average, to have 1.6 children per married family or 1.3 children per worker. Because contract construction workers often do not bring families with them, the in-migration associated with their jobs would be lower than for operational workers.

TABLE 4-49
Expected Family Size of In-Migrating Workers

	Sterling Employees	Contract Employees	Secondary & Replacement Employees
Family Size	3.10	2.10	2.70
Per 100 Workers			
Number of Workers	100	100	100
Number of Spouses Present	80	60	70
Number of Children	130	50	100

Sixty percent are expected to have families present with 0.8 children per family or 0.5 children per worker. The secondary or replacement jobs that draw immigrants would tend to be full-time, higher-wage positions—not part-time, minimum-wage work. Still, the in-migrating workers filling these jobs would be younger and have smaller families than the employees hired for mine operations positions. Seventy percent could be expected to have families with 1.43 children per family or 1.0 child per worker.

Applying these family size estimates to the in-migrating worker projections produces the total immigration figures displayed by Table 4-48. In-migration associated with evaluation adit construction would be just 115 persons. The contract construction period would bring 909 people to the local area in just over a year. Then, a few months later this figure would drop to 467 individuals. As Sterling hiring resumed and the mine approached full production, total in-migration associated with the project would be expected to grow to 982 persons. A check on the reasonableness of these projections is provided by the 1998 population and employment data which reveal population to employment ratios of 2.2 to 1 in Sanders County and 2.1 to 1 for Lincoln County. The Rock Creek project in-migrating population estimate of 982 persons associated with 497 new jobs represents a population to employment ratio of 2.0:1. This comparison suggests that the in-migrating population projections are reasonable.

Several factors would influence where migrants would settle within the local area. They would seek to minimize their commuting distance, but would be constrained by the availability of housing and of other community services. For secondary and replacement workers, the job site would not be at the mine but in local area communities and existing businesses. The short-term nature of contract construction jobs makes contract workers more tolerant of long commutes, but also means that they use temporary housing and would be unlikely to purchase homes. Rental units and other suitable short-term housing are scarce in the local area with southern Lincoln County having the most to offer. Building sites and existing housing on the market are also relatively scarce. This is especially true in western Sanders and eastern Bonner counties where housing demand has already inflated residential property values. The Alternative I demographic projections for Sanders and Lincoln counties suggest that factors not associated with the mine proposal could be expected to produce substantial population growth in western Sanders County over the next 5 to 10 years, keeping housing scarce and expensive, while southern Lincoln County is expected to see relatively slow growth, greater housing availability and more moderate housing costs.

Evaluation Adit Construction Community Effects

The social and economic effects of evaluation adit construction would be almost imperceptible in the local area. The peak employment of 91 direct and secondary jobs would represent an increase in local labor demand of about 1.5 percent with most jobs lasting only six to nine months. About 40 workers (118 people) would move into the local area. A significant portion of these would be project management and administrative staff. Since there would be no assurance of long-term employment for these immigrants, they would seek rental housing, the scarcity of which widely distribute their settlement.

Mine Construction and Startup Community Effects

The socioeconomic implications of the employment, income, and population projections for the period extending from the beginning of mine construction through initial full production operations would be significantly different, both in magnitude and in kind, for the various communities in the local area. The greatest effects would be observed in the communities closest to the proposed project, while more distant areas would experience much more modest changes. Table 4-50 presents projected local area resident employment for three key times during mine construction and startup. The first set of estimates are for the peak employment level expected during contract construction work—which would occur about 15 months into startup activity. The second set of estimates represents minimum employment after contract construction ended. This minimum would follow the contract construction peak by about six-to-nine months. The final set of estimates reflect anticipated employment as the mine reached full production and shifted to sustained operations. This would occur nearly 4 years after the start of construction. Table 4-51 shows projected hiring of employees from outside the local area and the associated immigration numbers for the same three points during mine construction and startup.

TABLE 4-50
Alternatives II & III Expected Local Hiring Mine Construction and Startup

Community	Sterling Workers	Contract Workers	Secondary Workers	Total Local Hire
Contract Construction Peak Employment				
Noxon/Heron/Trout Cr. Area	11	32	19	62
Thompson Falls Area	8	22	13	43
Troy Area	13	28	21	62
Libby Area	13	41	22	77
Eastern Bonner Co.	4	15	7	26
TOTAL	49	138	82	269
Construction Employment Low				
Noxon/Heron/Trout Cr. Area	15	--	8	23
Thompson Falls Area	11	--	5	16
Troy Area	17	--	9	26
Libby Area	18	--	9	27
Eastern Bonner Co.	5	--	3	8
TOTAL	66	--	33	99
Full Production Operations Employment				
Noxon/Heron/Trout Cr. Area	57	--	28	86
Thompson Falls Area	40	--	20	60
Troy Area	65	--	32	97
Libby Area	67	--	33	100
Eastern Bonner Co.	20	--	10	30
TOTAL	249	--	123	372

In the following discussions of the anticipated effects of mine construction and startup on the communities within the local area, it is assumed that, if either Alternative II or III were selected for implementation, the Hard-Rock Mining Impact Plan would be modified to reflect the anticipated effects of these alternatives on local government services and that, in accord with the provisions of the Montana Hard-Rock Mining Impact Act, the modifications would essentially mitigate potential fiscal impacts of the mine on local government service providers.

Noxon/Heron/Trout Creek Area. Workers living in the Noxon/Heron/Trout Creek area of western Sanders County (including the Bull River drainage) would be hired for some of the new jobs created by mine construction. The actual number employed would depend on a number of factors, but at the peak of construction it would be reasonable to expect that about 43 direct jobs and 19 secondary jobs would go to the residents of these communities. However, many of these jobs would be for short-term contract construction work, so a few months after this peak the numbers still employed would drop to one-third of the peak levels. Some of those hired and then laid off would have a good chance of eventually being hired by Sterling for mine operating positions. At full mine operations Noxon/Heron/Trout Creek area residents could be expected to hold about 57 direct and 28 secondary jobs (Table 4-50).

Alternative II or III mine development scheduling would bring an estimated 328 people to the Noxon/Heron/Trout Creek area during the first 15 months of construction (Current population of this area is approximately 3,100). Then, as contract personnel were laid off, more than half of these 328 would depart the area. A second wave of immigration would follow which would bring project-related immigrant numbers up to 378 at full mine operations.

TABLE 4-51
Alternatives II & III Expected Settlement Locations of Immigrating Workers & Families

	Immigration Worker Settlement			Immigration Population Settlement			
Community	**Sterling Workers**	**Contract Workers**	**Sec. & Rep. Workers**	**Total Workers**	**Spouse**	**Children**	**Immigrant Total**
Contract Construction Employment Peak							
Noxon/Heron/Trout Cr. Area	15	83	40	138	90	100	328
Thompson Falls Area	10	41	26	77	51	60	188
Troy Area	6	31	26	63	42	49	154
Libby Area	4	21	26	51	33	42	126
Eastern Bonner Co.	4	31	13	48	31	34	113
TOTAL	39	207	131	377	247	285	909
Construction Employment Low							
Noxon/Heron/Trout Cr. Area	16	--	38	54	39	59	152
Thompson Falls Area	10	--	26	36	26	38	100
Troy Area	6	--	25	31	23	33	87
Libby Area	4	--	25	29	21	31	81
Eastern Bonner Co.	4	--	13	17	12	18	47
TOTAL	40	--	127	167	121	179	467
Full Production Operations Employment							
Noxon/Heron/Trout Cr. Area	48	--	85	133	98	147	378
Thompson Falls Area	27	--	61	88	64	96	248
Troy Area	13	--	36	49	36	53	138
Libby Area	8	--	36	44	32	46	122
Eastern Bonner Co.	10	--	24	34	25	37	96
TOTAL	106		242	348	255	379	982

These immigration projections are based on the expectation that housing would be the limiting factor on the settlement of in-migrating workers. Specifically, these projections assume that, with or without assistance from Sterling, some temporary housing facilities would be developed near the project site. Such facilities would enable more workers to settle in this area than would be able to otherwise. It has not been assumed that it would be feasible to develop housing to meet the needs of the entire expected non-local contract construction labor force. Many would be forced to commute longer distances to meet their temporary housing needs. Individuals hired for long-term mine jobs would have difficulty finding housing. Some would have to settle initially in communities more distant from the mine and then relocate to permanent residences in the Noxon/Heron/Trout Creek area after contract construction workers had left the area.

The projected long-term project-driven population increase of 378 persons in the Noxon/Heron/Trout Creek area represents a 12 percent increase over a period of several years with a potential that the employment base underlying that increase would be relatively stable. These are attributes typically associated with beneficial community growth and development. However, the expectation that construction immigration would increase population 11 percent in just over a year, with inadequate housing availability being the primary limiting factor and many of the migrants being in the area for a short period, is a scenario to which the term "boom town" is often applied.

Experience with such rapid population change in small communities suggests that certain phenomena often occur. Some individuals are forced to live in marginal or sub-standard housing, and demand for temporary housing may escalate rental rates to the detriment of low- or fixed-income community members. Recreational vehicles, used for housing by temporary residents, may crowd available facilities and spill over to sites not suited for residential use. Local private and public service providers (restaurants, retail businesses, recreation facilities, medical services, police, emergency services, schools) may have difficulty responding to sudden increases in demand and may be forced to "tough it out" until the initial migration peak has passed. While some immigrants would be expecting to become long-term residents and would seek to become integrated into the community, others would be well aware of their temporary status and unlikely to participate. At worst, an influx of temporary residents with large cash incomes, few ties to the community, and limited social and recreational opportunities can pose problems for limited law enforcement resources. To what extent these phenomena would surface in the western Sanders County communities is impossible to predict, but it would be unrealistic not to expect some detrimental effects from the sudden influx, and equally sudden departure, of the large contract construction workforce. Measures adopted in the Hard-Rock Mining Impact Plan would help to alleviate the stress on public services, but they would not deal with impacts on private services or with those resulting from lack of housing.

A point of particular concern with population fluctuations such as those predicted for the Noxon/Heron/Trout Creek area is the potential for impacts on the schools. The employment and population projections for the area imply that at the peak of contract construction there would be at least 70 new students in the school system—30 of whom would be gone a few months later. These children would be entering and leaving school systems which had a total enrollment of 376 during the 1999-2000 school year. Although school enrollments in the area are projected to be generally declining during the next 10 to 15 years, the sudden arrival and departure of this many students in school systems of this size would be disruptive. The eventual total school enrollment increment at full mine operations would be about 100 students. Depending on project timing, this increase could be partially offset by the enrollment declines expected in the coming years if mine development does not occur.

Thompson Falls Area. Workers living in the Thompson Falls vicinity would be expected to be hired for about 30 direct jobs and 13 secondary jobs at the peak of construction phase employment. Eleven direct jobs and 5 secondary would remain following the contract construction force layoffs. Then, local resident employment would grow to about 40 direct and 20 indirect jobs at full mine operations.

The Alternative II or III construction schedule would bring 188 immigrants to the Thompson Falls vicinity over a period of 15 months with nearly 90 of these leaving a few months later. Immigration would then resume, topping out at 248 total immigrants in the Thompson Falls area when the mine reached full production. The availability of short-term housing meeting the needs of contract construction workers would be a factor limiting the initial immigration peak, while the price and availability of housing on the market may constrain long-term settlement.

The projected immigration numbers are equivalent to a population influx of nine percent during the brief run-up to the peak of construction activity and a total of eleven percent from construction start to full mine operation. A nine percent increase in fifteen months would not be easy for a community the size of Thompson Falls to absorb, but a "boom town" scenario probably would not arise. The projected growth is more moderate than that predicted for the communities in the immediate vicinity of the mine site, and as an incorporated town and the county seat Thompson Falls should be better able to absorb growth impacts.

The variation in employment levels during mine startup would bring 42 new students to the Thompson Falls school system during the first 15 months of mine construction, with about a third of them departing a few months later. The project total enrollment increment at full mine operation would be about 67 students. Depending on the timing of the construction peak influx and the distribution of the new enrollees over the grade structure, the system and its facilities (1999-2000 enrollment 614) might have difficulty absorbing this load. Any effects of the long-term enrollment increase would probably be mitigated by expected enrollment declines if the mine is not developed.

Sanders County Overview. How mine startup would alter the Alternative I (No Action) population and economic predictions for Sanders County is difficult to anticipate. Under Alternative I, Sanders County would be expected to continue to have population growth rates exceeding those of the state as a whole. This growth would be driven primarily by the immigration of retirees and other persons whose incomes are not tied to residence in any particular location. These immigrants, drawn the area by its amenity values, would provide the basis for employment growth in the service, trade, and finance/education/government sectors of the economy. Employment in the goods production and resource commodity sectors would be static.

For most people the choice of where to live is constrained by the need to be within commuting distance of a job location. Since this constraint does not apply to retirees or to those whose incomes are not tied to residence in any particular location, housing availability and the perceived amenities offered by an area or community become paramount factors in their choice of where to live. Typically these "amenity immigrants" will move to an area perceived as being attractive until housing prices or availability cause them to seek elsewhere for the desired amenities or until something happens to make the area less attractive. Even the threat or the uncertainty that some potential activity may reduce the attractiveness of an area may send them to other locations.

Housing prices in western Sanders County have already escalated in response to the demand of these immigrants. Just the impact of mine development on housing availability and cost in western Sanders County would be apt to send some amenity immigrants elsewhere. There would be a general tightening of the real estate market, and the housing needs of some long-term mine employees (especially management and supervisory personnel) would compete directly with amenity immigrant needs. Also, since these immigrants often use temporary housing while they build a permanent residence, a critical shortage of temporary housing would discourage their settlement in the area.

Although mine development is not predicted to have significant effects on the amenities throughout western Sanders County and any boom town effects would probably be mild and of brief duration, there still could be some impact on amenity immigration. This effect would result from uncertainty and fears (realistic or not) about potential mine impacts. This uncertainty could inhibit immigration until the mine had been in operation long enough to demonstrate its actual impacts. The magnitude of any population and economic growth that might be foregone by Sanders County if potential amenity immigrants settle elsewhere is beyond prediction. The basic mechanisms of amenity immigrant locational choice are not readily quantifiable, with mine development impacts on many of the relevant factors being highly uncertain.

Troy Area. Workers living in the Troy vicinity or along Highway 56 south of Troy would be hired for about 41 direct jobs and 21 secondary jobs at the peak of construction phase employment. About 17 direct positions and 9 secondary jobs would remain a few months later. Then, local resident employment would grow to about 65 direct and 32 indirect jobs at full mine operations.

The Alternative II or III construction schedule would bring a population increment of about 154 people to the Troy vicinity over a period of 15 months, about 67 of whom would leave after a few months. Immigration would then resume, building to just over 138 total immigrants in the Troy vicinity at full mine production.

The projected immigration numbers are equivalent to a population influx of seven percent during the brief run-up to the peak of construction activity and a total of six percent from construction start to full mine operation. Given population projections for slow growth in Lincoln County, the Troy area should have no difficulty absorbing these immigration numbers. The distance from Troy to the mine site would be a factor limiting immigration. A substantial portion of the immigrants expected to arrive during the second wave of immigration would be filling job vacancies created when Troy area residents were hired by the mine.

Employment fluctuations during mine construction and startup would bring approximately 34 new students to the Troy school system during the first 15 months of mine construction, with about a third of them departing a few months later. The projected total enrollment increment at full mine operation would be somewhat over 37 students. During the 1999-2000 school year enrollment in the Troy elementary and high school systems totaled 576 students. This enrollment represented a drop from peak levels recorded in the early 1990s, and the school age population is expected to decline further, if the mine is not developed. New enrollment associated with mine development would reduce this expected decline in student numbers.

Libby Area. Libby area residents could be expected to land about 54 direct jobs and 41 secondary jobs during the peak period of mine construction activity. At the low point a few months later they would still hold roughly 18 direct and nine secondary jobs. Then, as the Sterling work force expanded to full operational levels, employment of Libby area residents would grow to about 67 direct and 33 secondary jobs.

Immigration to the Libby area would peak at about 126 persons at the height of contract construction, drop to 81, and then eventually reach 122 at full mine production. Since immigrants hired for long-term mine positions would be unlikely to chose permanent residences this distance from the job, most of the population increment would be tied to secondary jobs and replacement employment.

Mine-related school enrollments at Libby would peak at about 29 students during contract construction, then drop to 22 before climbing again to about 32 at full mine operations. These new students would be entering a system which had a total student population of 1,919 during the 1999-2000 school year. Population projections for Lincoln County (without mine development) indicate a decrease in the county school age population of 11 percent between 1999 and 2010, so the student influx expected from mine development should not pose an enrollment problem for the Libby system.

Lincoln County Overview. The Alternative I (No Action) discussion for Lincoln County predicted slow population growth with a shift to a substantially older population distribution. All economic growth was expected to occur in the services and finance/education/government sectors, with the resource commodity and goods production sectors anticipated to lose 50 jobs by the year 2020. The mine, at full operations, would add approximately 260 persons to the Lincoln County population projected under the No Action Alternative. This would equate to a 1.3 percent increment on the 19,770 population projected for the year 2010. Direct and secondary employment at full mine operations of persons who would reside in Lincoln county would total about 224 workers, with about 75 percent of this employment being in the resource commodity and goods production sectors. (Mine jobs would, of course, be reflected in Sanders County employment statistics, not Lincoln County.) The personal earned income of Lincoln County residents derived from mine direct and secondary employment would total approximately $6.2 million in 1995 dollars. This would equate to about 2.0 percent of 1995 total Lincoln County estimated personal income with retirement and pension benefits included.

Mine development would provide employment and income growth in an otherwise slow-growth Lincoln County economy. While the fluctuations in employment and population expected during mine construction and startup would be less than ideal, there appears to be no basis for expecting that mine development would have detrimental effects on Lincoln County social or economic life.

Clark Fork Area. The effects of mine startup on the portion of eastern Bonner County in the vicinity of the community of Clark Fork would be similar to those projected for the Thompson Falls area. Workers living in the Clark Fork area would be expected to be hired for about 19 direct jobs and 7 secondary jobs at the peak of construction phase employment. A third of these jobs would remain following the contract construction force layoffs. Then, local resident employment would grow to about 20 direct and 10 indirect jobs at full mine operations.

The Alternative II or III construction schedule would bring a population increment of about 113 people to the Clark Fork vicinity over a period of 15 months, with 47 of these remaining a few months later. Immigration would then resume, as ASARCO built its work force, topping out at 96 total immigrants in the Clark Fork vicinity when the mine reached full production.

The Clark Fork area, which is accustomed to yearly recreation and tourism booms, should be able to accommodate the projected short-term mine construction population influx with little difficulty unless the mine construction peak coincides with the peak tourism season. In that case, the availability of temporary housing and of facilities for recreational vehicles could become very limited. Bonner County population and the size and prosperity of its economy are such that it is unlikely that mine related immigration and employment would have a discernible effect on the county or its economy.

Mine Operations Community Effects

It is anticipated that the Rock Creek mine project would have an operating life of up to 30 years. During this period the socioeconomic effects on the local area would be expected to be relatively stable, but there would be some adjustments.

Table 4-52 displays where mine direct and secondary employees would be expected to live at the time the mine achieves full production operations. About 230 would reside in Sanders County, 224 in Lincoln, and 42 in eastern Bonner County. During the operating period, as the local communities adjusted to the influx of migrants to the area, as area residents hired by the mine reacted to their new employment location, and as turnover occurred in the mine workforce, there would be a slow shift of employee residence to the communities located near the work site. Because the work site for most secondary jobs would be in the various local area communities, secondary employee involvement in this shift would be minimal. The magnitude of the shift in community residence would depend on a number of unpredictable factors, but it would not be unreasonable to expect that Lincoln County might eventually lose a third of the employees expected to reside there initially. This would result in roughly 305 workers living in Sanders County and 150 in Lincoln County in the later years of mine operations.

Table 4-52 also shows a distribution of personal income (in 1995 dollars) to the communities of the local area. This distribution is based on the expected earnings of mine and secondary employees and their projected community of residence. The table projections indicate that the initial Sanders County share of employee earnings would be about $6.6 million per year. Lincoln County could expect about $ 6.2 million, and the Bonner County share would be about $1.2 million. If the residence shift suggested above did occur, the resulting earnings distribution would become roughly $8.9 million to Sanders County, $3.9 million to Lincoln, and $1.2 million to Bonner. For Sanders County these employment and earnings estimates indicate that mine operations at full production would equate to between 5.9 and 7.9 percent of 1995 county employment and from 10 to 13 percent of 1995 total earned income. The same estimates for Lincoln County show resident employment equaling 1.6 to 2.5 percent of 1995 county employment and earnings of 2.4 to 3.9 percent of 1995 earned income. While the employment and earnings projected for the Clark Fork area of Bonner County would be significant for that community, they would amount to less than 0.2 and 0.3 percent of county 1995 employment and earnings respectively.

TABLE 4-52
Alternatives II & III Operating Phase Residence and Income Distribution

Projected Employee Area of Residence			
Community	**Sterling Workers**	**Secondary Workers**	**Total Workers**
Noxon/Heron/Trout Cr. Area	105	34	139
Thompson Falls Area	67	25	92
Troy Area	78	35	113
Libby Area	75	36	111
Eastern Bonner Co.	30	12	42
TOTAL	**355**	**142**	**497**

Projected Annual Income Distribution Based on Employee Residence			
Community	**Sterling Employment**	**Secondary Employment**	**Total Employment**
Noxon/Heron/Trout Cr. Area	$3,475,500	$543,320	$4,018,820
Thompson Falls Area	$2,217,700	$399,500	$2,617,200
Troy Area	$2,581,800	$599,300	$3,141,100
Libby Area	$2,482,500	$575,280	$3,057,780
Eastern Bonner Co.	$993,000	$191,760	$1,184,760
TOTAL	**$11,750,500**	**$2,269,160**	**$14,019,660**

Note: The figures in this table represent expected residence and income distribution at the beginning of full production operations. Residence shifting over the life of the mine is expected to increase residence and income in Sanders County and decrease those figures in Lincoln County.

The numbers presented in Table 4-52 and in the two preceding paragraphs require considerable care in their interpretation and use. A number of factors must be kept in mind, including:

- The indicated employee residence distributions are based on assumptions and estimates of variables that cannot be predicted with certainty. They are, at best, very rough predictions.
- The earnings distributions are based on statewide average mining industry and non-agriculture employee weekly earnings, multiplied by the project direct and secondary employment estimates. If average annual mine employment does not equal 355 employees, if less secondary employment is generated, or if local wages do not match the statewide averages, then potential earnings are overstated.
- Only social security insurance withholding has been deducted from gross earnings in making these calculations. Since tax withholding and deductions for pension or medical benefits have not been deducted, the figures do not reflect spendable income.
- Because of the limited availability of many goods and services in the local area communities there is considerable "leakage" in their economies. A very substantial portion of earnings

allocated to any particular community area would not be spent in that community but would go directly to other local communities or out of the local area entirely.

- For the western portion of Sanders County, in particular, the earnings figures do not represent net earnings gain. As noted in the discussion of mine startup impacts, it is possible that foregone amenity immigrant incomes could partially or completely offset these gains.

- Any local area expenditures by the mine which do not produce direct or secondary employee earnings have not been included in these estimates.

One effect that the startup and continued operation of a large industrial facility such as the proposed project may have on the economy of a local area with a limited population and labor force is that wages and prices in some portions of the economy may increase—to the benefit of some individuals and the detriment of others. Mine employment would provide high-paying long-term employment for those able and qualified (or trainable) for the work required. Qualified workers in the local area would apply for mine positions producing a chain reaction of job vacancies and replacement hiring. Many individuals would have the opportunity to improve their employment situation and earnings. Given the small size of the local area labor pool, however, it is probable that a shortage of individuals with the skills required by the mine would develop and that local employers would have difficulty finding qualified replacements for workers hired by the mine or would have to offer higher wages than they have in the past. These employers would either have to absorb additional labor costs or pass them on to customers. Typically the local construction industry can be especially hard hit, with a shortage of workers developing at the same time that housing demand escalates. Housing shortages and price increases in any of the basic goods and services sectors of the economy would be detrimental to individuals on fixed incomes and to those low-income employees who lack the ability or skills to compete for the type of jobs where wages were increasing.

With 355 direct employees and 142 secondary positions in the local area relying on its contribution to the local economy, the mine would be the largest single employer in the area. Changes in its operating employment levels would be keenly felt. Once the local economy had adjusted to a particular operating level, any reductions-in-force would release individuals whose life style would be attuned to mine wage rates and who would find very few opportunities for comparable employment in the local market. Any shutdown of operations for a few weeks or months would cause a sudden drop in local area income while laid off workers, expecting a resumption of operations, would be unlikely to seek other work.

Mine Closure and Reclamation Community Effects

One reality of any mining project is that eventually the deposit of economically minable ore is exhausted and the mine ceases to operate. For the Rock Creek project it is anticipated that this would occur after 22-30 years of production. Mine closure would cause the abrupt loss of an estimated 320 direct and 132 indirect jobs, with mine reclamation expected to employ approximately 35 workers and a handful of secondary jobs for two additional years. This would produce an initial drop in employment earnings in the local area of $12.9 million per year (in 1995 dollars) followed by a second drop of $1.1 million. Unless other large mining projects are operating in the area at the time, closure of the Rock Creek mine could eliminate half, or more, of all the resource commodity sector jobs expected to exist in the local area economy in the year 2020.

The situation would probably be very similar to what happened following the 1993 closure of the Troy Mine when approximately 300 workers lost their jobs. Two-thirds of these workers entered a federally funded worker retraining/transition program. About half of the laid off workers continued living in the area 2 years after shutdown (pers. comm. Mike Bissell, Libby Job Service, March 7, 1995). If Rock Creek Mine closure followed the same pattern and half of the mine workers left the area for other employment locations, it would generate an exodus of nearly 180 workers and up to 560 persons. Some secondary employees who would lose their jobs also would depart, adding perhaps another 70 workers and 150 persons to the exodus.

Fiscal Effects

The proposed project would increase local and state government revenues. These revenues would come from three sources: property taxes on the mine land, plant, and equipment; gross proceeds tax on the value of ore produced; and property tax on new homes and commercial facilities built as a result of mine development. The project would increase costs for cities, schools, and counties through mine-related immigration and resulting increases in local government service costs (Fodor 1996). These additional local government expenditures would pay for capital outlays, personnel, and support costs.

Sanders County and the Noxon area school districts would be the primary recipients of tax revenues on the mine and mill facilities, but Montana law provides for tax-base sharing among affected Montana local government units when a mine is designated as a large-scale mineral development. Therefore, several other taxing entities would share in the project tax revenues (see Alternatives IV and V analysis for a summary of the Hard-Rock Impact Plan and tax base sharing).

When construction of mine facilities was complete, the taxable property value would be about $5.3 million (ASARCO Incorporated 1997b). This taxable value would decline as the mine facilities and equipment were depreciated out, reaching fully depreciated values in 10 to 15 years. Actual annual local tax revenues would depend on local mill levy rates, state property tax equalization, and property tax prepayments and credits under the Hard Rock Impact Plan.

Montana levies a metal mines license tax on a mine's annual gross revenues in excess of $250,000. This is a percentage tax on the value of ore concentrate shipped to the refinery. Tax revenues would fluctuate depending on silver and copper prices and the project’s annual production levels. By law, seventy-five percent of these revenues would be allocated to Montana's general fund. The remaining 25 percent would be allocated to Sanders County, and distributed through the county to appropriate departments and districts. The county would be required to reserve at least 40 percent of this revenue in a trust fund account which could be expended only when a 50 percent reduction in the mine operations work force occurred.

The peak tax revenue year would occur when mine facility construction was complete and the mine reached full production. In that year (assuming present local mill levies remain in effect), Sanders County would receive about $384,000 in total property and gross proceeds tax revenues (ASARCO Incorporated 1997b). The municipality of Thompson Falls would receive about $44,500, and the Noxon, Trout Creek, and Thompson Falls school districts would receive a combined total of about $546,800. Revenue levels based on taxable property and equipment values would decline over a period of about 15 years as value of mine facilities and equipment depreciated out. Revenues based on gross proceeds would follow production levels and market values.

Community Services

Under Alternative II or III, local government would need to serve rapidly fluctuating populations. First there would be an influx of nearly 1,000 persons in just over a year at the start of mine construction, then a decrease of 500 persons a few months later, followed by growth to just over 1,000 immigrants as the mine reached full production. Twenty to thirty years later mine closure could produce an exodus of up to 680 persons. The rapid population fluctuations during mine startup could cause difficulty for some service providers in responding to demands requiring change in staffing and resource allocation (Wenner 1992). A particular problem for service providers under Alternatives II or III would be deciding how to staff up for the sudden and brief construction influx when it would be followed by a substantial and prolonged dip in population.

Anticipated fluctuations in school enrollment were identified in the mine construction and startup discussion as having differing effects on the schools in the local area. Additional enrollment in the Noxon and Trout Creek schools could require some staffing increases and possibly facility expansion, but tax prepayments and increased tax revenues over the life of the mine should provide adequate fiscal resources to make these adjustments. Since Lincoln County school enrollments were projected to decline over the next 10 to 15 years (if the mine is not developed) the arrival of students associated with mine operations would not be expected to create staffing or capacity difficulties. The sudden influx and equally sudden departure of the children of contract construction workers would be large enough in some school systems to be disruptive during the brief period that it lasted.

Small communities which lack temporary housing facilities as well as a wide range of public and private services may experience law enforcement problems when a large temporary work force with no community ties, above-average income, marginal housing, and a high percentage of individuals who are not accompanied by families suddenly arrives. If such problems were to develop in association with the startup construction phase of the Rock Creek project, they would be more likely to emerge in the communities located nearest to the mine site.

Community fire, emergency, medical, and social service providers would benefit from the additional tax revenues generated by the mine and should be able to adapt to the long-term changes in demand associated with mine operations. However, they could have a hard time adjusting their staffing to the sudden changes in service demands associated with mine construction and startup. Obtaining and training new staff takes time, and the fire and ambulance services, in particular, could experience difficulty finding and training additional volunteers. It is anticipated that the mine would maintain its own ambulance and would support and cooperate with local emergency service providers.

If one assumes that all housing needs would need to be met with new housing, then the estimated long-term increase of a large portion of 133 operations-related households on the Noxon and Heron water systems would be expected to overtax these existing systems. However very little property for development remains within the service boundaries of these systems. The Trout Creek, Thompson Falls, and the Clark Fork and Hope water systems could readily accommodate small water demand increases from expected project immigrants (the remainder of the 133 households not at Noxon or Heron, 88 households, and 34 households, respectively). (See Table 4-53 for breakdown of anticipated housing needs during construction and mine operation.) The actual increased need or use of public systems would be less as some of the new residences would be constructed outside these water service areas where water for new residences would likely be supplied from private wells. Ground water resources are generally sufficient for expected household needs. Specific local ground water availability has not been established and may be insufficient in local areas.

Since the Thompson Falls sewage treatment facility is near capacity, demands from immigrating families would be difficult to accommodate. Growth could require additional municipal waste treatment capacity or could force new residential and commercial construction outside of Thompson Falls city limits. Most new rural residences would rely on septic tanks for new residential wastewater disposal. Potential problems with construction and operation of new septic systems would be evaluated on a case-by-case basis as part of county sanitation permitting.

If mine development does result in impacts on these community systems, the Hard Rock Mining Impact Plan has provisions for providing resources to deal with these impacts. However, it would be the responsibility of the local governments to allocate the resources for those upgrades and not the state or Sterling. Expansion of these facilities would have to comply with all applicable water quality and water rights regulations.

Land Use and Housing

During project operations about 400 acres of private lands at the impoundment site would be dedicated to mine use. Following mine closure, reclamation would allow tree regrowth on the impoundment, but the site probably would not support future commercial timber production. The mill site would support forest regeneration following reclamation and could be returned to wildlife, forestry, and recreation uses (see Soils and Reclamation for details). The Alternative II loadout facility at the Hereford rail siding would put 0.5 acres of private lands at that location to industrial use. Under Alternative III the loadout would create a 1.0 acre industrial facility at Miller Gulch. Alternatives II and III also would involve acquisition or conservation easements on about 3,000 acres of private lands for grizzly bear mitigation (3,074 and 2,692 acres, respectively). This mitigation would preclude future residential and commercial development.

As noted in the Alternative I discussion of land use trends, population growth in the area is converting substantial areas of private land from timber or agricultural production and open space use into residential subdivisions and ranchettes. It also is shifting the demands on public land resources away from traditional resource commodity production toward a greater emphasis on recreation, and aesthetic values. Mine development would generally reinforce these trends, at least in the Clark Fork Valley, by adding to population and housing demand pressures. It should be expected, however, that land use demand driven by mine development would differ somewhat from the existing pattern driven by retiree and amenity immigrant population growth. Although some mine employees would compete in the same market as amenity immigrants for relatively large residential properties offering good scenic or other amenity values, most would be more likely to seek properties providing good basic family housing locations. The development of some businesses catering to new residential areas and commuting mine workers also would be expected near the mine site along Highway 200.

During the first fifteen months of mine construction and startup workers arriving in the local area would be expected to need housing as shown by Table 4-53. Contract construction workers would need temporary housing for only a few months to a year. Their housing requirements would be for about 126 families and 81 single or unaccompanied individuals. Few, if any, of these individuals would purchase housing. They would seek rentals, motel units, and mobile home or recreational vehicle sites. Some would share accommodations for as long as they remained in the area. Workers hired by Sterling and long-term secondary or replacement employees would be arriving at the same time and would require housing for about 122 families and 48 single individuals. Although some of these individuals and families would eventually purchase or build their own homes in the area, many would need temporary housing initially and would compete with the contract construction workforce for the very limited supply.

TABLE 4-53
Alternatives II & III Housing Needs of Immigrating Workers

Community	Permanent Housing		Temporary Housing		Total Housing
	Family	Single	Family	Single	
Contract Construction Peak					
Noxon/Heron/Trout Cr. Area	40	15	50	33	138
Thompson Falls Area	26	10	25	16	77
Troy Area	23	9	19	12	63
Libby Area	21	9	13	8	51
Eastern Bonner Co.	12	5	19	12	48
TOTAL	122	48	126	81	377
Full Production Operations					
Noxon/Heron/Trout Cr. Area	98	35	--	--	133
Thompson Falls Area	64	24	--	--	88
Troy Area	36	13	--	--	49
Libby Area	32	12	--	--	44
Eastern Bonner Co.	25	9	--	--	34
TOTAL	255	93	--	--	348

During this period the Noxon/Heron/Trout Creek area and, probably, the Thompson Falls and Clark Fork areas would experience a severe shortage of rental and other short-term housing. A moderate-sized mobile home court (roughly 25 units) could be developed to help reduce this housing shortage. The applicant is not proposing to develop a work camp, but may provide assistance to a private mobile home court operator in the area (ASARCO Incorporated 1997b). In southern Lincoln County the larger communities, minimal recent growth, and greater availability of motel units and RV parks should allow that area to house the construction period influx of temporary residents with relative ease. Some long-term immigrants who would eventually settle in communities closer to the mine site would probably find temporary quarters in the Troy and Libby areas until they were able to purchase or build permanent homes.

Mine operations workers would have the kind of secure jobs with above-average wages that would allow them to purchase or build homes. Some immigrants hired into secondary and replacement jobs would be in the same situation. Others would be more likely to need rental housing or mobile home spaces. The anticipated mine operation phase immigration would place less strain on local housing supplies than would the earlier influx of construction workers. Nearly two-thirds of the immigrants who would arrive in the area by the time the mine reached full production would be expected to reside in western Sanders County (162 families and 59 singles). Then, as noted in the discussion of operating phase population effects, there probably would be some additional shifting of mine employee residence locations to Sanders County over the life of the mine.

Alternatives IV and V

Because the phases of mine life, and the employment levels and schedules would be essentially identical under Alternatives IV and V, the social and economic impacts of the two alternatives can be addressed with a single analysis. The primary factors differentiating Alternatives IV or V from Alternatives II or III, in terms of socioeconomic impacts, would be a modified mine development schedule and different employment levels.

Project Employment, Income, and Immigration Projections

Table 4-54 and Figure 4-7 display the employment pattern which would be expected under Alternatives IV or V. The evaluation adit construction phase would last about a year-and-a-half, employing a maximum of 73 workers. It could lead directly into mine construction, or could be followed by a period of inactivity before mine construction would start. Mine construction and start-up would take almost 5 years. About 73 workers would be employed during the first 18 months, then about 275 contract construction workers would be added for 18 months. When contract construction was complete, employment would drop to 180 workers before climbing back to 340 mine employees as the mine approached full production. This labor force of 340 would represent full production employment through the mine operations phase, which would be expected to last up to 28 years. Mine closure and reclamation activities would require about 35 workers for 2 years.

These levels of direct mine employment would stimulate secondary employment in the local economy as shown by Table 4-54 and Figure 4-7. The combined total of direct and secondary employment associated with the project would begin with 93 jobs during exploration adit construction and the first 18 months of mine construction. Then, it would jump to over 430 jobs in a matter of 3 to 6 months and remain at that level for a year-and-a-half before dropping to an estimated 252 direct and secondary workers after completion of contract construction work. About 6 months later, a substantial block of mine positions would be filled bringing total employment to 444 individuals. From there employment would build to 476 jobs as the mine reached full production.

The potential increment to total personal income in the local area from the projected operating phase employment would be approximately $13.4 million per year—four percent below the same projection for Alternative II or III. This difference reflects the different alternative estimates of full production mine employment, and it is possible that the actual employment levels would be essentially the same under any of the action alternatives.

The number of workers who would immigrate to the local area in response to the proposed project under Alternatives IV or V is shown by the “Workers” column under “Cumulative Local Area Immigration” in Table 4-55. Applying the family sizes displayed by Table 4-49 to these in-migrating worker estimates produces the total immigration figures shown by Table 4-55. Area in-migration associated with evaluation adit construction is expected to be 117 persons. Mine employment turnover and replacement hiring during the first 2 years of mine construction would bring only a small number of additional immigrants to the area, but the start of contract construction would bring total immigrant

TABLE 4-54
Alternative IV & V Direct & Secondary Employment Projections

		ASARCO Employment	Contract Employment	Direct Employment	Secondary Employment	Total Employment	Employment Increment
Evaluation Adit Construction							
Yr. 1	1st. Qtr.	23	--	23	--	23	23
	2nd. Qtr.	47	--	47	7	54	31
	3rd. Qtr.	55	--	55	14	69	15
	4th. Qtr.	55	--	55	16	71	2
Yr. 2	1st. Qtr.	73	--	73	16	89	18
	2nd. Qtr.	73	--	73	20	93	4
	Indef.	20	--	20	8	28	-43
Mine Construction and Startup							
Yr. 1	1st. Qtr.	73	--	73	8	81	53
	2nd. Qtr.	73	--	73	20	93	12
	3rd. Qtr.	73	--	73	20	93	0
	4th. Qtr.	73	--	73	20	93	0
Yr. 2	1st. Qtr.	73	--	73	20	93	0
	2nd. Qtr.	73	--	73	20	93	0
	3rd. Qtr.	73	270	348	20	363	270
	4th. Qtr.	73	275	348	83	431	68
Yr. 3	1st. Qtr.	73	275	348	84	432	1
	2nd. Qtr.	73	275	348	84	432	0
	3rd. Qtr.	73	275	348	84	432	0
	4th. Qtr.	73	273	346	84	430	-2
Yr. 4	1st. Qtr.	180	--	180	78	258	-172
	2nd. Qtr.	180	--	180	72	252	-6
	3rd. Qtr.	317	--	317	72	389	137
	4th. Qtr.	317	--	317	127	444	55
Yr. 5	1st. Qtr.	317	--	317	127	444	0
	2nd. Qtr.	317	--	317	127	444	0
	3rd. Qtr.	340	--	340	127	467	23
Mine Operations							
Up to 28 Years		340	--	340	136	476	9
Mine Closure							
Approx. 2 Yrs.		35	--	35	10	45	-431

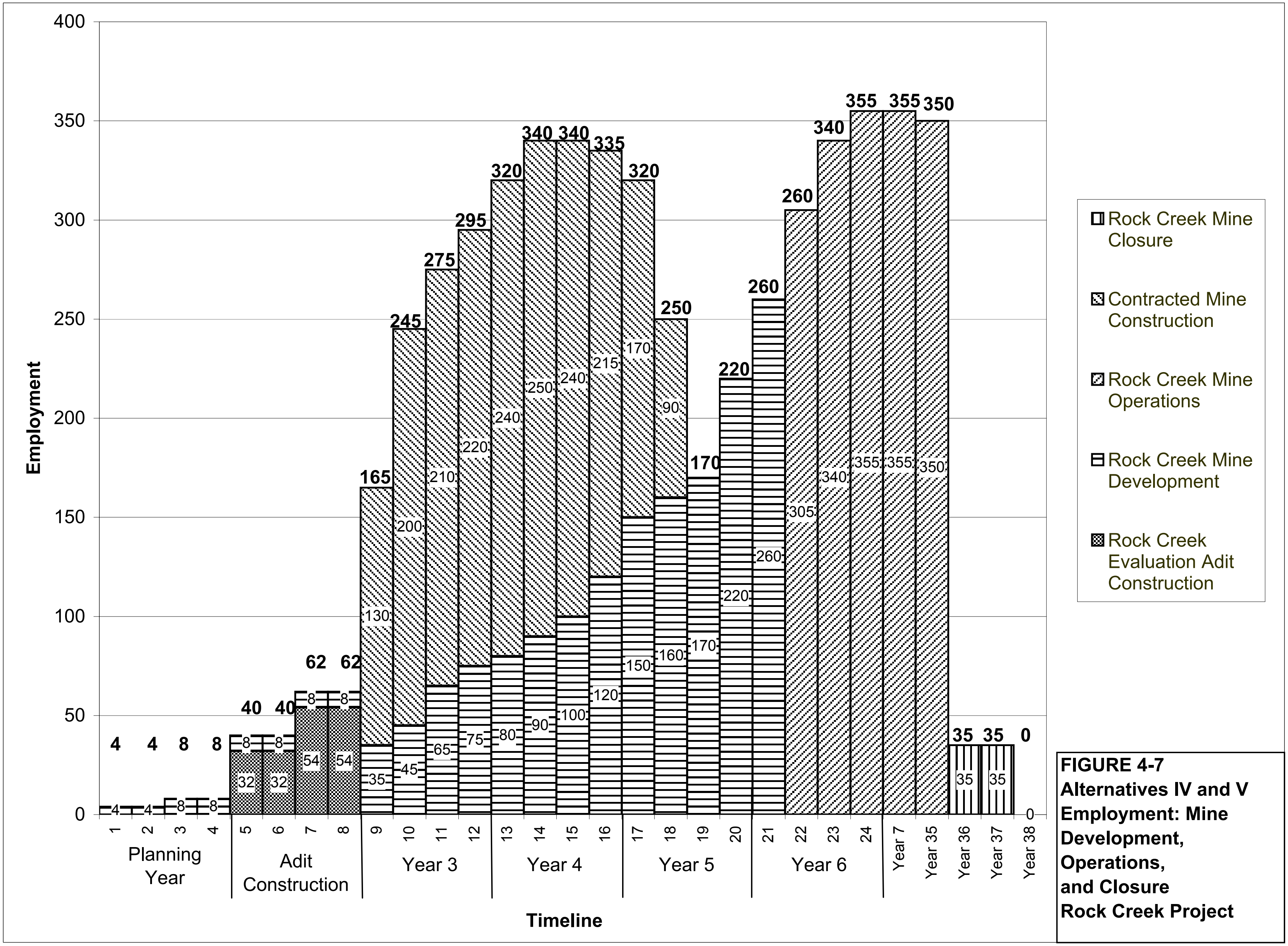


FIGURE 4-7
Alternatives IV and V
Employment: Mine Development, Operations, and Closure
Rock Creek Project

TABLE 4-55
Alternative IV & V Local Area Immigration Projections

		Cumulative Local Area Immigration				Migration Increment			
		Workers	Spouses	Children	Total	Workers	Spouses	Children	Total
Evaluation Adit Construction									
Yr. 1	1st. Qtr.	12	10	16	38	12	10	16	38
	2nd. Qtr.	23	18	29	70	11	8	13	32
	3rd. Qtr.	30	23	36	89	7	5	7	19
	4th. Qtr.	33	25	39	97	3	2	3	8
Yr. 2	1st. Qtr.	36	28	43	107	3	3	4	10
	2nd. Qtr.	40	30	47	117	4	2	4	10
	Indefinite	25	19	28	72	-15	-11	-19	-45
Mine Construction and Startup									
Yr. 1	1st. Qtr.	39	30	46	115	14	11	18	43
	2nd. Qtr.	50	37	57	144	11	7	11	29
	3rd. Qtr.	55	41	62	158	5	40	5	14
	4th. Qtr.	55	41	62	158	0	0	0	0
Yr. 2	1st. Qtr.	55	41	62	158	0	0	0	0
	2nd. Qtr.	55	41	62	158	0	0	0	0
	3rd. Qtr.	217	138	143	498	162	97	81	340
	4th. Qtr.	289	188	214	691	72	50	71	193
Yr. 3	1st. Qtr.	319	209	244	772	30	21	30	81
	2nd. Qtr.	319	209	244	772	0	0	0	0
	3rd. Qtr.	319	209	244	772	0	0	0	0
	4th. Qtr.	317	208	243	768	-2	-1	-1	-4
Yr. 4	1st. Qtr.	166	120	178	464	-151	-88	-65	-304
	2nd. Qtr.	163	118	175	456	-3	-2	-3	-8
	3rd. Qtr.	215	160	243	618	52	42	68	162
	4th. Qtr.	262	193	290	745	47	33	47	127
Yr. 5	1st. Qtr.	283	207	311	801	21	14	21	56
	2nd. Qtr.	283	207	311	801	0	0	0	0
	3rd. Qtr.	291	214	321	826	8	6	10	25
Mine Operations									
	1st. Qtr.	301	221	331	853	12	8	12	32
	2nd Qtr.	304	223	334	861	3	2	3	8
Up to 28 Years		304	223	334	861	0	0	0	0

numbers to more than 772 over a period of less than 6 months. A little more than a year later more than 300 of this total would have departed the area. As Sterling hiring resumed in the later portion of mine startup, the total in-migration associated with the project would be expected to grow to 861 persons.

Evaluation Adit Construction Community Effects

The social and economic effects of the evaluation adit construction phase would be essentially imperceptible in the local area. The peak anticipated employment of 93 direct and secondary jobs would represent an increase in the local area labor market of only about 1.5 percent with most jobs lasting about a year. About 40 workers (117 people) would move into the local area. A significant portion of these would be project management and administrative staff. Since there would be no assurance for these immigrants of long-term employment, they would be reluctant to purchase housing and the limited availability of rental housing would distribute their settlement widely over the local area.

Mine Construction and Startup Community Effects

Table 4-56 presents expected local area resident hiring distribution for three key points during mine development. The first estimates are for the employment peak during contract construction activity. The second set represent minimum expected employment following termination of contract construction. This minimum would follow the contract construction peak by 6 to 9 months. The final set of estimates reflect anticipated employment as the mine shifts to sustained production operations. This would occur about 5 years after the start of construction. Table 4-57 shows expected hiring of employees from outside the local area and the associated immigration distribution for the same points during mine development used in Table 4-56.

Noxon/Heron/Trout Creek Area. Workers already living in the Noxon/Heron/Trout Creek area of western Sanders County would be hired for about 36 direct jobs and 17 secondary jobs at the peak of contract construction. 47 of these residents would remain employed after the end of contract construction, with some having shifted from contract jobs to Sterling positions. At full mine operations Noxon/Heron/Trout Creek area residents would be holding about 55 direct jobs and 27 secondary jobs (three jobs fewer than projected under Alternatives II or III).

About 60 people would migrate into the Noxon/Heron/Trout Creek area during evaluation adit construction and the first 18 months of mine development. Then, when contract construction got underway, there would be a sudden influx of almost 240 additional people in less than 6 months. About a year later, as contract personnel were released from project work, nearly 150 people would leave the area. A second wave of immigration would follow which would bring project-related immigrant population back up to 332 at full mine operations.

TABLE 4-56
Alternatives IV & V Expected Local Hiring Mine Construction and Startup

Community	Sterling Workers	Contract Workers	Secondary Workers	Total Local Hire
Contract Construction Peak Employment				
Noxon/Heron/Trout Cr. Area	11	25	17	53
Thompson Falls Area	8	18	11	37
Troy Area	13	22	18	53
Libby Area	13	33	19	65
Eastern Bonner Co.	4	12	6	22
TOTAL	49	110	71	230
Construction Employment Low				
Noxon/Heron/Trout Cr. Area	32	--	15	47
Thompson Falls Area	22	--	11	33
Troy Area	37	--	17	54
Libby Area	38	--	18	56
Eastern Bonner Co.	11	--	5	16
TOTAL	140	--	66	206
Full Production Operations Employment				
Noxon/Heron/Trout Cr. Area	55	--	27	82
Thompson Falls Area	38	--	19	57
Troy Area	62	--	31	93
Libby Area	65	--	32	97
Eastern Bonner Co.	20	--	9	29
TOTAL	240	--	118	358

The projected eventual project-driven population increase of 332 persons in the Noxon/Heron/Trout Creek area represents an 11 percent increase over a period of several years driven by an employment base that would be expected to remain stable for an extended period. This long-term pattern suggests beneficial community growth and development. However, the expectation that 240 individuals would immigrate to these communities in about 6 months time during the startup of contract construction gives reason for concern. While the total numbers involved in this contract construction influx are about 9 percent smaller than were projected for the same phase under Alternatives II or III, the time period during which they would be expected to arrive is shorter because contract construction employment would reach its maximum level more quickly. The availability of temporary housing would again be the primary factor limiting the number of contract construction immigrants settling in these communities, and the more sudden influx would allow less time for the housing market to react.

TABLE 4-57
Alternatives IV & V Expected Settlement Locations of Immigrating Workers & Families

Community	Immigration Worker Settlement			Immigration Population Settlement			
	Sterling Workers	Contract Workers	Sec. & Rep. Workers	Total Workers	Spouse	Children	Immigrant Total
Contract Construction Employment Peak							
Noxon/Heron/Trout Cr. Area	12	74	39	125	81	92	298
Thompson Falls Area	6	33	26	65	43	50	158
Troy Area	3	17	26	46	31	38	115
Libby Area	2	16	26	44	29	37	110
Eastern Bonner Co.	1	25	13	39	25	27	91
TOTAL	24	165	130	319	209	244	772
Comstruction Employment Low							
Noxon/Heron/Trout Cr. Area	16	--	36	52	39	58	149
Thompson Falls Area	10	--	25	35	25	37	97
Troy Area	6	--	25	31	22	32	85
Libby Area	4	--	25	29	20	30	79
Eastern Bonner Co.	4	--	12	16	12	18	46
TOTAL	40	--	123	163	118	175	456
Full Production Operations Employment							
Noxon/Heron/Trout Cr. Area	45	--	71	116	86	130	332
Thompson Falls Area	258	--	51	76	56	84	216
Troy Area	12	--	31	43	31	46	120
Libby Area	8	--	31	39	28	41	108
Eastern Bonner Co.	10	--	20	30	22	33	85
TOTAL	100	--	204	304	223	334	661

Under Alternative IV or V the Noxon/Heron/Trout Creek area schools would gain about 64 students from the beginning of exploration adit construction through the peak of contract construction work. About 47 of these would arrive during a 3- to 6-month period. Enrollment would drop by 23 students during the employment dip following contract construction completion. There would be additional turnover in students enrolled in the system, however, with students from contract construction families leaving and being replaced by students from mine operations families. The eventual total school enrollment increment at full mine operations would be about 91 students. Depending on project timing, this increment could be partially offset by enrollment declines expected if mine development does not occur.

Thompson Falls Area. Workers living in the Thompson Falls vicinity would be expected to be hired for about 26 direct jobs and 11 secondary jobs at the peak of construction phase employment. About 22 direct jobs and 11 secondary would remain following the contract construction force layoffs. Then, local resident employment would grow to about 38 direct and 19 indirect jobs at full mine operations.

The Alternative IV or V construction schedule would bring the immigration of about 38 people to the Thompson Falls vicinity during the initial period of mine construction, followed by an additional 120 arrivals when contract construction begins. After a little more than a year the Thompson Falls area immigrant total would drop to about 97 persons before immigration would resume, topping out at 216 total immigrants at full production. The availability of short-term housing meeting the needs of contract construction workers would be a factor limiting the initial immigration peak. Housing availability and prices also could constrain long-term settlement.

The projected immigration numbers are equivalent to a population influx of six percent during the brief run-up to the peak of construction activity and a total of ten percent from construction start to full mine operation. These increases are more moderate than those predicted for Thompson Falls under Alternatives II or III and should not pose any substantial problems for the community. The primary noticeable effect would be housing scarcity and probable increased housing costs.

Mine employment during initial development would bring 10 new students to the Thompson Falls school system. Then, there would be a sudden influx of an additional 25 students during contract construction. About 14 of these would depart after a little more than a year in the system. The total enrollment increment at full mine operation would be about 59 students. The Thompson Falls school system, which is projected to have declining enrollment if the mine is not developed, should be able to absorb this anticipated enrollment.

Sanders County Overview. The mechanisms having the potential to alter the Alternative I (No Action) population and economic predictions for Sanders County which were discussed in the Alterative II or III analysis of effects would also apply under Alternative IV or V. Mine construction and startup impacts on housing availability and cost, combined with uncertainty and fears (realistic or not) about potential mine impacts, could send some amenity immigrants elsewhere.

Although there is no significant difference between the action alternatives in terms of long range effects on Sanders County population, employment, and income, the development schedule associated with Alternatives IV or V could have some short-term benefit for county social and economic conditions in comparison with the Alternative II or III schedule. Part of this benefit would come from the fact that under the Alternative IV or V schedule the period of peak contract construction activity would not begin until at least a year-and-a-half after Sterling initiated actual mine development (under Alternative II or III this period of intense activity would begin the process). The Alternative IV or V schedule would give school systems and other public service providers more time to plan for the contract construction population influx. There also might be some development of temporary housing facilities before the contract construction influx.

A second factor associated with the Alternative IV or V schedule that might be beneficial for the Sanders County communities would be that the drop in employment levels and the exodus at the close of contract construction activity would be less severe than under the Alternative II or III schedule. Under Alternative II or III there would be a 70 percent drop in total direct and secondary employment between the peak of contract construction activity and the employment low point following the end of contract work. This drop would be 40 percent under Alternative IV and V, and the employment dip would not last as long because the mine would more quickly move to full operations employment. A less severe and shorter employment dip between contract construction and full production should smooth out the adaptation of the Sanders County communities and local economy to the effects of mine development.

Troy Area. Workers already living in the Troy vicinity would be hired for about 33 direct and 18 secondary jobs at the peak of contract construction. Because of the mining skills available in the labor pool, Troy area resident employment would drop by only about four jobs at the conclusion of contract work. Then, local resident employment would grow to about 62 direct and 31 indirect jobs at full mine operations.

The Alternative IV or V construction schedule would bring a population increment of about 22 people to the Troy vicinity during the initial period of mine construction, followed by an additional 93 arrivals when contract construction begins. After a little more than a year the Troy area immigrant total would drop to about 85 person, then immigration would resume topping out at 120 total immigrants at full production. The Troy area should have no difficulty absorbing these immigration numbers.

Projected mine employment during construction and startup initially would bring about six new students to the Troy school system. There would be an influx of an additional 21 students during contract construction, with half-a-dozen of these departing after a little more than a year in the system. The total enrollment increment at full mine operation would be about 32 students.

Libby Area. Local area residents living in the Libby area of southern Lincoln County could be expected to land about 46 direct jobs and 19 secondary jobs during the peak period of mine construction activity. At the low point of employment a few months later they would still hold about 38 direct and 18 secondary jobs. Then, as the Sterling work force expanded to full operational levels, employment of Libby area residents would grow to about 65 direct and 32 secondary jobs.

Immigration to the Libby area would peak at about 110 persons at the height of contract construction, drop to 79, and then eventually reach 108 at full mine production. Since immigrants hired for long-term mine positions would settle nearer the mine site if they could, a substantial portion of this population increment would be tied to secondary and replacement employment.

Libby mine-related school enrollments would increase by about three students during the initial period of construction, peak at about 25 students during contract construction, then decease by only three or four before climbing again to about 29 at full mine operations. In 1995-1996 the school administration reported a lack of adequate space in the elementary portion of the system, and a need for additional staff at all levels. However, population projections for Lincoln County (without mine development) indicate a decrease in the county school age population of 11 percent between 1999 and 2010, so the student influx expected from mine development should not pose an enrollment problem for the Libby system.

Lincoln County Overview. As it reached full operations under the Alternative IV or V schedule, the mine would add just short of 228 persons to the Lincoln County population projected under the No Action Alternative. This would equate to a 1.2 percent increment on the 19,770 population projected for the year 2010. Direct and secondary employment at full mine operations of persons who would reside in Lincoln county would total about 216 workers, with about 75 percent of this employment being in the resource commodity and goods production sectors. (Mine jobs would, of course, be reflected in Sanders County employment statistics, not Lincoln County.) The personal earned income of Lincoln County residents derived from mine direct and secondary employment would total approximately $6.0 million per year in 1995 dollars. This would equate to about 1.9 percent of 1995 total Lincoln County estimated personal income with retirement and pension benefits included.

Clark Fork Area. The effects of mine construction and startup on the portion of eastern Bonner County, Idaho, in the vicinity of the community of Clark Fork would be similar to those projected for the Thompson Falls area. Workers living in the Clark Fork vicinity would be expected to be hired for about 16 direct jobs and six secondary jobs at the peak of construction phase employment. This employment level would drop by five or six jobs with the contract construction layoffs. Then, local resident employment would grow to about 20 direct and nine indirect jobs at full mine operations.

The Alternative IV or V construction schedule would bring a population increment of about 12 people to the Clark Fork vicinity during the initial period of mine construction, followed by an additional 79 arrivals when contract construction begins. After a little more than a year the immigrant total would drop to about 46 persons before immigration would resume topping out at 86 total immigrants at full production.

Mine Operations Community Effects

It is anticipated that the Rock Creek project would have an operating life under Alternative IV or V of up to 28 years. Table 4-58 displays the residential distribution of mine and secondary employees projected to exist at the time the mine achieves full production operations. Sanders County would have approximately 219 residents employed in mine-associated primary or secondary jobs, Lincoln County would have about 216, and the Clark Fork area of Bonner County could expect to have about 41. Over the course of the operating period there would be a shift of employee residence to the communities located near the work site. The Lincoln County communities which are the most distant from the project site could eventually lose a third of the employees expected to reside there initially. This would result in about 290 workers living in Sanders County and 145 in Lincoln County in the later years of mine operations.

Table 4-58 also shows a distribution of personal income (in 1995 dollars) to the communities of the local area. This distribution is based on the expected earnings of direct and secondary employees and their projected area of residence. Although the worker numbers residing in Sanders County and Lincoln County would be about equal, a greater percentage of the Sanders County residents are projected to be direct employees, so the Sanders County share of mine based employee earnings would be about $6.3 million per year while the Lincoln County share would be about $6.0 million. The Bonner County share would be about $1.2 million. If the expected residence shift did occur, the resulting annual earnings distribution would become roughly $8.4 million to Sanders County, $3.9 million to Lincoln, and $1.2 million to Bonner. For Sanders County these employment and earnings estimates equate to between 5.8 and 7.8 percent of 1995 county employment and from 10 to 13 percent of 1995 total earned income. The same estimates for Lincoln County show resident employment equaling 1.7 to 2.6 percent of 1995 county employment and earnings of 2.5 to 4.0 percent of 1995 earned income. While the employment and earnings projected for the Clark Fork area of Bonner County would be significant for that community, they would amount to less than 0.2 and 0.3 percent of county 1995 employment and earnings respectively.

TABLE 4-58
Alternatives IV & V Operating Phase Residence and Income Distribution

Projected Employee Area of Residence			
Community	**Sterling Workers**	**Secondary Workers**	**Total Workers**
Noxon/Heron/Trout Cr. Area	100	33	133
Thompson Falls Area	63	23	86
Troy Area	74	34	108
Libby Area	73	35	108
Eastern Bonner Co.	30	11	41
TOTAL	**340**	**136**	**476**

Projected Annual Income Distribution Based on Employee Residence			
Community	**Sterling Employment**	**Secondary Employment**	**Total Employment**
Noxon/Heron/Trout Cr. Area	$3,310,000	$527,340	$3,837,340
Thompson Falls Area	$2,085,300	$367,540	$2,452,840
Troy Area	$2,449,400	$543,320	$2,992,720
Libby Area	$2,416,300	$559,300	$2,975,600
Eastern Bonner Co.	$993,000	$175,780	$1,168,780
TOTAL	**$11,254,000**	**$2,173,280**	**$13,427,280**

Note: The figures in this table represent expected residence and income distribution at the beginning of full production operations. Residence shifting over the life of the mine is expected to increase residence and income in Sanders County and decrease those figures in Lincoln County.

The numbers presented in Table 4-58 and in the two preceding paragraphs require considerable care in their interpretation and use. A number of factors must be kept in mind, including:

- The indicated employee residence distributions are based on assumptions and estimates of variables that cannot be predicted with certainty. They are, at best, very rough predictions.

- The earnings distributions are based on statewide average mining industry and non-agriculture employee weekly earnings, multiplied by the project direct and secondary employment estimates. If average annual mine employment does not equal 340 employees, if less secondary employment is generated, or if local wages do not match the statewide averages, then potential earnings are overstated.

- Only social security insurance withholding has been deducted from gross earnings in making these calculations. Since tax withholding and deductions for pension or medical benefits have not been deducted, the figures do not reflect spendable income.

- Because of the limited availability of many goods and services in the local area communities there is considerable "leakage" in their economies—a very substantial portion of earnings allocated to any particular community area would not be spent in that community but would go directly to other local communities or out of the local area to regional market centers.

- For the western portion of Sanders County, in particular, the earnings figures do not represent net earnings gain. As noted in the discussion of mine construction and startup impacts, it is possible that foregone amenity immigrant incomes could partially or completely offset these gains.

- Any local area expenditures by the mine which do not produce direct or secondary employee earnings have not been included in these estimates.

One common effect that the development and operation of a large industrial facility, such as the proposed project, may have on the economy of a local area with a limited population and labor force is that wages and prices in some portions of the economy may increase—to the benefit of some individuals and the detriment of others. Mine employment would provide high-paying long-term employment for those able and qualified (or trainable) for the work required. Qualified workers in the local area would apply for mine positions producing a chain reaction of job vacancies and replacement hiring. Many individuals would have the opportunity to improve their employment situation and earnings. Given the small size of the local area labor pool, however, it is probable that a shortage of individuals with the skills required by the mine would develop and that local employers would have difficulty finding qualified replacements for workers hired by the mine or would have to offer higher wages than they have in the past. These employers would either have to absorb additional labor costs or pass them on to customers. Typically the local construction industry can be especially hard hit, with a shortage of workers developing at the same time that housing demand escalates. Housing shortages and price increases in any of the basic goods and services sectors of the economy would be detrimental to individuals on fixed incomes and to those low-income employees who lack the ability or skills to compete for the type of jobs where wages were increasing.

With 340 direct employees and 136 secondary positions in the local area relying on the mine's contribution to the local economy, it would be the largest single employer in the area. Changes in its operating employment levels would be keenly felt. Once the local economy had adjusted to a particular operating level, any reductions-in-force would release individuals whose life style would be attuned to mine wage rates and who would find very few opportunities for comparable employment in the local market. Any shutdown of operations for a few weeks or months would cause a sudden drop in local area income while laid off workers, expecting a resumption of operations, would be unlikely to seek other work. It should be noted, however, that because the mine facility would be designed to operate most economically and efficiently at a particular operating level, it is anticipated that shutdowns or substantial reductions in force during the operating phase would be a rare occurrence.

Mine Closure and Reclamation Community Effects

One reality of any mining project is that eventually the deposit of economically minable ore is exhausted and the mine ceases to operate. Under Alternative IV or V it is anticipated that this would occur after no more than 28 years of production. Mine closure would cause the abrupt loss of an estimated 305 direct and 125 indirect jobs, with mine reclamation expected to employ approximately 35 workers and a handful of secondary jobs for 2 additional years. This would produce an initial drop in employment earnings in the local area of $12.3 million per year (in 1995 dollars) followed by a second drop of $1.2 million per year. Unless other large mining projects are operating in the area at the time, closure of the Rock Creek mine could eliminate half, or more, of all the resource commodity sector jobs expected to exist in the local area economy in 2020.

The situation probably would be very similar to what happened following the 1993 closure of the Troy Mine when approximately 300 mine workers lost their jobs. Two-thirds of these workers entered a worker retraining/transition program. About half of the laid off workers continued living in the area 2 years after shutdown (pers. comm. Mike Bissell, Libby Job Service, March 7, 1995). If Rock Creek Mine closure resulted in half of the mine workers leaving the area for other employment locations, it would generate an exodus of 170 mine workers and 530 persons. Some secondary employees who would lose their jobs also would depart, adding perhaps another 65 workers and 135 persons to the exodus.

Fiscal Effects

The local government fiscal implications of Alternative IV or V differ from those described for Alternative II or III primarily in the timing of costs and revenues. The project would increase costs for cities, schools, and counties through mine-related immigration and the resulting increases in local government service costs (Fodor 1996). These additional local government expenditures would pay for capital outlays, personnel, and support costs.

Hard-Rock Mining Impact Plan

Because the demands for local government services created by this project would not coincide with the boundaries of the affected local government districts, and because the tax revenue from the project would be generated too late to allow local government entities to respond in a timely fashion to the increased demand for their services resulting from mine construction and startup, the Montana Hard-Rock Impact Act requires preparation of a Hard-Rock Mining Impact Plan. The applicant completed this plan in coordination with Sanders County and other affected jurisdictions (ASARCO Incorporated 1997b) and the plan was approved by Sanders County on October 21, 1997. This plan provides a coordinated mechanism for allocating project tax revenues to local government jurisdictions that would experience increased capital and operating costs but not receive appropriate project tax revenues. It also calls for prepayment of selected local taxes where revenues would lag behind demands on local government services. Under the plan, an estimated total of $725,000 in tax pre-payments would be made during project construction and startup. These prepayments would be treated as credits against Sterling's future tax liabilities. In addition, special grant payments (estimated $158,500) would be made to alleviate inequities in location and timing of local government receipts. The impact plan forecasts project induced increases in operating revenues and net operating costs for 19 affected local government jurisdictions, establishes a schedule for payments, and specifies conditions that would trigger adjustments or amendments to the plan if impacts exceeded those anticipated.

The applicant drafted the Hard-Rock Mining Impact Plan using local labor market conditions which existed shortly after the Troy Mine (located in southern Lincoln County about 20 miles northwest of the Rock Creek project site) shut down, laying off approximately 300 employees. The Plan's estimates of local labor force availability were developed based on data obtained when many of these workers were seeking employment in the area. Since that time most of these workers have either found other employment or have left the area, and there has been a trend of declining unemployment. The Plan also did not address the phenomenon of immigration associated with replacement hiring as non-local workers fill some of the job vacancies created when local workers leave other employment to take mine jobs. For these reasons the estimates of local area immigration contained in the Hard-Rock Plan are only about 55 percent of those projected in this EIS's Alternative IV and V analysis for the peak construction period and less than 30 percent for full operations. If the immigrant numbers which actually materialize approach those projected in this EIS, virtually every Hard-Rock Plan condition calling for a plan amendment would be met. If this happens, local government service providers could expect to receive assistance beyond the base level estimates in the plan. However, if the additional funding didn't materialize until after the impacts had appeared, the plan would not have served its intended purpose of giving providers the resources needed to plan and prepare in advance for increased demands on their services.

Community Services

Hard-Rock Mining Impact Plan payments would provide local government entities with financial resources but would not be a cure-all for all issues that could arise. While the impacts and demands on local government services under Alternative IV or V would be almost the same as those projected under Alternative II or III, there would be some mitigating factors. The sudden population influx associated with the contract construction period would be about 600 people rather than the more than 900 expected from Alternative II or III, so local government would have more time to plan and prepare. Government entities would also be in a better position to staff-up to deal with this influx because the drop in population expected to occur when contract construction work ended would be much smaller (an exodus of about 300 persons rather than nearly 450). School systems, in particular, should be in a better position to handle the smaller numbers of students expected to enroll, and then depart, as a result of contract construction population impacts.

The impacts on water and wastewater treatment facilities would be the same under Alternative IV or V as is described for Alternatives II and III although the housing numbers are somewhat reduced. (See Table 4-59 for housing needs under Alternatives IV and V)"

DEQ cannot require that a community expand water and wastewater treatment facilities just because a mine was or might be approved near that community. DEQ also cannot specify how a community uses funds acquired through implementation of the mine's associated Hard Rock Impact Plan. Only the community's governing body can submit plans for expansion of near capacity facilities. Nevertheless, if a facility violated its MPDES permit or Montana water quality standards, then it could be fined and required to abate the violation. Abatement may involve expansion of the facility that was noncompliant.

The impact analysis did not include analysis of the potential for increased nutrient loading from facilities expanding as a result of population growth related to mine operation. Without specific plans with specific discharges proposed, it is difficult, if not impossible to quantitatively define what that impact would be. However, a brief statement has been added to the cumulative impacts section of Chapter 4, Hydrology, to identify that "there is potential for additional nutrient loading to the Clark Fork River, from the expansion of water and waste water treatment facilities, both private and public, at communities experiencing growth resulting from mine-related employment; however, the impact could not be quantified. Expansion of any such facilities would be subject to successful revision of its MPDES or NPDES permit and compliance with Montana or Idaho water quality standards respectively depending upon where the facility was located.

Land Use and Housing

During project operations about 400 acres of private lands at the impoundment site or paste disposal facility would be dedicated to mine use. Following mine closure, reclamation would allow tree regrowth but the site probably would not support future commercial timber production. The mill site would support forest regeneration following reclamation and could be returned to wildlife, forestry, and recreation uses (see Soils and Reclamation for details). Because the water treatment site of approximately 20 acres would continue to operate after project closure, alternative land uses would be precluded at this site for several decades. The proposed Miller Gulch loadout facility would require construction of .5 mile of new rail siding on 1.5 acres and an enclosed industrial ore car loading facility on 0.5 acres. The rail siding and loadout would be located northwest of the existing solid waste transfer site (see Figure 2-24). This area would be devoted to industrial uses for the life of the project. During mine closure, the ore loading structures would be removed, and the site reclaimed. Alternatives IV or V also would involve acquisition or conservation easements on about 2,536 and 2,350 acres respectively of private land as part of grizzly bear mitigation actions. This would remove those lands from future residential and commercial development.

The Alternative II and III discussion noted that mine development would accelerate the conversion of private lands in western Sanders County from timber or agricultural production and open space use into residential subdivisions and ranchettes. The land use effects of Alternatives IV and V would be identical. Mine employees would compete in the market for residential properties offering basic family housing locations, and the development of some businesses catering to new residential areas and commuting mine workers would be expected near the mine site along Highway 200.

During mine construction and operations workers arriving in the local area would require housing as shown by Table 4-59. Most contract construction workers would need housing for a year to 18 months. Their housing requirements would be for about 99 families and 66 single or unaccompanied individuals. Most of these contract employees would seek rentals, motel units, and mobile home or recreational vehicle sites. Some would have a good enough chance of being hired for permanent mine employment that they would compete for permanent housing. Workers hired by Sterling and long-term secondary or replacement employees would require permanent housing for about 111 families and 45 single individuals. About a third of these long-term immigrants would arrive prior to the contract construction influx and have their housing established before the peak immigration period began. Although housing demand during the contract construction period under Alternatives IV or V would not be as high as that anticipated under Alternatives II or III, it should still be expected that the Noxon/Heron/Trout Creek area and, probably, the Thompson Falls and Clark Fork areas would experience a shortage of rental and other short-term housing during this period.

The anticipated mine operation phase immigration would place less strain on local housing supplies than would the earlier influx of construction workers. Sixty percent of the immigrants who would arrive in the area by the time the mine reached full production would be expected to reside in western Sanders County (140 families and 50 singles). Then, as noted in the discussion of operating phase population effects, there probably would be some shifting of mine employee residence locations to Sanders County over the life of the mine.

TABLE 4-59
Alternatives IV & V Housing Needs of Immigrating Workers

Community	Permanent Housing		Temporary Housing		Total Housing
	Family	Single	Family	Single	
Contract Construction Peak					
Noxon/Heron/Trout Cr. Area	37	14	44	30	125
Thompson Falls Area	23	9	20	13	65
Troy Area	21	8	10	7	46
Libby Area	20	8	9	7	44
Eastern Bonner Co.	10	4	15	10	39
TOTAL	111	43	98	67	319
Full Production Operations					
Noxon/Heron/Trout Cr. Area	86	30	--	--	116
Thompson Falls Area	56	20	--	--	76
Troy Area	31	12	--	--	43
Libby Area	28	11	--	--	39
Eastern Bonner Co.	22	8	--	--	30
TOTAL	223	81	--	--	304

Cumulative Impacts

The analysis presented in the preceding pages of the potential socioeconomic effects of the Rock Creek Mine proposal is based on the assumption that the "Reasonably Foreseeable Activities" identified in Chapter 2, Part IV, would not happen. Should those activities occur, most of them would not alter the projected socioeconomic effects of the Rock Creek Mine. That would not be true, however, of the Troy Mine or the Montanore Project. The cumulative socioeconomic effects of either or both of these projects in conjunction with the Rock Creek proposal would differ significantly in type and magnitude from those described for the Rock Creek project alone. These cumulative impacts would be highly variable, depending on which projects were in what stages of development or operation at any given point in time.

Rock Creek - Troy Unit Cumulative Effects

The Troy Mine is an ASARCO property and market conditions which would prompt the company to develop the Rock Creek project probably would also cause it to reopen the Troy Mine. In fact, the ASARCO 1997 Annual Report states that, "The Company plans to restart Troy in conjunction with the development of the nearby Rock Creek silver-copper deposit..." and company officials have suggested that Troy would be used as a training facility for the Rock Creek work force. In other words, the Troy Mine would reopen about the time that Rock Creek evaluation adit construction would begin and would operate through the Rock Creek development period shutting down about the time Rock Creek reached full production (although its operation could continue beyond that point as long as the Troy deposit remained economically workable).

The Troy Mine would draw most of its expected 100 operating employees from southern Lincoln County with a few coming from western Sanders County. This mine employment would create about 40 new secondary jobs, most of which would be in the communities of Troy and Libby. Individuals employed at the Troy Mine would not be interested in short-term contract construction work at Rock Creek. Sterling would use some of them for Rock Creek evaluation adit construction and operations startup, but it would replace them at Troy so long as that facility remained in production. This would reduce the local labor pool available to take positions at Rock Creek, which would increase non-local hiring and local area immigration during Rock Creek construction and startup.

The short-term socioeconomic effects of the combination of Troy Unit operation with Rock Creek construction and startup on the Alternative IV or V schedule would be very similar to those predicted in the analysis of Rock Creek Alternatives II or III. Local area immigration numbers during contract construction would be similar to those expected for the same period under Alternatives II or III as would the exodus at the end of contract work.

If the Troy Unit were still operating when Rock Creek reached full production, then total immigration in the local area would exceed that projected under any Rock Creek alternative, but the additional population would tend to settle in southern Lincoln County and should not produce significant additional socioeconomic impacts. With most of the additional employment and immigration going to Lincoln County communities, the personal income increment derived from the combined effect of the two projects also would go to that county. Since the approximate remaining economic life of the Troy Unit is projected to be 5 to 6 years, its shutdown would not occur at the same time as that of Rock Creek, so the local area could be safe in expecting that the employment associated with both projects would not be lost at the same time. If Troy's shutdown did take place in a manner that resulted in most of its workforce transferring to Rock Creek, long-term cumulative socioeconomic effects from the two projects would be essentially identical to those expected for the Rock Creek Project alone.

Rock Creek - Troy Unit - Montanore Cumulative Effects

The greatest foreseeable socioeconomic effects would occur if the Troy mine were to reopen and the Rock Creek and Montanore projects were to begin simultaneous development. This is a scenario that could result from an increase in ore prices. If the peak construction periods for the two developing projects coincided, the result would be a sudden demand for nearly a thousand mining and construction workers plus more than 300 secondary employees. With all three facilities in production, nearly 900 workers would be employed by the mines, and secondary employment would total about 350 jobs. These employment demands would impinge on an area of southern Lincoln County, western Sanders County, and eastern Bonner County that has a population of 17,000-18,000 and a labor force of 7,500-8,000. This small labor pool would not be able to supply the demand for workers having the abilities (even with training programs) to meet the needs of the three mines. The result would be a very substantial influx of workers and their families from outside the local area. This population influx could easily total 2,000-2,500 individuals, and might go substantially higher depending on the timing of mine activities, the condition of local and regional labor markets, and other factors.

Lincoln County residents would fill the mining jobs at Montanore and the Troy Unit as well as the secondary positions with work sites in that county. Non-locals filling positions at Montanore or Troy would settle in southern Lincoln County. Because Lincoln County has the lion's share of the population base and the communities with the most housing and existing services, and because it is projected to see only very modest growth in the near future, it would be in the best position to absorb a substantial population influx. The Troy and Libby areas would see tight housing and employment markets, but they probably would avoid other detrimental effects frequently associated with employment and population booms.

With Lincoln County responding to Montanore and the Troy Unit, it would essentially drop out of the local area (for analysis purposes), leaving the communities of western Sanders County and eastern Bonner County as the potential base of labor, housing, and social services available to meet the demands created by the Rock Creek project. The much smaller population base and labor pool of this reduced area would result in reduced local hiring rates. In this setting local hiring for mine positions could fall to 40 percent, with contract construction and secondary employment rates dropping to 25 percent and 75 percent respectively.

These local hiring rates produce an estimate that during the peak of Rock Creek project contract construction Sanders and Bonner County residents would be hired for 161 direct and secondary jobs rather than the 108 projected under Alternative IV or V. More than half of this increase would be in secondary positions, and only a handful would be Sterling jobs. During this period population immigration numbers would reach 869 people rather than the 547 projected for western Sanders County and the Clark Fork area of Bonner County under Alternative IV or V (Table 4-60). More than 730 of these 869 immigrants would arrive in a period of less than 6 months. This immigration total would be equivalent to a 14 percent increase over the area's 1995 population. Permanent housing for up to 113 families and 42 individuals would be needed, and contract personnel would need temporary housing for 124 families and 83 single or unaccompanied workers. The population influx would increase school enrollments by 190 students, 72 more than predicted by the Alternative IV or V analysis.

A population influx of this magnitude, occurring in a matter of months, would have the potential to produce a classic "boom town" situation in western Sanders and eastern Bonner counties. The severity of the impacts would depend to a large extent on how well local government and the company worked together to plan and prepare. Strong measures would be needed to deal with the demands for housing and public services. The very limited available housing stock combined with the absence of reserve capacity in existing domestic water and wastewater systems would make it essential to increase the housing supply by building both permanent housing and temporary work camps before mine contract construction got underway. It would be vital that the existing Hard-Rock Mining Impact Plan be revised, so that grants and tax pre-payments to local government would reflect the anticipated population influx (2.7 times that predicted in the Plan) and so that this assistance would be available before the event. The need for advance preparation based on a revised Impact Plan would apply in particular to the schools which could see enrollment increments nearly four times those predicted by the existing Plan. Because the Impact Plan provides no assistance to local government outside of Montana, some of the greatest difficulty in responding to increased demand for public services would be likely to emerge in the Clark Fork area of Bonner County.

TABLE 4-60
Socioeconomic Effects on Western Sanders County & Eastern Bonner County
from Combined Development/Operation of Troy Unit, Montanore Mine, And Rock Creek Mine

	Total Employment	Local Hire	Non-Local Hire	Total Immigration	School Enrollment	Permanent Housing		Temporary Housing	
						Family	Single	Family	Single
Rock Creek Contract Construction Peak									
Mine Employment	73	29	44	136	40	35	9	0	0
Contract Construction Emp.	275	69	206	433	72	0	0	124	83
Secondary & Replacement Emp.	174	63	111	300	78	78	33	0	0
TOTAL	522	161	361	869	190	113	42	124	83
Rock Creek Full Production									
Mine Employment	340	136	204	632	186	163	41	--	--
Secondary & Replacement Emp.	276	102	174	470	122	122	52	--	--
TOTAL	616	238	378	1102	307	285	93	--	--

Once the western Sanders and eastern Bonner County communities had weathered the contract construction boom, 275 contract construction workers would be laid off and almost immediately Sterling would hire more than a hundred mine production workers. Six months later another 140 mine workers would be hired. Some contract workers would be hired for production positions, either immediately or after 6 months of unemployment, but a good many would also leave the area. At the same time newly hired production workers would be arriving. Mine workers, whether they were drawn from the construction population or from other sources, would place different demands on the local communities. They would need permanent, not temporary, housing and would have more family members accompanying them. The expected population increment in western Sanders County and eastern Bonner County would be 1,100 individuals at full mine production (Table 4-60). These immigrants would need long-term housing for 285 families and more than 90 single persons. They would add more than 300 students to school enrollments.

With 476 direct and secondary mine jobs at full production going to western Sanders and eastern Bonner Counties the mine would account for $13.4 million in annual personal income (in 1995 dollars) to the area. Somewhat over 400 of these jobs and $11.4 million in income would go to western Sanders County. These figures would be equivalent to 12 percent of total 1995 Sanders County employment and nearly 18 percent of personal income. The Sanders County economy would be extremely sensitive to any changes in mine employment. So long as the mine continued to operate at a high and stable rate of production, it would be a powerful factor underlying local prosperity. However, when the mine closed the local area impacts would be much more severe than those which were seen in southern Lincoln County when the Troy mine ceased operations. It also should be anticipated that the sudden development in a small economy of a facility that would have the projected demands on the available labor pool and would pay wages so far above existing local averages would cause a general increase in local wage rates. This increase in combination with housing price escalation could produce a substantial increase in the local cost of living.

None of the effects described in the above paragraphs would be conducive to attracting amenity immigrants or even to keeping those who have already arrived. Housing availability and pricing alone might be sufficient to send prospective amenity immigrants to other areas and to cause some who had already arrived to sell out and leave. Some, if not most, of the amenity-based income and employment gains projected for western Sanders County and the Clark Fork area, if the project is developed, would be foregone. The area's economy would shift abruptly to greater dependence on resource commodity production and substantially decreased reliance on retirement incomes and service industry employment. Local government and the entire community social structure would initially be very focused on dealing with the effects of mine development and the associated influx of direct and secondary workers and their families. Once these issues were dealt with, they would shift to agendas giving a high degree of consideration to the needs and interests of young working families. Some sectors of the community would benefit from this change in priorities while others would likely find their needs and interests carrying less weight in community affairs.

TRANSPORTATION

Summary

The action alternatives would affect between 16 and 22 miles of existing National Forest roads. Traffic patterns, safety, and volumes would be affected to a greater or lesser degree for all action alternatives. Traffic on Montana Highway 200 would increase from about 7 to 62 percent over 1997 traffic volumes. Traffic volumes on the National Forest transportation system within the affected area would increase by 2,300 to 2,800 percent under Alternatives II through IV and would increase by only 1,100 percent for Alternative V as a result of busing employees and eliminating ore concentrate hauling. Soils and vegetation disturbance would range between 33 to 65 acres, and 43 to 82 acres, respectively, for the action alternatives.

Impacts associated with access to alternative rail loadouts differ: the ore concentrate trucks would operate on Montana Highway 200 and FDR No. 150 for Alternative II and operate only on FDR Nos. 150 and 150B for Alternatives III and IV. Alternative V would have no ore concentrate trucks as the concentrate would be piped to the rail loadout facility.

Between 4.18 and 5.28 miles of road would be closed to motorized vehicular access to mitigate impacts to wildlife (see Threatened and Endangered Species section for more detail).

Introduction

Acreages discussed in this section are only those impacted by the main roads; utility corridors and associated project maintenance roads are considered elsewhere in this EIS (see Soils). Some assumptions were used in number of occupants per vehicle and approximate clearing and soil disturbance acreage per mile. Typical per mile disturbance acreage for soils and vegetation is shown on Table 4-61. Typical acreages for double-lane roads apply to FDR Nos. 150 and 2741, and the mine portal access roads. Portions of the utility and pipeline corridors that parallel FDR No. 150 would require a right-of-way width 30 feet wider than proposed clearing width as shown in Table 4-61. This additional disturbance is discussed under Soils and Reclamation.

Plans were already in existence for reconstruction of segments of Montana Highway 200 prior to this mine proposal. Existing FDR No. 150 and its bridges would need to be rerouted and reconstructed to handle the increased traffic efficiently and safely.

Alternative I

Future Forest Service ecosystem management activities such as wildfire burns, timber sales, and other activities would cause short-term (from less than a week to 2 to 3 years) increases in traffic volume and pattern. These activities are not sufficient in size to require FDR No. 150 to be upgraded to a double-lane road. There are no current plans for capital improvements to the roads or bridges for forest activities. Road maintenance could be expected to remain at current levels. Road cut-and-fill slopes are mostly stabilized and revegetated. There are small areas that have not revegetated due to soil type, slopes, aspect or past borrow material removal. These areas are small and contribute little to any sedimentation.

TABLE 4-61
Soil and Vegetation Disturbance for Roads

Disturbance	Double-lane Road[1] (acres per mile)			Single-lane Road (acres per mile)		
	Average Width (ft)	Construct[2]	Reconstruction[3]	Average Width (ft)	Construct[2]	Reconstruction[3]
SOILS	54	6.5	4.0	29	3.5	*
CLEARING	70	8.5	5.5	37	4.5	*

Note: [1] ROW width 100' for double land roads and 43' to 50' for single lane roads.
[2] Acres per mile.
[3] Small variable amounts to add needed tumouts or to provide better sight distance.

Alternative II

Road Construction/Reconstruction

Under Alternative II, 1.34 miles of new road diverging from Montana Highway 200, and an additional 1.12 miles of road around the mill site would be constructed along the FDR No. 150. Neither route was field located; maps were drawn for approximate location by the applicant. This alternative has 4-plus miles of construction and about 5.3 miles of reconstruction. Table 4-62 shows approximate disturbance by alternative for all transportation corridors.

TABLE 4-62
Approximate Gross Disturbed Acres per Alternative
(for Access, Adit, Railroads, and Rail Siding)

	Action Alternatives			
	II	III	IV	V
Acres of Soil Disturbance[1]				
Construction	19	30	20	20
Reconstruction	23	35	13	13
Total Acres of Soil Disturbance	**42**	**65**	**33**	**33**
Acres of Vegetation Clearing				
Construction	25	38	25	25
Reconstruction	31	44	18	18
Total Acres Cleared	**56**	**82**	**43**	**43**
Rail Loadout	0	4	4	NA[2]

Note: [1]Soil disturbance acres are included in the acres of vegetation clearing.
[2]Included in Alternative V acreage.
Figures based on the assumption that the existing road occupies 2.5 acres/mile that would be fully disturbed during construction.

The proposed new segment of FDR No. 150 would cross some unstable soils in the vicinity of Montana Highway 200. The magnitude of unstable soils in this area is unknown, but construction of the road in these soils would increase costs associated with soils stabilization. The approach to Montana Highway 200 does not meet MDT's requirements for sight distance.

Three bridges on FDR No. 150 would need to be constructed over Rock Creek; one new and two replacements. The new bridge would cross Rock Creek somewhere in the vicinity of milepost 2 on existing FDR No. 150. This general area of the creek has a large 200- to 300-foot floodplain with some braided channels. The horizontal alignment of the existing road may require the new bridge to be skewed to the drainage, thus increasing the bridge length and the associated southern approach to the bridge. This skewed approach renders the bridge more susceptible to washout during flooding because more bridge is exposed to flow and more piers are needed for support. Also, since the approach would be built at an angle to the creek, corners would be exposed to erosion or washout.

The two bridge replacements would be installed in their existing locations over Rock Creek (mileposts 2.3 and 5.0), moving slightly up- or downstream to accommodate the road's horizontal alignment. A detour bridge would be necessary to accommodate traffic during replacement activities. This detour bridge would have to accommodate not only passenger cars, but trucks up to 40-ton gross vehicle weight; two side-by-side bridge crossings and associated clearings. This would increase the potential for sedimentation in Rock Creek. A short addition to the 6-foot-diameter culvert on the West Fork of Rock Creek near its confluence with the east fork would be required.

Road reconstruction designs would use as much of the existing road alignment as possible. Any remaining road segments would be obliterated and revegetated. Cleared acreage would remain essentially treeless as long as the road was needed. Disturbed soils would be susceptible to erosion during, and up to 2 years after, earthwork. However, sediment movement into stream courses would be minimized using erosion-control techniques along or when crossing streams, and by using BMPs in road design and construction.

The new mine adit access road would be about 1.67 miles long. Its mapped location crosses slopes ranging from level to 60-plus percent. The elevation difference between the mill site and adit would be about 580 feet. This elevation change would require a minimum of a 9-plus percent sustained grade for the entire road. This long, steep grade would require numerous surface water deflections to channel surface water runoff off the traveled way. Construction of this road segment could generate up to 60,000-plus cubic yards of soil and rock for road building and turnouts. On slopes over 55 percent, the roadway would be built entirely on the excavated (cut) side of the slope and not on the embankment (fill) side. This is because fill would not adhere to steep side slopes. Residual fill material could either be cast over the roadside or hauled to another location. Impacts associated with construction of the adit access road include high probability of either the bank sloughing and/or road slumping. Secondary impacts would include large visible roadcuts, removal of old growth timber and habitat, and increased possibility of sedimentation to Rock Creek.

Aggregate Source. It is estimated that upwards of 50,000 cubic yards of aggregate would be needed for road construction and reconstruction. The tailings impoundment starter dam borrow areas may provide a source of aggregate (gravel) for road construction and reconstruction. However, this source has not been investigated for this use, the material has not been tested for quality, hardness, and durability, and its quantity is unknown. Any aggregate material must be tested and must meet minimum/maximum Forest Service standards prior to use for roads. An additional source of aggregate would be evaluation adit waste rock. The applicant has indicated that they would use this material if insufficient or unsuitable material was in the borrow areas (pers. comm. Dave Young, ASARCO Incorporated, to Richard Stearns, June 22, 1994). Use of the evaluation adit waste rock could significantly reduce the size of the waste rock dump, however, there would be a potential for residual nitrates on the waste rock to reach Rock Creek affecting water quality. Use of waste rock for road construction would most likely require Agency approval.

There are two partially developed existing aggregate sources on NFS lands within the project area. One is adjacent to the solid waste transfer site just west of the tailings impoundment area and the other is located at about milepost 2 on FDR No. 150, northeast of the impoundment area. The aggregate site west of the solid waste transfer has a buried solid waste disposal site immediately west of it in a clearing. The solid waste transfer site is located on top of a clay floor. Neither source has been explored to determine if sufficient quantity would be available. If Sterling decided to use these sources, disturbances would be increased approximately 5 acres and Sterling would be required to reclaim the pits according to a Forest Service Mineral Material Permit.

If common source borrow areas on NFS lands were needed outside of the proposed borrow areas, a pit survey and subsurface exploration would be necessary to determine quantity, and pit development and restoration needs. Impacts associated with this activity would be analyzed in an additional NEPA document.

Rail Loadout

The Hereford rail siding is located 3.5 miles northwest of Noxon, adjacent to Montana Highway 200 and Montana Rail Link track on private land. Access from the highway to the tracks is provided by about 0.25 mile of county road. A new highway intersection would not be needed as there is adequate sight distance. There would be about eight ore trucks over a 24-hour day traveling 6 miles from the loadout to the intersection with FDR No. 150 on Montana Highway 200. The concentrated ore that would be shipped by truck and rail is not considered a hazardous material under current hazardous material classification (pers. comm. Dave Young, ASARCO Incorporated, with Paul Kaiser, April 20, 1994).

The additional activity at the rail siding would increase noise levels affecting residents living near the siding (see Sound). There would be an increased potential for accidents due to the slower speeds of the ore trucks on Montana Highway 200 and their turning onto and off the highway at both the rail siding and FDR No. 150.

The existing rail siding may need some improvements to handle the ore cars. A cost estimate of $144,000 was developed for these improvements (Keller 1994).

Traffic Volumes

Traffic volumes and patterns would be the same for all action alternatives for FDR No. 150. During the construction phase, about 400 workers would travel to the mill/mine site daily. There would be about 50 service/supply trucks delivering construction materials daily. This combined traffic would result in a potential 450 round trips on the road, or 900 average daily traffic (ADT). This would last about 4 years. The start-up and termination phases of construction would not generate this much traffic, however. During the operation phase, there would be about 355 employees making up a three-shift per day, 7-day week. Three shifts per day would generate a maximum of 355 round trips per day, or 710 ADT. Along with service, delivery, and trucks hauling concentrate, the total traffic from mine operation would be 740 ADT.

Traffic during both the construction and operational phases would increase traffic volume on state highways leading to the mill entrance road. This increase in traffic would be greatest on Montana Highway 200. Using the maximum ADT for the construction phase would place a 62 percent increase in traffic on Montana Highway 200. This increase would be an unknown split between west- and eastbound traffic on Montana Highway 200. MDT has no current plans to upgrade or reconstruct any highways affected by this proposed traffic increase.

FDR No. 150 would experience a 2,800 percent increase in traffic during construction, from 33 to 933 ADT, assuming the recreation traffic would remain the same. During the operational phase, traffic would amount to 740 ADT including delivery and ore truck trips. This increase would amount to a 49 percent increase in ADT for Montana Highway 200. On FDR No. 150, this would be a 2,300 percent increase in ADT. A double-lane road is necessary to handle this traffic. ASARCO has stated that they would encourage carpooling to minimize the impact on road use (Dave Young, ASARCO Incorporated, letter to Paul Kaiser, September 17, 1993). However, past experience with carpooling at the Troy Mine did not meet with great success.

The traffic pattern during the construction phase would be heaviest in the early morning and late afternoon, with the potential for some traffic any time during the day or night. During the 30-year operation phase, traffic would be greatest just before and after a shift change, and then during normal office business hours for management, clerical, and maintenance personnel. Shift change hours have not been established at this time. Increases in early morning and late afternoon traffic would increase the risk of vehicle-wildlife accidents on both FDR No. 150 and Montana Highway 200 (see Biodiversity and Threatened and Endangered Species).

Truck traffic associated with the rail loadout would generate 16 ADT, adding a little over 1 percent to the existing traffic. It would be less than 1 percent when the ADT for the mine workers is taken into account. This truck traffic would drive over 35,000 miles a year on Montana Highway 200.

Traffic accidents would increase in direct proportion to increased traffic. KNF has no accident data for FDRs in the project area. Users tend to increase vehicle speeds on improved roads beyond design standards; this could increase the potential for traffic accidents on FDR 150. Users on Montana Highway 200 would also have an increased risk of traffic accidents due to the increase in traffic volumes.

Traffic Management

A road surface would need to be maintained for traffic movement on FDR No. 150 during road construction and reconstruction for passenger cars and delivery trucks. Sterling would need to develop a traffic plan to allow private landowners reasonable access to their property, and public access to National Forest lands. In addition, emergency medical evacuation would need to be considered in the plan for workers at the mill or mine site. During reconstruction of the FDR No. 150, and to some extent FDR No. 2741, a 30-minute delay could be anticipated. This delay could happen at any time or along any road segment being reconstructed.

When a road was being reconstructed, the road surface would be usable with a passenger vehicle during non-work periods (evening and weekends). Signing would conform to Manual of Uniform Traffic Control Devices. Any closure of FDR No. 150 due to construction activities would be posted at the beginning of the road and public notification made in a local paper.

Road Maintenance

The maintenance of roads used by Sterling for mine operation, by the public, and Forest Service administrative and commercial traffic, would be prorated commensurate with use by each party. The Forest Service would be responsible for all public recreation traffic and Forest Service administrative and commercial traffic. Sterling would be responsible for all employee traffic, freight- and concentrate-truck traffic, and other traffic associated with operation of the mine. Those road(s) used solely by Sterling would be Sterling's responsibility. A Commercial Road Use Permit issued by KNF must spell out the type, amount, and frequency of maintenance. The increased amount of maintenance by Sterling would keep FDR No. 150 open to the public year-round, resulting in increased recreational traffic and activities and indirect impacts to other resources (see Recreation, Biodiversity, Threatened and Endangered Species, and Wilderness).

Road Closures

Road closures to implement the proposed project may consist of gates, berms or decommissioning. Each road would need the local Forest Service District IDT to do an on the ground evaluation or review of the particular road and of the Forest Service resource management uses/needs for the particular area that each road serves. If annual seasonal access is needed, then a gate may be installed to allow administrative vehicle access and recreational foot and horse traffic. If annual seasonal access is not needed (from 1 to 20 years with no access needed), then a berm may be installed to preserve the road prism, but limit all access to foot or horse traffic. If the need for the road is no longer necessary to serve Forest Service resource management needs, then the road may be decommissioned. This may include ripping the surface, removing drainage structures, outsloping the road bed, full or partial recontouring of the road prism or a combination of all or some of these practices.

Alternative III

Road Construction/Reconstruction

This alternative changes the location of the Montana Highway 200-FDR No. 150 intersection to meet DOT standards and has about 3.4 miles of construction and about 4.6 miles of reconstruction (see Table 4-62). Soil would be disturbed on about 65 acres: 30 acres for construction and 35 acres for reconstruction. Necessary clearing would amount to about 82 acres: 38 acres for the construction segment (8.5 acres per mile) and 44 acres for reconstruction (5.5 acres per mile).

Two bridges are necessary for this route: a new one over Engle Creek and a replacement at milepost 5.0 on FDR No. 150 over Rock Creek. The bridge across Engle Creek has advantages over the Alternative II proposal due to road alignment, length of bridge, length of road in floodplain, stream channel stability resulting in less erosion potential, and associated cost savings. The construction segment of the route has been reconnoitered from just above the Engle Creek crossing to Montana Highway 200. The road would be situated on a flat-to-moderately-sloped bench above the floodplain. The reconstruction segment would use as much of the existing road as possible. Any unused portion would be obliterated and revegetated according to an Agency-modified reclamation plan (see Chapter 2, and Soils and Reclamation, Chapter 4).

A third existing treated timber bridge over Rock Creek at milepost 2.3 would need to be replaced. Additional soil disturbance of about 0.02 acres would result from the bridge replacement. Although this acreage is small, it is immediately adjacent to Rock Creek. The impacts associated with bridge replacement could be mitigated by required BMPs in the contract, and by timing construction during normal low water flows. No detour bridge would be required because this bridge would be constructed after relocated FDR No. 150 was passable.

The mine portal access road changes with this alternative. Existing FDR Nos. 150 and 2741, and a 0.23 mile spur road to the mine adit would be reconstructed to double-lane standards. Soil and rock disturbance for this route would total an additional 17 or so acres over its 1.7 mile length. Clearing would total about 19 additional acres for this route. No bridges or major culverts (78-inch diameter and larger) are anticipated for this route. This would eliminate potential slumping and erosion of the steep slopes between the mine portal and the mill sites associated with the proposed mine adit access road. Impacts to old growth habitat are also reduced (see Biodiversity).

Trucks hauling waste rock from the mine to the waste rock dump would use the 0.23 mile spur road and a new 0.32 mile waste dump road, at the upper edge of both dumps, paralleling FDR No. 2741. This would disturb about 5 acres of soil and rock, and require 6 acres of clearing. These roads would accommodate only mine traffic.

A 0.25-mile road would be constructed to tie FDR No. 1022 (McKay Creek Road) to the new FDR No. 150 to access Montana Highway 200 (see Figure 2-19). The existing highway intersection for FDR No. 1022 would be obliterated. This short stretch of new gravel road would be constructed to single-lane standards with turnouts. About 1 acre of soil would be disturbed and 1 acre of clearing necessary. This would consolidate two FDR road intersections with Montana Highway 200 and would improve traffic safety along the highway.

Miller Gulch Rail Siding

The rail loadout would be located northwest of the solid waste transfer site (see Figure 2-19). The rail loadout and rail construction site would disturb about 4 acres of soil and require 4.5 acres of vegetation clearing.

The Miller Gulch rail loadout access road, tailings dam road, and public roads would be single-lane with turnouts. All roads would be paved. The rail siding would necessitate construction of about 0.3 miles of new road, 1.5 acres of soil disturbance and 1.7 acres of vegetation clearing. Additional disturbances would be associated with the tailings dam road (included in the tailings impoundment disturbance acreage). About 0.05 acres of additional disturbance would be required for turnouts.

Sterling haul trucks, maintenance and administrative vehicles, and Agency administrative vehicles would use about 3 miles of existing or relocated FDR No. 150B. FDR No. 150B begins at a junction with FDR No. 150 near Engle Creek continues to its junction with Government Mountain Road west of the tailings impoundment (see Figure 2-19).

Traffic Volumes

Total traffic on FDR No. 150 above the mill site and FDR No. 2741 would probably be low compared to the access road to the mill site. No estimate of ADT was completed on this segment. The public would be able to use about the first 1.4 miles of this route for recreation access. Mine and maintenance workers would use this road, and an occasional piece of heavy mine equipment could be moved from the mine to the equipment maintenance building for repairs. It can be assumed that all miners would use the main parking area and be shuttled to the mine adit as parking at the adit would be very limited. The majority of traffic would occur during shift changes, with some traffic likely during any hour of the day or night. If Sterling chose a two-shift operation, the traffic would potentially decrease by about one-third, due to the elimination of traffic associated with the third shift.

Carpooling could be used to increase auto occupancy from 1 to 1.5, thereby decreasing the ADT for FDR No. 150 by 33 percent; from 800 to 536 ADT during the construction phase, and from 710 to 475 ADT during the operational phase. The service, delivery, and concentrate truck ADT cannot be reduced.

The ADT on FDR No. 150B, except for the county road, and the rail loadout access road would be approximately 25. No estimate was made for the county road.

An indirect beneficial effect of the Miller Gulch loadout would be the elimination of concentrate truck traffic on Montana Highway 200. This would mitigate some public concerns over vehicle safety of truck traffic on the highway. There would be about a 35,000-mile-per-year reduction in truck mileage compared to the Hereford loadout. An additional indirect beneficial impact would be the energy/fuel savings that would result from this travel reduction.

Traffic Management

A traffic management plan meeting the requirements of Alternative II (see Chapter 2, Alternatives Descriptions) would be necessary to handle expected traffic flow and patterns. FDR No. 150B would be signed to restrict public travel. The rail siding access road would be limited to Sterling and Montana Rail Link vehicles and signed to discourage public use.

Upon mine closure, the Forest Service with input from Sterling would determine roads to be retained and their respective levels of service. Roads not necessary to meet public needs would be removed and reclaimed by Sterling.

Alternative IV

Road Construction/Reconstruction

The mill-access-road, from State Highway 200 to mill site entrance, length for FDR No. 150 is 26,800-feet (5.1 miles). This would result in a reduction of total acres disturbed (see Table 4-62). The existing FDR No. 150 alignment from the mill site entrance to the heavy equipment adit portal access road entrance would be used to route the non-mining traffic around the main mill site, and to FDR No. 150A. This route would be about 1900-feet long and would be a double lane, aggregate surfaced road. From the heavy equipment portal access road to the mill site's upper boundary the road would revert to a single-lane road. This 400 feet of road would need reconstruction to a transition segment from a double-lane to single-lane road. An additional adit portal access road for heavy equipment of about 400-feet (0.08 mile) would need to be constructed from FDR No. 150 to the portal site.

In addition to the three bridges (crossing Rock and Engle creeks) required for this alternative, an overpass structure would be needed to allow an underpass road for mine adit access by workers and small equipment, and for the ore conveyor belt. This would require the existing vertical alignment on FDR No. 150 to be modified, allowing for a lesser grade on the bridge overpass than exists on the current road. A maximum of 4-percent grade is desirable for the overpass structure. This overpass grade would cause a small increase in approach grades to the structure. The difference in elevations from finished grade FDR No. 150 to finished grade adit access road would be about 20-feet. Building the overpass would avoid the need to relocate FDR No. 150 around the mill site and would help retain a vegetative buffer between the road and mill site. This would, in turn, help reduce sediment loading to surface waters and reduce visual impacts.

Traffic Volumes

Traffic volume for Alternative IV would be similar to Alternative III except that mine-related traffic above the confluence would be limited to exploration and maintenance-related activities. Most mine traffic would be able to access the mine adit from the mill site without entering or crossing FDR No. 150. However, a mix of public, mine and Forest Service traffic would occur between the mill site entrance and the heavy equipment adit portal access road entrance on FDR No. 150. This segment of road would be used primarily for movement of heavy equipment from the adit portal to the mill site for maintenance. Those pieces of equipment that were too wide or tall to use the overpass route would use the secondary access route to the adit portal. Double-lane design and proper signing would mitigate traffic conflicts on this segment.

<u>Alternative V</u>

Road Construction/Reconstruction

For the most part, the proposed road construction and reconstruction locations would not change from Alternative IV. However, the alignment of FDR No. 150 has been shifted near the waste water treatment facility to potentially take advantage of an existing old road prism. The change of the adit portal location to within the mill site eliminates the need for an overpass structure over FDR No. 150 within the mill site. FDR No. 150 above the mill site entrance and through the north permit boundary would be a single lane aggregate surfaced road, with intervisible turnouts (turnouts visible from the next turnout in each direction). This alternative will reduce sediment loadings to surface water and reduce visual impacts compared to Alternative IV. One bridge would need to be replaced at milepost 5.0 on FDR No. 150 and a new bridge, over Engle Creek, for the connecting segment of FDR No. 150 to State Highway 200. The existing bridge on FDR No. 150 at milepost 2.3 would be adequate for the proposed traffic; potential repairs to the bridge may become necessary during the mine operation life. This reduction in one bridge replacement would reduce sediment loading to surface waters. BMP's would be used during all construction/reconstruction activities. Vegetation screening and planting specifications would be incorporated into the road design and construction drawings. During mill site construction activities, any native or aggregate surfaced road will have a dust palliative used to control the generation of dust. Road design criteria to mitigate impacts to sensitive species would be achieved with an on-the-ground review with wildlife biologists and engineers prior to and during the design of FDR No. 150 (see Biodiversity, Harlequin duck).

Restricting timing for road construction and reconstruction from the period from August 1 to March 31 could increase the number of operating seasons necessary to complete the road work. Losing 4 to 8 weeks of normal construction season could also cause more short-term erosion impacts to Rock Creek, by having to have additional operating seasons. Restricting the hauling of waste adit rock to the paste facility site from April 1 to July 31 could have similar impacts. In addition, only being able to haul and place rock from August 1 to March 31 may cause additional engineering concerns of placing rock for the dam on frozen ground. The period of about November 1 to March 1 may not be suitable for dam construction work. An alternative would be to create a site near the starter dam where the rock could be stockpiled. This would increase costs by having to handle the rock twice.

Rail Loadout Road Access

The proposed pipeline for ore concentrate would not eliminate the need for a road to the rail loadout facility. The proposed enclosed rail loading facility would reduce the amount of road necessary within the rail loadout area, thus reducing potential long-term sedimentation into surface waters. Due to a reduction in ADT, from 16 to 4, for this facility, the rail loadout access road could be a single lane, aggregate surfaced road. The route to the rail loadout facility would be from State Highway 200 and Sanders County Government Mountain road. Mine-related traffic needing to go to the rail loadout facility from the mill site would travel down FDR No. 150 to State Highway 200, along Montana Highway 200 to Government Mountain road, and then up Government Mountain road to the Rail Loadout Access road. FDR No. 150B would not be used for this access from the mill site.

Traffic Volume

Busing and required carpooling may decrease the ADT over Alternative IV during mill and adit construction (see Table 4-63). A decrease of peak ADT could be expected to go from 636 to about 400, for a 37% decrease in traffic from Alternative IV. The lowest ADT would be the first 2 years with about 80, increasing to 210+ ADT in year three and in year four increased to 540+ ADT and in year five it is 430 ADT. The large increase in years three and four is due to the hauling of adit waste rock to the tailings paste facility.

TABLE 4-63
FDR No. 150 Traffic Volume Percent Increases

	Alt. I	Alt. II	Alt. III	Alt. IV	Alt. V
Construction Phase at Mill Site					
ADT	33	933	636	636	400
% Increase	--	2,730	1,830	1,830	1,120
Operation Phase at Mill Site					
ADT	33	740	505	505	100
% Increase	--	2,140	1,430	1,430	300

Mine-related traffic would be at the highest level during construction of the mill site and adit. The busing proposal for hourly employees, during mine operation, (Hydrometrics 1997a) would reduce the ADT on FDR No. 150 for about 4 miles. The parking lot would be at the waste water treatment facility about 1 mile up FDR No. 150. This proposal would reduce the ADT, and wildlife/vehicle accidents. The ore concentrate pipeline would eliminate the ore concentrate truck traffic of 16 ADT. The busing and 12 hour shift schedule would decrease the ADT another 150. This would bring the mining related ADT to about 60. The traffic mix of buses, delivery trucks, salaried workers, public, and Forest Service administrative vehicles would still require the road to be constructed to a double lane standard. Total traffic ADT would be about 100 from the parking area to the mill site. This would be a decrease of about 80% in ADT over Alternative IV, from 505 to 100 ADT for the operation phase of the mine.

To accommodate this traffic during years three and four of mine construction, the double lane road segments would need to be constructed during year two. The existing single lane road would not accommodate the 100+ ADT safely during the later years of adit and mill site construction.

Traffic Management

A transportation management plan meeting requirements of Alternative V (see Chapter 2, Alternatives Descriptions) would be necessary to handle expected traffic flow and patterns. FDR No. 150B would be gated at the both the junction with FDR No. 150 and near the paste plant facility. This would be about a one mile segment restricted to Forest Service administrative and pipeline maintenance traffic. Access to the paste plant facility would be from Montana Highway 200 and the county's Government Mountain road and FDR No. 150B along the toe of the paste facility. Access to the rail loadout would be along the same state and county roads. Both FDR No. 150B and rail loadout access roads would be signed to discourage public use. FDR No. 150, providing public, Sterling, and Forest Service administrative traffic, would be open to all traffic. FDR No. 150 would be open in the winter to the mill site, but beyond the mill site the road would not be snow plowed except during construction of the evaluation adit. ADTs for existing FDR No. 150 at M.P. 4.5 is 33. To ensure busing and carpooling would be implemented, it would become a part of the mine permit.

All road construction equipment that needs to cross the bridge over Rock Creek at M.P. 2.3 would need to be at legal highway loading. Off highway loads would require a structural analysis of the bridge for the type of proposed vehicles to use the bridge.

Cumulative Impacts

The impacts of mine traffic and road construction when combined with the effects of future timber harvest and recreational activities would result in 1) cumulative increases in traffic on Montana Highway 200 and FDR Nos. 150 and 2741, 2) the potential for increased indirect effects of sediment and erosion, dust, noise, and 3) a slight increase in traffic safety hazard on roads associated with the project. Increased traffic associated with the rail loadout would mix residential with other rail-associated traffic at the Hereford loadout. Mine traffic accessing the Miller Gulch rail loadout would mix with residential and logging traffic.

Future Forest Service ecosystem management activities that would increase the open road density may require closure of some existing open roads within BMUs during mine operation. Roads to be restricted would depend on the activity needs at that time (see Threatened and Endangered Species).

RECREATION

Summary

For all action alternatives, most recreational vehicle access in the Rock Creek drainage would continue. Foot and vehicle traffic at the mill site, portals, and tailings impoundment or paste facility would be restricted. Between 4.18 and 5.28 miles of road would be closed to motorized vehicular access to mitigate impacts to wildlife.

Local population growth would likely increase recreational use in the area. Increased activity in the Rock Creek drainage could reduce the quality of hunting in the drainage if game populations were displaced.

Recreational use would be modified by changes in access, number of users, and lands available for use. Recreational activities which could be affected by any of the action alternatives include hunting, fishing, camping, berry picking, recreational driving, and other related activities.

Alternative I

Recreational opportunities and use levels, patterns, and growth trends would be expected to continue as they now occur or as may be altered by future management activities. Use levels are increasing annually by an estimated 1 to 3 percent.

Alternative II

Most recreational vehicle access in the Rock Creek drainage would continue. However, 5.28 miles of road would need to be closed to restrict motorized use (while still allowing nonmotorized use) to compensate for mine-related impacts to wildlife. Closures would include 1.88 miles at the upper end of the Chicago Peak Road (FDR No. 2741), the upper 0.18 miles of a spur road (FDR No. 2741x), 0.51 miles of spur road 2741A, and the upper 2.71 miles of the Orr Gulch Road (FDR No. 2285). Access on open roads would be temporarily impacted by delays and increased traffic during the construction phase of the project. Mine-related and recreational road use would be mixed for about 6 miles on FDR No. 150.

Public access would be restricted on about 500 acres at the mill site, mine portal site, and tailings impoundment. This would slightly reduce hunting opportunities and other general forest recreational pursuits in the area. Increased mine related activities could also reduce the recreational desirability of the area for some users.

Road closures would tend to concentrate motorized recreational pursuits to a slightly smaller area, but would increase opportunities for nonmotorized recreational activities. Access to popular sites such as Chicago Peak or Engle lakes would be more difficult because of road closures. Recreational use in areas closed to motor vehicles would decrease slightly. After mining ceased and reclamation was complete, the need for continued closure of roads would be reviewed. Need for continued closures would be dependent on the existing conditions for the grizzly bear and other wildlife at the time. It is likely that roads closed at the beginning of the project would become overgrown and would not be reopened after reclamation.

Hunting, Trapping, and Fishing

Public access restrictions in the vicinity of the mine portals, mill site, and tailing impoundment site would reduce available hunting areas, altering some individuals' hunting schemes. Sterling would prohibit possession of firearms and hunting within their private lands where hunting has occurred in the past. Some commonly used hunting camp locations would become unavailable or undesirable for campsites. On the other hand, paving and plowing of FDR No. 150 might improve general access for hunting and fishing.

Local population growth would likely result in increased fishing, hunting, and trapping in the study area. Increased use of the area could eventually reduce the quality of trapping, thus eventually reducing trapping. Mine employees who hunt could be expected to spend more of their time hunting in the Rock Creek drainage than in other areas because of their necessary access for work.

Because of increased populations and the potential for increased hunting in the Rock Creek drainage, competition between commercial outfitting and the general public could increase. This may decrease the quality of the hunting experience and opportunity for a successful hunt. Some of the commercial hunting activities that currently occur in the Rock Creek drainage may be relocated to other areas within the recreation study area. This would not have a noticeable effect on hunting in the study area.

Increased activity in the Rock Creek drainage may cause some game species to relocate within or out of the drainage (see Wildlife). This movement of animals, along with the potential increased number of hunters, could reduce the quality of the hunting in the drainage. New residents would likely follow the current fishing patterns of local residents. The majority of fishing activity would occur on the Noxon and Cabinet Gorge reservoirs and wilderness lakes that have fish (neither Copper nor Cliff lakes have a fishery). Increased fishing pressure may slightly reduce fish populations.

Recreation Setting

The Forest Service currently classifies the study area's recreational setting as "Roaded Natural." Development of the mine would be more consistent with a "Roaded Modified" classification within the Rock Creek drainage due to the dominating visual modification associated with the mine. The rest of the recreation study area would remain unchanged.

Alternative III

All impacts would remain the same as under Alternative II with the following exceptions. Mine-related and recreation activities would be mixed for about 8.5 miles on FDR Nos. 150 and 2741. Recreationists using the Chicago Peak Road (FDR No. 2741) would share it with periodic heavy equipment use (see Transportation). Recreational travelers could experience delays, limited roadside parking, and increased risk of collisions because of shared use with mine-related traffic from the mill site to the mine portal turnoff. Access to some locally favorite huckleberry picking sites would become less convenient because of heavy mine use of the Chicago Peak Road. Public access would be restricted on approximately 520 acres.

Motor vehicle use would be restricted on 4.18 miles of roads to compensate for mine-related impacts to grizzly bears. Closures would be restricted on 1.88 miles of the upper end of Chicago Peak Road, and 1.61 miles on the upper end of Orr Gulch Road, 0.51 miles of spur road 2741A, and 0.18 miles of spur road 2741x, reducing impacts as compared to Alternative II, for people accessing the wilderness. Other road closures would remain the same.

Alternative IV

Impacts would remain the same as Alternative III except as follows. Public access would be restricted on approximately 490 acres. Heavily used camping sites near the proposed mill site would become less popular for recreational use. Few huckleberry picking sites would be affected.

Mine-related and recreation traffic would be mixed along approximately 5 miles of FDR No. 150 below the mill site. Road closures restricting motorized access would be the same as Alternative III.

Alternative V

Most recreational vehicle access in the Rock Creek drainage would continue. During construction, access to the Rock Creek drainage could be delayed periodically due to construction activities. Mine-related and recreational traffic would be mixed along the lower 5 miles of FDR No. 150. There would be a total of 5.22 miles of roads closed under Alternative V. Vehicle access would be restricted on the upper end of the Orr Gulch Road FDR No. 2285 (1.61 miles), on two short spur roads FDR Nos. 2741A and 2741x (0.69 miles combined) off of the Chicago Peak Road, and a portion of FDR 150. The road closure on FDR 150 (2.92 miles) would be in sections 5 and 8, T26N, R32W, on Government Mountain. The last 1.88 miles of the Chicago Peak Road, FDR No. 2741 would not be closed under this alternative. Foot and vehicle traffic would be restricted at the mill site, the portals, the water treatment plant, the paste plant, and the tailings impoundment. These areas would comprise about 440 acres. Sterling would not allow camping on their lands below the confluence of the east and west forks of Rock Creek from April to July 31 to minimize potential disturbance to harlequin ducks.

Access restrictions would have some impact on recreational use in the drainage. Road closure of the Orr Gulch Road would make for a longer hike to reach the CMW in the Engle Peak/Engle Lake area. The road closure of FDR No. 150 on Government Mountain would break the existing loop road, and would adversely affect recreationists who have historically used the loop road. Hunters and huckleberry pickers would be the primary users that would be affected by this road closure. Access to the private land in Section 5 on Government Mountain would need to be provided to the land owner through a permit system. Dispersed recreation users, and particularly huckleberry pickers, would be displaced from two or three favorite camping locations in the Rock Creek drainage. Other camping sites within the Rock Creek drainage would probably become more congested or would receive higher use levels as a result of the displacement. Hunting opportunities would change. Increased activity could displace some animals, making them less available for harvest. Restricted mine areas would reduce hunting opportunities slightly, but snow plowing of FDR No. 150 could increase hunter access as well. Busing of mine employees would reduce to some degree the amount of vehicle traffic on FDR No. 150, thus reducing levels of disturbance for recreationists along the road up to the proposed mill site. However, road design would limit the number of pullouts along the road to the mill site to minimize potential disturbance to harlequin ducks. This would slightly reduce recreational opportunities along lower Rock Creek.

The food storage order in BMUs 4, 5, and 6 would affect campers in these areas. The order to store unattended food in a bearproof fashion would create an inconvenience for some recreationists. Trail management for the St. Paul and Rock Creek trails could limit some use on these trails in the future.

Cumulative Impacts

Cumulatively, access could increase in the area if additional roads were built for timber harvest. These roads would be restricted to nonmotorized access after timber harvest. Recreational use could increase as local populations increase due to natural immigration or from the Montanore Mine.

The quality of hunting and trapping would be affected by both timber and mineral activities and the potential increase in the number of hunters and trappers. Timber harvesting might displace big game to other areas within and/or out of the Rock Creek drainage. This movement of animals could reduce the quality of the hunting experience and the likelihood of a successful hunt. Once harvest activities were terminated, game could be expected to return to the areas provided suitable habitat remains.

WILDERNESS

Summary

Under the No-Action Alternative, use of the CMW would be expected to increase as projected in the Forest Plan. The impacts associated with this proposal would not occur.

Under the action alternatives, mine-related activities outside the CMW would likely be heard, seen, or smelled from some locations within the CMW. The proposed air-intake ventilation adit within the wilderness boundary could be noticeable to some wilderness visitors and more visible but less audible under Alternatives III, IV, and V than under Alternative II. The air-intake ventilation adit under Alternatives III, IV, and V would be less noticeable than Alternative II after reclamation.

Introduction

The Wilderness Act directs the Forest Service to protect the natural character of wilderness and to provide for recreational, scenic, scientific, educational, cultural, and historical uses of wilderness areas. The four requisite attributes of wilderness are:

1) Natural integrity: the extent to which human influences alter natural processes by comparing the condition of the area to its probable condition without human impacts.

2) Apparent naturalness: closely related to natural integrity. Both qualities may be altered by the same activities. Apparent naturalness focuses on how the activities are perceived by the general public. They include impacts that are seen, heard, or smelled.

3) Solitude: isolation from the evidence and presence of other humans. Features that contribute to solitude include size of area and distance from perimeter to center. Vegetation and topographic screening are also related to solitude.

4) Primitive recreation: provides opportunities for isolation from the evidence of humans. Visitors feel they are a part of the natural environment. They may enjoy a high degree of challenge and risk, and use of outdoor skills.

The Forest Service also describes additional wilderness attributes of outstanding ecological, geological, scenic, and historical features. Ecological features include threatened or endangered species of animals and plants and old growth vegetation. Geological features include landforms that represent significant examples of geological processes. Scenic values are based on significant scenic qualities of the natural landscape in the wilderness. The quality of these natural features depends on how unusual, outstanding, and uncommon the natural features are in the landscape of the geographic region. Cultural and historical features comprise all evidence of historic and prehistoric human use of an area.

Alternative I

Use and character of the CMW is expected to continue as projected in the Kootenai Forest Plan.

Alternative II

Natural Integrity

The only surface structure proposed within the wilderness is the air-intake ventilation adit. This adit would be located on a north-facing aspect, on an estimated 60 percent slope, that supports little vegetation. The adit would occur in goat summer/transition range and would disturb about 3,000 square feet of surface area.

There would be a relatively small, localized increase in particulate pollutants at the proposed mill site and tailing impoundment site resulting from the project. Wind erosion of tailings may occur under extremely windy conditions. The potential exists for these pollutants to reach the CMW Class 1 airshed. However, air pollution levels in all areas are expected to remain well below state and federal ambient air quality standards (see Air Quality).

Potential subsidence, a remote possibility, could cause topographic or lake water level changes to the surface (see Geology and Hydrology). The 404(b)(1) permit would require a contingency plan to be implemented if any surface waters were affected.

There is a slight possibility that postclosure ground water seepage from the underground mine reservoir could exit in outcrop zones in the wilderness (see Hydrology).

Displacement of some wildlife species from areas disturbed by mining activities could increase some wildlife populations within the CMW. Isolated areas of habitat within the CMW could be altered and/or stressed by increased use (see Biodiversity).

Certain natural processes within the CMW may be altered. These would include potential impacts to goats and grizzly bears and short-term displacement of other wildlife and related impacts on habitat. Wildlife and their habitat are primarily influenced by weather, topography, elevation, and other natural factors but mining-related disturbances could adversely affect natural processes of selected species. Overall, however, the wilderness would largely retain its existing character provided subsidence did not occur.

Apparent Naturalness

The air-intake ventilation adit, the grate across the adit opening, or site disturbance associated with construction of the adit may be visible from some locations in the east fork Bull River drainage. However, any of the locations where the adit would be visible are in rugged terrain, generally inaccessible, and are not on popular routes or at destinations generally used by wilderness visitors. Therefore, for most wilderness visitors, the adit would not change the apparent naturalness of the wilderness. Although the adit would continue to exist after the life of the mine operations, reclamation procedures would close the opening and make it much less apparent than during operations.

Some wilderness visitors could feel that the naturalness of the CMW was adversely affected because of their knowledge that the ventilation adit and underground mine existed within the wilderness boundary. This could be considered an emotional violation of apparent naturalness.

The tailings impoundment site, portions of the transportation and utility corridors, and a small part of the mill site could be seen from some locations within the wilderness (see Scenic Resources). These facilities would reduce the apparent naturalness of lands outside the wilderness, but would not visually change the apparent naturalness of designated wilderness lands.

Mine-related noises that could be heard in the wilderness include noise from construction, the air-intake ventilation adit, underground blasting, and activities at the exploration adit (0.25 mile away). Sounds from the mill site (1.0 mile away) and motorized equipment associated with the mine also could be heard from some locations within the wilderness. Magnitude of these noises is dependent on location of the sound and the wilderness visitor, and weather conditions (see Sound). Mine-related noise would reduce the apparent naturalness of the wilderness for visitors, primarily in the Chicago Peak vicinity and near the air-intake ventilation adit. However, human-caused noises (such as vehicles and trains) can already be heard from many locations in the wilderness, moderating this impact.

No mine-related sounds are expected to be audible from the wilderness lakes most often visited by wilderness users. These include Copper, Rock, Saint Paul, and Moran lakes. Therefore, the apparent naturalness of those areas would not be affected by mine-related noise.

Although air pollution levels are expected to remain well below ambient air quality standards, the presence of air pollutants may be evident to some wilderness visitors on a short-term and intermittent basis (see Air Quality). Pollution levels high enough to be noticed are expected to be very localized and intermittent. Evidence of such pollutants would depend on such factors as 1) the type and amount of pollution, 2) wind speed and direction, and 3) the location of the visitor. Evidence of pollutants noticed would decrease with distance from the source. If the pollutants were noticed, they would reduce the apparent naturalness of the wilderness. Generation and evidence of air pollution would cease after final reclamation.

Solitude/Primitive Recreation

Opportunities to see, hear, or otherwise notice mine-related activities would exist from some locations within the wilderness. This would reduce the opportunity to experience solitude or enjoy a primitive recreation experience at those locations as compared to the current situation.

The proposed project would bring over 900 additional residents into the area during the life of the mine. With an assumption that half of the additional residents would visit the CMW at least once a year, recreation wilderness visitation would increase approximately 5 percent over current use. These people would be expected to follow wilderness use patterns of the other local residents. Their activities would occur predominantly at the lakes that support fishing and on the trails leading to those lakes. Some of these people could be expected to stay in the area and use the wilderness after the mine closed. Opportunities for solitude would decrease to a minor degree. However, opportunities for solitude from other humans would increase slightly at Chicago Peak and Engle lakes because road closures (1.88 miles on Chicago Peak Road and 2.71 miles on Orr Gulch Road) would reduce accessibility to trails leading to those areas.

Impacts from human activities are currently apparent at most of the popular destinations in the wilderness. These impacts primarily consist of site disturbance and litter from day-use visitors and campers. Impacts from increased local population use are not expected to be substantially different in kind or amount from existing impacts. Therefore, the apparent naturalness or primitive recreation activities would be minimally affected.

Impacts to solitude/primitive recreation under Alternative II would be potentially significant in the vicinity of the air-intake ventilation adit.

Ecological, Geological, Scenic, and Historical Features

Mine-related impacts would not alter the historical features within the wilderness. However, ecological, geological, and scenic, features would be modified as discussed under Geology, Hydrology, Aquatics/Fisheries, Scenic Resources, Biodiversity, and Threatened and Endangered Species.

Wilderness Act

Section 4(b) of the Wilderness Act of 1964 states: "Except as otherwise provided in this Act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use." The CMW would continue to serve the public purpose of recreation, scenic, scientific, education, conservation, and historic use. Therefore, Alternative II would be consistent with the Wilderness Act of 1964.

Section 4(d)(3) of the Act states that holders of unpatented mining claims validly established as of midnight December 31, 1983, shall be accorded rights under the 1872 Mining Act on those NFS lands designated by the Act, as a wilderness area. This same section states that lands within a wilderness going to patent shall convey only title to the mineral deposits within the claims. The right to cut and use needed timber from those claims is granted if needed timber is not otherwise reasonably available. The United States reserves all title to the surface and surface resources of the claims. Reasonable stipulations may be prescribed "... for the protection of the wilderness character of the land consistent with the use of the land for the purposes for which they are leased, permitted, or licensed." This section indicates that minerals operations as proposed can occur within the wilderness but may be subject to management requirements that are above and beyond those normally imposed on operations outside of a wilderness, so long as such management requirements do not prevent the operator from exercising due rights under the United States mining laws.

The ventilation adit portal and the underground mining proposed in the wilderness are considered necessary for the mining operations. Noise from the ventilation adit could degrade the wilderness character. However, this is not inconsistent with the Wilderness Act since this facility may be required for mine-worker health and safety.

Alternative III

Impacts to wilderness-related activities are similar to those described under Alternative II except for the following items.

Apparent Naturalness

Mitigation under this alternative looks at other feasible options to the wilderness air intake ventilation adit. If any other option was determined feasible, the adit would not be placed in the wilderness thereby reducing wilderness impacts. If the wilderness adit was needed, the adit could be potentially visible from more areas in the wilderness than the Alternative II location because of its location on a nearly vertical face. However, surface disturbance at the adit portal would be reduced to an estimated 800 square feet. Final design standards that reduced the visibility of the air-intake ventilation adit and helped blend other mine facilities outside the wilderness with the surrounding landscape would reduce impacts to the CMW and its visitors. Reducing the noise levels emanating from the air intake adit, at the mill site, and at other mine operations would reduce the amount of noise that could potentially reach the wilderness (see Sound). These measures would help maintain the apparent naturalness of the wilderness, and would provide more solitude and/or primitive recreation experience for a majority of wilderness visitors.

Monitoring lake levels and the water balance at Cliff Lake, Copper Lake, and Moran Basin, and performing more detailed rock mechanics and hydraulic monitoring and frequent review of mining plans would reduce or minimize the potential for subsidence or surface water disruption or water loss in the wilderness.

The low probability of postclosure ground water seepage from the underground mine reservoir would be reduced with additional monitoring and mitigation requirements.

Solitude/Primitive Recreation

Road closures of 1.88 miles on Chicago Peak Road and 1.61 miles on Orr Gulch Road would reduce motorized access to the wilderness trailheads in those areas, slightly increasing the opportunity for solitude.

Alternative IV

Impacts to wilderness-related activities would be similar to those described for Alternatives II and III with the following exceptions.

Apparent Naturalness

The mill at the junction of the east and west forks of Rock Creek (1.25 miles from the wilderness) would be visible from some locations within the wilderness such as Ojibway and Rock peaks (see Scenic Resources). Sounds and odor impacts from the mill would occur in different areas of the wilderness than those associated with the west fork mill site but would generally be unnoticeable. Exceptions to this would be intermittent blasting and the possible visibility of the wilderness air-intake ventilation adit fan from high points to the northeast.

Solitude/Primitive Recreation

Effects to solitude would be similar to Alternatives II and III, except that since slightly fewer people are expected to immigrate into the local area under this alternative and Alternative V, a few less people would be expected to use the wilderness.

Alternative V

Apparent Naturalness

Wilderness impacts would be very similar to those impacts identified in Alternative IV. Mine related activities outside of the CMW would likely be heard, seen, and/or smelled from some locations within the CMW. The potential air-intake ventilation adit within the wilderness boundary could be noticeable to some wilderness visitors, but would be less noticeable than in Alternative II.

Solitude/Primitive Recreation

Opportunities for solitude would increase in the Engle Peak and Engle Lake area because the road closure on the Orr Gulch Road would lengthen the hike to reach these areas and in turn potentially reduce the number of visitors. Vehicle access would be maintained to Chicago Peak under this alternative, so wilderness use from this trailhead would be similar to existing use in this area. However, increased human populations in the area could increase visitation to the wilderness, and slightly reduce the opportunities for solitude. A difference between Alternatives IV and V would be that sounds associated with the evaluation adit could be somewhat reduced under Alternative V since propane generators rather than diesel generators would be used as a power source. No mine related noises are expected to be audible at the wilderness lakes most often visited by wilderness visitors.

Cumulative Impacts

Cumulatively, mining, timber harvest, and other existing or planned activities outside of the wilderness would alter some natural processes occurring in the wilderness in the short term; these processes would have negligible effects in the long term. Additional mineral activity that may occur within the wilderness is expected to consist primarily of surface sampling, surveying, and core drilling, although none is currently proposed. These activities have occurred in the past with some evidence that habitat use by goats has been altered. This could have a slight effect on natural integrity.

Many human activities that occur outside the wilderness are already seen and/or heard from the wilderness. The Rock Creek Project in combination with other future activities would slightly reduce the apparent naturalness of the CMW. Cumulative activities would not change the overall condition of this narrow wilderness.

The Rock Creek Project in combination with the Montanore Mine near the wilderness would increase the chances for wilderness visitors to see, hear, or smell human activities beyond what is currently evident. The apparent naturalness of the area would decrease slightly with increased human use. Evidence of these projects would not be apparent from the wilderness lakes most often visited by wilderness users. Rather, opportunities to experience solitude or a primitive recreation experience would decrease with human use of the area.

CULTURAL RESOURCES

Summary

Eight historic sites were documented during the cultural resource investigations. All of these properties were determined to be ineligible for listing on the National Register of Historic Places (NRHP) by consensus of the KNF and Montana State Historic Preservation Office (SHPO). No mitigation measures would be necessary prior to impacting these sites. The areas surveyed during the cultural resource investigation are outlined in Figure 4-8.

Introduction

Section 106 of the National Historic Preservation Office and its implementing regulations (36 CFR 800) defines an undertaking as “any project, activity, or program that can result in changes in the character or use of historic properties, if any such historic properties are located in the area of potential effects. The project, activity, or program must be under the direct or indirect jurisdiction of a Federal agency or licensed or federally assisted by a Federal agency. Undertakings include new and continuing projects, activities, or programs. Any project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency includes:

1) Those carried out by or on behalf of the agency.
2) Those carried out with Federal financial assistance.
3) Those requiring a Federal permit, license, or approval; and
4) Those subject to State or local regulation administered pursuant to a delegation or approval by a Federal agency.

The Rock Creek Project requires Federal approval and therefore, Section 106 of the National Historic Preservation Act applies to all lands within the project area; state, federal, and private.

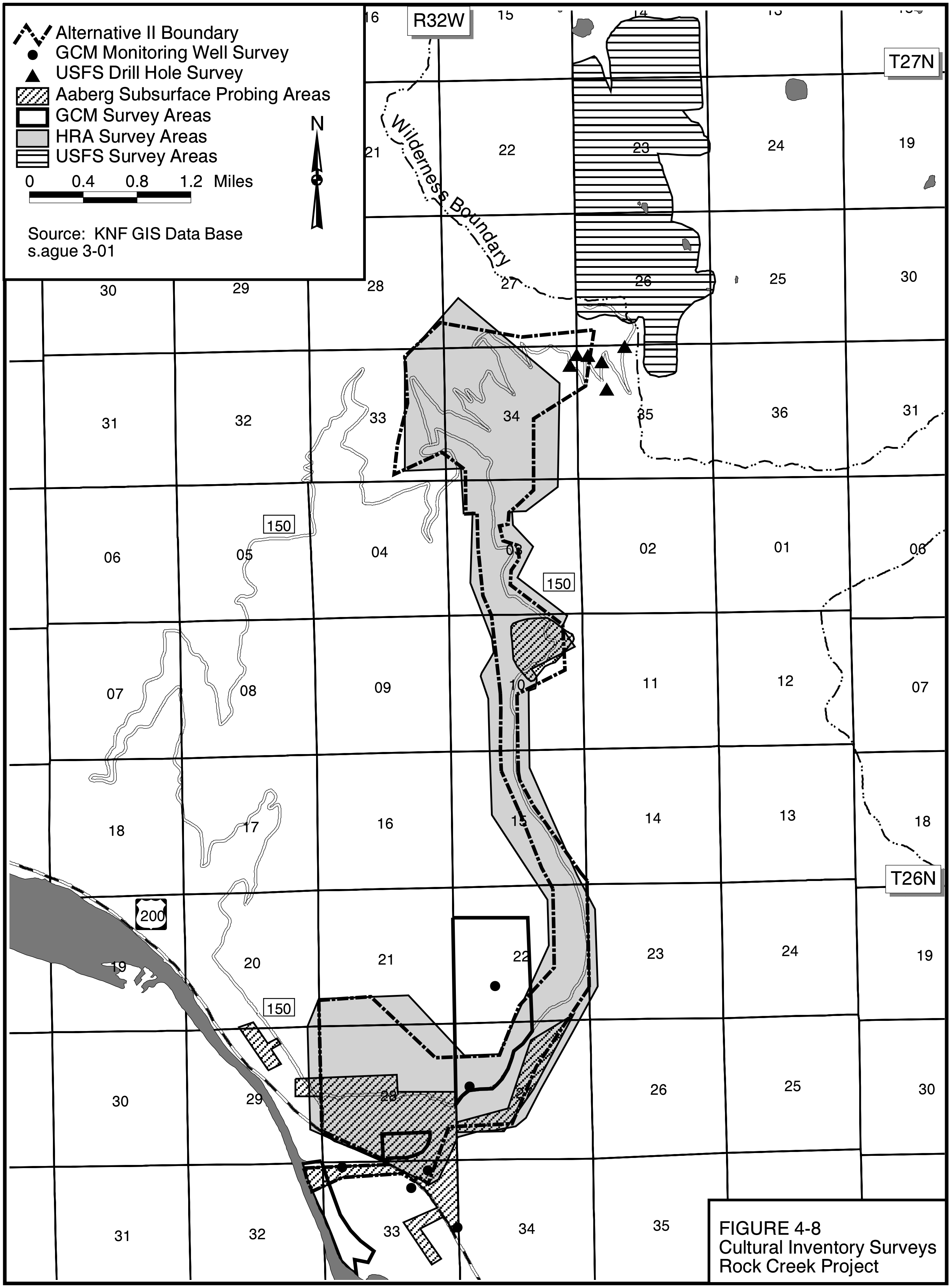


FIGURE 4-8
Cultural Inventory Surveys
Rock Creek Project

If any human remains or other undiscovered cultural materials are discovered during the construction on Forest Service Lands, the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act require that the Forest Service be notified immediately. Failure to notify the Forest Service would be a violation of the Archeological Resource Protection Act. If human remains are encountered on state or private lands, the Montana Burial Bill requires notification. An MOU would be developed to address protocol for addressing inadvertent discoveries for human remains and any other cultural materials. See Appendix K for the Cultural Resource Monitoring Plan.

Alternative I

No direct, indirect, or cumulative changes or impacts to cultural resources would occur beyond natural weathering and deterioration.

Alternative II

A total of seven inventories were conducted within the Rock Creek Project area. Subsurface testing was conducted in 1994 in areas identified as having a high potential for buried prehistoric sites. In the subsurface testing strategy, fifteen areas were identified for auger tests. A total of 417 auger probes were excavated at intervals between 10 and 30 meters and to depths up to 83 centimeters. The results were all negative. Given that the auger probes were 10" in diameter, only approximately .0068 acres of project lands received subsurface testing. The potential for having missed locating subsurface materials is high.

Although eight historic sites were documented during cultural resource investigations, none are eligible to the NRHP even though there would be direct effects to two sites and therefore no mitigation measures are required. Two of the sites will be directly affected by the project. The remaining may see increased vandalism, artifact collecting, and inadvertent physical disturbance as a result of increased human activity and accessibility to the sites over the life of the mine.

Alternative III

A total of seven inventories were conducted within the Rock Creek Project area. Subsurface testing was conducted in 1994 in areas identified as having a high potential for buried prehistoric sites. In the subsurface testing strategy, fifteen areas were identified for auger tests. A total of 417 auger probes were excavated at intervals between 10 and 30 meters and to depths up to 83 centimeters. The results were all negative. Given that the auger probes were 10" in diameter, only approximately .0068 acres of project lands received subsurface testing. The potential for having missed locating subsurface materials is high.

No known cultural resources would be directly affected by the construction of the mill, portals, roads, borrow areas, slurry lines or dump facilities. Site 24SA173, a historic homestead site on private land, would be buried by construction of the tailings impoundment and associated features. The site has been determined ineligible for listing on the NRHP and no mitigation measures would be necessary (Caywood 1986). Site 24SA370, a historic logging site (springboard stumps), would be potentially disturbed by the construction of a wetlands mitigation site. This site also has been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

The five historic sites within the permit boundary outside areas of direct disturbance would receive indirect impacts from changes in the historic landscape from increased traffic, equipment storage, road construction, staging operations, and other construction-related activities. All cultural resources indirectly affected have been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

Increased vandalism, artifact collecting, and inadvertent physical disturbance as a result of increased human activity and accessibility to sites in the area over the mine life potentially would impact all existing historic sites. Sites with standing structures (24SA169 and 24SA172) have a higher profile and would be more vulnerable to cumulative impact. All cultural resources cumulatively affected have been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

Alternative IV

A total of seven inventories were conducted within the Rock Creek Project area. Subsurface testing was conducted in 1994 in areas identified as having a high potential for buried prehistoric sites. In the subsurface testing strategy, fifteen areas were identified for auger tests. A total of 417 auger probes were excavated at intervals between 10 and 30 meters and to depths up to 83 centimeters. The results were all negative. Given that the auger probes were 10” in diameter, only approximately .0068 acres of project lands received subsurface testing. The potential for having missed locating subsurface materials is high.

A short segment (about 400 feet) of Site 24SA328, the Heidleberg Mine Road, would be physically impacted by mine/mill site construction. This site was determined ineligible for listing on the National Register of Historic Places. No mitigation measures would be necessary.

Alternative V

A total of seven inventories were conducted within the Rock Creek Project area. Subsurface testing was conducted in 1994 in areas identified as having a high potential for buried prehistoric sites. In the subsurface testing strategy, fifteen areas were identified for auger tests. A total of 417 auger probes were excavated at intervals between 10 and 30 meters and to depths up to 83 centimeters. The results were all negative. There are 1,555 acres in Alternative V, 1,348 acres are classified as high probability (87%), with 482 acres classified as land that will be disturbed. Given that the auger probes were 10” in diameter, only approximately .0068 acres of project lands received subsurface testing. The potential for having missed locating subsurface materials is high. No known NRHP eligible sites would be affected and therefore no mitigation measures are required. Under this alternative, monitoring of surface disturbing activities in areas outlined in Figure 4-9 will be required (see Appendix K, Cultural Resource Monitoring Plan for more details).

Cumulative Impacts

Human disturbance to cultural resources would increase from the project as well as from reasonably foreseeable activities within the drainage. All cultural resources cumulatively affected have been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

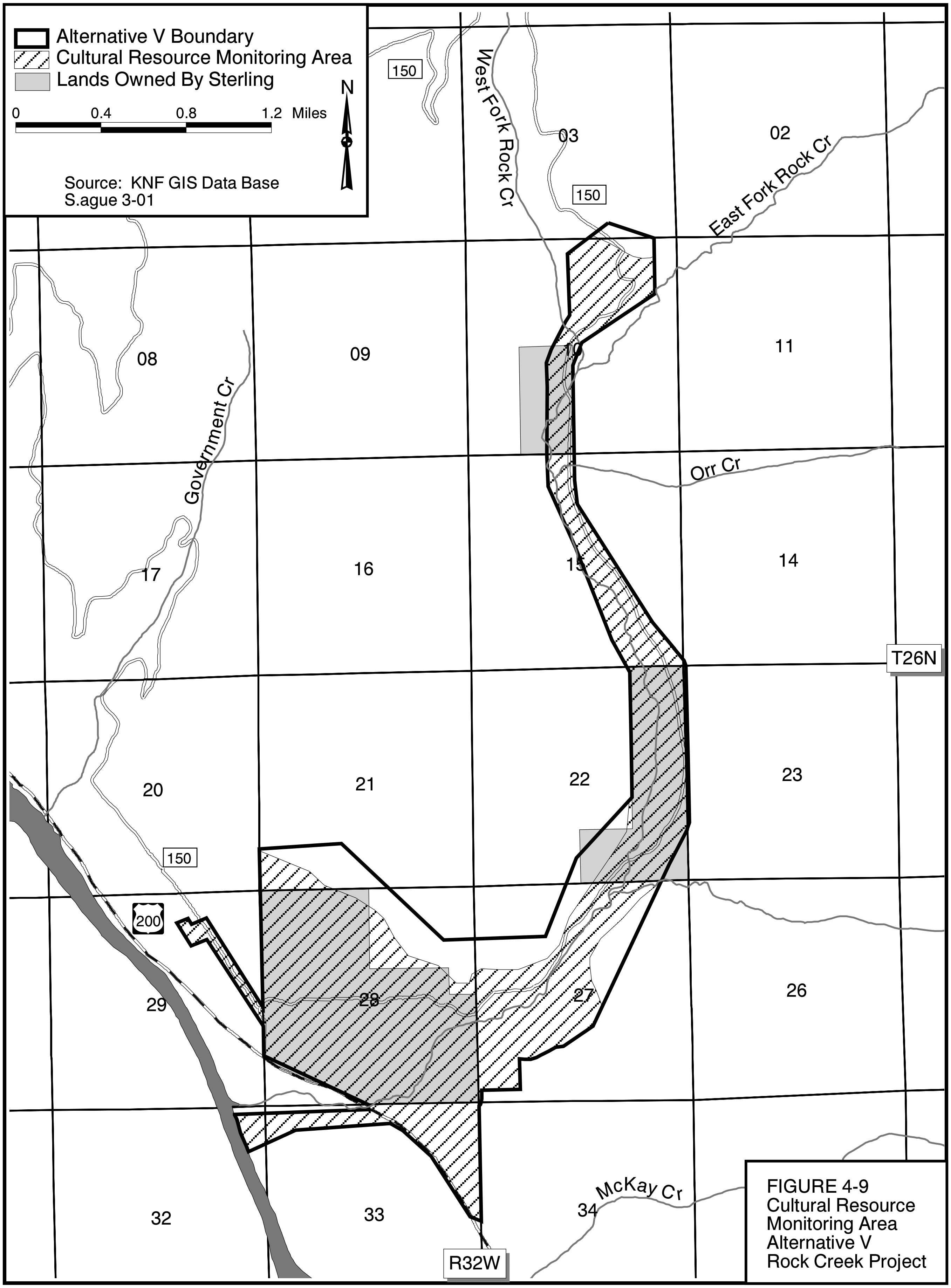


FIGURE 4-9
Cultural Resource
Monitoring Area
Alternative V
Rock Creek Project

AMERICAN INDIAN TREATY RIGHTS

Summary

Under the No-action Alternative, no change in the status of current American Indian Rights would occur. Under alternatives II-V, there may be effects on fisheries, wildlife, and vegetation as well as limits on Tribal access during the life of the project and beyond that would affect the ability of Salish, Kootenai, and Upper Pend d'Oreilles Tribal members to fully exercise current treaty rights within the project area. These effects may vary in magnitude by alternative but are common to each. Impacts cannot be quantified based on tribal information submitted to date. The Confederated Salish and Kootenai Tribes (CSKT) and the Kootenai Tribe of Idaho (KTI), both treat tribes, have identified general issues of concern to treaty rights and traditional uses in their response to comments on the draft EIS and the supplemental draft EIS, as well as in meetings with the Forest Service. They have chosen not to provide site-specific comments associated with their treaty.

Introduction

Chapter 3 describes the treaty rights that pertain to lands and waters within the proposed project area and some that could potentially be affected by the one or more of the action alternatives. Several American Indian tribes, including the Confederated Salish and Kootenai Tribes (CSKT) and the Kootenai Tribe of Idaho (KTI), both treaty tribes, have expressed concerns about impacts to a number of uses that are either expressly identified in the treaties as well as rights protected by several federal laws and regulations. These concerns are similar to the issues identified in Chapter 2 that were used to develop the agencies' alternatives to the proposed action. The tribes' concerns about these issues have been complied from comments submitted during comment periods on the draft and supplemental EISs as well as those brought forward in meetings between the USFS and some of the tribes. Rather than describe the impact on American Indian treaty rights and traditional uses in each resource section the concerns are listed below.

Treaty Rights

- Resources discussed under the Hellgate Treaty;
- Medicinal and Sacred Herbs and other Tribal plants of special concern;
- Huckleberries;
- Mitigation activities;
- Protection of resources to tribes that have ceded their lands to the government;
- No mention of the KTOI and its use of these lands; and
- Access to the land.

Geological Concerns

- Protective measures for adit exploration;
- Failure at the tailings, interceptor wells, or holding lagoons;
- USFS allowing company to drill under the Cabinet Mountains Wilderness;
- ARD - a more extensive study needed due to presence of galena;
- Leaching - tailing impoundment or paste facility constructed with waste mineralized material from initial mine excavation;
- Subsidence to wilderness surface and lakes;

- Potential impacts from earthquake activities; and
- Stability of the tailings facility using paste technology.

Soils
- Reclamation of the tailings impoundment – contamination from future hydrological activities;
- Re-vegetation of plant materials should be all native species; and
- Cleanup plans and remediation of site in event of a hundred year flood.

Water Resources
- Was baseline data recorded during flooding in February 1996 and how it would have affected the project if it had been in operation;
- 100 year flood events and rain-on-snow events effects on tailings impoundment;
- Leaching of minerals into ground water due to substrate material underlying the tailings impoundment/paste facility;
- Unlined tailings impoundment/paste facility will continually leak and contaminate ground water;
- Seepage collection system to operate for 20-60 years, will company be around then to ensure cleanup will occur;
- After mine closure tailings impoundment/paste facility will continue to seep and would diminish with time for several decades before reaching a steady state – admission of blatant pollution and define steady state;
- Provisions for failure of interception wells and trenches for unlined tailings impoundment paste facility;
- Large multimillion gallon reservoir within mine;
- Subsidence of lake in the wilderness – how to repair damage or mitigate for losses;
- Experimental bio-treatment facility not proven or adequate;
- Demand company use proven and best available water treatment technology;
- Mitigation measures to be utilized for cleanup and how costs will be paid if passive biological treatment for de-nitrification fails;
- Bio-reactor not being able to work in cold climate conditions;
- Mine water discharge quantity and quality – how will it be treated and for how long;
- Bio-reactor not capable due to waste created – where will contaminants from bio-reactions go;
- Reverse osmosis system will require disposal of concentrate that is ten times the concentration then the incoming feed;
- Mitigation measures are not conservative enough in protecting the resources of the area;
- Cumulative effects of mining activities on Rock Creek drainage ;
- Full effects to Clark Fork River and Lake Pend Oreille in the event of a failure of systems collecting contaminated ground water;
- Effect of heavy metals on Rock Creek, Clark Fork River, and Lake Pend Oreille;
- Ground water and Rock Creek contamination due to alluvial soils and discharge of waste water into Rock Creek ;
- Lack of adequate water quality data for Clark Fork drainage makes it difficult to assess current conditions and project future metals loading into the river and lake;

- Lack of baseline date, little water quality information related to Clark Fork River, nutrient loading record for Clark Fork River at the Idaho/Montana state line, no long-term information as to flow rates, sedimentation and structure of Rock Creek;
- Negative impacts on ground and surface water quality from nitrates, heavy metals, and process chemicals; and
- Protection of surface and ground water.

Wetlands
- Destruction of wetlands and certainty of model designs for creation of new wetlands;
- Review and permitting COE office not consulting with other COE offices; and
- Cumulative metals buildup, water fluctuations, species composition changes (plant and animal), impacts of wetlands degradation to other resources.

MPDES Permit
- Uncertainty regarding design and implementation of impoundment seepage collection system – can professional evaluation of data and assurances that protection of water resources be safeguarded by state of Montana;
- Statement of Basis (SOB) – non-degradation determination section—the state of Montana should error on side of protecting ground water and not ignore its responsibility to protect its water and fisheries resources;
- Permit application does not list the overflow pipe and seepages from the proposed bio-reactor as point source outfalls;
- SOB – section D partially addresses Idaho's designation of Lake Pend Oreille as a Special Resource water – state of Montana is ignoring this issue and does not place Idaho as an equal partner and should have input in the permit preparation; and
- Location, size of diffuser, mixing zone, monitoring.

Biodiversity
- Twelve populations of five species of plants being eliminated including three populations of crested-shield ferns;
- Loss of habitat, displacement and increased stress and mortality risk for harlequin ducks, lynx, fishers, and wolverines;
- Probable impacts to harlequin duck, fisher, lynx, wolf, woodpeckers, wolverine, mountain goat, and numerous bird species; and
- Effects to old growth forests.

Threatened and Endangered Species
- Habitat loss and recovery of grizzly bear population; and
- USFWS Biological Opinion.

Fisheries and Aquatics
- No display of macro invertebrate data collected;
- Heavy metals effects on fish populations;
- USFS not protecting natural resources by promoting and eliminating a primary watershed utilized by bull and westslope cutthroat trout;
- Arsenic levels generated by this project;
- Viability of native fish populations;

- Habitat improvement and protection – reduce existing road miles in drainage and postponement of timber sales;
- Reduced water levels impacts on amphibians and other aquatic life – adequate baseline data not taken to determine how lakes interact with ground water sources;
- Decline of sensitive fish species due to habitat loss, degradation and increased mortality risk; and
- Mitigation of the loss of bull trout habitat.

Forest Plan
- FS allowing destruction of Rock Creek.

NEPA
- Conclusions based on worst case scenarios not happening; and
- Cumulative Impacts.

Wilderness/Recreation
- Mining being allowed in and or under the Cabinet Mountains Wilderness;
- Noise effects on the wilderness;
- Visual effects on the wilderness;
- Air quality due to mine adit ventilation ducts;
- Reduction to wilderness lake levels;
- Montanore, Way Up and 4th of July mines cumulative impacts to wilderness;
- Road building near wilderness; and
- Emergency mine evacuation activities, digging for access, surface disturbance.

Cultural and Aesthetics
- Ancient trails, cultural practices, and cultural sites;
- Mitigation for cultural properties;
- FS did not meet intent, goals, or spirit of the law regarding consultation with the Tribes; and
- Viewshed, aesthetic, access, sound and solitude.

Air Quality
- Air Quality

Health and Safety
- Toxicity of process reagents and their effects on the environment and animals;
- HAZMAT response and storage plan;
- Spills involving reagents into Rock Creek;
- Transportation of mined material spilling into Rock Creek – heavy metals and diesel;
- Pipeline transportation of waste slurry to tailings impoundment – break in pipeline; and
- Tailings Impoundment to become a dumping site.

Socioeconomics
- Cost benefit analysis, risks to society, classifications, quantification, presentation is the social benefit greater then the social costs.

Miscellaneous
- Economic feasibility of the operation;
- Liability of agencies preparing document in the event an NRDA action;
- Required bonds, type of bonds, bonding calculations and what they cover; and
- Monitoring expenses during operation and in the future.

Alternative I

There would be no change in the status of current treaty rights within the Rock Creek drainage except on those that could be affected by possible timber sales on NFS lands.

Traditional uses of lands and waters within the Rock Creek drainage would not be affected. Traditional uses could be affected by possible timber sales on NFS lands, timber sales and other activities on private lands, the existing trends of use of the drainage by the general public, and the existing trends of population growth and expansion in the region. These impacts cannot be quantified as there are no reasonably foreseeable activities identified and the tribes have not provided site-specific information for the agencies to determine the level of impact.

Alternative II

The proposed action affects about 584 acres of land within the original 28,000 square miles encompassed by the Hellgate Treaty. The actual use of this drainage by tribal members with treaty rights cannot be quantified. Additionally, no tribes with Treaty Rights to the area have identified specific sites associated with hunting, gathering or fishing. This may be related to issues of confidentiality for the tribes and not to an absence of actual sites.

Traditional American Indian uses of resources potentially affected by Alternative II could be affected even though impacts to the resources might be mitigated by various features of the plan of operations and required permits. The effect on traditional uses is discussed below according to each area of concern identified above.

- *Treaty Rights* — All interested tribes have voiced concerns about effects to water quality/fisheries and the CSKT expressed concern over effects to grizzly bear, huckleberries, and medicinal plant resources as well. Under this alternative, bull and westslope cutthroat trout may decline if project impacts create habitat degradation (see Aquatics/Fisheries). Brook trout may be impacted as well. Habitat for grizzly bear, a cultural/spiritual symbol for the CSKT, could be fragmented between its north and south ranges, reducing habitat effectiveness, thus reducing opportunities to see grizzlies (see Threatened and Endangered Species). Impacts to wildlife habitat/vegetation, old growth, and wetlands could potentially affect plant species of interest to the tribes. Impacts that project-related activities would have on plant-related treaty rights is unknown because other than huckleberries, no specific plant species have been identified as important. Huckleberries at the mill site would become unavailable in the short term.

Tribal access to the drainage would overall increase due to the upgrade of FDR Nos. 150 and 2741 but would be restricted from mine facilities sites. Road closures for grizzly bear mitigation would be in place until after operations ceased and reclamation was completed and then would be reevaluated for their respective need to be reopened or remain closed (see Transportation and Recreation).

- *Geological Concerns* — The scientific analysis for defining the impacts for the above mentioned issues have been discussed within the Geology and Hydrology sections in Chapter 4 and individually discussed in the Response to Comments section. Depending on the scale of an environmental mishap as a result of the proposed action with respect to the concerns mentioned above, Traditional American Indian use of that portion of the land and surrounding area could be eliminated or significantly reduced.

- *Soils* — Reclamation of all surface disturbances is a requirement of the reclamation plan and is described in Chapter 2. Technical issues regarding storm water control and ground and surface water quality are addressed in the Hydrology section in Chapter 4 of the EIS and individually discussed in the Response to Comments section. All of the original native plants would be lost at those sites. The only native species to be used for reseeding are those listed in the revegetation plan for Alternative II in Appendix J. Additional plants species could be added if requested. The soils as they currently exist would be lost at those sites. No mitigation measures could be implemented to change the loss of the soil structure in areas where surface disturbance would take place. Reclamation of the disturbed area would require the use of some native species in order to reestablish the post-mining land use of wildlife habitat and would lessen the impacts but not replace the lost populations. The mitigations established to lessen the impacts to soils and water quality may not be adequate to meet the needs of continued traditional use of the resource.

- *Water Resources* — The scientific analysis describing the effects for the above mentioned water issues have been discussed within the Hydrology Section, Chapter 4 of the EIS and in the MPDES permit contain in the Appendices. The current general public use of the ground water and surface water will not change. The changes that will occur would be within the parameters of state and federal laws and regulations. The water treatment systems proposed under Alternative II may not be adequate to mitigate the loss of the original water quality and changes to the systems may have to be imposed in order to comply with the limits in the MPDES permit. Because there will be changes to both ground water and surface water quality (calculable but not measurable), traditional American Indian uses of the water may be lost. The value placed on the original water by American Indians may be lost.

- *Wetlands* — The impacts for the reduction in wetlands have been analyzed in the Wetlands Section, Chapter 4 of the EIS and in the Wetlands Mitigation Plan for Alternative II. Mitigation in the form of establishing new wetland areas would be included with the COE 404 permit. The reduction of the original wetlands may create a loss of traditional American Indian use of those areas in the form of certain plants and displacement of some animal species. The wetland revegetation plan lists the native species that would be required to be used in the reclamation process but it does not include all of the known species that current utilize the sites. Additional plant species could be added on request. Depending on the scale of a given impact if it were to occur, American Indian traditional use may be eliminated or at least reduced.

- *MPDES Permit* — The MPDES permit is a permit required by the state of Montana. The proposed permit meets Montana and Idaho water quality standards and standards set by EPA for Lake Pend Oreille. The impacts associated with the proposed discharge are described within the EIS in the Hydrology and Aquatics/Fisheries sections in Chapter 4 and in the Statement of Basis for the proposed MPDES permit in Appendix D. Since the proposed permit is based on Alternative V, some component of the permit would have to be revised to correlate to features of Alternative II that differ from Alternative V. The MPDES permit does allow water quality changes that are within the parameters of state and federal laws and regulations. The diffuser location and function was analyzed in a separate document with its recommendation incorporated into the final EIS (U. S. Forest Service 2001a). The requirements established in the permits or EIS may not be adequate to mitigate for the loss of American Indian traditional use of the water or the value placed on both surface and ground water after treatment or mixing.

- *Biodiversity* — The impacts to the tribal issues listed above are addressed in the Biological Assessment, Biological Opinion, and in the Biodiversity section of the EIS and within the Response to Comments Section. The EIS concludes that there are potential effects to the plants and animals listed, but none are significant and most are indirect. Although the potential impacts are indirect, the effect to American Indian traditional uses may still be affected because of the traditional American Indian values on these particular plants and animals or their traditional use of those resources.

- *Threatened and Endangered Species* — The impacts to grizzly bears is disclosed in the Threatened and Endangered Species section in Chapter 4. The Biological Assessment and Biological Opinion (see Appendices B and E respectively) address the effects and mitigations associated with grizzly bear under Alternative V. Many of the mitigations set forth in these documents are not part of Alternative II. The BA and BO may have to be revised should a decision be made to permit Alternative II. The mitigations proposed under Alternative II may not be adequate to mitigate for the potential loss of traditional values placed on the grizzly by American Indians.

- *Fisheries and Aquatics* — Tribal issues regarding fisheries and aquatics listed above have been addressed in the Aquatics/Fisheries, Threatened and Endangered Species, and Hydrology sections in Chapter 4. The Biological Assessment and Biological Opinion (see Appendices B and E respectively) address the effects and mitigations associated with bull trout under Alternative V. Many of the mitigations set forth in these documents are not part of Alternative II. The BA and BO may have to be revised should a decision be made to permit Alternative II. The potential effects to the aquatic resources in Rock Creek, Clark Fork River and Lake Pend Oreille would not change how the general public use this resource. However the mitigations described for Alternative II may not adequately address the value the American Indian place on this part of the environment and therefore affect the traditional use.

- *Forest Plan* — The environmental effects to Rock Creek are described in this EIS under the various resource areas listed in Chapter 4. Traditional uses of this watershed will be affected directly and indirectly because of the scope of the activity being proposed. Although mitigation measures have been designed to scientifically minimize the impacts to the resources they may not be adequate to address the American Indian's ability to continue certain traditional use activities.

- *NEPA* — Effects are described in Chapter 4 for each resource based upon what is reasonably expected to occur. The cumulative effects of the alternatives are discussed at the end of each resource section in the final EIS.

- *Wilderness/Recreation* — The Wilderness Act allows for mining activity including if prove to be necessary, a ventilation adit. A description of impacts to noise, visuals, and air quality are addressed in the appropriate sections in Chapter 4 of the EIS. The quality standards set by law or regulation for these resources are the maximum limits that can be proposed for mitigation. The limits or standards set for noise, visual, air quality and water quality may not be adequate to mitigate to a level where traditional use will not be impacted that is acceptable for American Indian traditional use.

- *Cultural and Aesthetics* — Cultural inventories were conducted in and outside the permit boundary and mitigation measures were established to protect any undiscovered sites. Visuals, access, sound, and solitude are discussed in the appropriate sections within the final EIS. The standards set by law, regulation or Forest Plan may not be adequate to American Indians affected directly or indirectly as a result of the proposed action for the above-mentioned issues. Meetings were held with the individual Tribes and solicitation of comments collected to assess the scientific and as much as possible the cultural, and traditional use of this area.

- *Air Quality* — The issues regarding air quality are discussed in the Air Quality Sections in Chapter 3 and 4 and in the proposed Air Quality Permit in the Appendix C. If a decision were made to permit Alternative II, it may be necessary to modify the permit due to differences between Alternative V on which the permit is based and Alternative II. The standards set by the air quality permit may not be acceptable to traditional American Indian values and uses for this area or resource.

- *Health and Safety* — Many of the tribal concerns about health and safety are discussed in the Hydrology and Aquatics/Fisheries sections in Chapter 4. A draft spill prevention plan is contained in the original submitted plan of operations and will need to be finalized prior to operation. Depending on the scale of a spill or accidental discharge, and the degree of successfulness in remediating the incident, traditional uses for American Indians could be significantly be diminished for this area.

- *Socioeconomics* — The Socioeconomics section in the EIS addresses the economic effects to the nearby communities and local governments. The Hard Rock Impact Plan is a requirement of the state of Montana. The plan is designed to lessen the financial cost to the local governments resulting from construction and operation of a hard rock mine project. There are no tribal agencies identified as qualified local governments as defined by state law and the project would not directly affect any reservations. Neither the Hard Rock Impact Plan nor the socioeconomic impacts assessed in the Chapter 4 list any direct or indirect impacts to the American Indians. However, Sterling's Hard Rock Impact Plan is based on Alternatives IV and V and may need to be modified if Alternative II is permitted. It is expected that impacts relative to the tribal issues above may have a potentially direct or indirect effect on American Indians but those effects are expected to be the same as for the general public.

- *Miscellaneous* — NEPA does not require an economic feasibility nor is it required by state or federal law on private minerals. Cost of monitoring is the responsibility of the state, the Forest Service, and the operator, and is based on law, regulations, and permit requirements. Bonds are discussed in the EIS in Chapter 1. It is expected that the miscellaneous issues listed earlier may have a potential direct or indirect effect on American Indians but those effects are expected to be the same as for the general public.

Alternative III

Traditional American Indian uses of resources potentially affected by Alternative III could be affected even though impacts to the resources might be mitigated by various features of the plan of the alternative requirement and required permits as described in Chapter 2 and analyzed in Chapter 4. The effect on traditional uses is discussed below according to each area of concern identified above.

- *Treaty Rights* — This alternative would directly affect 608 acres of land (public and private) within the original treaty lands.

  The general concerns of the CSKT and KTI and identification of specific sites are the same as written in Alternative II.

  The reduction in the amount of old growth habitat disturbed may reduce impacts to important vegetation but without knowing the species involved, the impact cannot be quantified. Additional mitigations for impacts to grizzly bear would also reduce impacts to this Tribal resource.

- *Geological Concerns* — The agencies incorporated several mitigation measures into Alternative to address tribal concerns, but there were a few residual impacts that were addressed by mitigations incorporated into Alternatives IV and V. Geology–related impacts would have an effect on traditional use.

- *Soils* — The agencies incorporated several mitigations and monitoring requirements that would increase the potential for successful reclamation and revegetation of mining-related disturbances including deeper soil salvage and replacement, more native species in the revegetation plan, earlier planting of trees and shrubs on the impoundment face, and increased monitoring. These mitigations while addressing the impacts may not be adequate to meet the needs of continued traditional uses related to soils.

- *Water Resources* — The agencies added several mitigations to Alternative III described in Chapter 2 that reduced, minimized, avoided, or mitigated impacts on water resources. This included revisions to the impoundment design and geochemical testing. Even so potential changes in surface and ground water quality and quantity may not adequately address the value the American Indian place on water resources, and therefore affect the traditional use of those resources.

- *Wetlands* — Under Alternative III, fewer wetland mitigation sites were proposed than under Alternative II. Nevertheless, the COE would have the final decision on the number of wetland replacement acres. Alternative III may not adequately address the values the American Indian places on wetlands and riparian areas, and therefore, affect the traditional use of these resources.

- *MPDES Permit* — Since the proposed permit is based on Alternative V, some component of the permit would have to be revised to correlate to features of Alternative III that differ from Alternative V. Potential changes in surface and ground water quality may not adequately address the value the American Indian place on water resources, and therefore affect the traditional use of those resources, although all discharges would meet the state's non-degradation water quality standards.

- *Biodiversity* — Several mitigations added to Alternative III for wildlife and threatened and endangered species would reduce impacts to wildlife, especially sensitive and indicator species. Fewer acres of old growth would be directly and indirectly affected. Requirements to field check for all sensitive species populations prior to construction may make it possible to avoid impacting some populations by modifying facility designs accordingly and whenever the list is modified, Sterling would have to recheck its surveys and perhaps resurvey sites to determine if any newly listed species were present. Even with these mitigations, Alternative III may still affect traditional use of these resources.

- *Threatened and Endangered Species* — The agencies added several requirements to address impacts to grizzly bears including the need for replacement acres to maintain habitat effectiveness for grizzly bears. Some of the mitigations set forth in the BA and BO documents are not part of Alternative III as they are based on Alternative V. The BA and BO may have to be revised should a decision be made to permit Alternative III. The mitigations proposed under Alternative III may not be adequate to mitigate for the potential loss of traditional values placed on the grizzly by American Indians.

- *Fisheries and Aquatics* — Several mitigations to minimize the effects to bull trout were added to Alternative III. However, should Alternative III be permitted, changes may have to be made to bring it into compliance with the requirements in the BO in Appendix E or else a new BO would be required. These mitigations required by Alternative III may not adequately address the value the American Indian place on this part of the environment and therefore affect the traditional use of these resources.

- *Forest Plan* — Effects to resources affected by modifying the Forest Plan and subsequent effects on traditional uses would be similar to Alternative II.

- *NEPA* — Effects of Alternative III are described for each resource in Chapter 4. Impacts to traditional uses of those various resources may not be mitigated under Alternative III.

- *Wilderness/Recreation* — The wilderness air-intake adit was relocated and additional requirements were incorporated so that the design and location would be reevaluated should the adit be required by MSHA. If the adit were relocated outside of the wilderness area or not needed at all, then some impacts on traditional uses of the wilderness may be minimized, but not completely eliminated.

- *Cultural* — Effects on cultural resources relative to traditional uses would be similar to Alternative II.

- *Air Quality* — If a decision were made to permit Alternative III, it may be necessary to modify the permit or the alternative due to differences between Alternative V on which the permit is based and Alternative III. The standards set by the air quality permit may not be acceptable to traditional American Indian values and uses for this area or resource.

- *Health and Safety* — Burial of all pipelines would help prevent vandalism and possible rupture of the pipelines. Nonetheless, depending on the scale of a spill or accidental discharge, and the degree of successfulness in remediating the incident, traditional uses for American Indians could be significantly be diminished for this area.

- *Socioeconomics* — Effects to socioeconomics relative to traditional uses would be the same as for Alternative II.

- *Miscellaneous* — effects relative to the concerns listed above would remain the same as for Alternative II.

<u>Alternative IV</u>

Traditional American Indian uses of resources potentially affected by Alternative III could be affected even though impacts to the resources might be mitigated by various features of the plan of the alternative requirements and required permits. The effect on traditional uses is discussed below according to each area of concern identified above.

- *Treaty Rights* — This alternative would directly affect 542 acres of the original treaty lands.

  The general concerns of the CSKT and KTI and identification of specific sites are the same as written in Alternative II.

  Impacts to vegetation-related treaty rights would be less than other action alternatives but cannot be quantified. Huckleberries at the upper mill site would not be affected by project activities. Less bear habitat would be affected and mitigations would be required to minimize the impacts. Tribal access above the confluence of the east and west forks of Rock Creek would remain at current levels although access would be improved between the confluence and Montana Highway 200. Access through mine facility areas would be restricted, but less road closure would occur.

- *Geological Concerns* — Effects to these resources relative to traditional uses would be the same as for Alternative III.

- *Soils* — Effects to these resources relative to traditional uses would be the same as for Alternative III.

- *Water Resources* — Even though the alternate mill site would reduce the effects to the West Fork of Rock Creek effects to these water resources relative to traditional uses would be similar to those for Alternative III.

- *Wetlands* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *MPDES Permit* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *Biodiversity* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *Threatened and Endangered Species* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *Fisheries and Aquatics* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *Forest Plan* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *NEPA* — Effects of Alternative IV are described for each resource in Chapter 4. Impacts to traditional uses of those various resources may not be mitigated under Alternative IV.
- *Wilderness/Recreation* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *Cultural* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *Air Quality* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *Health and Safety* — Effects to these resources relative to traditional uses would be the same as for Alternative III.
- *Socioeconomics* — Even with implementation of the Hard Rock Impact Plan it is expected that impacts relative to the tribal issues on socioeconomics above may have a potentially direct or indirect effect on American Indians, but those effects are expected to be the same as for the general public.
- *Miscellaneous* — Effects to these resources relative to traditional uses would be the same as for Alternative III.

Alternative V

Traditional American Indian uses of resources potentially affected by Alternative V could be affected even though impacts to most resources have been mitigated for by various features of the alternative requirements and required permits. The effect on traditional uses is discussed below according to each area of concern identified above.

- *Treaty Rights* — This alternative would directly affect 481 acres of original treaty lands.

  The general concerns of the CSKT and KTI and identification of specific sites are the same as written in Alternative II.

  Impacts to vegetation-related treaty rights would be less than other action alternatives but cannot be quantified. Huckleberries at the upper mill site would not be affected by project activities. Less bear habitat would be affected and less mitigation would be required to minimize impacts. Tribal access above the confluence of the east and west forks of Rock Creek would remain at current levels although access would be improved between the confluence and Montana Highway 200. Access through mine facility areas would be restricted, but less road closure would occur.

- *Geological Concerns* — Numerous mitigations have been incorporated into Alternative V to address issues similar to tribal concerns (see Geology in Chapter 4). Nevertheless, no mitigation measures can be implemented to minimize the impact to the potentially affect geologic resources to a level that would not have an effect on traditional use.

- *Soils* — Several new mitigations and monitoring requirements were added to Alternative V that would enhance reclamation and revegetation success. However, Alternative V would still affect traditional uses associated with soils and vegetation.

- *Water Resources* — Alternative V includes a requirement for additional extensive monitoring during evaluation adit construction in order to obtain data needed to finalize plans and designs for some mining-related facilities and operational requirements and to confirm assumptions used for analysis in the final EIS. Buffers were added to reduce the risk of affecting wilderness lakes or generating new springs and seeps from water stored in the underground workings. The paste technology proposed for constructing the tailings storage facility under Alternative V, would greatly reduce the potential seepage through the tailings compared to a traditional impoundment. The original proposed water treatment systems were replaced with anoxic biotreatment and reverse osmosis systems, systems proven to be able to treat similar waters to similar standards. However, the water resources related mitigations established in Alternative V may not adequately address the value the American Indian place on this part of the environment, and therefore, affect the traditional uses associated with water resources.

- *Wetlands* — Mitigation was established to monitor for impacts to springs and seeps and associated vegetation that may be affected by the proposed action. Monitoring of the vegetation was the result of tribal input. The underground buffer zoned would help to minimize the risk of impacts to wetlands associated with wilderness lakes, springs, and seeps and minimize the potential for generation of new springs and seeps. The wetlands mitigation plan for Alternative V identifies several additional mitigation sites should the COE require a greater level of mitigation or if proposed mitigations sites are unsuccessful. Alternative V may not adequately address the values the American Indian places on wetlands and riparian areas, and therefore, affect the traditional use of these resources.

- *MPDES Permit* — The proposed permit includes limits that are based on the low flow of the river due to routine shutdowns of Noxon Dam on weekends and evenings. The limits meet both Idaho and Montana's non-degradation based water quality standards and Idaho's requirements for Special Resource Waters. Provisions are included to allow the permit to reopened for modifications needed to comply with proposed TMDLs on the Clark Fork River. Even so, the water resources related mitigations established in Alternative V and requirements of the proposed MPDES permit may not adequately address the value the American Indian place on this part of the environment, and therefore, affect the traditional uses associated with water resources.

- *Biodiversity* — Alternative V includes several mitigations designed to reduce or mitigate impacts to harlequin ducks as well as all mitigations proposed under Alternatives III and IV. The mitigations proposed under Alternative V may not be adequate to mitigate for the potential loss of traditional values placed on the wildlife and plants by American Indians.

- *Threatened and Endangered Species* — The USFWSs BO developed a reasonable and prudent alternative, reasonable and prudent measures, and terms and conditions that included the mitigations in the BA an included a few new items. The agencies have incorporated all requirements of the BO into Alternative V. The mitigations proposed under Alternative V may not be adequate to mitigate for the potential loss of traditional values placed on the grizzly by American Indians.

- *Fisheries and Aquatics* — Additional mitigations and monitoring to minimize the effects to bull trout is described and assessed in the BA in Appendix B and in the USFWS's BO in Appendix E. These requirements have been incorporated into Alternative V. However, the mitigations established in Alternative V may not adequately address the value the American Indian place on this part of the environment, and therefore, affect the traditional uses associated with fisheries and aquatics.

- *Forest Plan* — Effects to resources affected by modifying the Forest Plan and subsequent effects on traditional uses would be similar to Alternative II.

- *NEPA* — Effects of Alternative V are described for each resource in Chapter 4. Impacts to traditional uses of those various resources may not be mitigated under Alternative V.

- *Wilderness/Recreation* — Closure of FDR No. 2741 was eliminated under Alternative V ensuring access to the wilderness along that route. Other mitigations proposed under Alternatives III and IV are carried forward into Alternative V. Even with these changes, Alternative V may not be adequate to mitigate impacts to the wilderness to a level where traditional use will not be impacted or that is acceptable for American Indian traditional use.

- *Cultural and Aesthetics* — Effects to these resources relative to traditional uses would be the same as for Alternative III.

- *Air Quality* — Alternative V includes several measures to reduce the amount of pollutants generated by equipment and the use of a SAG mill to reduce dust. Although impacts on air quality would be reduced effects to these resources relative to traditional uses would be similar to Alternative III.

- *Health and Safety* — A Road Risk Assessment was completed by the USFS (USFS 2001a) to incorporate additional preventive measures to reduce the potential of accidents and hazardous material discharge into the riparian areas and creeks. Effects to these resources relative to traditional uses would be the same as for Alternative III.

- *Socioeconomics* — Even with implementation of the Hard Rock Impact Plan it is expected that impacts relative to the tribal issues on socioeconomics above may have a potentially direct or indirect effect on American Indians, but those effects are expected to be the same as for the general public.

- *Miscellaneous* — Effects to these resources relative to traditional uses would be the same as for Alternatives III and IV.

Cumulative Impacts

Increased access to the general project area could increase the use of treaty-related resources by the general public as well as Tribal members. Logging operations within the Rock Creek drainage would impact additional areas of potentially significant plant species and increase the impacts to grizzly bears. The regional wide effect the proposed action may have on American Indians traditional use with respect to treaty rights in conjunction with other proposed projects within the treaty rights boundary is not discussed as that is beyond the scope of this document.

SOUND

Summary

Project development would cause noise impacts from both stationary sources (evaluation adit generators, air-intake ventilation adit fans, conveyors, mill operations, pumping stations and the rail loadout facility), and mobile sources (construction equipment, blasting, ore truck and employee traffic). The loudest stationary sounds would be audible within 2 miles under ideal transmission conditions. Under normal conditions, with the effects of topographic and vegetative absorption, noises from project facilities could be heard for about 0.87 mile. Vehicles traveling FDR No.150 and Montana Highway 200 typically would be heard 0.25 mile and 0.67 mile away, respectively. Mitigation measures and location alternatives could significantly reduce construction and operation noise impacts to the CMW, and eliminate noise impacts to residents near the proposed Hereford rail loadout under Alternatives III, IV and IV.

Alternative I

The upper Rock Creek area would continue to have quiet sound levels characteristic of rural areas and wilderness lands (Parker 1987), while the lower Rock Creek area would have sound levels primarily influenced by human activities along the Clark Fork River Valley. Existing natural sound levels in the upper Rock Creek drainage ranging from 25 to 32 decibels-A scale (dBA) (Parker 1987) would continue, with occasional elevated noise levels caused by logging and firewood gatherers. Infrequent vehicle use of FDR No. 150 would continue to generate about 50 dBA, while growing traffic levels on Montana Highway 200 would gradually increase local noise levels from an estimated 70 dBA toward 74 dBA as measured at the edge of the roadway. These noises generally would be buffered by terrain or vegetation. Sound levels at the Hereford rail siding would continue as moderately quiet, except for passing trains.

Alternative II

Project impacts are difficult to predict because actual project noise impacts would be a function of 1) existing sound levels, 2) people's desired sound levels, and 3) the characteristics and conduction of noise. The desired Rock Creek drainage sound levels are "quiet" and are generally of a natural origin (Rodman 1987) because most of the area is managed for wilderness, grizzly bear habitat, dispersed recreation and intermittent timber cutting. Expected sound levels would generally not exceed 55 dBA (U.S. Environmental Protection Agency 1974; Harrison, Clark, and Stankey 1980). The project would noticeably increase both the level and character of noises at the mill and mine portal sites. Traffic along project haul roads and operation of the rail loadout would also cause elevated noise levels. Figure 4-10 compares typical noise levels with expected levels to be generated by selected project components.

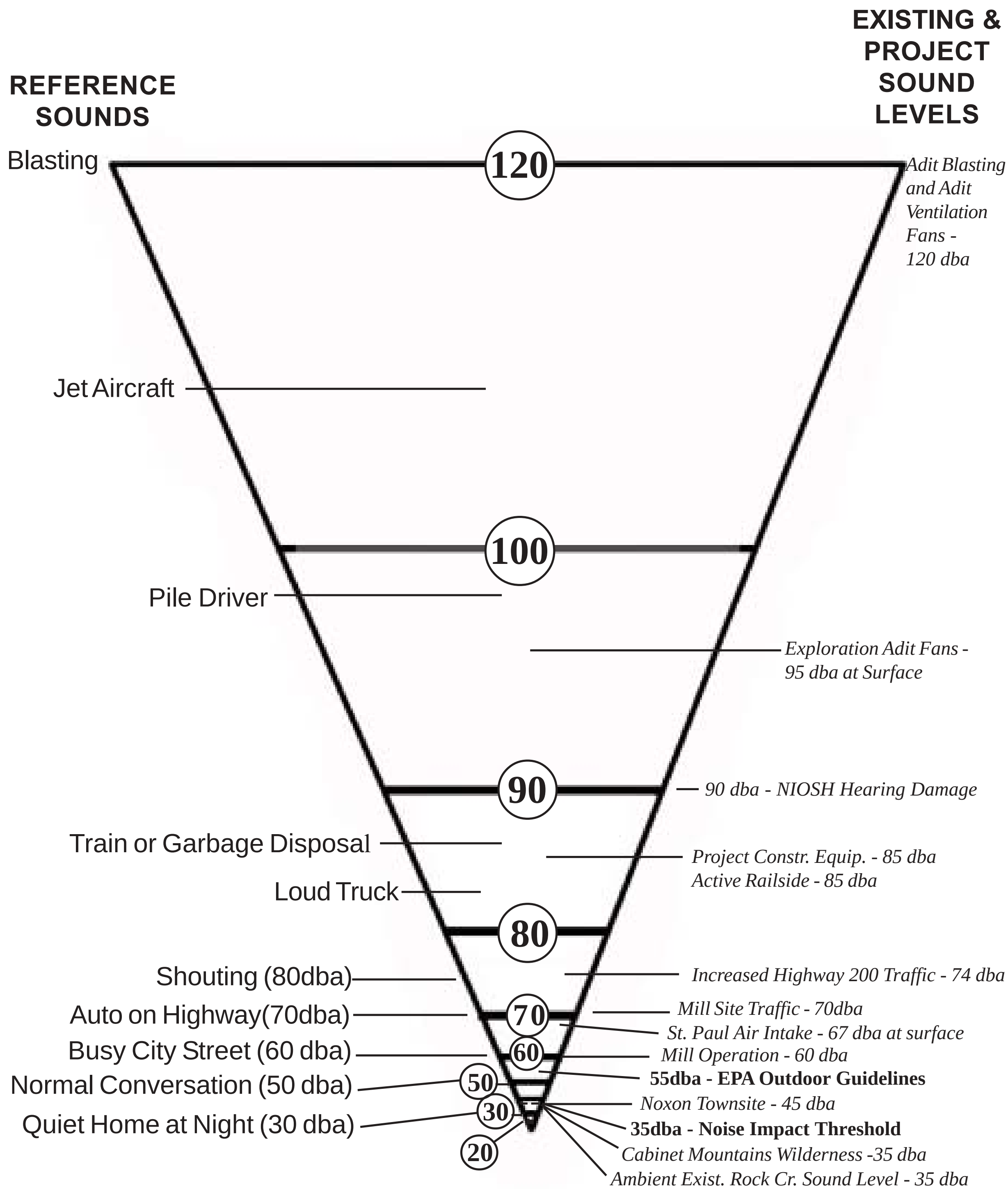
Construction-Phase Effects

The loudest noises would be generated intermittently at the mill site and adits when blasting peak noise levels would reach up to 125 dBA measured at 900 feet for a few seconds. Noise transmission would be loudest when blasting was carried out at the surface; underground blasting noises reaching the surface would have different degrees of muffling. When construction operations are totally underground, the primary source of construction noise would be the adit ventilation fans, which generate 120 decibels. Bulldozers, trucks and other construction vehicles would be expected to generate up to 85 dBA.

To provide ventilation during adit construction for both the ventilation and mine adits, 4-foot-diameter fans encased in tubing would be located between the entrances and the working faces of the adits. As mining progresses, these fans would be moved back into the mine 500 feet, with additional fans added at 3,000-foot intervals. These ventilation fans operate continuously, generating up to 123 dBA and would be clearly noticeable (45 dBA) up to 1.0 mile away. The fans could be audible for more than 2.0 miles, depending on noise transmission conditions. When adit construction was complete, these fans could be located within the mine, decreasing surface noise levels by an estimated 3.0 dBA per 1,000 feet of tunnel or a possible reduction of 29 dBA. Following relocation inside the mine, an unmuffled mine ventilation fan would still generate up to an estimated 114 dBA at the mine portal, audible for slightly more than 1.0 mile on the surface (at greater than the 35 dBA background level). Diesel-powered generators at the evaluation adit would continuously generate up to 85 dBA at 50 feet (audible for 1.0 mile or more).

Chain saws, logging trucks, and other construction equipment used for powerline and tailings pipeline construction would also generate an estimated 110 dBA at 50 feet. Although these activities would take place in hilly, forested terrain, all of these sounds would be audible for 1.0 mile or more. Surface blasting, trucks with inadequate mufflers, and truck back-up alarms could be audible for up to 2.0 miles.

During project construction, most activities would be expected to regularly exceed the EPA 55 dBA health and welfare noise guideline (U.S. Environmental Protection Agency 1974). Personal hearing protection measures would be necessary to protect workers from during exposure to noise levels greater than 90 decibels for 8 hours or more per day (National Institute for Occupational Safety and Health 1978). Under optimum sound transmission conditions, the adit and mill construction sounds reaching



NOTE: Each 10 decibel (dba) increase is twice as loud as the preceeding Increment

FIGURE 4-10
Existing Sound Levels and Projected Sound Impacts
Rock Creek Project

residential areas in the Clark Fork Valley would not be intrusive (estimated 35 to 50 dBA). Noise from constructing the impoundment's starter dams (adjacent to Montana Highway 200) would be audible for 1.0 mile or more in all directions, including some residential areas near Noxon Reservoir.

Infrequent adit and mill site blasts of 125 dBA could generate 60 to 80 dBA bursts reaching residential areas in the valley and the CMW. Occasional bursts of construction and blasting noise would cause local displacement of some big game species (U.S. Environmental Protection Agency 1985) (see Biodiversity for details).

Construction truck traffic to and from the exploration adit, mill site, tailings impoundment, and rail loadout would temporarily increase noise levels. Haul trucks with properly operating mufflers would be expected to generate up to an estimated 86 dBA at 50 feet. The noise effects would be similar to those of trucks transporting logs from a timber sale.

Powerline construction would temporarily increase daytime sound levels along the proposed utility corridor. During the estimated 3-month line construction period, equipment would generate up to 115 dBA at 50 feet.

Operation-Phase Effects

Routine mine operation noise levels of 52 to 62 dBA would be noticeably louder than the natural upper Rock Creek sound levels (30 dBA), but generally would be lower than mine construction levels (about 86 dBA). Most mine and mill operating sound levels would slightly exceed the EPA 55 dBA outdoor noise guideline. Primary noise sources would be the conveyor, crushing plant, and ball mill, each of which would be expected to produce between 52 and 62 dBA. Once the mine operations adits intercepted the exploration adit, the loudest project noise would be generated from the mine ventilation fan near the mouth of the exploration adit at an estimated 114 dBA for over 1.0 mile. Underground blasting would be expected to produce peak surface sounds of up to 55 dBA, but generally would be marginally audible at the surface (Parker 1987). Mine and mill site operations noises reaching the Clark Fork Valley generally would be inaudible.

Operations around the tailings impoundment normally would have lower noise levels, but during the first 7 years of mine operations, the ongoing embankment construction would occasionally emit up to 110 dBA. Ore haul trucks and employee traffic would generate increased traffic noise levels along FDR No. 150 and Montana Highway 200. This increased traffic would significantly increase noise levels (from 30 to 70 dBA) on FDR No. 150, but would have smaller noise increases on Montana Highway 200 (increasing levels from 70 to 74 dBA). Vehicles traveling FDR No.150 and Montana Highway 200 typically would be heard 0.25 mile and 0.67 mile away, respectively.

The proposed 230 kV powerline from near Montana Highway 200 to the upper Rock Creek mill site would produce a soft hissing and crackling sound during wet weather (up to 43 dBA). In fair weather, these sounds are virtually inaudible.

Activities at the Hereford rail loadout would generate up to 87 dBA from haul truck/rail car loading six to eight times a day, between 8 a.m. and midnight, 7 days a week. This would substantially increase noise levels in the Hereford residential area (for 16 hours per day) compared to present levels without train noise.

Cabinet Mountain Wilderness

Noise generated from exploration adit construction, mine adit construction, mill site construction and operations, and the mine air-intake ventilation fan would be audible inside the CMW. The wilderness boundary is about 0.25 mile above the exploration adit and 1.0 mile above the mill site. The ridges to the north and east of the upper mill site are within the wilderness boundary. Equipment generating sound levels of 115 dBA or louder would be audible at wilderness locations within 1.0 mile of the adit or mill. Mine operations sounds (particularly the 114 dBA from the ventilation fan) would be noticeable at the wilderness perimeter. Other than the air-intake ventilation fan noise, most operation noises normally would not be noticeable in comparison with existing wilderness sound levels (25 to 35 dBA). Under optimal sound transmission conditions, the mill operating noises reaching the wilderness from the upper Rock Creek mill site could, on occasion, exceed background wilderness sound levels. Topographic relief would help screen interior wilderness areas from mill site noises, but any mining noises would be disturbing to wilderness visitors because of their obvious mechanical origin (U.S. Environmental Protection Agency 1985).

The proposed air-intake ventilation adit on the north side of Saint Paul Peak (inside the wilderness) would emit an estimated maximum of 67 dBA (based on Harrison 1978). This noise would be substantially above natural ambient wilderness sound levels of 30 dBA. Following construction of the air-intake ventilation adit in about the fifteenth year of mine operations, an estimated 450 acres of wilderness would be exposed to elevated noise levels (see Figure 4-11), for 7 to 15 years. The air-intake ventilation fan noise would be expected to be the dominant sound in a 100-acre wilderness cliff area. Because wilderness visitors expect quiet and solitude, the fan's mechanical sounds would be intrusive to wilderness visitors.

Alternative III

This alternative's mitigation measures would reduce the project's major noise sources (construction equipment, air-intake ventilation adit, and mining/mill operations) thereby minimizing noise impacts to sensitive noise locations, primarily the CMW and local residences. Locating the rail loadout near the Rock Creek tailings impoundment would eliminate noise impacts at the Hereford loadout and substantially reduce impacts to nearby residents along Montana Highway 200 although there would be noise from the construction and operation of the rail siding and loadout facilities over the mine life.

Cabinet Mountain Wilderness

Placement of the wilderness air-intake ventilation adit nearer to the Saint Paul ridge would expand the zone of mine noise impact, compared to Alternative II, if all other factors remained constant. However, Alternative III air-intake ventilation adit fan noise mitigations would reduce surface noise emissions by 21 dBA (from 67 to 46 dBA- about quiet room levels). The wilderness air-intake ventilation adit would be expected to create ambient noise levels within 400 feet of the adit or on about 12 acres of the CMW, and these adit fan noises would generally be noticeable within about a 100-foot radius. The net effect of placing the air-intake ventilation adit higher on the ridge and reducing the intake fan noise levels would be a substantial reduction in the wilderness area where fan noise would be noticeable as compared to Alternative II (see Figure 4-11). The remaining noise-impacted area would be sited on a near cliff face with very low levels of human use. See Biodiversity for air-intake ventilation adit impacts to wildlife.

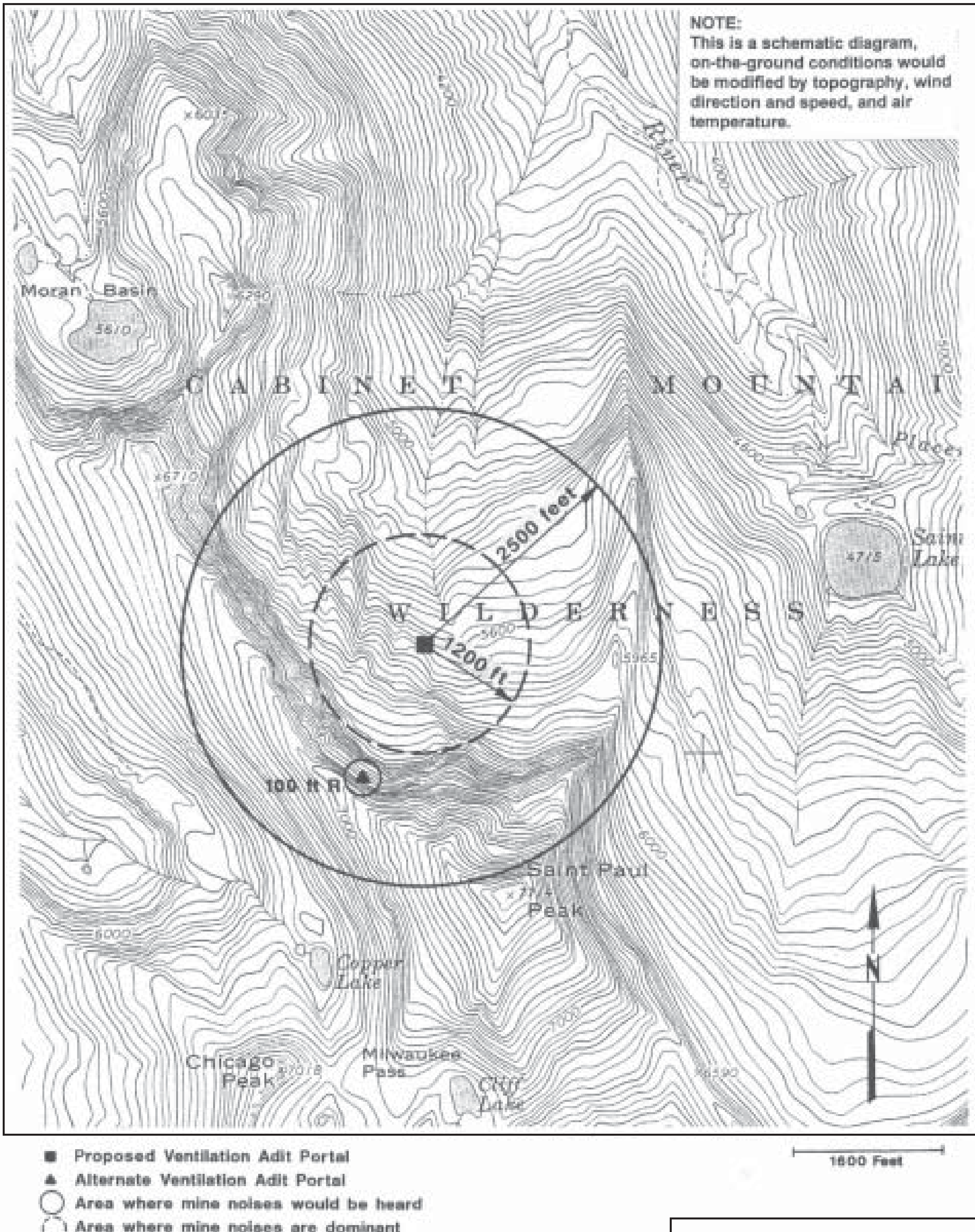


FIGURE 4-11
Noise Influence Area in the Wilderness
Rock Creek Project

Alternatives IV and V

Noise impact mitigations would include those described in Alternative III, and the lower mill site location would provide a 25 percent greater noise buffering distance from the CMW (1.25 mile versus 1.0 mile in Alternatives II and III). Noises reaching the CMW would be generally expected not to exceed normal ambient wilderness noise levels (35 dBA). Retention of forest screening around the mill site and other measures would provide some additional noise attenuation to meet the 55 dBA noise mitigation standard when measured 250 feet uphill from the crushing plant and ball mill. Busing of construction workers to the evaluation adit and the mill site would reduce the frequency (but not the peak levels) of traffic-generated noise in the upper Rock Creek drainage in Alternative V. Piping the ore concentrate to the Miller Gulch loadout site would eliminate long-term ore concentrate truck traffic under Alternative V. Operational noise at the rail loadout would be somewhat reduced as there would be no trucks dumping concentrate and the operation would be contained within a building that would muffle loading noises somewhat.

Cumulative Impacts

The cumulative effect of the Rock Creek and Montanore projects would be to increase the acreage within the CMW where human sounds were noticeable. However, the two projects would not have any areas of noise overlap.

SCENIC RESOURCES

Summary

All action alternatives would result in major and significant visual impacts for the Rock Creek drainage and Clark Fork Valley. The proposed impoundment or tailings paste facility would affect many views in the Clark Fork Valley, including those from Noxon, along portions of Highway 200, and the lower portion of Noxon Reservoir. The form, color, texture and large size of the impoundment or tailings paste facility would contrast dramatically with the surrounding landscape. Effects would last for several decades until sufficient tree and shrub growth could be established on impoundment or paste faces to reduce the contrast with surrounding terrain and vegetation. The proposed and alternate mill sites in the Rock Creek drainage would introduce an industrial facility to a forested landscape and alter existing views for recreationists and other users of FDR Nos. 150 and 2741 and NFS lands near the project. The west fork mill site would not be visible from any surrounding wilderness peaks. Under Alternatives IV and V, the confluence mill site would be visible to wilderness visitors in background views from Ojibway and Rock peaks in the CMW.

The utility and transportation corridor(s) with cleared rights-of-way and paralleling power- and pipelines would significantly change the existing setting along FDR No. 150 in the Rock Creek drainage. Burial of the pipelines under Alternative V would reduce the visual impacts associated with their presence in the utility corridor.

The proposed Hereford rail loadout under Alternative II would create a significant visual intrusion for surrounding residents. Under Alternatives III, IV, and V, traffic and dust associated with *the Miller Gulch rail loadout would create a minor visual intrusion for travelers on adjacent Government Mountain road.*

Under all action alternatives, construction of the 3-acre waste rock dump and portal area for the evaluation adit would result in minor visual impacts to recreationists in the upper Rock Creek drainage.

Alternatives III, IV, and V would result in less visual impact compared to Alternative II due to both applicant- and Agency-proposed mitigations although impacts for either the tailings impoundment or paste disposal facilities and the mill site would still be major and significant.

Under all action alternatives the Forest Plan Visual Quality Objective (VQO) of Partial Retention for MA 31 and MA 23 would be met several decades following mine closure. The impoundment surfaces under Alternative II may never meet Retention or Partial Retention VQO standards. None of the VQOs prescribed using the policy guidelines of the Visual Management System would be achieved under action alternatives during mine life. Additional reclamation requirements and mitigations under Alternatives III, IV, and V, would increase the likelihood that mine facilities would meet Forest Plan and VMS VQO standards sooner than Alternative II but not for several decades.

Introduction

Drawing from both Visual Management System (VMS) and Forest Plan VQOs, the Agencies designated VQOs for project facilities (see bold text in Table 4-64) to assess visual impacts, guide development of visual mitigation measures, and serve as the standard for evaluating long-term reclamation success. These are:

- ***Preservation*** (Forest Plan definition);
- ***Retention*** (VMS definition);
- ***Partial Retention*** (VMS definition); and
- ***Rehabilitation*** - a short-term, life-of-mine management alternative used to return existing visual impacts in the natural landscape to a desired visual quality (VMS definition).

VMS objectives were selected for most project facilities rather than Forest Plan objectives due to concern for scenic quality in the project area, high viewer sensitivity in the Clark Fork Valley, and the more rigorous standards of VMS objectives compared to the Forest Plans. Other VQOs included in Table 4-64 but not applied to project facilities are:

- ***Modification*** (Forest Plan definition);
- ***Partial Retention*** (Forest Plan definition); and
- ***Preservation*** (VMS definition).

Alternative I

Under Alternative I, more gradual and less dramatic changes to the landscape would occur in the Rock Creek drainage and Clark Fork Valley near Noxon. The landscape would continue to undergo modifications associated with timber harvesting, commercial and residential development, and other activities. The Montanore Mine would affect the existing landscape character on the east side of the CMW, but would have no direct visual effects near Rock Creek. Recreation-related improvements that could be proposed for Federal Energy Regulatory Commission relicensing of Noxon and Cabinet Gorge dams could result in a more developed recreation setting around these reservoirs.

Alternative II

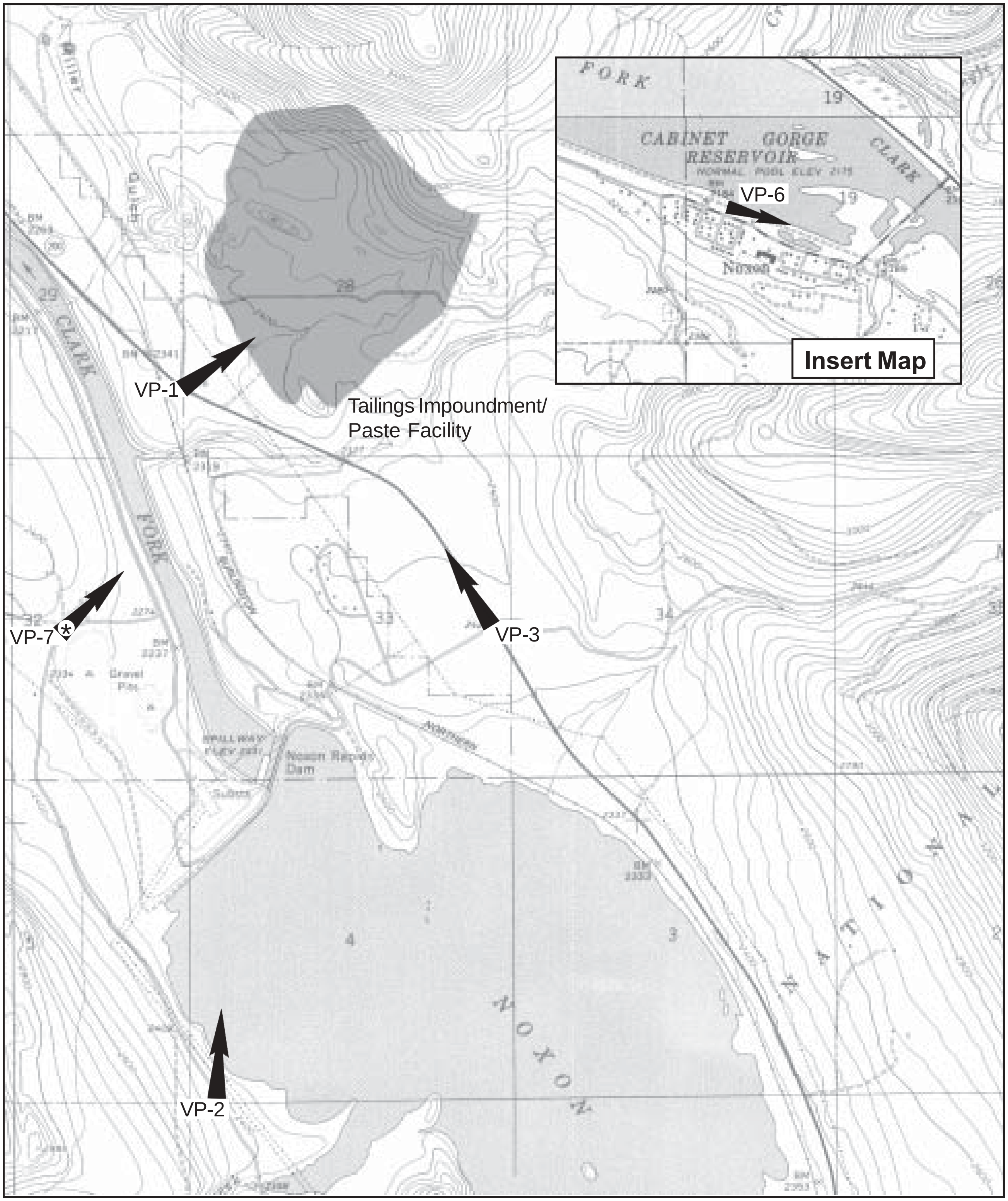
Alternative II would result in long-term landscape changes from mining operations and the addition of industrial mining facilities to the forest landscape during mine life. Project-related population increases, housing development, increased traffic levels, and secondary economic growth in the Clark Fork Valley would contribute to a more developed setting. This development could extend from Sandpoint, Idaho, to Noxon, Heron, and Thompson Falls, Montana, during the construction and operation phases of the project.

TABLE 4-64
Long-term Project Visual Quality Objectives (VQOs)[1]

Project Facilities	Visual Quality Objectives[2]	
	VMS	Current Forest Plan[3]
Rock Creek tailings impoundment or tailings paste facility	**Retention**	Partial Retention
West fork mill site (including waste rock dumps and utility corridor)	**Partial Retention**	Modification
Confluence mill site (and utility corridor)	**Partial Retention**	Modification
Evaluation adit	**Partial Retention**	Modification
Ventilation adit	Preservation	**Preservation[4]**

1 Using the policy guidelines of the VMS, a rehabilitation VQO would be applied to all mine facilities during life-of-mine.
2 VQO in bold type would be applied to this project component in the long term.
3 For MA 31 and MA 23, a Partial Retention VQO would be applied to most mine facilities following reclamation. VQOs do not apply to MA 31 and MA 23 during the life of the mine.
4 A Preservation VQO under VMS would prohibit all management activities except for very low impact recreation facilities. A Preservation VQO from the Forest Plan would result in management activities that are not detectable to the visitor.

Viewpoints 1, 4, 5, and 7 located in the Clark Fork Valley and Rock Creek drainage used in visual simulations of project facilities are shown on Figures 4-12 and 4-13. Viewpoints 2, 3, and 6 were used for simulation in the draft and supplemental EISs.



Ground Viewpoint (and direction of view)

Aerial Viewpoint (and direction of view)

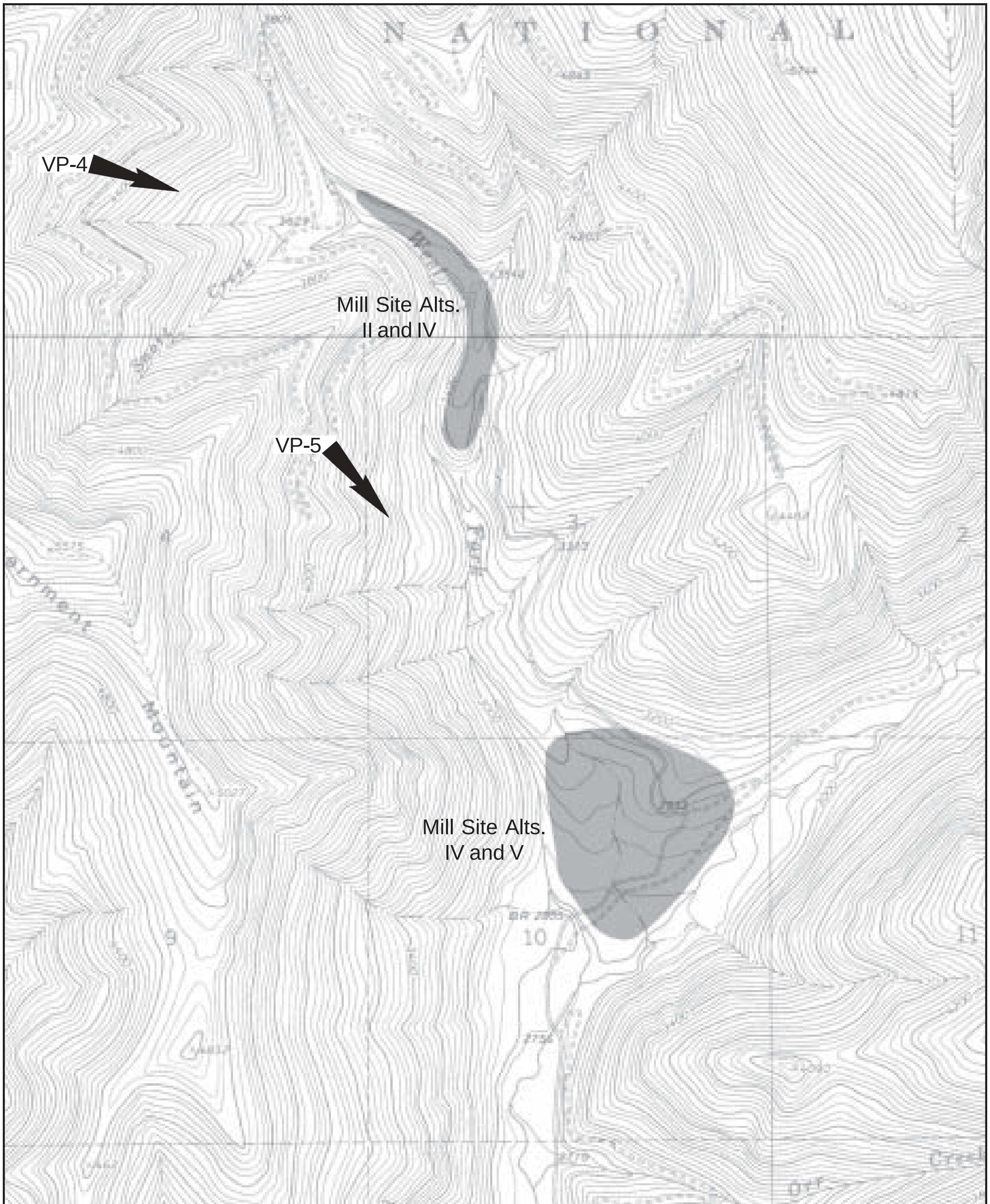
2500 Feet

N

Readers should refer to the draft and supplemental EISs for visual simulations from viewpoints 2, 3, and 6.

SOURCE: Tetra Tech EM Inc. 1996

FIGURE 4-12
Viewpoint Locations for Impoundment Simulations
Rock Creek Project



SOURCE: Tetra Tech EM Inc. 1996

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VIEWPOINT (AND DIRECTION OF VIEW) FOR SIMULATIONS

2000 Feet

FIGURE 4-13
Viewpoint Locations for Mill Site Simulations
Rock Creek Project

Evaluation Adit

The evaluation adit's 3-acre waste rock dump and adit portal would create a noticeable landscape alteration. Potential views would extend to portions of the Rock Creek drainage along FDR No. 150 on Government Mountain and the Clark Fork Valley. The background distance of this adit from most viewpoints in the Clark Fork Valley (greater than 7 miles), and the relatively small area disturbed would decrease impacts to minor levels. Lights for night-time operation or sunlight reflecting off the steel fuel storage tanks and/or building at the adit's portal would be the most noticeable elements of this facility.

Minor reconstruction of 4.6 miles of FDR No. 2741 (Chicago Peak Road), construction of additional turnouts, and an approximately 0.2-mile spur road, would create some landscape scars from cuts and fills. These changes would be noticeable from viewpoints in the upper Rock Creek drainage and the portion of FDR No. 150 within the Snort Creek drainage. Effects would diminish once vegetation was successfully established. Snowplowing on this road would increase its visibility for those winter recreationists who used the upper Rock Creek drainage.

Other support facilities for the evaluation adit also would contribute to visual impact. Some clearing of undergrowth would be necessary for portions of the 6-inch temporary pipeline between the adit and Clark Fork River resulting in short-term and minor impacts. The most visible portion of this clearing would extend down ridgelines from the evaluation adit to the valley floor of the West Fork of Rock Creek -- a distance of about 1.5 miles (with an elevation drop of approximately 2,300 feet). Clearing and pipeline location for the remainder of this corridor on the valley floor of Rock Creek and the West Fork of Rock Creek adjacent to FDR No. 150 would result in slight visual impacts.

Support facilities for the evaluation adit – office, changehouse, warehouse, and employee parking – located adjacent to FDR No. 150 in lower Rock Creek, would create the first noticeable project-related change in this part of the drainage. Visual effects of these support facilities would be moderate and the daily movement of personnel on rotating shifts and delivery of supplies to the evaluation adit would extend an industrial character throughout the drainage along Forest Service roads. Buildings would be removed after facilities for the main adit and waste water treatment were operational.

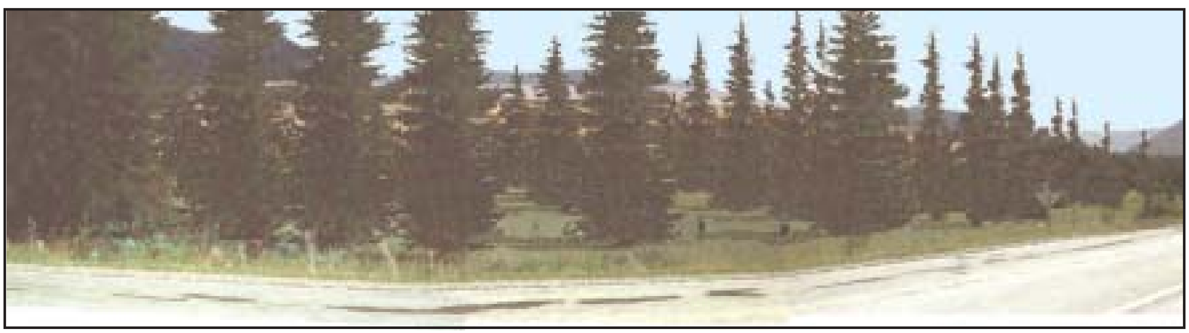
Tailings Impoundment

The proposed tailings impoundment would contribute most to long-term landscape changes, by introducing a large, new, and incongruous landform to the surrounding landscape (see Figure 4-14). The contrast and visibility of the impoundment would increase over the life of the project as it became larger and height increased above the 80- to 90-foot height of surrounding trees, becoming more of a significant visual intrusion for those who value the existing landscape in the Clark Fork Valley near Noxon.

Contrast would remain high until sufficient tree growth was established on impoundment faces following mine closure. It is unlikely that tree or shrub growth of sufficient height or density could be established on the impoundment surface and embankment slopes (see Soils and Reclamation) to blend effectively with the surrounding landscape. Establishment of grass cover during mine operation would reduce the grayish-white color of the impoundment faces, but would still result in a light green or tan color that contrasted with adjacent tree-covered hillsides.

A. Existing View

B. Year 7 of Mine Operations



C. Year 33 of Mine Operations

D. Year 70 Reclaimed (37 Years After Mine Closure)

SOURCE: Tetra Tech EM Inc. 1996

FIGURE 4-14
Visual Simulation of Proposed Tailings Impoundment (Alternative II) - From Intersection of FDR No. 150 and Montana Highway 200 - (Viewpoint1)
Rock Creek Project

The tailings impoundment under Alternative II would be visible to residents of the Clark Fork Valley surrounding Noxon, Highway 200 travelers, and recreationists using Noxon and Cabinet Gorge reservoirs. Noxon area residents would have middleground views (about 2 miles distant) of the impoundment with locations along the Clark Fork River at Noxon providing the most unrestricted views. Montana Highway 200 travelers would have foreground to middleground views (0.25 to 3 miles distant) of the tailings impoundment where the existing highway alignment provided direct unscreened views of the proposed site. Potential views for highway travelers could extend for several more miles if highway alignments changed or screening vegetation was removed.

Recreationists on and around the lower portion of Noxon Reservoir and upper portion of Cabinet Gorge Reservoir, where screening vegetation was not present, would have unrestricted views of the proposed tailings impoundment. Locations along the west edge of Noxon Reservoir would provide the most unrestricted views of the impoundment. Recreationists and other users of the west loop of FDR No. 150 to Government Mountain would have immediate foreground views (less than 0.25 mile) of the impoundment where this road joins Montana Highway 200. Recreationists using the proposed route of FDR No. 150 southeast of the impoundment would have foreground views of the impoundment.

Mine, Mill and Associated Facilities

The mill site would create an industrial setting on NFS lands within the Rock Creek drainage during operation of the mine. The adit and access roads, conveyor system, substation, and buildings, as well as other support facilities, would contribute to a developed industrial setting dramatically and significantly different from the present forested landscape (see Figure 4-15).

Project facilities would be highly visible (foreground views) to recreationists using relocated FDR No. 150 (where it would skirt the mill site) due to the absence of vegetative screening and high contrast between the industrial mine facilities and surrounding natural setting. The mill and associated facilities would be intermittently visible from FDR No. 2741 (middleground views) to recreationists accessing or leaving the CMW and to recreationists using Government Mountain in the Snort Creek drainage. The mill facilities would be a visual intrusion to those recreationists and forest users who value the existing, more natural appearing setting. Mill facilities would cover approximately 40 acres, with reclaimed postmining topography creating a flat narrow bench along the valley floor approximately 0.1 mile wide and 0.7 mile long that would contrast with the gently sloping valley floor.

The 2,500-foot-long conveyor would create a strong linear feature in the viewed landscape as it dropped approximately 500 feet from the adits to the mill site. The 10-acre waste rock dump would create a permanent, noticeable, and unnatural shape on hillsides above the West Fork of Rock Creek. Reclamation and revegetation of the rock dump would be difficult, and its light color and fine texture would persist many years after mining ceased. New roads would create highly noticeable lines on hillsides above the mill site -- the 1.41-mile access road to the adits, the maintenance access road to the surface conveyor transfer point, and temporary access trails for construction of conveyor towers and the powerline to the adits.

A. Existing View

B. View During Mine Operation

FIGURE 4-15
Visual Simulation of Proposed Upper Mill Site - (Alternative III) From FDR No. 150 (Snort Creek Drainage) on East Side of Government Mountain (Viewpoint No. 4)
Rock Creek Project

SOURCE: Tetra Tech EM Inc. 1996

Utility and Transportation Corridor

The utility and transportation corridor along Rock Creek would replace the existing tree-lined gravel road with a more developed linear corridor. Changes along FDR No. 150 below the confluence of the east and west forks of Rock Creek with its widened road and paralleling power- and pipelines would result in a cleared, linear, 100-foot wide corridor. An additional slurry and reclaim pipeline and road would be constructed parallel to and above FDR No. 150 on the west side of Rock Creek below Big Cedar Gulch but would not be visible to travelers along FDR No. 150. A 1-mile section of the utility corridor above the confluence would not parallel FDR No. 150 and would not be visible to travelers except near the confluence and mill site. Increased traffic levels would add to the developed character of this corridor and would continue for mine life.

Waste Water Treatment Facility

The 10-acre site for the biotreatment system and ion exchange facility located northeast of the impoundment would have moderate visual effects during mine operation. Landscape alteration would result from creation of a level area for the facility on this steeply sloping site. Vegetation clearing also would be necessary, potentially increasing visibility of this facility for travelers and recreationists using the new FDR No. 150.

Hereford Rail Loadout

The proposed Hereford rail loadout would generate significant visual impacts (foreground views) for those residents immediately adjacent to the proposed site. The frequent (every 3 to 4 hour) arrival and unloading of concentrate trucks using the 12-foot high drive-over ramp, and night-time operation lighting would contribute to the visual intrusion for nearby residents.

Effects on CMW Visitors

Visitors to several mountain peaks within the wilderness would be able to see parts of the proposed project (middleground to background views) (see Table 4-65). Each of these wilderness peaks is visited by a few hiking parties each summer (see Recreation). Visitors to Goat, Rock, and Engle peaks, or those accessing the CMW by way of the Engle Peak (No. 932) or Wanless Lake (No. 924) trails, would have a background view (3 miles and greater) of the impoundment. Neither the mill nor the evaluation adit would be visible from the CMW though associated facilities such as improvements to the Chicago Peak Road could be visible from access trails. The proposed air-intake ventilation adit could be visible to wilderness visitors using the north face of Saint Paul Peak. The degree of contrast and impact could vary slightly, depending on final location of the air-intake ventilation adit, but would likely be low. Existing roads, timber harvests, and development in the Clark Fork Valley also would be visible in views out of the CMW from these peaks. Proposed project facilities would not be visible from the numerous lake basins, such as Rock, Engle, Wanless, or Saint Paul lakes, within the CMW. Potential effects on wilderness visitors resulting from views of these project facilities could vary, depending on personal expectations.

TABLE 4-65
Project Facilities That Would Be Visible From Wilderness Peaks by Alternative

Project facility	Cabinet Mountains Wilderness Peaks					
	Goat	Engle	Ojibway	Rock	Chicago	Saint Paul
Rock Creek impoundment or tailings paste facility (Alts. II through V)	X	X		X		
Confluence mill site (Alt. IV and V)			X	X		
Ventilation adit (all)						X

Notes: **X** = visible

Compliance With Visual Management System Visual Quality Objectives (VQO)

The industrial character of proposed mining operations, duration of mining activity, and length of time required for landscape restoration following mine closure would make it impossible to meet the prescribed VMS VQOs under Alternative II (see Table 4-64). Instead, a life-of-mine restoration objective of Rehabilitation would be applied to address on-going reclamation, until the visual quality of the landscape could be restored to the standards of VMS VQOs several decades after project completion.

The visual mitigation measures proposed by the applicant in Alternative II would somewhat reduce the visual impact of mine operations in the long term. However, mitigations would not be able to overcome the differences in form, line, color, and texture between mine facilities and the surrounding natural-appearing landscape to effectively achieve VQOs within the VMS time frames that specify meeting objectives either immediately or within the first year of mine operation.

It may be possible for the visual quality of the mill site and the utility corridor to be restored to prescribed VMS VQOs several decades after mine closure with successful implementation of Sterling's proposed mitigation. The ability to meet VQOs would depend on soil productivity and resulting tree growth. It is unlikely, however, that the impoundment would ever meet Retention VQO standards because tree growth would be very slow or stunted under this alternative (see Soils and Reclamation).

Compliance with Forest Plan VQOs

With the proposed amendments to the Forest Plan to designate new management areas for the permit area (see Forest Plan Direction), the Forest Plan VQO of Partial Retention for MA 31 (Mineral Development) and MA 23 (Electric Transmission Corridor) would be met several decades following mine closure with the successful completion of reclamation activities, decommissioning and removal of above ground facilities, and regrowth of vegetation. The impoundment under Alternative II may never meet Partial Retention VQO standards. MA 31 and MA 23 would not have a life-of-mine VQO (see Appendix O - New Management Area Descriptions).

Alternative III

Evaluation Adit

Mitigation measures that would shield or baffle exterior adit lights when visible at night from viewpoints in the Clark Fork Valley, treat the steel fuel storage tanks and paint the building at the adit portal to reduce reflection, would help reduce visual impacts to minor levels. Other mitigation measures to regrade waste rock dumps to approximate existing contours and revegetate them with shrubs and trees as well as grasses would reduce impacts to low levels and help meet VQOs at the end of operations.

Tailings Impoundment

Long-term visual effects of the alternative tailings impoundment design would be similar to those for Alternative II – introducing a large, new, and incongruous landform to the surrounding landscape. Visual impacts would result from the changed setting in the Clark Fork Valley and from Noxon and Cabinet Gorge reservoirs (see Figure 4-16). The alternative design would result in a delayed reclamation and revegetation schedule. Reclamation and revegetation could not be initiated on the lower portion of the impoundment face until completion of a 200-foot-wide sand shell after the seventh year of construction. Impoundment height would then be approximately 167 feet above surrounding terrain, more than 87 feet above any surrounding trees at the foot of the impoundment.

Final reclamation and revegetation would be completed in a phased sequence for the remaining years of operation after year 7 when upstream impoundment construction methods were used. Following year 8 of operation, application of a colored tackifier or hydroseeding layer to the newly built impoundment lifts would help reduce the contrast and color prior to regrading, topsoiling, and planting. Planting containerized shrubs and trees along with seeding grasses and forbs following year 7 of operation rather than at the end of mine operations would help reduce the color contrast between the impoundment face and surrounding hillsides about 20 to 30 years after completion of construction. Constructing and regrading the impoundment faces to more closely resemble the surrounding landscape in form and shape would help reduce visual impacts in the long term. Respreading approximately 24 inches of soil on the impoundment would enhance tree and shrub growth and establishment (see Soils and Reclamation) to blend more effectively with surrounding hillsides several decades after mine closure. Long-term visual impacts to recreationists using surrounding trails, roads, and wilderness areas located above the impoundment would continue until tree cover became established. Views of the impoundment along Montana Highway 200 would be screened by 6- to 10-foot trees planted adjacent to the highway soon after permits were granted.

Other facilities associated with construction of this alternative impoundment design would be a minor source of visual impact -- the primary cyclone areas at the northeast corner of the impoundment, secondary cyclones located on the crest of the impoundment, and a 50-foot-wide and 4,000-foot-long road and pipeline right-of-way on the hillside directly above the impoundment. Other features would be present for decades after mine closure – seepage collection berms, ditches and pumphouses surrounding the impoundment base, seepage return lines on the impoundment face, and a 4,600-foot-long diversion ditch above the impoundment. Use of noncontrasting colors and tones for life-of-mine facilities and immediate revegetation of disturbed soils around these facilities would make these a minor source of visual impact. Visual impacts from the tailings impoundment under Alternative III would be significant.

A. Existing View

B. Year 7 of Mine Operations

C. Year 33 of Mine Operations

D. Year 70 Reclaimed (37 Years After Mine Closure)

FIGURE 4-16
Visual Simulation of Proposed Tailings Impoundment (Alternative III and IV) - From Intersection of FDR No. 150 and Montana Highway 200 - (Viewpoint1)
Rock Creek Project

Mine, Mill, and Associated Facilities

Visual impacts of the west fork mill site during mine operation under Alternative III would be similar to those for Alternative II. Agency-proposed mitigation to treat and/or paint mill facilities to blend with the surrounding landscape would reduce impact levels somewhat, but visual impacts would still be adverse in the short term due to the presence of an industrial facility in a previously natural appearing landscape and its high visibility from surrounding roads (see Figure 4-15).

Overall visual impacts would decrease slightly under this alternative. Deposition of waste rock in two dumps on hillsides above the mill site and revegetation with trees and shrubs would help reduce the rock dumps' long-term visual impact. A new access road to the mine portals would not be built; however, 1.26 miles of the lower Chicago Peak Road would be upgraded from its present width of 14 feet to 24 feet for access to the adit, increasing cut-and-fill disturbances. Other maintenance roads and access trails to the surface conveyor transfer point, conveyor towers, and powerline structures would be the same as Alternative II. The 0.57 mile of buried 12-inch pipeline between the mine adits and valley floor would create a noticeable line on hillsides above the West Fork of Rock Creek until revegetation efforts were successful. Regrading and revegetating the mill site, and portal to more closely resemble the premining landscape would reduce long-term visual impacts to minor levels following mine closure. Long-term impacts would depend on the growth rate of trees and shrubs. Short-term visual impacts from the mill site and mine under Alternative III would be significant.

Utility and Transportation Corridors

The utility corridor with its above-ground pipelines, transmission line, and 12-inch buried water discharge pipeline would parallel FDR No. 150 for an additional 1.3 miles below Big Cedar Gulch and an additional 0.4 miles below the mill site under this alternative. These increased distances would result in increased visibility of the corridor. However, reducing right-of-way clearing and use of wood poles, dark-colored insulators, and non-shiny conductors for the transmission line would help create a more natural-appearing corridor. Vegetative screening for the substation in the lower Rock Creek drainage may have limited effectiveness in reducing its visual impact. Visual impacts would be similar to those for Alternative II.

Other elements of this alternative such as construction of a new approach to Montana Highway 200 from FDR No. 150 and a new 0.2-mile tie road between FDR Nos. 150 and 1022 would not result in significant differences between alternatives.

Water Treatment Facility

This facility would result in moderate visual effects to travelers and recreationists on FDR No. 150 during mine operation. While landscape alteration (cut and fill) would be less on this gently sloping site than that for Alternative II, the visibility of the facility would be high until sufficient vegetation could be grown in this logged area to effectively screen views for travelers.

Miller Gulch Rail Loadout

Travelers on FDR No. 150 going to and from Government Mountain would experience minor visual impacts from a rail siding location near Miller Gulch due to dust and increased traffic levels. Grading and tree removal would be necessary for additional track and construction of loading facilities, and a short 0.2-mile spur road off of FDR No. 150. The nearest residence to the rail siding would be about 0.2 mile away near Montana Highway 200 and screened from view by a 700-foot buffer of trees.

Effects on CMW Visitors

The visibility of the impoundment during operation from Goat, Engle, and Rock peaks in the CMW would be the same as Alternative II. Agency-proposed mitigation for reclamation of the impoundment surface would be more successful at establishing sufficient tree cover to blend the surface with surrounding terrain and reduce its visibility from wilderness viewpoints. The higher cliff location for the ventilation adit on the north face of Saint Paul Peak would result in a smaller area of surface disturbance though visibility of the adit could be increased depending on final location (see Wilderness). Surface treatment of the adit opening following mine closure to restore natural color and texture should make the opening virtually undetectable.

Compliance With Visual Management System VQOs

Like Alternative II, prescribed VMS VQOs would not be met under Alternative III during mine operation due to the industrial character and duration of mining activity, and length of time required for landscape restoration from proposed mining operations. The restoration objective of Rehabilitation would be applied to project facilities until impacts were mitigated to the desired visual quality several decades after project completion. Successful implementation of Agency-proposed mitigation measures and reclamation techniques in Alternative III would help restore the visual quality of project landscapes to VQO standards sooner than under Alternative II but it would still require several decades. Alternative III would not be able to meet prescribed VQO time frames.

Compliance With Forest Plan VQOs

Forest Plan VQOs would not apply to MA 31 and MA 23 during the life of mine. Agency-proposed reclamation techniques (see Soils and Reclamation), including phased final reclamation during mine life, greater soil salvage and replacement depths and improved vegetation growth, would help achieve Forest Plan VQO standards for MA 31 and MA 23 sooner following mine closure than under Alternative II. With the successful completion of reclamation activities, decommissioning and removal of above ground facilities and regrowth of vegetation a Partial Retention VQO for MA 31 and MA 23 would be achieved several decades following mine closure and therefore would be consistent with MA 31 direction.

Alternative IV

Visual impacts of the tailings impoundment, evaluation adit, utility corridor, water treatment facility, new road construction for FDR Nos. 150 and 1022 in the lower Rock Creek and Clark Fork drainages, and the Miller Gulch rail loadout would be the same as those for Alternative III.

Mine, Mill, and Associated Facilities

The mill site at the confluence of the east and west forks of Rock Creek would use waste rock from the adit to create a large pad approximately 50 feet high covering 47 acres. Its terraced shape and flat top, as well as the portal area immediately upslope of the mill pad, would create forms that would contrast with the adjacent natural landscape during mine operation.

A 100-foot-minimum visual buffer of trees retained between FDR No. 150 and the mill site would limit foreground views and reduce impacts for recreationists using this road and FDR No. 150A. The mill site would be visible in middleground views from portions of FDR No. 150 near Snort Creek on the east face of Government Mountain and FDR No. 2741. For those viewpoints above the mill site, its elevated location at the confluence of two drainages, industrial character, and lack of vegetation would increase contrast with the surrounding landscape (see Figure 4-17). The large soil stockpile near the mill site also would create a contrasting shape and color during mine life. Final revegetation of pad faces immediately following construction (about year 4 of operation), regrading and shaping the pad surface during final reclamation to a more natural shape, and replication of naturally occurring species and their distribution during revegetation would help reduce visual impacts to low levels in the long term. Associated facilities for the more compact confluence mill site would create less contrast than those for the west fork mill site. The 750-foot long conveyor would drop about 100 feet from the conveyor adit to the mill site (compared to a 2,500-foot long conveyor at the west fork mill site). A 0.2-mile mine access road would be located largely within the mill site. The utility corridor would be 5.2 miles long, the shortest of the action alternatives. The West Fork of Rock Creek would retain much of its existing natural character, except for road upgrades and other facilities needed for the evaluation adit. Visual impacts from the mill site and mine under Alternative IV would be significant in the short term.

Effects on CMW Visitors

Visitors to Ojibway Peak at the head of the East Fork of Rock Creek would have a distant view (approximately 5 miles) of the confluence mill site. Visitors to Rock Peak and those entering or leaving the CMW by way of the Engle Peak Trail (No. 923) also would have background views of the confluence mill site (3 miles distant).

Compliance With Visual Management System VQOs

VMS VQOs would not be met under Alternative IV during mine operation due to the industrial character and duration of mining activity, and length of time required for landscape restoration from proposed mining operations. Like Alternatives II and III, the restoration objective of Rehabilitation would be applied to project facilities until impacts were mitigated to the desired visual quality. Successful implementation of Agency-proposed mitigation measures and reclamation techniques in Alternative IV would help restore the visual quality of project landscapes to VQO standards sooner than under Alternative II but it would still require several decades. Elimination of a separate waste rock dump, immediate planting of the mill pad face, and retention of a vegetative buffer around the base of the mill pad under Alternative IV would further help this site meet post-mine VQO standards.

Compliance with Forest Plan VQO

Under Alternative IV, the post-mine VQO of Partial Retention (MA 31 and MA 23) for the confluence mill site, water treatment plant, evaluation adit, tailings impoundment, and utility corridor would be achieved following successful implementation of reclamation activities, decommissioning and removal of above ground facilities, and regrowth of vegetation several decades after mine closure.

A. Existing View

B. Year 33 of Mine Operation

SOURCE: Tetra Tech EM Inc. 1996

FIGURE 4-17
Visual Simulation of Proposed Confluence Mill Site - (Alternative IV) From FDR No. 150 on East Side of Government Mountain (Viewpoint 5)
Rock Creek Project

Alternative V

Viewpoint 6 at Noxon and viewpoint 7 (an aerial viewpoint) shown on Figure 4-12 have been added to simulated viewpoints to compare construction options of the tailings paste facility, while viewpoint 3 at the turnoff to Noxon Dam on Highway 200 was not used. From viewpoint 3, the Bottom-Up option under Alternative V would appear similar in form and construction to the impoundment of Alternative IV. From this viewpoint, the Top-Down option under Alternative V would not be visible until later years of mine operation. Visual simulations for viewpoint 6 at Noxon are shown in Figures 4-13 and 4-14 of the 1997 Supplemental EIS.

Evaluation Adit

Visual impacts of the evaluation adit would be similar to those for Alternatives II through IV. The adit would create a noticeable and minor landscape change near the upper portion of FDR No. 2741 (Chicago Peak Road). Minor reconstruction would result in some fresh roadside cuts and fills. Mitigation measures that would treat the shop building at the adit portal to reduce reflection and shield or baffle exterior lights when visible at night from viewpoints in the Clark Fork Valley would help reduce visual impacts to minor levels. Other measures to regrade the waste rock dump to approximate existing contours and revegetate with shrubs, trees and grasses would reduce impacts to low levels and help meet VQOs at the end of operations.

Under Alternative V, support facilities for the evaluation adit would be located at the junction of the Government Mountain Road and Rock Creek Road and would result in moderate visual effects. The location of facilities adjacent to this road junction and the county trash transfer site would result in highly visible project-related changes for travelers on these roads and persons using the transfer site. Like Alternatives II through IV, these support facilities would be removed following completion of evaluation activities or relocated to either the mill site or waste water treatment plant after they became operational.

Tailings Paste Facility and Plant

All tailings paste construction options would result in major and significant visual impacts for the Clark Fork Valley. The paste facility would affect many views in the valley, including those from Noxon, along limited portions of Highway 200 (with retention of roadside trees), and the lower portion of Noxon Reservoir and surrounding hillsides (see Figures 4-18 through 4-21). The form, color, and texture of the facility and its large size and scale would contrast dramatically with the surrounding landscape. Figure 4-19 shows the tailings paste facility without the mitigation of trees planted between the facility and Highway 200. Failure of the planting could result from fire, disease or vandalism. With all construction options, visual impacts would begin to decrease with the initiation of final reclamation activity on the deposit, but would remain potentially significant until successful revegetation was completed and tree cover was established several decades after mine closure (see following discussion on construction and reclamation of deposition options). Landform shaping of the deposit surfaces and top would help decrease its geometric engineered appearance. Outer faces of the series of approximately 80-foot tall toe buttresses that would be constructed around the base of the paste facility for all options would be reclaimed immediately after construction, helping to reduce their visual impact to lower levels.

A. Existing View

B. Year 7 of Mine Operations

C. Year 20 of Mine Operations

D. Year 70 Reclaimed
(37 Years After Mine Closure)

SOURCE: Tetra Tech EM Inc. 1996

FIGURE 4-18
Visual Simulation of Tailings Paste Facility With Bottom Up Construction (Alternative V) - From Intersection of FDR No. 150 and Montana Highway 200 (Viewpoint 1)
Rock Creek Project

A. Existing View

B. Year 7 of Mine Operations

C. Year 20 of Mine Operations

D. Year 70 Reclaimed
(37 Years After Mine Closure)

SOURCE: Tetra Tech EM Inc. 1996

FIGURE 4-19
Visual Simulation of Tailings Paste Facility With Bottom Up Construction (Alternative V) - With No Trees - From Intersection of FDR No. 150 and Montana Highway 200 (Viewpoint 1)
Rock Creek Project

A. Existing View

B. Year 7 of Mine Operations

C. Year 20 of Mine Operations

D. Year 33 of Mine Operations

E. Year 70 Reclaimed - (37 Years After Mining)

SOURCE: Tetra Tech EM Inc. 1996

FIGURE 4-20
Visual Simulation of Tailings Paste Facilty With Top Down Construction (Alternative V) - Above Clark Fork Valley (Viewpoint 7)
Rock Creek Project

A. Existing View

B. Year 7 of Mine Operations

C. Year 20 of Mine Operations

D. Year 33 of Mine Operations

E. Year 70 Reclaimed - (37 Years After Mining)

SOURCE: Tetra Tech EM Inc. 1996

FIGURE 4-21
Visual Simulation of Tailings Paste Facility With Bottom Up Construction (Alternative V) - Above Clark Fork Valley (Viewpoint 7)
Rock Creek Project

If lights were necessary for night-time deposition of paste, they would be shielded or baffled to reduce their visibility from viewpoints in the Clark Fork Valley. Sterling would also utilize state-of-the-art lightbulb colors to minimize light pollution.

The paste plant building would be highly visible from viewpoints in the surrounding Clark Fork Valley following its construction. Though a hillside location adjacent to the paste deposit would provide a topographic backdrop for the plant, its 110-foot height would make it highly visible until the paste deposit created a landform in later years of mine operation that would screen it from valley viewpoints to the west. Painting and/or treatment of the building along with retention of adjacent hillside trees would reduce its impact somewhat.

Bottom-Up Option. Paste deposition that would begin at the lower (southern) edge of the deposit footprint and move upslope toward the flank of Government Mountain would create a highly visible south face during the first 19 years of mine operation. Outer faces on the southwest and south edges would rise approximately 320 feet above the deposit base to an elevation of 2,680 feet and the deposit crest would be located about 0.4 mile from Highway 200. Remaining portions of the east and west faces would be constructed until approximately year 30 of mine operation and would remain highly visible from viewpoints in the Clark Fork Valley during construction (see Figures 4-18, 4-19, and 4-21 for simulations of the tailings paste facility with Bottom-Up construction). Final reclamation of completed portions of the outermost compacted paste zones, including reshaping outer slopes and planting grasses, forbs, shrubs and trees, would occur every year during construction and would help reduce color contrast of the deposit. Active disturbance would be greatest at approximately year 19 of operations and would cover about 62 percent of the deposit footprint. As outer faces were completed and reclamation was initiated, visual impacts would begin to decrease from high levels.

The created paste landform would resemble the impoundment of Alternatives II, III and IV, with outer slopes of 3:1 (33 percent) and a relatively flat 178-acre top surface. Design modifications could flatten the outer slopes, incorporate varying slopes ranging from 3:1 to 5:1, and push the crest farther away from the highway to create a more natural appearing landform that would help achieve visual mitigation and reclamation goals.

Top-Down Option. Under this option, paste deposition that would begin at the uppermost edge of the deposit footprint and move towards Highway 200 would result in a highly visible face towards the Clark Fork Valley throughout mine operation (see Figure 4-20 for simulations of the tailings paste facility with Top-Down construction). Deposition would begin at approximately the 2,740 feet elevation on the flank of Government Mountain and advance towards the south in initial 1-foot thick lifts. Maximum active disturbance for this option is estimated at 121 acres or about 40 percent of the deposit footprint. When construction was completed, outer faces would rise approximately 380 feet above the deposit base, with the deposit crest approximately 0.6 mile from Highway 200. Reclamation of the outer face along the upper edge of the deposit could be initiated about year 14 of mine operation. Reshaping of outer slopes and planting of grasses, forbs, shrubs and trees would help reduce color contrast of the deposit. With initiation of reclamation, visual impacts would begin to decrease from high levels. With this option, the created landform at the end of mine life would more closely resemble natural landforms than the Bottom-Up Option, with outer slopes of 5:1 (20 percent) and a smaller top surface of approximately 70 acres.

Combined Option. Under this option, paste deposition that would include both Bottom-Up and Top-Down placement of paste could result in maximum active disturbance (approximately 305 acres) among the three deposition options. Active deposition of paste under this option would likely begin at the bottom edge of the deposit to construct the outer zone of compacted paste and help ensure deposit stability, and at some point in mine operation shift to Top-Down deposition adjacent to Government Mountain. Although the outer compacted paste zone could be reclaimed on an annual basis as it was built, its construction would take longer if active deposition shifted to Top-Down construction before its completion. Reclamation of outer faces and the top surface of the Top-Down portion of the deposit could begin in later years of mine operation when design height was reached and deposition reached the outer limit of the footprint.

Final form of the deposit under the combined option would incorporate design components of both Bottom-Up and Top-Down construction, with lower deposit faces at approximately 33 percent slope, upper faces at 20 percent slope, and intermediate slopes transitioning between these two. Maximum deposit elevation would approximate that of the Top-Down option (2,740 feet) and acreage of the top surface about 70 acres. The combined option offers opportunity for preferential spigotting of paste and landform shaping of outer faces and top surface of the deposit compared to the other options, while also depositing the bulk of the paste mass near Government Mountain and away from Highway 200.

Mine, Mill, and Associated Facilities

Under Alternative V, reduction of disturbed acreage at the confluence mill site from approximately 47 to 30 acres, relocation of the mine portal from the east to the west side of FDR No. 150, and elimination of the tailings thickener would slightly reduce visual impacts from those for Alternative IV. The 100-foot minimum buffer of trees that would be retained between FDR No. 150 and the mill site would limit foreground views for recreationists traveling near the mill site. Overall visual impacts would be adverse and significant due to the presence of an industrial facility in a previously natural appearing landscape and its high visibility from surrounding roads above the mill site (see Figure 4-22).

Utility and Transportation Corridors

Under Alternative V, visual impacts of the utility and transportation corridor would be less than those for Alternative IV, due to the burial of the pipelines along most of the corridor. The 230-kV transmission line would still parallel paved FDR No. 150 for 5.3 miles in the lower Rock Creek drainage. Pipelines at the three above-ground stream crossings along this corridor would be encased in a secondary pipeline and suspended beneath or adjacent to the bridges. Other shorter segments of utility corridors containing fewer buried pipelines than the main corridor would parallel access roads to and around the paste deposit, to the rail loadout facility, and to the discharge outfall in the Clark Fork River and individually would result in minor visual impacts.

A. Existing View

B. Year 33 of Mine Operation

SOURCE: Tetra Tech EM Inc. 1996

FIGURE 4-22
Visual Simulation of Confluence Mill Site (Alternative V) - From FDR No. 150 on East Side of Government Mountain (Viewpoint 5)
Rock Creek Project

Waste Water Treatment Facility

Waste water treatment facilities including process buildings, in-ground biotreatment cells, above-ground brine storage tanks, and a half-acre aeration pond would result in moderate visual impacts similar to those for Alternatives III and IV. Visibility for travelers and recreationists on the new FDR No. 150 would be high until sufficient vegetation could be grown in this recently logged area to effectively screen views from the road. These life-of-mine facilities would be treated or painted to help them blend with surrounding vegetation and landscape.

Miller Gulch Rail Loadout

Placement of facilities necessary for processing concentrate for rail transport into an enclosed building would reduce visual impacts from those described for Alternatives III and IV. Pipeline transport of the concentrate to this facility also would help reduce visual impacts from mine traffic and generated dust. The approximately 200-foot long and 50-foot tall building would be treated or painted to visually blend with surrounding vegetation. If lights were necessary for security or night-time operation, shielding and strategic placement would be used to minimize light pollution for nearby viewpoints.

Effects on CMW Visitors

The visibility of the paste deposit from CMW viewpoints under all construction options would increase incrementally during mine life as the paste deposit grew in size and filled the deposit footprint. In later years of mine operation, visibility of the deposit from CMW viewpoints (Goat, Engle and Rock peaks) under any construction option of Alternative V - would be comparable to that of the impoundment under other alternatives unless reclamation had been initiated on the surfaces and top of the deposit. Agency-proposed reclamation measures under Alternative V would be more successful at establishing sufficient tree cover to help blend the deposit surfaces with surrounding terrain than under Alternative II. Under Alternative V, landform shaping of the deposit surfaces and top could help decrease its geometric engineered appearance.

The confluence mill site would be visible from Ojibway and Rock peaks and the Engle Peak Trail (No. 932) under Alternative V.

Compliance With VMS VQOs

Like the other action alternatives, prescribed VMS VQOs would not be met under Alternative V during mine operation and the restoration objective of Rehabilitation would be applied to project facilities until impacts were mitigated to the desired visual quality. With natural landform shaping and completion of revegetation that replicates surrounding landscapes, a VQO of Retention may be achieved for the tailings paste facility decades after mine closure. Like Alternative IV, elimination of the waste rock dump, immediate planting of the mill pad face, and retention of a vegetative buffer around the base of the mill pad would further help this site meet post-mine VQO standards.

Compliance with Forest Plan VQOs

Like Alternatives III and IV, successful completion of reclamation activities several decades following mine closure would achieve the post-mine VQO of Partial Retention (MA 31 and MA 23) for the confluence mill site, biotreatment facility, evaluation adit, tailings paste deposit, and utility corridor.

Compliance with the Forest Plan VQOs would be the same as that for Alternative IV with a Partial Retention VQO achieved several decades following mine closure with successful completion of reclamation activities, decommissioning and removal of above-ground facilities, and regrowth of vegetation. Application of mitigation measures to reduce visual impacts during mine life would be consistent with the Forest Plan.

Cumulative Effects - Scenic Resources

Timber sales on NFS and corporate lands and continued commercial and residential development in the Clark Fork Valley, in addition to project development, would alter existing views in the project area. Relicensing of Noxon and Cabinet Gorge hydroelectric projects is not expected to contribute to alteration of the existing visual character of the project area or cumulative effects. Direct cumulative visual impacts would occur for wilderness hikers visiting Ojibway Peak at a location where views extend both to the East Fork of Rock Creek on the west face of the Cabinets and Libby Creek on the east face of the Cabinets. From a small area on the peak, both the confluence mill site for the Rock Creek project and several LAD sites and the evaluation adit for the Montanore Mine would be visible. Indirect impacts may occur for CMW visitors to other wilderness peaks, as either project may be visible from some wilderness viewpoints. Proposed improvements for Montana Highway 200 and continued exploration for locatable minerals should have no major cumulative effects on the visual setting of the Clark Fork Valley or Rock Creek drainage. Cumulative visual impacts for any action alternative could be potentially significant depending on viewer expectations for the scenic integrity of the landscape and valued landscape attributes, as well as specific views from any viewpoint.

EVALUATION OF RESTRICTIONS ON PRIVATE PROPERTY

In 1995, the Montana State Legislature amended MEPA to require state agencies to evaluate in their MEPA documents any regulatory restrictions proposed to be imposed on the use of private property (MCA §75-1-201(1)(b)(iv)(D)). This section has been included in order to satisfy the requirements of this new law. The proposed action (Alternative II) evaluated in this EIS would allow Sterling to mine on lands owned privately by Sterling as well as on public lands owned by the United States. The No Action Alternative and the three agency action alternatives (Alternatives III-V) comprised of numerous modifications and mitigations have been developed as part of this EIS. These alternatives would alter and restrict the way mining and reclamation would be conducted on private and public lands at the proposed mine site in order to protect environmental, cultural, and social resources. The following sections provide a comparison of the costs associated with each alternative to the proposed action. The costs cited are those that are necessary to comply with discretionary restrictions over and above the costs of the proposed action.

Federal and state laws would that regulate Sterling's activities at the proposed mine site include:

- National Environmental Policy Act (NEPA)
- Clean Air Act
- Clean Water Act
- Archeological Resources Protection Act
- National Historic Preservation Act
- Endangered Species Act
- Migratory Bird Treaty Act
- Organic Administration Act

- Native American Graves Protection and Repatriation Act
- American Indian Religious Freedom Act
- Montana Environmental Policy Act
- Montana Metal Mine Reclamation Act
- Montana Clean Air Act
- Montana Water Quality Act
- Montana Hazardous Waste Act
- Solid Waste Management Act
- Montana Water Use Act
- Hard Rock Mining Impact Act
- County Noxious Weed Control Act

Alternatives and mitigation measures designed to make the project meet minimum environmental standards specifically required by federal or state laws and regulations are not required to be evaluated if the agencies have no discretion to alter or waive them. Components of the alternatives that are taken from permit applications, such as the MPDES, Air Quality, and 404(b)(1) permits, are not considered discretionary even though they are not based on the proposed action, Alternative II, but rather on the preferred alternative, Alternative V. (Please note, however, that once a permit is approved, the various components (modifications and mitigations) comprising the permit conditions then become mandatory for compliance purposes under both state and Forest Service regulations.) The agencies developed the cost figures in Table 4-66 in cooperation with ASARCO and Sterling (ASARCO Incorporated 1998b).

Analyzed in this section are the costs of various components or mitigations that comprise each agency alternative. Alternatives would either prohibit development altogether (Alternative I) or allow mine development but with numerous changes in the plan of operations and facility locations compared to the proposed action (Alternative II). For each alternative, the benefits and the costs of discretionary mitigations as they relate to the use of Sterling's private property are compared. The action alternatives and the mitigation measures evaluated do not prohibit development of the proposed project, but could require Sterling to spend additional funds beyond the minimum required for compliance with environmental regulations. The higher the costs associated with regulatory compliance, the less the economic benefit gained from the use of the property, and the more restrictive the regulatory action is to the use of private property. The rationale for including the various modifications and mitigations is discussed in either the alternative descriptions in Chapter 2 or the impact analysis sections in Chapter 4.

Alternative I

The no action alternative would prohibit development of the proposed Rock Creek Mine. The benefits of this alternative would be the elimination of predicted impacts caused by implementation of mine development and construction. Sterling lands within the Rock Creek drainage might become available for residential or commercial development or other uses Sterling might decide to pursue. The costs include a possible loss in Sterling's mineral property value, a potential drop in the value of the company's stock, and a loss of future economic benefits, including those needed to recover permitting expenses. This alternative is extremely restrictive of Sterling's private property. Should this alternative be selected, Sterling would most likely initiate a legal takings action. Although costs cannot be estimated, the state and federal government might be liable for a substantial sum. In addition there would be a loss of potential tax base and employment.

Table 4-66
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative			Comments
	III	IV	V	
MODIFICATIONS				
Deposition of tailings as a paste rather than as a slurry	N/A	N/A	$ 42,000,000	Capital of 12,000,000 plus $1,000,000 annual operating costs over life of mine
Alternate rail load-out location near Miller Gulch	$ 300,000	$ 300,000	$ 300,000	New rail siding
Enclosure of the rail loadout facility and use of covered railcars to minimize ground contamination and blowing of concentrate at the site and en route to smelter	N/A	N/A	$ 500,000	
Sterling and Agencies review air intake ventilation adit plan and determine if there are any other options available at the time	$ 10,000	$ 10,000	$ 10,000	Additional ventilation studies
Sterling to submit detailed study to evaluate variations in topography and rock formations if wilderness adit is needed	$ 15,000	$ 15,000	$ 15,000	Study and report
Alternate location for wilderness ventilation adit, site to be verified by agencies	$ 15,000	$ 15,000	$ 15,000	Study and report
Modified mine portal access via FDR No. 150 and 2741	$ 250,000	N/A	N/A	
Rerouting and combining of the utility and road (primarily FDR No. 150) corridors	$ 0	$ 0	$ 0	May actually be less expensive because no separate maintenance roads need built and maintained, easier access to utilities along main road, etc.
Relocation of mine portal, adits & mill site, subsequently reducing utility & road corridor length	$ 0	$ 25,000,000	$ 25,000,000	Additional adit construction costs
Relocation of the evaluation adit support facilities site away from Rock Creek	N/A	N/A	$ 0	No additional cost, just different location

Table 4-66 (Cont.)
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative			Comments
	III	IV	V	
MITIGATIONS				
Reclamation Plan:				
Pipeline reclamation plan modified	N/A	N/A	$ 0	Plan different but cost same as original plan
More specific soil salvage, handling and replacement plan	N/A	N/A	$ 50,000	Engineering studies and plan
Deeper soil salvage and replacement	$ 2,000,000	$ 2,000,000	$ 2,000,000	Added cost for moving soil
Rocky soil replaced on slopes 8% or greater, lacustrine soils on flatter slopes	N/A	N/A	$ 500,000	
Soils stockpiled and signed separately according to erodability	$ 100,000	$ 100,000	$ 100,000	Added cost for topsoils placement management
Liming of soil stockpiles within 300 feet of surface water or less than 6 feet above ground water levels	$ 50,000	$ 50,000	$ 50,000	More detailed engineering plans
Vegetation Removal and Deposition Plan	$ 25,000	$ 25,000	$ 25,000	Engineering costs, mitigation costs additional
Hand planting trees and shrubs on slopes exceeding 30%	$ 0	$ 0	$ 0	No additional costs over Alt. II
Planting locally grown trees grown with appropriately inoculated mychorizza	$ 0	$ 0	$ 0	No additional costs over Alt. II
Tree and shrub seedling protection-- Shade cards, netting; drip irrigation used April-June for up to 3 years on tailings disposal facility	$ 100,000	$ 100,000	$ 100,000	Alt. II uses dust control sprinklers for irrigation
Scarification of soil prior to seeding	$ 100,000	$ 100,000	$ 100,000	Estimated at $250/acre

Table 4-66 (Cont.)
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative			Comments
	III	IV	V	
Direct haul of topsoil to be maximized	$ 0	$ 0	$ 0	
Inoculating legumes	$ 25,000	$ 25,000	$ 25,000	
Using locally collected seeds	$ 150,000	$ 150,000	$ 150,000	Annual cost of $5,000 for collection of seeds
Organic matter added to soil stockpiles	$ 100,000	$ 100,000	$ 100,000	
Slash used for BMPs and erosion control	$ 0	$ 0	$ 0	
Using old existing road near waste water treatment plant	N/A	N/A	$ 0	
More palatable forb and grass species	$ 0	$ 0	$ 0	Change in species to be used, little change in cost
Regrading evaluation adit dump and mine portal areas to eliminate benches	$ 0	$ 0	$ 0	Will be installed without benches
Closure plan for ventilation adit to return to pre-mining appearance and configuration	unknown	unknown	unknown	Adit would be sealed but surface reclamation would be difficult to achieve on a cliff face
Plant trees following year 8 on impoundment slopes	$ 0	$ 0	$ 0	No change in original cost; difference in timing only
After year 7 of impoundment construction plant seeds with hydromulch (with approved color additive) or tackifer to each lift following construction until final reclamation	$ 0	$ 0	N/A	No change in original cost; difference in timing only
Planting native shrubs and trees at evaluation adit	$ 0	$ 0	N/A	Similar to proposed reclamation plan but different species
Geochemical testing and analysis:				

Table 4-66 (Cont.)
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative			Comments
	III	IV	V	
Geochemical sampling and acid-base testing and monitoring program-data collected during evaluation adit construction	$ 150,000	$ 150,000	N/A	
Development of Acid Rock Drainage and Metals Leaching Plan and Evaluation Adit Data Evaluation Plan	N/A	N/A	$ 150,000	
Expanded geochemical testing and monitoring to include testing (of Rock Creek Project and Troy Mine) prior to and during operations including acid-base accounting, kinetic leaching tests, and response plan for collection and treatment of contaminated water	N/A	N/A	$ 250,000	
Geochemical contingency plans/mitigations	N/A	N/A	$ 25,000	Development of plan only, mitigations additional cost
Rock mechanics testing:				
Rock mechanics and hydrogeologic sampling, testing and monitoring program	$ 1,500,000	$ 1,500,000	$ 1,500,000	Annual monitoring costs of $50,000
Expanded rock mechanics and hydrogeologic sampling, testing, and monitoring during evaluation adit construction	N/A	N/A	$ 50,000	Annual monitoring costs during evaluation adit construction.
A subsidence control and monitoring plan including underground mine plan review	$ 300,000	$ 300,000	$ 300,000	Annual review costs of $10,000
Monitoring Plan Mitigations:				
More detailed long-term reclamation monitoring plan	$ 1,500,000	$ 1,500,000	$ 1,500,000	Annual cost of $50,000 for additional monitoring

Table 4-66 (Cont.)
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative			Comments
	III	IV	V	
More detailed wetlands reclamation monitoring plan	Included with previous item			
Continuous online analysis of nitrogen, and continued collection of water quality data from Troy Mine for comparison purposes	N/A	N/A	$ 3,000,000	Additional annual cost of $100,000
Long-term postoperational groundwater monitoring of tailings disposal facility seepage and seepage through mill pad (all Alts.) and Alt. III waste rock dump	$ 3,000,000	$ 3,000,000	$ 3,000,000	Additional annual cost of $100,000
A comprehensive, long-term water monitoring plan which includes monitoring lake levels at Cliff and Copper lakes to be coordinated with subsidence control and monitoring plan, wetlands mitigation plan, and fisheries/aquatics monitoring plan	$ 0	$ 0	$ 0	No additional cost, incorporated with other monitoring costs
BOD Monitoring of effluent	N/A	N/A	$ 300,000	Annual cost of $10,000
Additional sampling at monitoring well downgradient of decommissioned Noxon sanitary landfill	N/A	N/A	$ 150,000	Additional annual sampling costs of $15,000
Water quality mitigations:				
Detailed water balance refined annually during operation	$ 1,500,000	$ 1,500,000	$ 150,000	Annual cost of $50,000 for engineering calculations and monitoring
Unaltered vegetation zone between Rock Creek and road and utility corridors to greatest extent possible	$ 0	$ 0	$ 0	No added costs, worked into site plan
Nearly perpendicular realignment of bridges over Engle and Rock creeks	$ 250,000	$ 250,000	$ 250,000	Additional excavation and paving

Table 4-66 (Cont.)
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative			Comments
	III	IV	V	
Additional water quality and flow monitoring, hydrgeologic characterization during evaluation adit construction	N/A	N/A	$ 50,000	Surveys only
Additional springs and seeps survey during evaluation adit construction	N/A	N/A	$ 50,000	Surveys only
Fisheries/Aquatics (including bull trout):				
A 300-foot stream-side buffer around the mill site	$ 0	$ 0	$ 0	No added costs, worked into site plan
Aquatic life mitigation plan for wilderness lakes to be prepared in conjunction with wetlands mitigation plan	$ 15,000	$ 15,000	$ 15,000	Consultant report only, mitigation would include additional costs
Threatened and endangered terrestrial species:				
Wildlife:				
Coordinate monitoring of neotropical birds, mountain goats, and sensitive species with appropriate state and/or federal agencies	$ 750,000	$ 750,000	$ 750,000	Annual cost of $25,000
Possibly creating bat habitat in evaluation adit	$ 0	$ 0	$ 0	Would be part of the reclamation and closure plan of the adit, no additional costs anticipated
Restricted timing for road construction/reconstruction on FDR No. 150 and 150B and hauling of waste rock to the paste facility site between May and August	N/A	N/A	$ 0	
Closure of FDR No. 150 to foot traffic during harlequin breeding season (May 1-Aug 1)	N/A	N/A	$ 0	

Table 4-66 (Cont.)
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative III	Agency Alternative IV	Agency Alternative V	Comments
Vegetation screening and planting between FDR No. 150 and Rock Creek	N/A	N/A	$ 25,000	Tree planting cost
No-stop zones with designated turn outs	N/A	N/A	$ 0	
ASARCO would not allow camping on their lands	N/A	N/A	$ 0	Posting of signs, enforcement of requirement
Limited access to 150B from junction with FDR No. 150 to the paste production plant	N/A	N/A	$ 0	
Busing of mine workers and visitors from parking lot in lower Rock Creek area	N/A	N/A	$ 7,500,000	Annual operating cost of $250,000
Wetlands:				
Contingency plan for impacts to wetlands and aquatics in wilderness lakes	$ 50,000	$ 50,000	$ 50,000	Consultant report only, mitigation costs extra
Aesthetics (sound, visual, air quality)				
Retain or plant trees to screen the northeast hillsides above the mill	$ 0	N/A	N/A	Part of reclamation plan
Operate all surface and mill equipment so that sound level do not exceed 55 dBA measured 250 feet from the mill	$ 250,000	$ 250,000	$ 250,000	Sound suppression divisions
Adjust intake and exhaust ventilation fans in the exploration and mine adits so that they generate less than 82 dBA measured 50 feet downwind	$ 100,000	$ 100,000	$ 100,000	
Modified right of way clearance measures and vegetation management	$ 0	$ 0	$ 0	

Table 4-66 (Cont.)
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative			Comments
	III	IV	V	
Plant trees between tailings disposal facility and Montana Hwy 200	$ 5,000	$ 5,000	$ 5,000	Completed in Spring 1997
Plant or retain a vegetative buffer of sufficient width between FDR No. 150 & the exploration adit support facilities, the biotreatment facility, & the substation in the lower Rock Creek drainage for visual screening	$ 50,000	$ 50,000	$ 50,000	Planting and road alignment
Treat and/or paint permanent (life-of-mine) structures within the project area to visually blend with the surrounding landscape	$ 10,000	$ 10,000	$ 10,000	Additional cost for color
Shield or baffle exterior exploration adit lights from viewpoints in the Clark Fork Valley and from night-migrating songbirds	$ 5,000	$ 5,000	$ 5,000	
Shield or baffle exterior mine facility lights from viewpoints in the Clark Fork Valley and from night-migrating songbirds	N/A	N/A	$ 5,000	
A 100-foot visual buffer between the mill site and FDR No. 150	N/A	$ 0	$ 0	No additional costs
Deposit mine waste rock in two dumps on hillsides adjacent to the mine adits in existing clearcuts. Adjacent vegetation would be retained the extent possible	$ 0	N/A	N/A	No additional costs
Treatment of exposed rock and waste rock surfaces with oxidating compounds if necessary to meet VQOs at mill and wilderness ventilation adit	$ 10,000	$ 10,000	$ 10,000	

Table 4-66 (Cont.)
Rock Creek Project Regulatory Restriction Analysis
Estimated Change in Cost to Sterling Compared to Implementing Alternative II

Modification/Mitigation Item	Agency Alternative			Comments
	III	IV	V	
Install temporary water line from evaluation adit with winch and cable	$ 0	$ 0	$ 0	No additional costs, different installation method
Miscellaneous (operational, transportation):				
Development of a transportation management plan	$ 25,000	$ 25,000	$ 25,000	Consultant report only
Pumping of concentrate to the rail loadout	N/A	N/A	$ 250,000	
Burial of all pipelines at least 24 inches deep	N/A	N/A	$ 200,000	
Realignment of adits with mill & elimination of portal site east of FDR No. 150	N/A	N/A	$ 0	Engineering and design change
Use of mine waste rock for starter dam construction/buttresses	$ 2,000,000	$ 2,000,000	$ 2,000,000	Haulage cost
TOTAL DISCRETIONARY COSTS:	$ 14,710,000	$ 39,460,000	$ 93,015,000	

<u>Alternative II</u>

Alternative II would allow Sterling to develop its mineral properties over 25-30 years depending upon the actual rate and efficiency of mining and milling. If Alternative II were permitted, Sterling might need to modify its MPDES and Air Quality permit applications with the state as well as its 404(b)(1) permit application with the COE to match the features of Alternative II that differ from the preferred alternative on which those permit applications were based. Once the evaluation adit was completed and mining commenced, Sterling would make profits from the sale of the ore mined and processed at the site once the capital and permitting expenses were recovered, and retain such value on their stocks as the market would support.

<u>Alternative III</u>

Alternative III would also allow Sterling to develop its mineral properties in the Rock Creek drainage over 25-30 years. Benefits from the restrictions imposed by Alternative III would include a more stable impoundment that is less likely to fail, numerous reductions in sound and visual impacts, a safer intersection of FDR No. 150 and Montana Highway 200, a reduction in impacts to fish, wildlife, threatened and endangered species, and wetlands, reduced potential for erosion, increased success of reclamation, and reduced risk of subsidence and acid rock drainage.

If Alternative III were permitted, the MPDES, air quality and 404(b)(1) permit applications would need to be modified to match the features of Alternative III that differ from the preferred alternative on which those permit applications were based. However, those requirements would be non-discretionary. The alternate designs or locations for facilities in Alternative III including the alternate rail loadout facility, relocating the wilderness air-intake adit (and mitigations associated with determining the need and location), and the modified mine portal access, would increase discretionary costs by $590,000. The change in the design of the impoundment ($4 million) and the alternate location of the intersection of FDR No. 150 and Montana Highway 200 ($100,000) are nondiscretionary changes. The rerouting of the utility and road corridors and the relocation of the water treatment facility, while discretionary would not result in increased costs to Sterling.

There are numerous new mitigations associated with Alternative III. Those associated with the reclamation plan include changes in the revegetation plan, timing of reclamation, soil salvage and handling plan, and new or modified reclamation plans and would increase discretionary costs by $2,750,000 plus an additional $275,000 in non-discretionary reclamation plan changes. Geochemical sampling, ARD testing, and monitoring would cost an additional $150,000 in discretionary costs. Most water quality, geologic, and reclamation monitoring mitigations are considered non-discretionary, however, $215,000 or $6,450,000 over the life of the mine would be for discretionary monitoring mitigations. Most of the water quality-related mitigations were incorporated into the MPDES permit application and thus are non-discretionary. However, discretionary items include annual refinement of a detailed water balance and near perpendicular alignment of bridges over Engle and Rock creeks and would result in an increase in costs of nearly $1,750,000. Mitigations associated with bull trout and terrestrial threatened and endangered species are considered to be non-discretionary as they are included in the Biological Assessment and considered to be necessary by the USFWS in order to preclude jeopardy for one or more species under the Endangered Species Act. Nonetheless, they would result in nearly $1 million plus the cost of reducing sediment sources for fisheries and bull trout mitigations and $6,135,000 for threatened and endangered species mitigations. Wildlife mitigations would result in $25,000 in additional annual discretionary monitoring costs or $750,000 over the life of the mine. The contingency plan for impacts to wetlands and aquatics in wilderness lakes would result in $65,000 in discretionary costs for preparation of the plan plus the costs of the implementing the plan should it be necessary. Aesthetics mitigations would result in nearly $350,000 for sound impacts, and $80,000 for visual impacts. All mitigations associated with air quality are included in the permit application and are thus non-discretionary. Other discretionary mitigations include use of mine waste rock for starter dams ($2 million for hauling costs) and $25,000 for preparation of a transportation management plan plus the unknown costs of implementing the plan.

Of the three agency alternatives, Alternative III is the least restrictive. Approximately $14.71 million dollars have been identified as additional costs of implementing discretionary modifications/mitigations over what has been proposed under Alternative II, the MPDES permit, the air quality permit, and the 404(b)(1) permit. Additional costs of implementing some plans and mitigations cannot be calculated until the plans themselves are finalized and approved by the agencies.

Alternative IV

Alternative IV would also allow Sterling to develop its mineral properties and has many of the same restrictive mitigations as Alternative III. The benefits of implementing Alternative IV compared to Alternative II include those associated with Alternative III as well as additional protection of fisheries and aquatics and an even greater reduction in the potential for erosion from the mill site due to the buffer zone around the alternate mill site.

Under Alternative IV the MPDES, air quality and 404(b)(1) permit applications would need to be modified to match the features of Alternative IV that differ from the preferred alternative on which those permit applications were based. However, those requirements would be non-discretionary. The alternate designs or locations for facilities in Alternative IV including the alternate impoundment design, the alternate rail loadout facility, relocating the wilderness air-intake adit (and mitigations associated with determining the need and location), and the alternate mill site, would increase costs by $25.34 million. The costs of discretionary mitigations would be the same as for Alternative III ($14.12 million).

Approximately $39.5 million dollars have been identified as additional costs of implementing discretionary modifications/mitigations under Alternative IV over what has been proposed under Alternative II, the MPDES permit, the air quality permit, and the 404(b)(1) permit. Additional costs of implementing some plans and mitigations cannot be calculated until the plans themselves are finalized and approved by the agencies.

Alternative V

Sterling would also be able to develop the Rock Creek Project under Alternative V. Alternative V has numerous benefits in terms of reduced impacts to water quality, fisheries and aquatics, wildlife, threatened and endangered species, sound, scenic resources, acid rock drainage, subsidence, and air quality compared to Alternative II.

The major increases in costs related to modifications associated with Alternative V compared to the other agency alternatives are due to the use of a tailings paste storage facility rather than an impoundment (a total of $42 million) and the enclosure of the rail loadout facility ($500,000). The alternate designs for facilities, including those identified for Alternative IV, would increase discretionary costs by $67.84 million.

The costs of discretionary mitigations would include all those identified for Alternative IV ($14.12 million) as well as several additional ones. There are additional soil salvage and handling plan requirements ($550,000), expanded geochemical testing and monitoring and contingency plan development ($275,000), additional sampling, testing, monitoring and surveying during evaluation adit construction (1.6 million), additional water quality monitoring ($125,000 annually or $3.45 million total), additional wildlife mitigations ($25,000), busing of mine workers and visitors ($250,000 annually or $7.5 million total), additional lighting mitigation ($5,000), and pumping the concentrate to rail loadout facility and burial of all pipelines ($450,000). The total cost of discretionary mitigations under Alternative V would be approximately $25.18 million.

The total cost of discretionary modifications and mitigations under Alternative V would be approximately $93.02 million over the life of the mine plus additional costs of implementing some plans and mitigations that cannot be calculated until the plans themselves are finalized and approved by the agencies. If the paste facility is considered to be non-discretionary because several permit applications are based around the use of that facility, then the total additional cost drops to nearly $51.02 million. This plan while being the most restrictive and the most costly is the most environmentally preferred action alternative and provides mitigations to reduce impacts that would be greater under the other action alternatives (Alternatives II-III).

PART 2: PROBABLE ENVIRONMENTAL EFFECTS THAT COULD NOT BE AVOIDED

The following discussion summarizes the previously identified impacts which are unavoidable. It does not reiterate the context previously provided in this chapter.

Forest Plan

This EIS includes Forest Plan amendments for those areas to be occupied by facilities should the project be approved. The amendments would convert MA 13 (old growth), MA 11 (big game winter range), and MA 14 (grizzly bear habitat) to MA 31 (mineral development) and MA 23 (electric transmission corridor) for the mine life and beyond. Therefore, if this project is approved, management area changes would be made to reflect appropriate designations for proposed uses.

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. Monitoring of the operation as described in Appendix K would verify compliance on an ongoing basis.

Geology

The recoverable portion of the Rock Creek ore body would be permanently removed. Approximately 15 percent of the metals in the ore would not be recovered during milling and would remain in the tailings.

Soils

Soil erosion to some degree would occur under all alternatives, even with implementation of mitigation measures proposed. The degree of impacts varies among the action alternatives. Soil productivity would be reduced in some locations such as the tailings impoundment area where soil profile characteristics would be drastically changed over premine conditions or in areas that would be unreclaimed such as some sections of new road.

Hydrology

The underground mine would produce water that would require disposal. During the operational period of the mine, some excess water would be used at the proposed mill facility and some excess water would be treated and discharged to the Clark Fork River. After mining was complete, and assuming the mine adits were not sealed, excess mine water would meet State discharge permit requirements and would be discharged to the Clark Fork River. If the adits were sealed after mining, the mine would fill with water until steady-state conditions were reached, where inflow would equal outflow. It is uncertain where outflow from the mine would discharge.

Development of the proposed tailings impoundment would permanently remove more than 300 acres of natural catchment area in the Miller Gulch drainage.

Sediment loading to Rock Creek and the Clark Fork River would increase over baseline conditions due to erosion from mine-related construction in these drainages.

Nitrogen loading below the proposed mill site would temporarily increase during project construction. The increase in concentration cannot be estimated with certainty. All nitrogen would be leached out within 1 to 5 years.

Loading of nutrients and dissolved metals in ground water below the proposed tailings impoundment would increase over baseline conditions. The increase would be limited to an Agency-approved ground water mixing zone and would likely exist over several decades.

Wetlands and Non-wetland Waters of the U.S.

There would be an unavoidable loss of existing wetlands and non-wetland waters of the U.S. under all action alternatives.

Aquatics/Fisheries

Declines in fish abundance in Rock Creek could be expected under action Alternatives II, III, and IV. These declines would be the result of the combined effects of fishing pressure, habitat and water quality degradation, of the project and natural events and foreseeable activities. The degree of impact varies between action alternatives.

Treated effluent discharged to Cabinet Gorge Reservoir will increase the loading of nutrients (nitrogen and phosphorus). These nutrients are likely to increase algal growth in the reservoir to a very small and unmeasurable degree.

Although the taking and/or intentional fishing for bull trout is prohibited in Rock Creek and Cabinet Gorge Reservoir (MFWP 1998), bull trout may be harassed or killed incidentally to legal fishing activities with the area influenced by the project.

Biodiversity

Seven populations of three plant species of special concern that would be partially or totally destroyed includes pointed broom sedge and yerba buena. Wavy moonwort, a KNF sensitive species, may be impacted if the population cannot be avoided. Impacts to these species vary by alternative. Noxious weeds would continue to spread in the region and would be accelerated under all action alternatives.

Wildlife habitat would be affected to different degrees for all action alternatives. Habitat would be directly lost through mine construction, rendered less effective because of increased disturbance, or fragmented because of increased human activities and mine facility development. Wildlife mortality from traffic collisions would increase within the project area and along roads or railroads with mine-related increased traffic. Mortality in some species would increase due to increased poaching or legal harvest. A decline in biodiversity would result from all action alternatives and would be least in Alternative V.

Long term viability of old growth dependent species is unlikely regardless of alternative, until existing stands have sufficiently matured, because of the low amount currently present in the compartment. Long-term viability is least likely with Alternative II and most likely with Alternatives I and V.

Indirect effects from increased human development associated with the project would affect wildlife habitat outside of the project area and would likely reduce the biodiversity of the Lower Clark Fork and Bull River valleys. Mountain goats would experience an increase in disturbance during the mine construction phase.

Threatened and Endangered Species

The project would displace grizzly bears from the project permit area in the long term (5-7 bear generations).

Socioeconomics

Action alternatives would provide employment opportunities and personal income, and the local area would experience substantial immigration. Mine associated employment would total roughly 500 workers earning a personal income total approaching $14 million per year. Sanders County, at least, would see a substantial increase in tax revenue. In western Sanders County it is possible that employment, income, and population gains would be offset by foregone employment, income, and population increases resulting from prospective amenity immigrants settling somewhere else because of housing scarcity and uncertainty about project effects. When the mine closed, the local economy would experience an abrupt loss of nearly all the mine jobs and employment earnings.

The sudden influx of workers and their families associated with the start of contract construction work would be likely to produce some boom town phenomena in western Sanders County. There would be a shortage of available housing, and some private and public service providers could have difficulty adjusting to suddenly increased demands knowing that the demand peak would drop off again when contract construction ended.

If the Troy Mine were to reopen and the Montanore Project were to resume development in the same time frame as Rock Creek began development, western Sanders County and the Clark Fork area would experience a classic boom town situation, with immigration numbers, and demands for housing and services putting extreme pressure on the housing market and local service providers. Very careful planning and preparation by Sterling and local government would be required to manage the situation.

Transportation

The project would convert certain NFS lands to roads, and traffic and accidents would increase in the project area during mine life.

Recreation

Increased use of and access to the Rock Creek drainage would occur, and recreational use of mine facilities sites would be restricted during mine life.

Wilderness

The CMW would experience increased use, access would be restricted, and mine activities would likely be heard, seen, or smelled from some locations within the CMW.

Cultural Resources

Cultural resources would continue to be impacted by neglect and the indirect impacts associated with increased human activity and growth in the area. These impacts would occur under all alternatives.

Native American Treaty Rights

Potential effects on fisheries, wildlife, and vegetation as well as restrictions on access would limit tribal members from fulfilling their treaty rights during mine life. Some of these effects could last into the long term.

Sound

There would be elevated noise levels in the Rock Creek drainage generated by project construction and operations. Additional traffic would generate slight increases in traffic noises in western Sanders County. Use of the Hereford loadout under Alternative II would increase noise for nearby residents.

Scenic Resources

Visual impacts of all action alternatives would be direct, long term and unavoidable. Existing settings and landscapes in both the Clark Fork Valley and Rock Creek drainage would be dramatically altered during mine operation and for several decades following operation.

PART 3: SUMMARY OF THE RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Forest Plan

The short-term mine construction and operations could devote between 147 and 201 acres of existing grizzly bear habitat, old growth habitat, and big game winter range to mine-related uses for the life of the project depending upon the alternative considered. These changes in use include amendments to Forest Plan Management Area designations to those appropriate to proposed uses in the short term, and subsequent appropriate revisions to the plan after mine closure. MA 31 (Mineral Development) designations would likely remain in place for the foreseeable future.

Air Quality

During mine life, air pollutant concentrations would be higher than current levels. Once mining and reclamation were completed, the pollutant concentrations would return to premining levels, assuming adequate revegetation success.

Geology

The tailings impoundment would be a permanent facility. The construction of the impoundment and associated dams would alter the topography in the impoundment area for the long-term. Construction of the mill would also permanently alter the mill site topography.

Soils

Soil losses would be a short-term. Soil productivity decreases would be short-term for much of the permit area. However, soil productivity would be decreased for the long-term (30+ years) in the tailings impoundment location because soil profile characteristics would be drastically changed over premine conditions.

Geotechnical Engineering

Risk of impoundment failure would decrease over time as the impoundment dewatered.

Hydrology

During mining, excess adit water would either be used in the mill or treated and discharged to the Clark Fork River. After mining, flow from the adit would be discharged to the Rock Creek if the adits were not sealed, and the discharge met applicable water quality standards.

During mining, the perimeter collection system would create a barrier to ground water flow in Miller Gulch and recharge would be reduced by about 131 gpm. Recharge would return to premining levels after seepage water quality met applicable water quality standards.

Mill make-up water would be withdrawn from a ground water source near the confluence of Rock Creek and the Clark Fork River during mine operation. Once mining was completed, the need for make-up water would be eliminated.

Wetlands and Non-wetland Waters of the U.S.

Short-term impacts to wetlands and non-wetland waters of the U.S. would occur during construction activities due to increased sediment contributions. Proposed BMPs would reduce sedimentation. Other potential short-term impacts would result from time delays between the development and functioning of the created wetlands and the destruction of the existing wetlands resources. A long-term impact would result from the 30-year delay in reconstructing the non-wetland waters of the U.S. channel at the proposed mill site for Alternative II.

Short- and long-term impacts may occur to wetlands downstream of the proposed tailings impoundment. The capture of surface water by the tailings impoundment and the capture of both surface and ground water by the proposed tailings impoundment seepage collection system would reduce the total drainage area contributing to the wetlands and potentially reduce the duration of saturation, inundation, and ponding of water in these wetlands. Decreased surface and ground water flow, especially during the growing season or dry periods, may allow vegetative species more tolerant of drier sites to replace species requiring more moist site conditions. The use of paste tailings disposal for Alternative V should delay impacts to some wetlands for up to 25 years and thus minimize the total cumulative impacts to wetlands for the short term.

Aquatics/Fisheries

Impacts from the action alternatives would be short term. Most impacts to the aquatic environment, such as increased sediment or impacts from spills, should recover within 30 years. Even if local eliminations of aquatic species should occur, recolonization should generally be rapid once the habitat recovered, particularly for macroinvertebrate and algae species.

However, in the unlikely event of a tailings impoundment failure, impacts on the aquatic environment would be long term. Spills of heavy metals could have long-term impacts on the aquatic environment. If overall habitat degradation was extensive, loss of pure strains of westslope cutthroat trout could be hastened.

Biodiversity

Long-term loss of productivity would occur on the tailings paste facility and other mine developments. Habitat would return to the paste facility but it would probably not be as diverse as originally present for a considerable length of time, if ever.

Increased mortality from illegal or legal kills, or vehicle collisions, may reduce short-term productivity in common species, and affect productivity over a longer term with uncommon species.

Wildlife adapted to open, non-forested areas would likely increase over the short-term within the project area. In the long term, as these sites become reforested, species adapted to forested habitats would increase.

The extent of impacts resulting from the loss of specific sensitive plant populations on the long-term viability of some of these species is unknown. Noxious weeds would continue to spread in the region in the short and long term and the spread would be accelerated under all action alternatives.

Threatened and Endangered Species

The short term effect to bald eagle, and gray wolf would be displacement of individuals attempting to use available habitat in the project area. No long term effects are anticipated for bald eagle, or gray wolf.

Short term effects to grizzly bear include changes in habitat components: a reduction in timbered cover and increase in open grass or shrub fields. The reduction in habitat effectiveness for grizzly bear would be long term (35 years for project activities and up to 25 additional years for physically disturbed sites to provide hiding cover), as would the loss of movement corridors for the grizzly. When a female grizzly is displaced from an area traditionally used, and she has cubs, she is unable to teach her cubs to use the area as she historically did. This means that there could be a delay in the reestablishment of grizzly use in the disturbed habitat for several bear generations (bear generation is 7-10 years - pers. comm. Wayne Kasworm, USFWS, 7-15-98) (USFWS 1993, pg 146), after all activity stops. Based on this, grizzly bear use in the Rock Creek mine permit area may be delayed for 50 years or more.

For bull trout, the baseline habitat and species condition indicators described in the Biological Assessment (see Appendix B) are functioning at risk or functioning at unacceptable risk. The primary cause of this condition is the intermittency of the stream, which has decoupled the migratory and resident forms of bull trout. Implementation of the preferred alternative is likely to maintain function for each indicator. Thus, over the long-term, the project is likely to have no effect on bull trout.

Socioeconomics

During the last quarter century the rate of Sanders County population and economic growth has mirrored statewide patterns. Along with the rest of Montana, the county has seen the resource commodity and goods production sectors of its economy decline in importance relative to the service and finance/education/government sectors. In western Sanders County, in particular, the immigration of retirees and of other individuals whose place of residence is not tied to a particular work location has been the driving factor in population and economic growth. These trends are expected to continue if the mine is not developed.

Mine development would change this picture significantly. Sanders County employment in the resource commodity sector would nearly double with the sector expanding from 12 percent of county employment in 1995 to somewhere in the vicinity of 20 percent of total employment at full mine production. Housing scarcity and uncertainty about mine impacts would likely slow the immigration of retirees and other amenity immigrants to the communities in the western portion of the County. Private and public service providers would devote more of their resources to meeting the demands posed by mine workers and their families, and become less attuned to the needs of the retirement population. When the mine closed, there would likely be a downturn in the Sanders County economy and, possibly, some population exodus. After 30 years during which the mine would be a major factor in the western Sanders economy and community life, it would require an extended period to restructure and reorient to whatever economic options might be available at that point.

Southern Lincoln County also would experience some employment and population growth from the mine during its term of operation. These mine effects would not alter existing trends in Lincoln County; they would help accelerate the slow growth expected for the county.

In the short term, mine operations would dominate land use on an estimated 2,000 acres in the Rock Creek drainage, with about 700 acres being used exclusively for mining. There would be a long-term loss of about 400 acres from commercial timber production. In addition, between 2,000 and 3,000 acres of private land would be acquired and legally dedicated to long-term grizzly bear habitat mitigation.

Transportation

In the short term, winter access would be increased in the Rock Creek drainage up to the mill site. Roads would not be snowplowed once mining ceased, returning access to premining conditions in the long term.

Cultural Resources

Cultural resources are nonrenewable. All short-term uses have the potential for permanent impacts to the long-term historic and interpretive value of cultural resources.

PART 4: IRREVERSIBLE & IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible effects are those effects caused by the proposal that cannot be reversed. Irretrievable effects are those effects caused by an alternative that change outputs or commodities of the land's use. These changes in output, however, must be reversible.

Forest Plan

The project would irretrievably devote NFS lands to mining uses for the 25-30 year life of the project. This would reduce local grizzly, timber, and big game winter range uses in the Rock Creek drainage. Following completion of mining, about 54 acres of NFS lands would not return to premining uses and would remain as MA 31, into the foreseeable future.

Geology

Assuming 65 to 75 percent mine recovery, approximately 88.4 to 100 million tons of ore would be removed by the Rock Creek Project, with about 48 to 43 million tons respectively left for structural support of the mine workings. Approximately 146 to 166 million troy ounces of silver and 1.20 to 1.37 billion pounds of copper would be removed from underground. Actual overall metal recovery would be slightly less because of mill and smelter losses. Approximately 79 to 71 million troy ounces of silver and

0.65 to 0.59 billion pounds of copper respectively would remain underground in structural supports. Their future recovery is very unlikely. Construction and operation of the Rock Creek Project would result in the irreversible commitment of these resources. Subsidence would be an irreversible effect of mining if it occurred.

Soils

Some soil would be irreversibly lost during construction and operation of the mine prior to the re-establishment of vegetation. Minor adverse effects would result from prolonged soil stockpiling, but following soil replacement, most soils should reach pre-mine productivity levels over time. Soil productivity in the impoundment area would be irreversibly reduced under Alternative II only. Soil productivity for areas such as new roads that would not be fully reclaimed also would be irreversibly reduced. Soil productivity would be irretrievably lost for all other unreclaimed areas until the end of mine life.

Hydrology

Water currently stored in joints and fractures above adits and mine workings would be drained and used in the milling process or treated and discharged to the Clark Fork River. Following mining, water would continue to flow into the mine workings. Water levels in the mine would rise until surface discharge occurs along natural pathways or at the mine adits. Use of water stored in joints and fractures would be an irreversible commitment of resources.

Proposed discharges from the water treatment systems would alter the water quality in the Clark Fork River within the mixing zone. Seepage from the proposed tailings facility would degrade the quality of ground water in a mixing zone under all action alternatives primarily by increasing the concentrations of nitrogen and metals. Changes in surface water or ground water quality would be an irreversible commitment of these resources.

Ground water quality effects in the tailings storage facility area would decrease following mining operations as seepage decreased. Some seepage from the tailings facility would continue in perpetuity. The tailings are not anticipated to be acid generating, and the quality of the discharge would remain the same or improve with time. Any permanent change in ground water quality in the ground water mixing zone and tailings facility areas would be an irreversible commitment of resources.

The withdrawal of make-up water from the Clark Fork River alluvium or the Clark Fork River would be an irretrievable commitment of this resource.

Mining activities would intersect water-bearing joints and fractures during underground operations. The use of stored water would be an irreversible commitment of resources.

Assuming the adit portal could not or would not be permanently sealed, water from the mine would likely discharge to the Clark Fork River in perpetuity. The expected quality of the mine discharge water is discussed in Hydrology. Mine discharge water quality would likely improve somewhat with the cessation of underground blasting and mining activities, but it is not known if or when it will return to ambient levels. There would be an irreversible and irretrievable load of some metals and nutrients to the

Clark Fork River should the discharge continue in perpetuity. However, the impact to the load would be so minor as to be immeasurable.

Development of the proposed tailings impoundment would modify more than 300 acres of natural catchment area and permanently remove one spring in the Miller Gulch drainage. Alteration of the natural drainage area and the spring would be an irretrievable and irreversible commitment of resources.

Because the loading rates would be expected to vary with time, a reduction in ground water quality in Miller Gulch would be both irreversible and irretrievable.

Surface and ground water resources overlying the underground workings could potentially be affected if faults or fractures acted as ground water conduits and ASARCO's pilot hole testing and grouting programs were ineffective. As a result, water levels and ground water inflow to lakes and streams might be reduced. The reduction in flow or in lake level cannot be quantified, but would likely be irreversible, if it occurred.

Wetlands and Non-wetland Waters of the U.S.

There would be an irreversible and irretrievable loss of existing wetlands and non-wetland waters of the U.S. under all action alternatives. Construction of the proposed mill facilities, access road, and tailings impoundment for Alternative II would result in the irreversible loss through burial of natural habitat of about 8.1 acres of wetlands. The applicant's original proposed wetlands mitigation plan, if successful, would create about 12.3 acres of wetlands to compensate for the loss which would replace the functions and values of the destroyed wetlands. An irretrievable loss of approximately 1.1 acres of non-wetland waters of the U.S. would also result from implementing Alternative II by the routing the existing drainage channel through the proposed mill site facility. Utility corridor and road upgrades would result in the loss of another 4 acres. The proposed mitigation plan, would recreate the 1.1 acres of non-wetland waters of the U.S. at the end of the mining by re-establishing the drainage channel in approximately the same location as it was prior to constructing the mill site.

For Alternative V, there would be an irreversible and irretrievable loss of 6.2 acres of existing wetlands and 0.4 acres of non-wetland waters of the U.S. The proposed mitigation plan would create about 10 acres of wetlands at three sites along Rock Creek and Miller Gulch. Successful wetland mitigation would compensate for the loss by re-establishing the diversity and abundance of habitat for aquatic and terrestrial species, reducing sediment transport to Rock Creek and attenuating peak flows.

Aquatics/Fisheries

If the impacts of the proposed mine are sufficiently severe to cause the loss of westslope cutthroat trout in the Rock Creek drainage, this would be an irretrievable loss of resources.

Biodiversity

Wildlife habitat directly lost through construction of mine facilities not planned for reclamation would be irretrievably lost. The paving of FDR No. 150 would be the most significant of these, because the improved road would continue to affect wildlife by providing a conduit for increased human access long after the mine closes. Reclaimed sites would likely have irreversibly reduced habitat quality because of reduced species diversity. Habitat lost as a result of mine-related human development (i.e., houses, roads, commercial facilities) would be irretrievably lost. This loss of habitat due to mine-related increased human development is likely to occur over time regardless of mine development but would occur at a more rapid rate, which may lead to the irretrievable lost opportunity to secure key habitat for several species.

Some populations of plant species of special concern would be irreversibly lost. One population of a KNF sensitive plant species, wavy moonwort, if it is found in subsequent surveys may be impacted if it cannot be avoided. In large part due to lack of knowledge about genetic viability, ecosystem requirements, and species adaptability, current sensitive plant conservation techniques have not been proved to be successful alternatives to avoidance. Noxious weed invasion would displace native species resulting in an irreversible loss of plant species diversity.

Threatened and Endangered Species

There would be no irreversible or irretrievable effects on the bald eagle, or gray wolf.

Due to the length of the proposed activity (25-30 years), the loss of available habitat and reduced habitat effectiveness, the habitat carrying capacity for grizzly bear would be reduced. This effect may be irreversible should the loss of the habitat keep the population potential below a viable level. If the population stays below the viable level, the effect becomes irretrievable without large scale augmentation.

Even with reclamation of the tailings impoundment and other areas disturbed by the project, the disturbed areas could have less habitat effectiveness than currently exists. This is based on a high probability of reduced species diversity. This habitat loss could further reduce the carrying capacity to the point that a viable level of grizzly bear could not be supported.

If the impacts are sufficiently severe to cause the loss of bull trout in the Rock Creek drainage, this would be an irretrievable loss.

Socioeconomics

The commitment of local area workers, social structure, and community services to support mine development and operation would be essentially irretrievable. At least for the life of the mine, these resources would not be available to support other economic options or potential community directions. The commitment of land resources at the mine site would be irretrievable for the life of the mine and irreversible to the extent that any areas could not be reclaimed and returned to their former use and productivity. Conversion of land to project-associated residential or commercial development would likely be irreversible.

Transportation

The gravel used in road construction and reconstruction would be difficult to salvage for other uses due to the relative shallow thickness (from a few inches up to 1 foot) over the road prism, and to the possibility of contamination with soils and other larger rocks. The asphalt used for the bituminous surface would be difficult to reuse, but bituminous surfaces have been recycled for use in road reconstruction. Commitment of gravel would be irreversible and use of asphalt would likely be.

Recreation

Some of the mine employees could be expected to stay in the area after the life of the mine. Those people could continue to engage in recreational activities in the area. Recreational resource demands would probably be slightly higher after mine closure than future demand without the project. However, it is not expected that mine employee recreational resource needs would significantly deprive other recreationists in the area from enjoying those same resources. Project-related recreation demands would irretrievably commit a portion of the recreation resource in western Sanders County.

Wilderness

Site disturbance associated with the air-intake ventilation adit would exist after mine life. Reclaimed disturbance from the adit would consist of a pile of rocks. This rock pile might look unnatural as compared to other rock piles in the vicinity. An irreversible impact to apparent naturalness would occur under Alternative II.

Cultural Resources

Any impacts to cultural resources are irreversible due to the nonrenewable nature of the resources.

Native American Treaty Rights

Impacts to treaty rights would be irretrievable unless the bull trout or grizzly bear was lost due to project impacts. In this case, there would be irreversible loss of those treaty rights.

Sound

The quiet sound levels characteristic of project area rural and wilderness environments would be irretrievably lost.

Scenic Resources

The project would be visible from viewpoints in the Clark Fork Valley, NFS lands, and the CMW. The visual impact of the utility and transportation corridor, evaluation adit, and ventilation adit would significantly affect some viewers. The agency-proposed reclamation and revegetation plan, when completed, would decrease visual effects of mine components. However, the paste deposit for Alternative V, tailings impoundment for Alternatives II, III and IV, both mill sites, and waste rock dumps for all action alternatives would irreversibly alter the natural landscape. Development of these project components would be an irreversible commitment of these visual resources.

PART 5: ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton signed Executive Order 12898 titled Environmental Justice. 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.

The action alternatives were evaluated for impacts relating to the social, cultural, and economic issues of the population at large. Such issues are termed "environmental justice" issues and no such issues regarding the well-being and the health of minorities and low income groups were identified during scoping. Other than members of four American Indian 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 implementation of this project.

Several different situations are often cited in defining environmental justice. The following is a summary of each:

- The targeted siting of potentially polluting facilities in areas with racial minorities or impoverished populations. The motives often attributed to the proponent are: 1) that they do not care about the affects on minority populations; and/or 2) that the site is desirable because minorities and the poor do not have the resources to oppose the project.

- Discrimination by regulatory agencies in enforcement of environmental standards where projects may be affecting low income or minority populations. The argument is that these groups cannot obtain the same level of regulatory protection as other groups that may be wealthier, more politically powerful, or of a different race.

- The inequitable distribution of project benefits, primarily economic, with project impacts such as increased pollution or perceived risk of pollution.

Therefore, environmental justice considerations can be grouped into three general categories: 1) facility siting and opposition, 1) regulatory agency discrimination, and 3) equitable distribution of project benefits and risks. The following is a discussion of these three categories.

Facility Siting and Opposition

The proposed mine is not located within or adjacent to any tribal reservations. It is, however, located with in the Hell Gate Treaty boundaries. The preferred alternative would restrict access to mine facility sites to all members of the public, including tribal members, but it would at the same time improve access via FDR No. 150 in the drainage as far as the mill site and to some extent to the CMW via FDR No. 2741. Numerous mitigations would be required to minimize, eliminate, or avoid impacts to resources wherever possible and practicable. However, none of the mitigations would lessen the impacts to traditional American Indian uses of those resources.

Tribal members have been invited to participate in the development and review of the EIS. Comments from the four tribes have been received on the draft and/or supplemental EISs and during development of the final EIS. It is likely that comments from individual tribal members were received as well but the agencies cannot determine which commentors were or were not tribal members.

Regulatory Agency Discrimination

DEQ, KNF, EPA, and the COE all have devoted considerable regulatory resources to studying the potential effects of the proposed action and its alternatives. DEQ and KNF have afforded the public and tribes several means of obtaining information regarding the proposal. Please see Chapter 1, Public Participation, for more details.

Equitable Distribution of Project Benefits and Risks

Since the project is neither adjacent to or near tribal 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. The potential impacts of the project would affect traditional American Indian uses of the project area. The communities in the area would benefit through provisions in the approved Hard Rock Impact Plan without regard to whether the people within the community were tribal members or not. Tribal members would also have the same opportunities to seek employment for higher paying jobs at the mine as would other members of the general population.

Conclusion

There are no environmental justice issues relative to the Rock Creek Mine that violate or are inconsistent with the intent of Executive Order 12898. All efforts have been made to minimize environmental impacts resulting from the mine regardless of the minorities or economic ability of the people in the area. Impacts to personal religious values or beliefs are not within the scope of the environmental justice initiative and cannot be resolved through environmental justice mandates. The regulatory agencies have actively pursued enforcement of these mandates. It is the communities within the project area, regardless of the population's minority or economic status, who would experience both the economic benefits and risks of the proposed project.