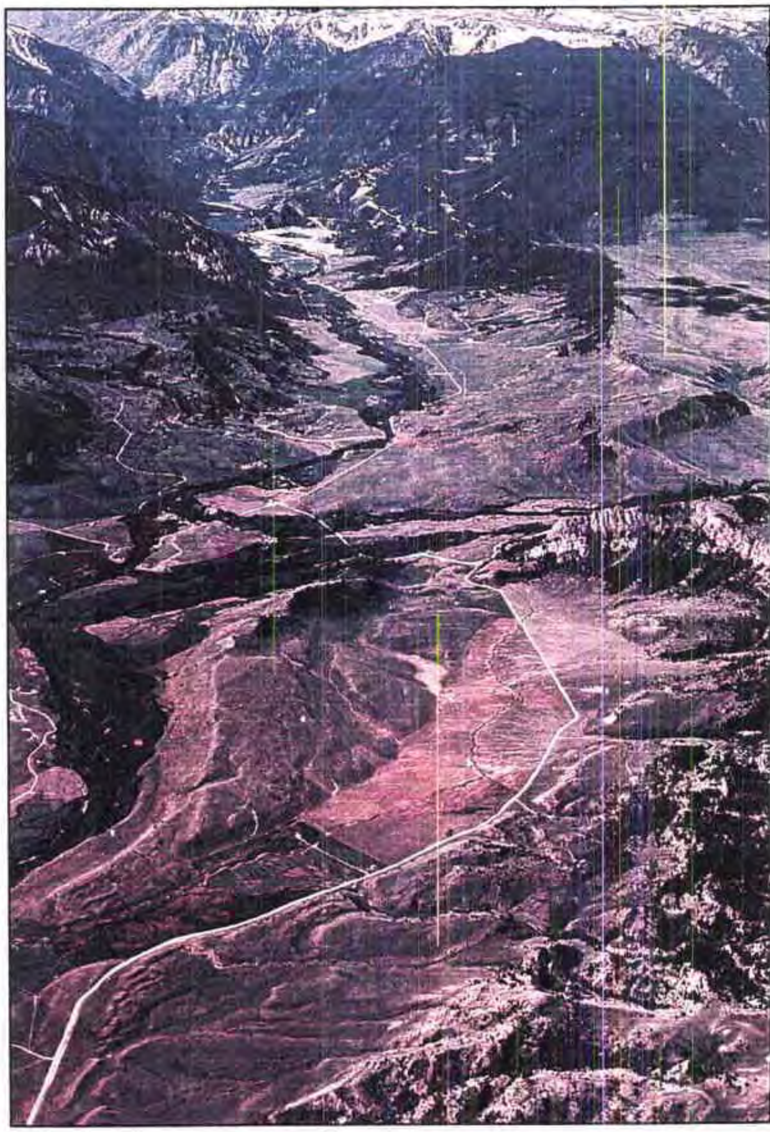
FINAL ENVIRONMENTAL IMPACT STATEMENT

Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment



Prepared by

Montana Department of Environmental Quality
and
U.S.D.A. Forest Service

October 1998

Custer National Forest
1310 Main St.
P.O. Box 50760
Billings, MT 59105

Montana Department of
Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

October 2, 1998

Re: Release of the final Environmental Impact Statement for the Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment

Dear Reader:

The Stillwater Mining Company (SMC) proposed a revision to its operating permit #00118 and approved plan of operations for the Stillwater Mine located outside Nye, Montana, in Stillwater County. The Custer National Forest (CNF) and the Department of Environmental Quality (DEQ) released the draft Environmental Impact Statement (EIS) for the Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment in March 1998. The agencies are now releasing the final EIS for this proposed action. A copy of this document is being sent to you for your review. You may also view the EIS on DEQ's web page at: http://www.deq.mt.us/eis.htm. This EIS covers the proposed revision and revisions to the Stillwater Mine's air quality permit as well as the Forest Service's biological assessment and evaluation for the proposed action.

We appreciate your continued interest in the analysis process concerning the development of this proposed project. Your involvement in the analysis process has aided us in the development of the final EIS. As a result of your input, we have included a more intensive investigation of tailings paste technology, including whole and slimes based paste backfill and landfill. We've expanded our rationale for dismissing the alternatives considered but dismissed, and revisited the issue of property values. Additional mitigations have been identified based on your comments and suggestions. The preferred alternative in the final EIS remains Alternative B, the proposed action.

Our decisions based on the analyses disclosed in the final EIS will be documented in a joint Record of Decision (ROD). Although the state must only wait 15 days before making a decision the Forest Service must wait 30 days from the date of the Federal Register notice on availability of the document, October 9, 1998. Therefore, the ROD should be published and released to the public within approximately one month.

If you have any questions or wish to obtain additional copies of this document, the previously released draft EIS, or summaries of either EIS, please contact the agency staff listed below:

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Sincerely,

Nancy Curriden, Forest Supervisor
Custer National Forest

Sincerely,

Mark Simonich, Director
Montana Department of Environmental Quality

Final Environmental Impact Statement

Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment

October 1998

USDA Forest Service
Custer National Forest

Nancy T. Curriden, Forest Supervisor

Montana Department of
Environmental Quality

Mark Simonich, Director

COVER SHEET

Type of Statement: Final Environmental Impact Statement

Proposed Action: Revision of Stillwater Mining Company's Existing Waste Management Plan and the Construction and Operation of the Hertzler Tailings Impoundment

Lead Agencies: Montana Department of Environmental Quality
USDA Forest Service, Custer National Forest

Abstract: The Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment Final Environmental Impact Statement describes the land, people, and resources potentially affected by the proposed action. The major federal and state action consists of the approval of all necessary permits to construct and operate the revised waste management plan. The proposed project would consist of four primary aspects: the construction and operation of a new tailings impoundment at the former Hertzler Ranch, the construction and operation of pipelines to transport tailings slurry and water between the mine and the Hertzler tailings impoundment, the construction and operation of a new waste rock storage facility, expansion of the Land Application Disposal system, and the removal of the limitation on daily production (currently 2,000 tons per day). The No Action Alternative, Proposed Action Alternative, and two additional action alternatives are analyzed in detail.

For Further Information, Please Contact:

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Preface

An Environmental Impact Statement (EIS) is not usually read like a book, from chapter one to the end. The best way to go about reading an EIS depends on your interests. You may be more interested in effects, whereas others might have more interest in the details of the proposed plan or be more concerned about what opportunities were made available for the public to be involved in the environmental analysis process. Many readers probably just want to know what is being proposed and how it will affect them.

This document follows the format established in the Montana Environmental Policy Act's regulations (ARM 17.4.601 to 17.4.636) and the National Environmental Policy Act's regulations (40 CFR 1500 to 1508). The following paragraphs outline information contained in the chapters and appendices so readers may find the parts of interest without having to read the entire document.

- *Summary:* contains a short, simple discussion to provide the reader and the decision makers with a sketch of the more important aspects of the EIS. The reader can obtain additional, more-detailed information from the actual text of the EIS.

- *Chapter 1 — Purpose and Need:* describes the proposed action, purpose of and need for the proposed action, history of the Stillwater Mine, decisions to be made by the agencies, agencies' roles and responsibilities, MEPA/NEPA process, and other permits required.

- *Chapter 2 — Public Participation, Issue Identification, and Alternative Development:* describes SMC's Proposed Action, the significant issues associated with the Proposed Action, and alternatives to that action, including the no action alternative. Action alternatives that at least partially meet the purpose and need were developed by the agencies in response to one or more of the key issues. Alternatives considered but dropped from detailed consideration are identified along with the rationale for not including them in the analysis. Reasonably foreseeable activities near the proposed project are identified. This chapter also provides a comparative analysis of the environmental effects of the primary alternatives to provide a clear basis of choice among options for the decision maker and public. The lead agencies' preferred alternative is identified.

- *Chapter 3 — Affected Environment:* describes the present condition of the environment that would be affected by implementation of the proposed action or any action alternative.

- *Chapter 4 — Environmental Consequences:* describes the probable direct, indirect, and cumulative effects to the human environment that would result from implementing the Proposed Action or alternatives. The discussion also addresses short-term uses versus long-term productivity, unavoidable impacts, and irreversible or irretrievable impacts. Resources without significant effects or issues are not discussed.
- *Chapter 5 — Consultation with Others:* identifies the agencies, companies, and organizations consulted as well as the cooperating agencies.
- *Chapter 6 — Preparers and Contributors:* identifies the people involved in the research, writing, and internal review of the draft EIS.
- *Chapter 7 — Distribution and Review of the Draft EIS:* lists the agencies, organizations, and individuals who received a copy of the draft EIS.
- *Chapter 8 — Glossary:* describes the technical terms, abbreviations, and acronyms used in the draft EIS.
- *Chapter 9 — References Cited:* lists the references cited in the draft EIS.
- *Index:* contains cross references and identifies the pages where key topics can be found.
- *Appendices:* contain technical and non-technical information that is important to full comprehension of the MEPA/NEPA analysis, but was too long to be included in the primary chapters.

Acronyms and Abbreviations used in this EIS

ABC	Anoxic Biotreatment Cell
ADT	Average Daily Traffic
APE	Area of Potential Effect
AQG	Ambient Air Quality Guidelines
AUM	Animal Unit Month
BACT	Best Available Control Technology
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CNF	Custer National Forest
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
DEQ	Montana Department of Environmental Quality
DHES	Montana Department of Health and Environmental Services
DNRC	Montana Department of Natural Resources and Conservation
DSL	Montana Department of State Lands
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impacts
gpm	Gallons per Minute
HDPE	High-density Polyethelene
KOP	Key Observation Point
LAD	Land Application Disposal
LOS	Level of Service
MDFWP	Montana Department of Fish, Wildlife, and Parks
MEPA	Montana Environmental Policy Act
MPDES	Montana Pollutant Discharge Elimination System
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
PM_{10}	Respirable Particulate Matter less than 10 microns in aerodynamic diameter
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
ppm	Parts per Million
PSD	Prevention of Significant Deterioration
ROD	Record of Decision

SHPO	State Historic Preservation Office
TDS	Total Dissolved Solids
tpd	tons per day
tpy	tons per year
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VQO	Visual Quality Objective

Summary — Stillwater Mine Revised Waste Management Plan Draft Environmental Impact Statement

Introduction

The Montana Department of Environmental Quality (DEQ) and the USDA Forest Service, Custer National Forest (CNF) served as joint lead agencies for the preparation of an Environmental Impact Statement (EIS) in response to a proposal filed by Stillwater Mining Company to amend its operating permit (#00118). This Executive Summary summarizes the draft EIS.

The proposed amendment, which SMC submitted on April 29, 1996, requests authorization to make specific changes to SMC's mine waste management operation at the Stillwater Mine. The specific changes include:

- constructing and operating a new tailings impoundment on the Hertzler Ranch, which is about 7.8 miles northeast of the mine site;
- installing a system of pipelines along Stillwater County roads 419 and 420 connecting the new tailings impoundment to the mine's mill and tailing reclaim circuit;
- expanding the waste rock storage areas on the east side of the Stillwater River across from the mine;
- relocating the Land Application Disposal system (LAD) from its current location on the east side of the Stillwater River near the mine site to both the Stratton Ranch (1.5 miles northeast of the mine along Stillwater County Road 419) and the Hertzler Ranch; and
- removing the 2,000 tons per day (tpd) restriction on processing ore. (Having no restrictions on processing allows SMC to expand its processing of ore to match the capabilities of mining and milling equipment. The average rate is expected to be around 3,000 tpd, but it may peak as high as 5,000 tpd occasionally.)

These facilities would allow SMC to continue mining platinum group metals for about 30 more years. The Proposed Action would involve private lands owned by SMC, public rights-of-way administered by Stillwater County, and National Forest System lands administered by CNF. The sites are located in Stillwater County, approximately 35 miles southwest of Columbus, Montana (**Figure S–1**).

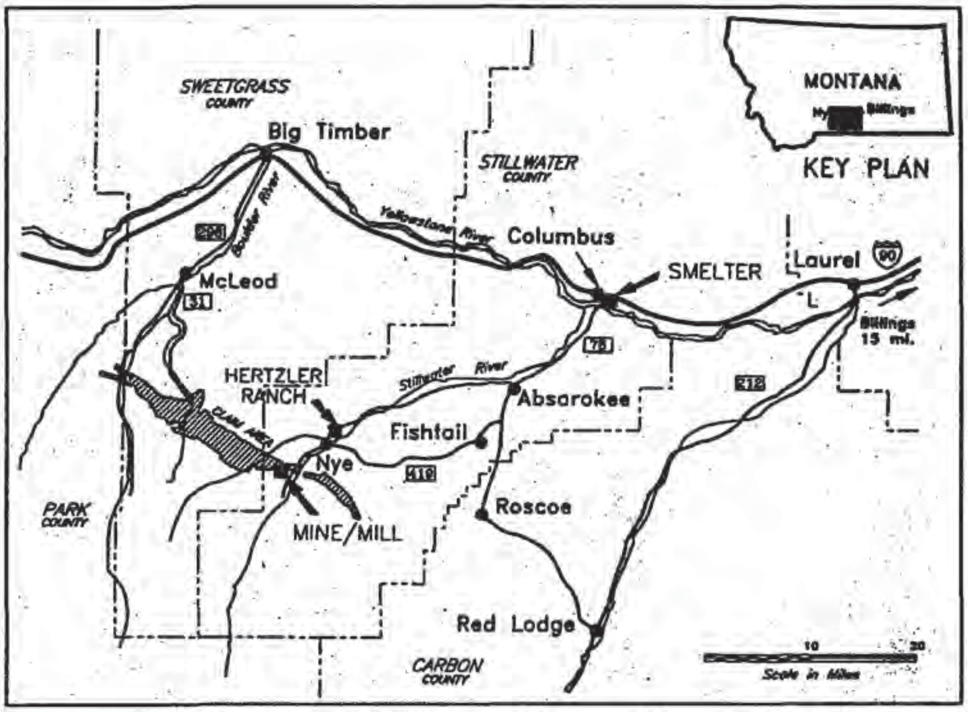


Figure S–1 Location of Stillwater Mine and Hertzler Ranch

This EIS was prepared to analyze and document the potential environmental consequences that may result from implementing the Proposed action or one of the alternatives. The EIS was prepared in accordance with the Montana Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA) and the respective laws and regulations of the State of Montana and the USDA Forest Service.

MEPA contains the procedures that govern the decision-making process on state and private lands in Montana. If any action taken by a state agency may "significantly affect the quality of the human environment", this law requires the preparation of an EIS. NEPA governs the decision-making process for federal agencies. Some of the affected lands for this project are administered by the CNF and the Forest Supervisor will use the EIS for compliance with NEPA's rules and regulations.

Purpose and Need

The purpose of SMC's Proposed Action is to permit a flexible and integrated waste management plan providing for long-term management of the disposal of tailings, waste rock, and other wastes generated by the Stillwater Mine. SMC needs to implement the Proposed Action because its current tailings impoundment will reach capacity in 2003. The Proposed Action would increase SMC's capacity for storing tailings and waste rock by almost 15 million tons and 17.5 million tons, respectively, and would allow the Stillwater Mine to operate for about another 30 years at an average production rate of 3,000 tons per day or as long as 50 years at an average production rate of 2,000 tons per day. The Proposed Action would also give SMC some flexibility in its operations it does not have currently.

History of the Project

SMC operates an underground platinum/palladium mine in Stillwater County, Montana (**Figure S–1**). Current permits allow SMC to produce ore at an average rate of 730,000 tons per year (tpy) or 2,000 tpd. At the mine's mill, SMC upgrades the ore by crushing, grinding, floating, and drying to a concentrate. This concentrate is then shipped by truck to a smelter and base metal refinery (BMR) in Columbus, Montana, for further upgrading. From the BMR, SMC ships the BMR product to Belgium for final refining.

SMC's original plan of operations was approved after completion of a Final Environmental Impact Statement (final EIS) in 1985. The current proposal, if approved, would be the tenth amendment to the original plan of operations and permit. The previous amendments are:

001 — Approved and permitted June 30, 1986. This amendment relocated mine and mill facilities. No increase in permit area or disturbed area resulted.

002 — Approved and permitted September 8, 1986. This amendment allowed excavation of a sand borrow area in the existing permit area. The disturbed area has been reclaimed.

003 — Approved and permitted January 8, 1987. This amendment allowed excavation of a second sand borrow area within the permit area and the disturbance has been reclaimed.

004 — Approved and permitted February 24, 1987. This amendment relocated the southern portion of the tailings impoundment toe dike to higher ground along Mountain View Creek on previously-disturbed land within the permit area.

005 — Approved and permitted March 2, 1989. This amendment was the first major amendment since the original permit was issued. It increased the permit area to 1,158 acres and permitted mining on the east side of the Stillwater River. The total allowable disturbance was increased by 72 acres.

006 — Approved and permitted July 21, 1989. This amendment allowed construction of a temporary sand slurry pipeline connecting the east and west sides of the mine area. No increase in permit area or disturbed area resulted.

007 — Approved and permitted November 15, 1990. This amendment allowed construction of the three Stillwater Valley Ranch percolation ponds and four monitoring wells. The permit area was increased 27 acres. The total allowable disturbance was increased by 7 acres.

008 — Approved and permitted on September 23, 1992. This amendment allowed production to increase from 1,000 tpd to 2,000 tpd. It also approved some expansion of support facilities, such as waste dumps, the mill, and the tailings impoundment.

009 — Approved and permitted February 28, 1996. This amendment allowed the construction of an underground connection between the east and west mining areas. No increase in permit area or disturbed area resulted.

Additionally, a minor amendment was approved to relocate the 5900 adit southward onto private land in order to reduce the visual effects due to development. The permit area was increased 48 acres and the total allowable disturbance was increased by 2 acres.

Currently, the total permit area is 1,340 acres and 255 acres are permitted for disturbance. However, only 120 acres have been disturbed by mining and exploration.

Decisions to be Made

The Director of the DEQ and the Supervisor of the CNF must make a decision on SMC's request to amend its permit. This decision will be documented in a Record of Decision (ROD). The process will lead to one of the following possible decisions:

1) approval of the proposed action amending the existing permit/plan of operations,

2) approval of an agency alternative to the proposed amendment,

3) approval of either the Proposed Action or an agency alternative subject to identified mitigation measures, or

4) denial of the proposed amendment (DEQ) or request for revision (CNF).

- DEQ can deny the proposed amendment. The authority for denial originates from the Montana Metal Mine Reclamation Act (MMRA) and Montana's water quality and air quality statutes. In addition, since 1982 DEQ and the courts have interpreted the Montana Environmental Policy Act (MEPA) as supplementing the basis upon which an operating permit under MMRA can be conditioned or denied. This means that DEQ may also deny or modify the mine operating permit under MMRA in order to avoid or mitigate an impact that would significantly degrade the human environment. The operator then has the option of revising the plan.

- The Forest Service is not granted the authority to deny a Plan of Operation or an amendment to a Plan of Operation (36 CFR 228, Sub-Part A). This finding is based on numerous court cases. If a proposed Plan of Operation or amendment to a Plan of Operation (amendment) is found to conflict with regulation, policy, or federal law, the Forest Service must notify the Operator or Claimant that a revision of the proposed Plan of Operation or amendment is required. The Operator or Claimant then has the option to either modify the Plan of Operation or amendment and resubmit it for approval or withdraw the Plan of Operation or amendment.

The proposal or an agency alternative, if approved, must comply with all applicable federal and state air and water quality laws and regulations.

Agencies' Roles and Responsibilities

The DEQ and Forest Service are the lead agencies for this Environmental Impact Statement (EIS). As discussed above, the Director of the DEQ and the Supervisor of the CNF are the officials responsible for making a decision on SMC's proposed amendment. A December 11, 1989, Memorandum of Understanding (MOU) between the State of Montana and the USDA Forest Service provides for the preparation of joint environmental analyses and the sharing of information, personnel, and funds.

MEPA/NEPA Process, including Tiering

NEPA and MEPA are Federal and State laws that direct the CNF and DEQ, respectively, to disclose the effects of proposed activities on Federal and State lands to the public and officials making decisions concerning the proposal.

The NEPA/MEPA process began when SMC proposed to amend its current operating permit/plan of operations. The agencies sought public input to help identify environmental issues and concerns through the process called "scoping."

Scoping activities for this project included mailing a scoping document to parties interested in or potentially affected by the proposal, holding a public meeting in Absarokee, Montana, on September 24, 1996, and receiving the public's responses.

In addition to public scoping, the agencies reviewed SMC's proposal for "completeness." The purpose of this review was to ensure the information contained in the proposal is adequate to complete the agencies' environmental analysis under MMRA and to identify additional information needed to complete an environmental analysis under MEPA. The environmental analysis phase of the NEPA/MEPA process began after the proposal was declared "complete" on January 28, 1997.

The regulations implementing NEPA and MEPA encourage tiering in EISs. Tiering is the process of referencing information presented in other previously-prepared NEPA/MEPA documents, such as EISs, to minimize repetition. This EIS is specifically tiered to the documents identified in the following section.

Identification of Related Environmental Documents

Several EISs have been prepared for the Stillwater Mine. They include the EIS prepared for the original operating permit/plan of operations and EISs prepared in support of amendments to that permit/plan of operations. The EIS summarized here was specifically tiered to the following environmental documents:

- Final Environmental Impact Statement, Stillwater Project, Stillwater County, Montana. Prepared by the Montana Department of State Lands and USDA Forest Service, Custer National Forest in 1985.
- Preliminary Environmental Review/Environmental Assessment (PER/EA), Stillwater Project East Side Adit Development. Prepared by the Montana Department of State Lands and USDA Forest Service, Custer National Forest in 1989.
- Final Environmental Impact Statement, Stillwater Mine Expansion 2000 TPD, Application to Amend Plan of Operations and Permit No. 00118. Prepared by the Montana Department of State Lands, Montana Department of Health and Environmental Services, and USDA Forest Service in 1992.
- Final Environmental Impact Statement for the Stillwater Mining Company Underground Valley Crossing and Mine Plan. Application to Amend Plan of Operations, Permit No. 00118. Prepared by the Montana Department of Environmental Quality in 1996.

Public Participation

Scoping

The DEQ and the Forest Service consider public participation a crucial component in defining the scope of the environmental analyses presented in this EIS. The agencies first informed the public of SMC's proposal by mailing the project's Scoping Document to the public in August, 1996. News articles about SMC's proposal appeared in local and regional newspapers during the first week of September, 1996. A Notice of Intent to prepare an EIS was published in the Federal Register on September 19, 1996. A public scoping meeting was hosted by the DEQ and the Forest Service in Absarokee on September 24, 1996. Public field trips were hosted by SMC on November 14 and 15, 1996. Since that time, two newsletters have been distributed to the agencies' mailing lists. The first, in March, 1997, summarized the scoping process and identified the issues that had been defined in response to the public comments received. The second newsletter was issued in September, 1997, and it provided information on the process of preparing the EIS.

DEQ and CNF reviewed and analyzed the comments they received during the scoping process. Public response to SMC's proposal included 52 letters and about 20 phone calls. Additionally, six people visited the Beartooth Ranger District's office in Red Lodge.

The agencies' process for identifying issues involved three overall steps. First, specific comments were arranged into groups of common concerns. Next, a primary issue statement was prepared for each group of comments. Finally, the issue statements were evaluated for applicability to this MEPA/NEPA analysis.

The analysis of comments initially identified 11 issues. Nine of these 11 issues were identified as key or significant issues. These issues were used to define the scope of the MEPA/NEPA analysis. Nine key issues were used to analyze environmental effects, prescribe mitigation measures, or both. Issues are "significant or key" because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict. The determination of an issue's significance is different than and separate from any determination of the significance of an environmental consequence.

Review of Draft EIS

The draft EIS was available for public review and comment from March 20, 1998, through May 19, 1998. DEQ and CNF encouraged reviewers to submit written comments on the document during this period. In addition, DEQ and CNF held a public open house and hearing on the draft EIS on April 28, 1998, to answer questions and provide the public with the opportunity to submit written and verbal comments in person.

Reviewers of the draft EIS submitted a variety of comments. Most of the comments were contained in 45 letters. However, eleven individuals provided verbal comments at the public hearing. Overall, the comments focused on the nine issues identified in the draft EIS (Section 2.2.1) and the MEPA/NEPA process. Appendix B contains a summary of the comments received on the draft EIS, and DEQ and CNF's responses to those comments.

The greatest number of comments focused on a wide range of water resources concerns. The main topic of concern centered around tailings paste technology. As a result of these and other comments raised on the draft EIS, additional information was added throughout the EIS. Additionally, 11 mitigations have been added as well as several new appendices.

Issue Statements for Key Issues

Issue statements have been developed from comments from the public and agencies to provide an understandable and measurable estimate of potential environmental consequences likely to occur if the Proposed Action or an alternative was permitted and implemented. The intent of the following issue statements is to clearly identify biological, physical, social, and economic resources that might be affected if one of the alternatives analyzed in the EIS is permitted and implemented.

Water Quality and Quantity

Implementation of SMC's proposed plans for long-term waste management might change the existing water quality and quantity around the existing and proposed new waste management facilities. These changes could result from proposed increases in the development of the sub-surface ore body. The current sediment load, chemical constituency, and function of area waters might be affected by construction and operation of the pipeline system adjacent to the Stillwater River, increased Land Application Disposal for waste water nitrates, pipeline construction crossing the West Fork of the Stillwater River, and construction and operation of the new tailings impoundment about 7.8 miles north of the current mine.

In response to these concerns, environmental effects will be estimated through analysis of sediment loads and water chemistry changes, past experiences and monitoring results collected since the mine began operating, and professional interpretation of site-specific conditions. Potential environmental consequences will be estimated for both surface and sub-surface water in the potentially-affected areas.

Wildlife

Mule deer populations in the Stillwater Valley have declined significantly since 1991. The number of fawns born during the spring of 1996 state-wide was the lowest on record, suggesting further declines are imminent. The area surrounding the proposed waste rock storage facility and tailings impoundment currently serves as important winter and spring range for mule deer. "Some mule deer within this seasonal population spend summers in Yellowstone National Park. Therefore, this mule deer population could have national significance" (Montana Department of Fish, Wildlife, and Parks, September 17 1996 letter to Randy Herzberg, Custer National Forest). Thus, potential effects to mule deer due to implementation of the Proposed Action are a concern.

To a lesser degree, the changes proposed by SMC might affect white-tailed deer and mountain lions that occupy the project area, the area between and including the existing mine, and the proposed impoundment site. The project area may also contain threatened, endangered, sensitive, or management indicator species.

Effects to wildlife will be estimated through identification of the type and location of existing wildlife uses within the potentially-affected habitats. Site-specific data collection, modeling, and professional interpretation also will be used.

Fisheries

SMC proposes to construct and operate 7.8 miles of pipeline adjacent to the Stillwater River and across the West Fork of the Stillwater River. The proposed tailings impoundment would be approximately 0.25 mile linear distance from the Stillwater River. The down-gradient distance from the tailings impoundment to the Stillwater River would be approximately 0.5 mile. Concerns related to the introduction of sediment and chemicals have been identified by the public. Currently, water from the Stillwater River provides high-quality habitat for trout in both the Stillwater and Yellowstone rivers.

Effects on fish will be estimated on the basis of data contained in the water quality and quantity section of the EIS and professional interpretation of site-specific conditions.

Air Quality

Air surrounding SMC's proposed tailings impoundment location currently is clean with low levels of particulates and odors. Particulate monitoring (PM10) in the area of SMC's mining facilities south of Nye has not indicated any infraction of state air quality standards. Implementation of SMC's proposed impoundment and waste rock storage will increase the amount of ground disturbance and traffic in the project area, which might also increase PM10 in the project area.

Environmental effects will be estimated through comparison of existing air quality conditions with conditions predicted for the different alternatives.

Social/Economics

Many of the residents in the area adjacent to SMC's existing and proposed facilities have been drawn there because of the "high quality of life" afforded individuals in this mountainous setting. These individuals perceive the area to have a rural, quiet, non-industrial, and unhurried pace. Implementation of this project might change social and economic factors associated with this "high quality of life." For example, increased numbers of people might be hired and choose to live in the area. Increased demands to Stillwater County infrastructure might result if local populations increase. As a result, residents might experience a change in property values, taxation, housing costs, and the overall cost of living.

Potential social and economic effects will be estimated by comparison with data from the existing Hardrock Impact Plan.

Tailings Impoundment Stability

SMC proposes to use construction material consisting largely of glacial debris, including boulders, cobbles, sand, gravel, and large amounts of fine clay, to build a new tailings impoundment about 7.8 miles north of existing mine and milling facilities. Many comments received during scoping related to the use of this material for construction of the impoundment.

Site-specific engineering studies and field data will be used to determine the suitability of this glacial material for construction and the risk of failure. Engineers from the Forest Service, DEQ, and the third- party contractor will review construction plans for the proposed action and alternatives for adequacy.

Aesthetics

The area surrounding SMC's proposed impoundment location currently is characterized by substantial modifications for agricultural and other uses. Approval of this proposal might increase traffic, industrial activities, and refuse, as expressed in many scoping comments.

The severity of these impacts will be estimated on the basis of past experience with construction and operation of this type of impoundment.

Transportation

SMC's proposal includes construction of a pipeline corridor with several pipelines along the roads (Stillwater County roads 419 and 420) between the proposed tailings impoundment site near Nye and the existing mine and mill. Implementation of this action might disrupt traffic flow on these roads.

Changes in traffic flow patterns will be determined for each alternative based on data from the Montana Department of Transportation (MDOT).

Reclamation

About 319 acres of additional disturbance would result if SMC's proposal is approved. Although most of this total (251 acres) would involve areas not disturbed by previous activities, some (68 acres) would involve areas disturbed by previous activities (redisturbance), such as chromium mining. Many commentors doubted SMC's ability to reclaim disturbed areas to required levels of stability and utility. Reclamation potential will be determined by comparing soil data, such as productivity, depth, structure, and location with planned disturbance size, slopes, and location. State reclamation standards will be addressed.

Alternatives

The process of developing alternatives to SMC's proposal involved four steps. First, the DEQ and CNF conducted project scoping to identify the key issues of concern. This scoping involved both internal agency and public concerns. It also considered environmental and project-design elements.

The second step consisted of formulating alternatives to the proposal. Each alternative had to at least partially meet the purpose and need for the project. Typically, driving issues are identified that help the agencies define what changes need to be made to avoid, eliminate, reduce, minimize, or mitigate impacts that would result from implementing the Proposed Action. DEQ and CNF had identified water quality and quantity, tailings impoundment stability, and reclamation as the potential driving issues for this EIS. However, as the Proposed Action was analyzed, no significant impacts were identified that could be further reduced by other alternatives, siting locations, or mitigations relative to these issues. Nevertheless, both MEPA and NEPA require a reasonable range of alternatives that meet the purpose and need. DEQ and CNF looked at alternate locations for various facilities, modifying the size and storage capacity of the proposed and existing impoundments, timing of construction, and operational changes. The agencies also considered alternatives that would avoid building an impoundment at the Hertzler Ranch. The four alternatives being considered do show a range of impacts relative to all nine issues.

The third step involved screening the potential alternatives for reasonableness. The MEPA/NEPA process requires that alternatives evaluated in detail be reasonable. The regulations for implementing NEPA provide a discussion of the need for reasonable alternatives in the NEPA process (40 CFR 1500.1(e) and 1502.14). Also, CEQ's 40 Most Asked Questions about NEPA (Question 2a) state, in part, that "reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense..." (CEQ 1981).

Based on this direction, the agencies focused their screening alternatives on technical, environmental, and economic feasibility. Technical considerations included the feasibility of constructing and operating the facilities. Environmental considerations included the potential for significant impacts and the feasibility of successfully mitigating the impacts of the alternative. Economic considerations included potential costs and benefits of implementing the alternative.

Finally, unreasonable alternatives were dropped from detailed consideration. If an alternative did not pass the technical, environmental, and economic screening for feasibility, it was not considered any further in the analysis.

Several alternatives were considered in this MEPA/NEPA analysis. They include a No Action alternative, SMC's Proposed Action, two modifications of SMC's Proposed Action, and a variety of alternatives considered but dropped from detailed evaluation. Each of these alternatives is briefly described below.

Alternative A — No Action

The No Action alternative is defined as the Stillwater Mining operation as currently permitted by DEQ and CNF (Permit #00118). This alternative was included to define the existing baseline conditions for comparison with the other alternatives considered in this analysis. Thus, this alternative reflects the existing conditions of the Stillwater Mine. Selection of this alternative would mean no additional changes would be allowed at this time at the Stillwater Mine, beyond those already permitted by DEQ and CNF through previous permitting processes and decisions. Previous analyses and decisions were documented in the 1985, 1992, and 1996 final EISs and their associated Records of Decision and the 1989 Environmental Assessment and its associated Decision Notice.

Implementation of this alternative would not meet the purpose of and need for the project. For example, under this alternative, SMC's need for additional capacity for storage of tailings necessary for production to continue beyond 2003 would not be met. Also, the operational flexibility and long-term planning sought by SMC in managing wastes would not be met. Although the No Action alternative would not meet the purpose of and need for the project, its inclusion in the analysis is required by MEPA (ARM 17.4.601 to 17.4.636) and NEPA (40 CFR 1502.14(d)).

Alternative B — Proposed Action

SMC's proposal to change its mine waste management operation includes plans for waste rock and tailings production, management, and disposal as well as water management and disposal. The proposed changes are summarized below. **Figure S–2** shows the overall locations of the primary facilities comprising the Proposed Action alternative. The application to amend Hard Rock Operating Permit #00118 (SMC 1996) contains detailed discussions of these aspects and facilities.

In addition to changing SMC's mine waste management operation, implementation of the Proposed Action would remove the limitation on daily production (currently 2,000 tpd). If selected, SMC's Hard Rock Operating Permit (#0118) would be based on an approved "footprint" of surface disturbance, not a rate of production. SMC would be able to alter daily levels of production to respond to changing conditions in the market. The amendment discusses levels of production ranging up to 5,000 tpd. The proposed amendment (Proposed Action) and all information related to this EIS are on file with the DEQ and CNF (Beartooth District Office) for public review.

Waste Rock Production and Management

Currently, SMC is permitted to store waste rock in four areas. They are the embankment of the existing tailings impoundment, a temporary storage area above the tailings impoundment, a permanent storage area near the west mine portal, and a permanent visual screening berm on the east side of the Stillwater River. SMC proposes to expand the visual berm on the east side of the river (which was previously permitted but not yet constructed) into a permanent east side storage site for storage of an additional 17.5 million tons. The storage site would be constructed in three stages and would occupy about 80 acres. The facilities currently occupying this site would be relocated. The LAD irrigators would be relocated to Stratton and Hertzler Ranch sites (this is discussed under Water Management). Soil stockpiles, sedimentation/percolation ponds, and water monitoring facilities would be relocated. Additional monitoring wells would be added, as needed.

Tailings Management

To provide for additional capacity for tailings, SMC would construct a new impoundment at the former Hertzler Ranch. SMC would operate the new tailings impoundment in concert with the existing impoundment to maximize operational flexibility. The Hertzler impoundment would occupy about 163 acres and be able to store approximately 15 million tons of tailings. The embankment would be constructed in three stages several years apart.

Tailings would be pumped to the Hertzler impoundment through two buried 7.8-mile long pipelines. Both pipelines would be double walled, constructed of 8-inch steel pipe lined with an inner sleeve of HDPE. The pipelines would be located in the rights-of-way for Stillwater County roads 419 and 420. Additionally, process water would be reclaimed from the impoundment and returned to the mill via another pipeline within the same right-of-way. Where possible, SMC proposes to bury the pipelines below the frost line. However, in some instances where the pipeline may not be buried below the frost line, such as within the roadway, SMC will insulate the pipeline to prevent freezing using the same technology currently being used on Alaskan pipelines.

Water Management and Disposal

As discussed under the No Action alternative, SMC handles two primary waste water streams at the Stillwater Mine. One stream is adit water, which is groundwater intercepted by the mine workings. The second stream is process and tailings water, which is the water used in the milling and concentrating circuits and pumping of the tailings. Under this alternative, SMC would continue to handle the water in these waste water streams differently.

Adit water from the mine workings is discharged at over 1,000 gallons per minute (gpm). SMC treats, and would continue to treat, the adit water before it uses or disposes of it. Treatment is primarily by clarification to remove fine particulates. Following treatment, the water would be used for irrigating reclaimed areas, crop and pasture land; stabilizing soils; controlling dust; and adding to the mill process as make-up water. During the winter, excess water is disposed of in sedimentation/percolation ponds. During the growing season, SMC would use an LAD system to irrigate agricultural and reclaimed lands.

SMC proposes to add LAD systems at Stratton and Hertzler Ranches. A pipeline buried with the tailings pipelines would transport the adit water to these sites. A new LAD storage pond, which could contain up to 80 million gallons of water, would be constructed at Hertzler Ranch. During the winter, excess adit water would be routed to percolation ponds and the LAD storage pond.

Tailings/process water includes water used within the milling and concentrating circuits, which contains low levels of reagents from the milling process. Although the reagents pose no hazard to human health or the environment, SMC handles the water containing these reagents separately from adit water. Process waters can also be used to slurry tailings to the Hertzler impoundment. In the tailings impoundments, water is either evaporated or reclaimed and pumped back to the mill for reuse.

To facilitate reclaiming tailings water, SMC would construct a reclaimed water pipeline between the mill and the Hertzler tailings impoundment. This 10-inch steel pipeline would be constructed and buried in the same rights-of-way as the tailings slurry pipelines. The pipeline would return tailings water from the Hertzler impoundment back to a process water head tank above the concentrator for reuse in the milling and flotation circuits.

Removal of Production Limit

In 1992, SMC received approval for an amendment to their Plan of Operations and Permit No. 00118 (DSL, DHES, and Forest Service 1992). That permit amendment allowed SMC to increase production to a maximum level of 2,000 tpd or 730,000 tpy. SMC now proposes to have that limit on production removed. The permit would be based on an approved "footprint" of surface disturbance, not a rate of production. SMC would be able to alter daily levels of production to respond to changing conditions in the market, as described under the Proposed Action.

Roads and Traffic

SMC does not propose any modifications to existing or previously-approved permit-related roads. Stillwater County roads 419 and 420 may be upgraded to allow for installation of the buried pipelines within their rights-of-way. SMC would negotiate an agreement with Stillwater County for these upgrades. The agreement would constitute an amendment to SMC's Hardrock Impact Plan for Stillwater County.

Workforce

Projections suggest that implementation of the Proposed Action would increase employment at the mine to approximately 700 workers. Forty to 45 percent of the additional workers (some combination of permanent employees and contractors) are expected to be local residents. This increase would trigger a revision to SMC's Hardrock Impact Plan.

Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Under this alternative, SMC would expand the existing tailings impoundment and construct a new impoundment at Hertzler Ranch. SMC also would then later construct a waste rock storage facility on the east side of the Stillwater River and develop additional facilities for LAD. A system of pipelines would be constructed to transport tailings and reclaim water. Pipelines would be constructed in the rights of way of Stillwater County roads 419 and 420 for a distance of 7.8 miles. The pipelines would carry slurried tailings water and adit water from the mill and mine to the Hertzler tailings impoundment and the land application system, respectively. Other pipelines would carry reclaim water back to the mill. The LAD system would include four center pivot irrigators at Hertzler Ranch and two irrigators at Stratton Ranch. **Figure S–3** shows the distribution of the primary facilities comprising this alternative. The primary facilities are described below.

Implementation of this alternative would result in a smaller impoundment at Hertzler Ranch than would be constructed under the Proposed Action (Alternative B). This smaller impoundment would be 29 feet shorter than the Proposed Action's impoundment and less visible. Finally, the areal extent of surface disturbance would involve about 129 acres, 34 acres less than what would be involved under the Proposed Action.

Selection and implementation of this alternative also would remove the limitation on daily production (currently at 2,000 tpd). The permit would be based on an approved "footprint" of surface disturbance, not a rate of production. SMC would be able to alter daily levels of production to respond to changing conditions in the market, as described under the Proposed Action.

Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Under this alternative, SMC would expand the existing tailings impoundment and construct a new impoundment on the east side of the Stillwater River. SMC also would develop additional facilities for LAD at Stratton Ranch. Pipelines to transport tailings water, adit water and reclaim water would be suspended across the river or attached to the bridge. Pipelines would be constructed to carry adit water to the Stratton Ranch for LAD as described in the Proposed Action. **Figure S–3** shows the distribution of the primary facilities comprising this alternative. The primary facilities are described below.

This alternative would not fully meet the purpose of and need for the project. It would only allow the placement of 15.9 million tons of waste rock and 13.3 million tons of tailings. Furthermore, the life of the project would be shortened from 30 years to 23 years.

Implementation of this alternative would result in no development at Hertzler Ranch. All new facilities would be concentrated in the general vicinity of the

Stillwater Mine and Stratton Ranch. This alternative would eliminate concerns about the facilities at Hertzler Ranch, including effects on the local aesthetics, surface water, groundwater, aquatic resources, and property values.

Selection and implementation of this alternative also would remove the limitation on daily production (currently at 2,000 tpd). The permit would be based on an approved "footprint" of surface disturbance, not a rate of production. SMC would be able to alter daily levels of production to respond to changing conditions in the market, as described under the Proposed Action.

Agency Mitigations

DEQ and CNF's decisions on the previous environmental analyses (1985 through 1996) required SMC to implement a variety of mitigation measures. Many of these measures are ongoing or annual requirements. Consequently, SMC must continue to implement them, regardless of the decision made on this analysis. A summary of the mitigation measures required in the previous decisions is included as **Appendix C**.

Through the analysis of environmental consequences, DEQ and CNF identified additional mitigation measures relative to this proposed action or the action alternatives discussed in this EIS. These measures are:

1) The agencies would require testing and monitoring of the permeability of the clay liner or compacted base on which the HDPE liner would be placed. If this testing showed that the material does not meet the minimum permeability requirement of 1x10-6 cm/sec, then additional clay material would need to be brought in to reduce the permeability. The actual cost of obtaining this material would vary depending upon how much material was needed and how far it had to be hauled to get to the site, because this affects the cost of purchasing the material and the amount of work involved in transporting the material to and placing the material at the site. SMC could also investigate other options of achieving the desired permeability. There are too many variables to determine what this cost might entail. If the monitoring showed that required permeabilities were obtained, SMC would noot incur costs for obtaining the additional clay material. No less restrictive method of protecting ground water has been identified.

2) SMC would be required to monitor ground water at the Hertzler Ranch to determine effects of seepage from the impoundment. The agencies would require an additional mitigation measure based on the results of the ground water monitoring. If ground water monitoring at the Hertzler Ranch indicated that nitrates or other

contaminants were migrating at concentrations that would cause increases above the trigger level in the Stillwater River, SMC would be required to conduct biological monitoring of periphyton and macroinvertebrates above and below the site twice a year. This mitigation measure, if implemented, would require SMC pay for additional monitoring and testing. This type of monitoring and testing costs approximately $30,000 per year. The number of years of testing required would depend upon when ground water monitoring indicated biological monitoring was necessary. The additional monitoring would be required to comply with both MMRA and the Montana Clean Water Act.

3) If monitoring at Hertzler Ranch showed that groundwater quality exceeded nondegradation standards outside of the mixing zone then SMC would be required to identify, collect baseline data prior to construction of the pipeline and Hertzler impoundment from, and monitor nearby down-gradient residential wells that could potentially be affected by seepage from the Hertzler impoundment. SMC would be required to pay for the collection and testing of water samples. Typical collection and laboratory costs for a single sample range between $35.00 and $330.00 for nitrates and a full range of the constituents specified in SMC's ground water monitoring plan respectively. The total cost would depend upon the number of wells being sampled. This sampling would ensure that down-gradient water users would be identified and help determine if their water supplies became contaminated as a result of the Hertzler impoundment. If that occurred, then SMC would provide replacement water sources as required under MMRA. No less restrictive means of ensuring long term compliance is available.

4) SMC would be required to purchase a 250 kW backup generator to ensure pipeline leak detection sensor function and operation during power failures or partial power outages. This would cost SMC approximately $50,000 to purchase and $32.00 per hour to operate; it would take about 4 hours of pumping to vacate the tailings pipeline. However, if a power outage resulted in undetected leaks or ruptures of the pipeline, the cost of fines, penalties, and repairs could potentially exceed that amount. SMC proposes to construct an underground water storage reservoir at the 6400 foot level, however, it may not be constructed immediately and it would take time for it to fill up with enough water to provide sufficient volume to flush the pipelines by gravity feed alone. There may also be times during mine life when there was insufficient volume of water in the storage reservoir. Therefore, there is no less restrictive means of ensuring that the pipelines could be flushed in the event of a rupture during a

power failure although a smaller generator would be sufficient to supply enough power to keep the leak detection system function.

5) If, after 2 years, agency review of pipeline monitoring data resulted in a decision to continue the monitoring of the tailings pipelines every six months and the water pipelines annually, there would be a continuing cost of monitoring the pipelines more frequently than SMC might want to specify. If the agency determined that pipeline monitoring frequency could be reduced, costs to SMC would be reduced slightly. No less restrictive means of ensuring pipeline failure does not occur has been identified.

6) SMC, DEQ, and CNF would re-evaluate paste technology applicability for use at the Stillwater Mine after 5 years of operations. There would be some costs for engineering studies. If the evaluation resulted in implementation of paste technology, there might be increases in construction and operational costs over more traditional mining and waste storage methods proposed under Alternative B. Those costs cannot be estimated at this time. No less restrictive means of providing a denser, and thus potentially smaller impoundment, which also retains less water and can be reclaimed in a shorter period of time has been identified. However, DEQ will make this evaluation again when paste technology is re-evaluated.

7) SMC would be required to work with the Stillwater Valley Bighorn Management Committee to explore options for mitigating indirect impacts to bighorn sheep. The company's main involvement would be attending meetings, developing mitigations, and implementing those mitigations. SMC currently works with the committee as required in their operating permit so no additional costs would be incurred for attending the meetings. No costs of mitigation implementation can be determined at this time because the plans have not be developed; the costs are not expected to be substantial. Furthermore, whether less restrictive means are available will be evaluated before a mitigation is imposed.

8) The agencies would require SMC to replace creeping meadow foxtail with a more palatable native species in the reclamation seed mix for the LADs. There would be virtually no difference in costs to SMC for implementing this mitigation measure.

9) SMC currently has a dust abatement program for the existing impoundment. As mitigation, the agencies would require that program be extended to the Hertzler or east side impoundments, depending upon the alternative implemented. The dust abatement program would be implemented whenever one of the impoundments

was not in use as well as when both were inactive. This mitigation would result in a slight increase in operating costs to keep both surfaces wet. This mitigation would be required under the air quality permit to comply with the Montana Air Quality Act.

10) During final design development of the Hertzler tailings impoundment, SMC would be required to conduct stability modeling and analyses on the Colorado Shale Unit for deep foundation failures. The agencies would also require that a professional engineering geologist or geotechnical engineer would observe the excavation of the Hertzler Ranch impoundment foundation and borrow areas to determine if any geomorphological features were exposed that would indicate ancient mass failure. If such features were observed or if the modeling indicated a potential for mass failure, then SMC would be required to develop a plan for a detailed bedrock drilling program and analysis. The plan would be subject to agency review and approval prior to implementation. Necessary changes to the design of the impoundment would be developed, reviewed and approved by the agencies, and implemented to resolve any problems identified by the drilling and bedrock analysis. There would be a slight increased cost for running the additional stability modeling during final design ($2,000 to $5,000). Since SMC typically has a professional engineer on hand during construction for quality control purposes, there would be no additional cost for the engineer to look for signs of mass failure. The costs associated with drilling and bedrock analysis and any resulting engineering designs and construction changes cannot be determined at this time. This mitigation would confirm that the shale bedrock and glacial till had not been affected by past mass movement and that the glacial till would provide a suitable foundation for the impoundment. This requirement would be required under MMRA and no less restrictive means of ensuring that the impoundment would not be subject to mass failure has been identified.

11) The agencies would require SMC to develop incentives for employee carpooling. This requirement is based on the need for minimizing the potential for accidents on road segments in need of resurfacing. Incentives could have varying costs to SMC depending upon what SMC included in their plan and how many employees take advantage of the incentives. These costs cannot be estimated at this time. This analysis of restriction would be reevaluated when a plan is submitted to the agencies. The need for this stipulation may be eliminated through the Hard Rock Impact Plan.

12) The agencies would require SMC to extend the first lift of the proposed Hertzler tailings impoundment to the full footprint so that the outer slopes can be reclaimed once and not redisturbed during

construction of the second lift. This could increase construction costs of the embankment of the first lift by approximately $1.2 million, but it would eliminate the need to reclaim that portion of the embankment a second time under alternatives B and C (there would be no impoundment at Hertzler Ranch under Alternative D). The cost for stage two would be reduced by $1.2 and so there would be no net increase in cost of constructing the impoundment Interim revegetation of the first left as planned under Alternative B would mitigate visual impacts and provide for slope stabilization, but the slope would be redisturbed when the second lift was constructed and require revegetation for a second time. There are no other ways to provide for final revegetation of the outer slope of the first lift and eliminate redisturbance of the slope. SMC could investigate modifying the final design so that there is no net increase in volume of borrow needed to build the first lift out to the final footprint, it is anticipated that this would reduce the height of the first lift which would be made upp in the second lift; this could reduce the up front capital needed to construct the first lift. This mitigation is more restrictive than that proposed under Alternative B.

13) SMC specified in its revision application that the outer slopes of the Hertzler impoundment and east side waste rock storage site would be reclaimed with a mosaic of vegetation and rock. SMC did not specify how long the soiled and vegetated slopes would be. The agencies would require a mitigation measure to specify that revegetated slopes would not exceed 150 feet in length before being intercepted by a rocky zone. This rocky zone or armor would be placed asymmetrically across the slope. This would not result in any additional costs to SMC and is an extension of a mitigation for the existing required under the 1992 ROD on the 2,000 tpd EIS. This mitigation would be necessary to ensure successful reclamation of these slopes, to reduce erosion, and comply with MMRA.

14) SMC would be required to have a professional archeologist present during construction of the pipeline and the embankments for the first lift of the Hertzler impoundment when construction of these facilities approaches identified and potential cultural sites. The archeologist would be responsible for identifying any cultural material that might be exposed during construction. This would result in additional costs of paying for those services. Current rates for a professional archeologist range between $25.00 and $50.00 an hour; SMC would also need to cover lodging and meals for the person hired for this purpose. The total cost would depend upon on how long construction took and on any needed mitigations. This restriction would be required to comply with the various federal laws pertaining to cultural,

historic, and archeological resources. No less restrictive means of protecting archeological resources has been identified.

Alternatives Considered But Eliminated

Several potential alternatives were considered for this analysis, but were dropped from detailed study for various reasons. The alternatives are listed below along with the main reason they were excluded from further consideration.

Eighteen Tailings Facilities Sites First Identified in 1985

Most of these sites were eliminated due to the same geotechnical or hydrogeological concerns identified during the 1985 evaluation. Although three were reevaluated during this analysis, they also were eliminated for the reasons indicated below:

➢ Tailings Impoundment at Stratton Ranch. Much of the area is geotechnically unstable and shallow groundwater is present.

➢ Tailings Impoundment at Beartooth Ranch in conjunction with an East Side Tailings Impoundment. This option had serious environmental concerns associated with it and too many technical challenges.

➢ Tailings Impoundment at Horseman Flats in conjunction with an East Stillwater Tailings Impoundment. The primary concern with the Horseman Flats site is associated with the risk involved in pumping the tailings long distances under high pressure. The potential for accidental discharge of tailings is very likely over the operational life of the facility.

Another five potential alternatives were identified as part of this analysis, but were eliminated as described below.

➢ Tailings impoundment in the Nye Creek drainage. Compared to the other alternatives available, technical, environmental, and economical concerns rendered this alternative unreasonable. The accessibility to the site during winter would be restricted and any closure of the access road would prohibit operational access to the tailings impoundment and water reclaim system. To develop the required impoundment capacity, the required dam would be almost twice as high as required at either the Beartooth or Horseman Flats sites. This increases the risk of failure and the consequences of a failure. The potential for accidental discharge of tailings from the tailings transport pipeline also would be very likely over the operational life of the facility.

- Dispose of tailings in the abandoned Benbow Mine. This alternative was determined to be unreasonable because implementation would be technically unfeasible. This alternative would require pumping tailings from the Stillwater Mine up the Nye Creek drainage and over the 8,800-foot high drainage divide, a vertical gain in elevation of more than 3,500 feet. the pipeline would have to be placed on the surface rather than be buried. During the course of operation, there would be a high probability that at some point, the pipeline would fail resulting in discharge of tailings to the environment. At this time, it is unknown if there is sufficient volume to dispose of the tailings in existing underground mine workings because the extent and condition of the underground workings is undefined.

- Convert the tailings to paste and landfill or backfill the paste (slimes or whole tailings paste). The agencies determined implementation of total tailings paste backfill and landfill at the Stillwater Mine is not reasonable at this time. This technology has only recently been implemented in a full-scale, operational mode in other underground mines and critical issues remain unresolved. Implementation of a total tailings paste backfill system also would not eliminate the need for additional aboveground storage for tailings. Construction of an overall paste backfill system would generate a comparatively large amount of new disturbances. Finally, the addition of the paste backfill system would require a substantial financial investment.

- Use of a thicker or second liner at the Hertzler Tailings Impoundment. No substantive decrease in the potential for seepage to reach groundwater could be demonstrated.

- Use the centerline method to expand the existing impoundment along with a new impoundment at Hertzler Ranch. The toe of the existing impoundment would be pushed farther into the PMF flood plain, which was not acceptable to the agencies.

Affected Environment

The project area is in Stillwater County, Montana, in the upper reaches of the Stillwater River valley. The surrounding area is mountainous, relatively sparsely populated and noted for its scenic beauty and recreational opportunities. The Absaroka-Beartooth Wilderness lies about 1.5 miles south of the project area. Yellowstone National Park lies approximately 25 miles to the south.

Surface water features in the project area are dominated by the Stillwater River. All drainages from project area lands enter the Stillwater River. Surface water quality in the Stillwater River Basin is generally good to excellent, reflecting the relatively undeveloped state of the area. Groundwater resources comprise two major aquifers; the unconsolidated alluvium/alluvial fan deposits of the

Stillwater valley, and the fractured bedrock system. Groundwater in the bedrock is mainly confined to openings, such as joints, faults, and shear zones. Groundwater samples from monitoring wells show the water is generally of good quality.

Thirteen vegetation types, as well as, disturbed lands that are barren have been identified in the project area. They include stony grasslands, sagebrush shrublands, skunkbush shrublands, drainage bottomlands, riparian woodlands, ravine aspen-chokecherry, open forest/meadow understory, open forest/rocky understory, douglas-fir forest, subalpine forest, revegetated chrome mining tailings, cultivated haylands, and disturbed lands.

The Stillwater valley supports a wide variety of wildlife. Three big-game species occur regularly in the project area: mule deer, white-tailed deer, and bighorn sheep. Black bear, mountain lions, and upland game birds also frequent the project area and its surrounding environment. The U.S. Fish and Wildlife Service has identified four threatened or endangered species that may occur in or near the project area. They are the bald eagle, peregrine falcon, grizzly bear, and black-footed ferret. The Stillwater River and the West Fork Stillwater River are considered substantial fishery resources by the Montana Department of Fish, Wildlife, and Parks.

Air quality in the project area is very good. Monitoring stations show the annual average of particulate matter is approximately 25 percent or less than the ambient standard. The major sources of particulate and gaseous emissions consist of mining activities, vehicle traffic (mining and residential), and residential wood burning.

Stillwater County had a civilian labor force in 1996 of 4,135 individuals, with an unemployment rate of about 6.2 percent. The major employer categories in the county (in order of decreasing employment) are mining, retail trade, government, manufacturing, and services. As of December 1997, SMC employed 620 people, or about 16 percent of the Stillwater County labor force. This level of employment represents about a 35 percent increase over the 460-employee level projected in SMC's Amended Hard Rock Impact Plan of 1988. SMC's 1996 property tax liability, including the smelter in Columbus and gross proceeds tax, was approximately $1.8 million. Community services are addressed by SMC's Amended Hard Rock Impact Plan in the jurisdictions of Stillwater County, the town of Columbus, the Absarokee Rural Fire District, and school districts in Absarokee, Columbus, Fishtail, and Nye.

The Woodbine Campground and trailhead are heavily used during the summer and fall months. These facilities are approximately 1.5 miles south of the SMC mine. The lowest elevation access point to the Absaroka-Beartooth Wilderness is located approximately 3.5 miles south of the mine and is a major point of access to the wilderness area.

Twenty-eight cultural resources have been recorded in the project area. Only seven are partially in or near the area of potential effect and only four of these are considered eligible for the National Register of Historic Places.

Summary Comparison of Alternatives and Environmental Consequences

The alternatives considered in detail and the likely environmental consequences of each alternative are summarized in **Table S–1** and **Table S–2**, respectively. The Proposed Action would disturb approximately 251 new acres for mine-related structures in areas previously used for mining and agriculture, the most of any of the alternatives, and Alternative D would disturb the fewest number of acres.

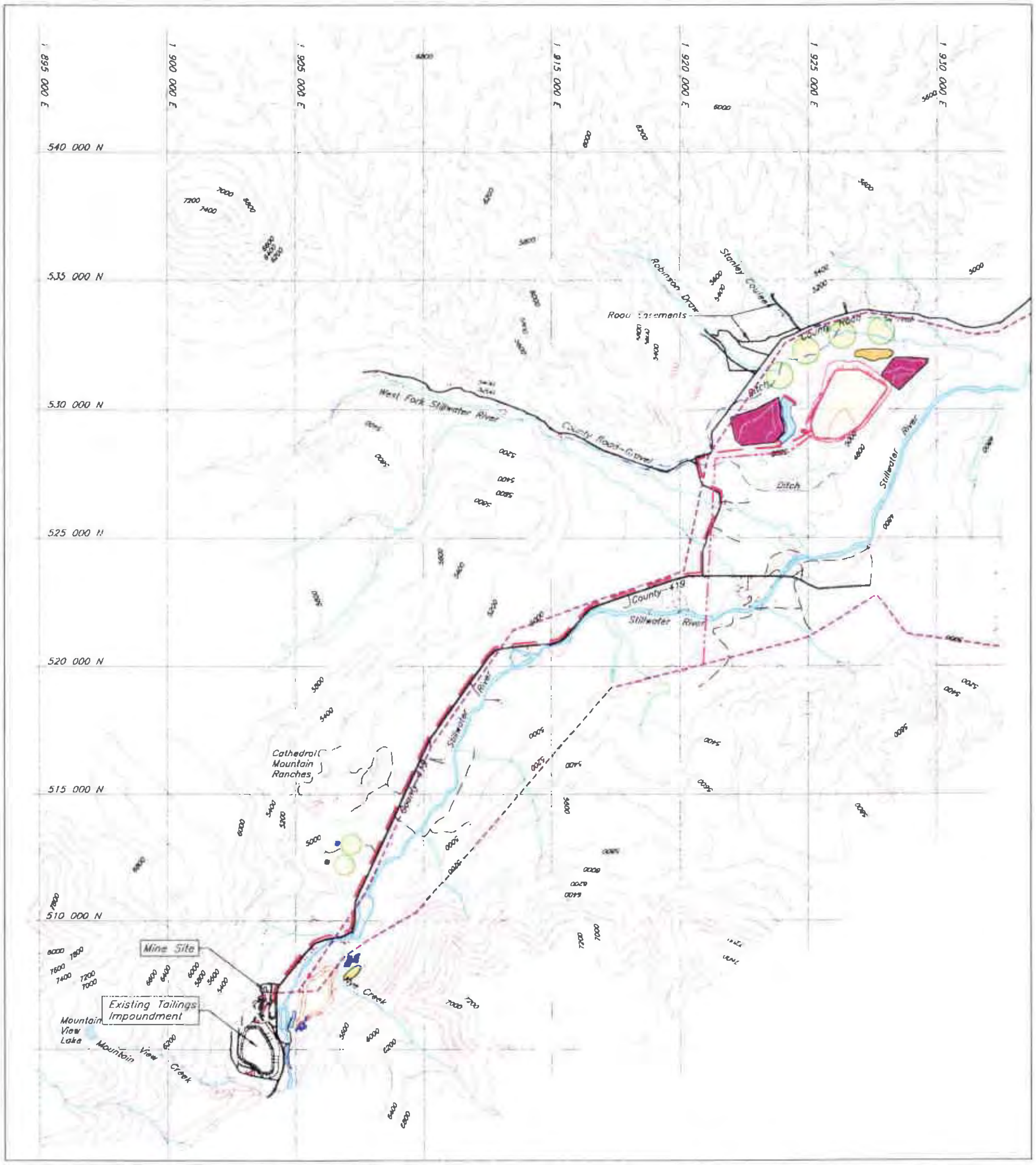
Groundwater quality would be affected by localized increases in nitrates under alternatives B and C, but Alternative D would increase nitrates only at the Stratton Ranch location. Surface water quantities would experience a short-term increase in runoff: the most for Alternative B, less under Alternative C, and least under Alternative D. Surface water quality would experience minor degradation in certain parameters, but no standards would be violated. This situation would be essentially the same for alternatives B and C, but with slightly less effect under Alternative D. Nitrate levels in the Stillwater River would increase similarly under all alternatives, but would not violate any standard. There would be a slight increase in runoff from waste rock from all alternatives. Approximately 1.5 acres of wetlands (Waters of the U.S.) would be affected by the pipeline route under Alternatives B and C, but Alternative D would affect less than one acre because of shorter pipelines. Effects to Waters of the U.S. would be mitigated through in-kind reclamation.

Air quality would experience slight increases in particulate matter, especially during construction phases under all alternatives. Alternative C would have lower dust levels during construction of the smaller impoundment at Hertzler Ranch, and Alternative D would concentrate dust generation at the mine site. Vegetation communities would be changed from the current mixture of native and introduced (agricultural) species to a different community after reclamation . Alterantive B would affect the largest acreage, and Alternative D the least acreage. Wildlife habitat would be affected during the life of the mine, with the greatest acreage affected under Alternative B, and the fewest under Alternative C. Alternatives C and D would also affect about eight acres of bighorn sheep range. Fish reproduction in the Stillwater River could be affected from increases in sedimentation over the short-term. This phenomenon would be the same for alternatives B and C, but slightly less under Alternative D.

Social and economic effects would include approximately 424 new residents, including 34 new school students, 45 new jobs created, and a continuation of tax payments by SMC for an additional 30 years. The socioeconomic effects would be the same for all action alternatives. Visual intrusion by new facilities would not violate visual quality objectives on National Forest system lands. Construction noise would be created at all locations under all action alternatives. Transportation increases from the project would increase the average daily trips on Stillwater County roads 419 and 420 from 803 to 906, regardless of the selected action alternative. Construction of the pipeline corridors would disrupt traffic on the roads in the short-term. Pipeline construction would be similar for alternatives B and C, but greatly reduced under Alternative D. No direct effects would occur to cultural resources, regardless of the action alternative selected.

Preferred Alternative

The agencies' preferred alternative is Alternative B, the Proposed Action, with the variety of mitigations listed in the final EIS. Alternative B would result in the construction of a second tailings impoundment at the Hertzler Ranch site, construction of a 7.8-mile long pipeline corridor along Stillwater County roads 419 and 420 between the mill and the new impoundment, construction of a waste rock storage facility on the east side of the river across from the mill, additional LAD sites at the Stratton and Hertzler ranch sites, and removal of the production cap.



LEGEND

- Proposed Pipeline Alignment
- Approximate Location of Overhead Power Line
- Approximate Location of Proposed Overhead Power Line
- Road
- Land Application Disposal Site
- Borrow Area
- Topsoil Stockpile
- Land Application Disposal Storage Pond
- Waste Rock Storage Area
- Hertzler Tailings Impoundment
- Sediment / Percolation Pond

Stillwater Mine
Revised Waste Management Plan
and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

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SCALE (FT)

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Alternative B
Location of Primary Facilities
Comprising the Proposed Action
Figure S-2

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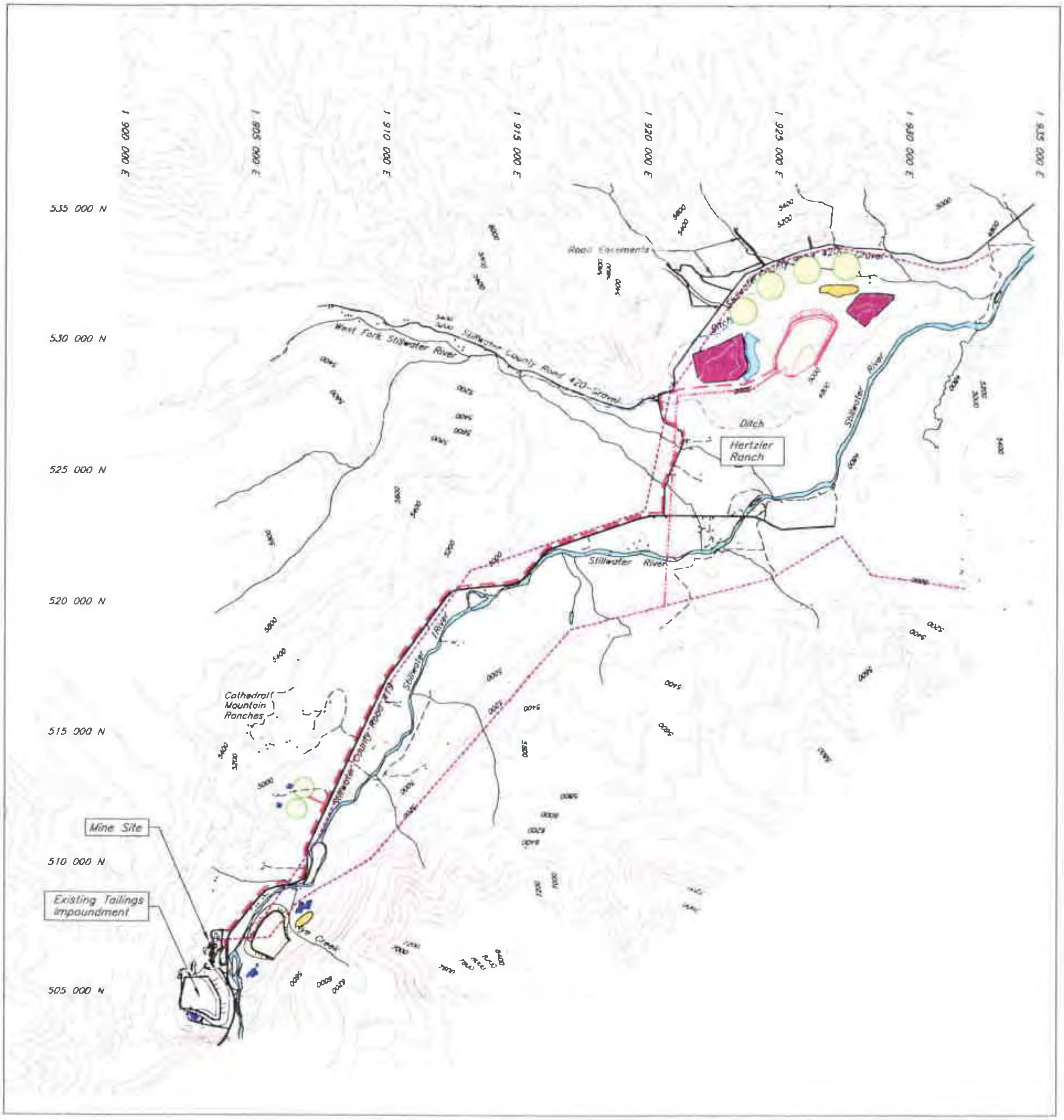

LEGEND

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Stillwater Mine
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TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

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SCALE (FT)

Location of Primary Facilities Comprising Alternative C - Modified Centerline Expansion and Hertzler Tailings Impoundment
Figure S-3

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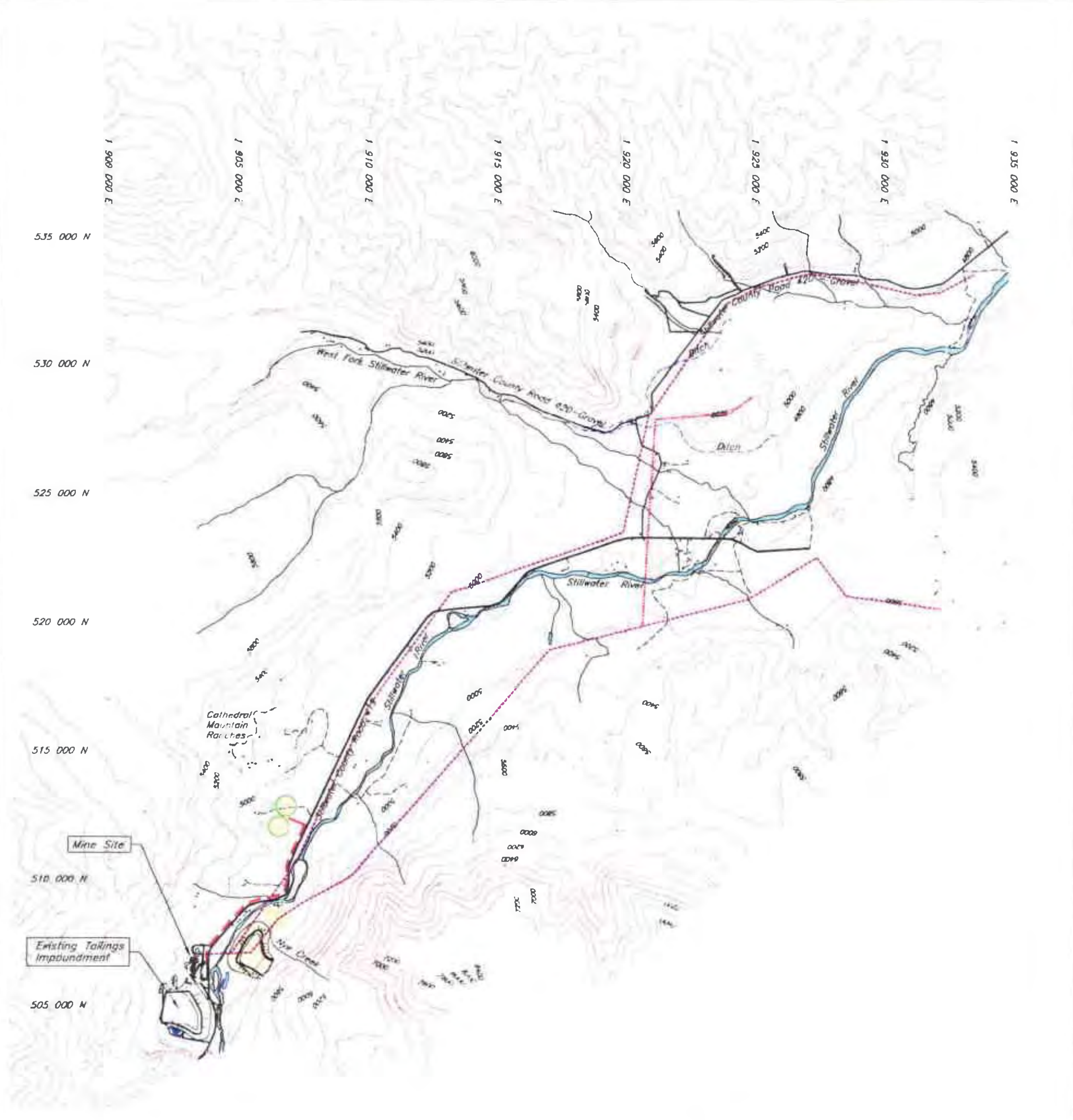

LEGEND

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- Topsoil Stockpile
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- Tailings Impoundment

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and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

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Location of Primary Facilities Comprising Alternative D - Modified Centerline Expansion and East Side Tailings Impoundment
Figure S-4

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Table S–1 Comparison of Alternatives Considered in Detail

Parameter	Alternative A	Alternative B	Alternative C	Alternative D
Waste Rock Production and Management				
Capacity (tons)				
Temp. & Permanent Storage Areas[1]	1,630,000	1,630,000	1,630,000	1,630,000
Completion of Existing Impoundment[1]	1,755,000	1,755,000	1,755,000	1,755,000
Expansion of Existing Impoundment	na[2]	na	2,660,000	2,660,000
East Side Visual Berm[1]	386,000	na	na	na
East Side Storage Site	na	17,886,000	15,226,000	na
East Stillwater Impoundment	na	na	na	9,840,000
Total	3,771,002	21,271,000	21,271,000	15,885,000
Areal Extent of Coverage (acres)				
Temp. & Permanent Storage Areas	18	18	18	18
Complete Existing Impoundment Embankment	15	15	15	15
Expansion of Existing Embankment	na	na	8	8
East Side Visual Berm	12	na	na	na
East Side Storage Site	na	80	80	na
East Stillwater Impoundment	na	na	na	72
Total	45	113	121	113
Tailings Production and Management				
Capacity (tons)				
Existing Impoundment (present day)	1,900,000	1,900,000	1,900,000	1,900,000
Existing Impoundment (additional)	1,600,000	1,600,000	1,600,000	1,600,000
Expansion of Existing Impoundment	na	na	4,850,000	4,850,000
Hertzler Ranch Impoundment	na	15,000,000	10,150,000	na
East Stillwater Impoundment	na	na	na	4,940,000
Total Capacity	3,500,000	18,500,000	18,500,000	13,290,000
Areal Extent of Coverage (acres)				
Existing Impoundment	45	45	45	45
Expansion of Existing Impoundment	na	na	8	8
Hertzler Ranch Impoundment	na	163	129	na
East Stillwater Impoundment	na	na	na	72
Total	45	208	182	125
Final Crest Elevations (feet)				
Existing Impoundment	5,111	5,111	5,175	5,175
Hertzler Ranch Impoundment	na	5,036	5,007	na
East Stillwater Impoundment	na	na	na	5,085
Water Management and Disposal				
LADs (acres)	24	104	104	40
LAD storage ponds (acres)	2	17	17	2
Tailings/Process water	evaporate/reuse	evaporate/reuse	evaporate/reuse	evaporate/reuse
Power Requirements (MW)	12	16	16	16
Roads and Traffic	no change	additional traffic	additional traffic	additional traffic
Workforce (# employees)	655	700	700	700
Monitoring	no change	program would expand	program would expand	program would expand
Reclamation	no change	revise accepted plan	revise accepted plan	revise accepted plan
Currently-permitted disturbance (acres)	255	255	255	255
Existing Non-SMC disturbance[2] (acres)	0	172	172	84
New SMC disturbance (acres)	0	251	217	1
Total disturbance (acres)	255	678	644	340
Bonding	no change	increase	increase	increase

Notes:

1. Placement of waste rock in the temporary and permanent storage areas, embankment to complete the existing tailings impoundment, and east side visual berm has been permitted by DEQ and CNF. No waste rock has been placed in the east side visual berm.. If an alternative with the east side storage site or East Stillwater impoundment is selected, the east side visual berm would not be constructed. Instead, its capacity would be absorbed into the east side storage site or East Stillwater impoundment.
2. Existing non-SMC disturbance includes 80 acres of pastureland at Hertzler Ranch and portions of the east side where chrome tailings were previously deposited. Neither of these locations has a cover of native species.

Table S–2 Summary Comparison of Impacts by Alternative

Issue or Resource	Indicator Units	Alternative: A — No Action	Alternative: B — Proposed Action	Alternative: C — Modified Expansion and Hertzler	Alternative: D — Modified Expansion and East Side Impoundment
Purpose and Need		Does not meet Purpose and Need	Does meet Purpose and Need	Does meet Purpose and Need	Partially meets Purpose and Need
Physical Size	Acres	255	678	644	340
Water Resources	Groundwater Quantity	Aquifers are localized and highly variable. Overall mine discharges may reach 1,061 gpm.	Recharge as much as 2,000 gpm at Stratton and Hertzler Ranch by LAD in summer. Overall mine discharges may reach 1,342 gpm at an average production rate of 3,000 tpd.	Same as B, but effects at Hertzler Ranch delayed.	Recharge only at Stratton Ranch. Overall mine discharges may reach 1,277 gpm at an average production rate of 3,000 tpd.
	Groundwater Quality	Generally good. No change would occur.	Localized increase in nitrates near LADs at Stratton and Hertzler Ranches and the waste rock storage facility (approx. loading of 13.6 lbs/day).	Same as B, but effects at Hertzler Ranch delayed.	Localized increase in nitrates near LADs at Stratton Ranch and east side tailings impoundment. Loading of nitrates from east side tailings impoundment would be less than the 13.6 lbs/day that would occur with waste rock facility.
	Tailings Pollutant From Pipeline Accident	Not applicable.	No long-term effects, but short-term effects from increased sediment would be primarily contained within the borrow ditch.	Same effects as B, but slightly shorter period than B.	Slightly higher risk than B due to exposed pipelines suspended over the Stillwater River.
	Surface Water Quantity	No change.	Small, short-term increase in runoff	Slightly less risk than B	Least runoff
	Surface Water Quality	Good to excellent. No change.	Minor change due to increased water discharges	Same as B	Slightly better than B due to a lower increase in water discharges
	Tailings Pollutant from Impoundment Failure	Only tailings from existing impoundment would possibly reach the river.	Same as A, only tailings from existing impoundment would reach the river if it failed Hertzler is ≥ ½ mile upgradient from Stillwater River.	Greater risk than B because more tailings would possibly reach the river if the modified, existing tailings impoundment failed	Greater risk than B or C. All tailings from two impoundments would reach the river if the impoundments failed

Table S–2 Summary Comparison of Impacts by Alternative, Con't.

Issue or Resource	Indicator Units	Alternative A — No Action	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Water Resources	Nitrates in Stillwater River	No change	Remain below Std. (an increase of 0.02 to 0.05 mg/L)	Same as B	Same as B
	Sedimentation	247 TDS mean adit water and 1,500 TDS mean process water. No change.	Sediment from pipeline construction would be contained within the borrow ditch. Sediment from Hertzler would have to travel about ½ mile to reach the river. No more than small, short-term increases during construction.	Modification of the existing impoundment would occur less than ¼ mile from the river. However, most sediment from this construction should be captured by SMC's stormwater containment system.	Same as C for the existing impoundment. Sediment would be generate from construction of the new impoundment less than ¼ mile from the river. However, most sediment from this construction should be captured by a new stormwater containment system.
	Heavy Metals	Some metals (cadmium, copper, lead, and zinc) have exceeded standards. on one or more occasions (from natural sources). No change.	Same as A.	Same as B.	Same as B.
	Water Wells	No effect.	No effect.	Same as B.	Same as B.
	Waters of the U.S.	None.	1.5 acres affected. Permitted under Nationwide Permits.	Same as B. Permitted under Nationwide Permits.	Less than 1 acre affected. Permitted under Nationwide Permits.

Table S–2 Summary Comparison of Impacts by Alternative, Con't.

Issue or Resource	Indicator Units	Alternative: A — No Action	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Wildlife	General Habitats Affected (acres)	No change from approved.	678 acres	644 — affects at Hertzler delayed up to 10 years.	340
	Winter Range Affected (acres)	No change from approved	678 acres of mule deer winter range affected (255 acres previously-permitted disturbance, 251 acres new disturbance, 68 acres previously disturbed, and 104 acres under LADs). No bighorn sheep habitat directly affected, but potential indirect effects to bighorn sheep from competition for forage from mule deer displacement.	644 acres of mule deer winter range affected (255 acres previously-permitted disturbance, 217 acres new disturbance, 68 acres previously disturbed, and 104 acres under LADs). 8 acres of bighorn sheep habitat directly affected. Same indirect effects to bighorn sheep as B.	340 acres of mule deer winter range affected (255 acres previously-permitted disturbance, 1 acre new disturbance, 60 acres previously disturbed, and 24 acres under LADs). 8 acres of bighorn sheep habitat affected. Same indirect effects to bighorn as B.
	T&E Impacts	No effect.	No effect.	Same as B.	Same as B.
Fisheries	Change in Stream Flow	No change.	No change.	Same as B.	Same as B.
	Increased Sedimentation	No change	No change.	Same as B	Same as B.
	Increased Nutrients	No change	No change	Same as B	Same as B
Air Quality	Criteria Pollutants Above Standards	None. (from 7 percent to 30 percent of NAAQS).	None.	Same as B slightly less dust.	Similar to B, but increased potential for dust with two impoundments in a high-wind area.
Social Economics	Population	No change (7,653 persons in the county).	456 new residents.	Same as B.	Same as B.
	Employment	No change (3,879 persons employed in the county).	45 additional people (a combination of permanent employees and contractors).	Same as B.	Same as B.
	Property Values	Would continue to increase.	Same as A, but some individual properties may loose value	Same as B, but delayed in time at Hertzler.	Similar to B. Any adverse effects are concentrated at the current mine site and new impoundment site.

Table S–2 Summary Comparison of Impacts by Alternative, Con't.

Issue or Resource	Indicator Units	Alternative: A — No Action	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Social Economics	Proximity of Residences to Mine Facilities	22 within 1 mile and 109 within 5 miles of existing impoundment	Same number of residences in proximity to existing impoundment. 33 within 1 mile and 158 within 5 miles of Hertzler	Same as B, but delayed activity at Hertzler.	Same as A, but increased amount of activity at existing mine site.
	New Students	No change (957 students).	34 new elementary students.	Same as B.	Same as B.
Tailings Impoundment Stability	Exceed Safety Factor of 1.0	Yes	Yes	Yes	Yes
	Risk of Failure and Consequences	No change.	Somewhat higher risk than A due because two impoundments would exist. Only failure of existing impoundment could discharge tailings directly into the Stillwater River.	Higher risk than B because existing impoundment would be expanded above the original design elevation. Only failure of existing impoundment could discharge tailings directly into the Stillwater River.	Risk about the same as B because existing impoundment would be expanded above the original design elevation. Failure of existing impoundment and new impoundment could discharge tailings directly into the Stillwater River.
Visual Quality	Meets Visual Quality Objectives for National Forest System lands.	Yes, no change.	Yes	Yes	Yes
Noise	Increased Noise Levels.	Yes, if production increases.	Yes, slightly at new locations.	Less than B, but effects at Hertzler Ranch delayed.	No noise effects at Hertzler, increased noise at mine site and east side, which would affect a larger number of residences because more homes exist around the mine site.
Lights and Lighting	Changes in the amount of lighting.	No change.	Minor additions of shaded lights.	Same as B, but effects at Hertzler Ranch delayed.	No lights at Hertzler Ranch, but increased lights at mine site and east side
Transportation	ADTs on County Road 419.	803	906	Same as B.	Same as B.

Table S–2 Summary Comparison of Impacts by Alternative, Con't.

Issue or Resource	Indicator Units	A — No Action	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Reclamation Potential	Sufficient Topsoil for Reclamation	Yes, 4,000 cubic yards	Yes, 142,500 cubic yards	Same as B, but disturbance delayed up to 10 years.	Cubic yards would be different, source would be the same.
	Suitable Revegetation Plan	Yes	Yes	Same as B.	Same as B.
	Microclimate	High winds drive dust and blast revegetation.	Less winds to affect revegetation at Hertzler.	Same as B, but delayed revegetation due to construction delay.	Same as A, but two impoundments and revegetation efforts would be subject to high winds.
	Vegetation Disturbance (acres)				
	Currently-permitted disturb.	255	255	255	255
	Existing non-SMC disturb.[1]	0	172	172	84
	New SMC Disturbance	0	251	217[2]	1
	Total disturbance	255	678	644	340
Cultural Resources	Sites Affected	None	None	Same as B.	Same as B.

(Alternative: columns A–D)

Note:

1. Existing non-SMC disturbance includes 80 acres of pastureland at Hertzler Ranch and portions of the east side where chrome tailings were previously deposited. Neither of these locations has a cover of native species.
2. Disturbance at Hertzler Ranch would be delayed up to 10 years relative to Alternative B.

Abbreviations in Table:

ADT	Average Daily Trips
APE	Area of Potential Effect
BMP	Best Management Practice
KOP	Key Observation Point
LAD	Land Application Disposal
T&E	Threatened and Endangered Species

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Chapter 1.0 — Purpose and Need

Chapter 1.0 — Purpose and Need

On April 29, 1996, Stillwater Mining Company (SMC) submitted an application to the Montana Department of Environmental Quality (DEQ) and the Custer National Forest (CNF) to amend its operating permit (#00118). In its application, SMC proposes to change its mine waste management operation. The changes include:

- constructing and operating a new tailings impoundment about 7.8 miles northeast of the mine site, which also is 2 miles northeast of Nye, Montana;
- installing a system of pipelines along Stillwater County roads 419 and 420 connecting the new tailings impoundment to the mine's mill and tailing reclaim circuit;
- expanding the waste rock storage area on the east side of the Stillwater River across from the mine;
- relocating the Land Application Disposal system (LAD) from the east side of the Stillwater River to the Stratton Ranch (1.5 miles northeast of the mine along Stillwater County Road 419), Hertzler Ranch, or both; and
- removing the 2,000 tons per day (tpd) restriction on ore production. (Having no restrictions on processing allows SMC to expand its ore production to match the capabilities of mining and milling equipment. The average rate is expected to be around 3,000 tpd, but it may peak as high as 5,000 tpd occasionally.)

The new tailings impoundment would be on the former Hertzler Ranch, which is owned by SMC. The pipelines would be located in the right-of-way of the county roads and the waste rock storage area would be primarily on patented mining claims. With implementation of the amendment, the areal extent of new disturbance created by SMC's activities would increase by 251 acres and the permit area would increase by 1,112 acres. If the amendment is approved, the permit area would encompass a total of 2,452 acres and permitted disturbance would increase from 255 acres to 678 acres.

1.1 Purpose and Need

The purpose of SMC's proposed action is to permit a flexible and integrated waste management plan to provide for the long-term management and disposal of tailings, waste rock, and other wastes generated by the Stillwater Mine. SMC needs to implement the proposed action because its current tailings impoundment will reach its capacity in 2003. The proposed action would increase SMC's capacity for storing tailings and waste rock by almost 15 million tons and 17.5 million tons, respectively, and would allow the Stillwater Mine to operate for about another 30 years at an average production rate of 3,000 tons per day or as long as 50 years at an average production rate of 2,000 tons per day. The proposed action also would give SMC some flexibility in its operations to respond to changing market values for its product, which it does not have currently (this flexibility is discussed in more detail in the description of the Proposed Action Alternative presented in **Chapter 2**).

1.1.1 Supply and Demand for Platinum/Palladium

Platinum and palladium (platinum group metals) are important to industrial and defense technology. Additionally, the United States Government has classified them as *Strategic Metals*. Platinum is used primarily as a catalyst in pollution control devices. Palladium is used primarily in space age electronics micro-circuitry, as a catalyst in the chemical industry, and in dental alloys.

Demand for platinum and palladium is growing. Platinum has a worldwide demand of about 4.7 million troy ounces annually (Engineering and Mining Journal 1996). As the European countries implement the use of automotive catalytic converters, the demand for platinum is expected to increase substantially. Worldwide demand for palladium is about 5.9 million troy ounces annually. The U.S. demand for both metals is about one-half of the total worldwide demand.

Historically, the Republic of South Africa and Russia have supplied the worldwide demand for platinum and palladium. The Stillwater Complex, which is the primary source of platinum group metals (PGM) ore at the Stillwater Mine, holds the only significant primary source of platinum and palladium outside South Africa and Russia. SMC's mining claims extend for more than 27 miles along the Stillwater Complex. As of December 31, 1997, proven and probable reserves of ore at the Stillwater Mine were estimated at almost 18 million tons (Gilbert 1998, pers. comm.). Data also suggest at least another 19 million tons of mineable ore exist at the Stillwater Mine (Gilbert 1998, pers. comm.).

Currently, the Stillwater Mine can supply about five percent of World's annual demand for PGM, but only a portion of the U.S. demand (about 6 percent of the total amount of PGM the U.S. imported in 1997). Sources of the platinum imported during 1997 were South Africa (60 percent), Russia (10 percent), the United Kingdom (10 percent), Germany (5 percent) and other countries (15 percent). Sources of imported palladium in 1997 were Russia (47 percent), South Africa (22 percent), the United Kingdom (10 percent), Belgium (8 percent), and other countries (13 percent). The current political situations in South Africa and Russia and the increasing demand for these strategic metals suggest demand for Stillwater ore may increase.

1.2 History of Project

SMC operates an underground platinum/palladium mine in Stillwater County, Montana (**Figure 1–1**). Current permits allow SMC to produce ore at an average rate of 730,000 tons per year (tpy) or 2,000 tpd. At the mine's mill, SMC upgrades the ore by crushing, grinding, floating, and drying to a concentrate. This concentrate is then shipped by truck to a smelter and base metal refinery (BMR) in Columbus, Montana, for further upgrading. From the BMR, SMC ships the BMR product to Belgium for final refining.

Every 100 tons of ore fed to the mill generates 99 tons of tailings. These tailings are pumped from the mill to an underground sand plant where the sand component is separated from the slimes (the smallest fraction of tailings). About 58 percent of the tailings are used as backfill in mined out stopes. The slimes and whatever sands cannot be used as backfill are pumped to the tailings impoundment. This impoundment was designed to hold 3.5 million tons of tails when lined to the 5111-foot level. At present rates of production, the impoundment will reach its design capacity in 2003.

SMC's original plan of operations was approved after completion of a Final Environmental Impact Statement (final EIS) in 1985. The current proposal, if approved, would be the tenth amendment to the original plan of operations and permit. The previous amendments are:

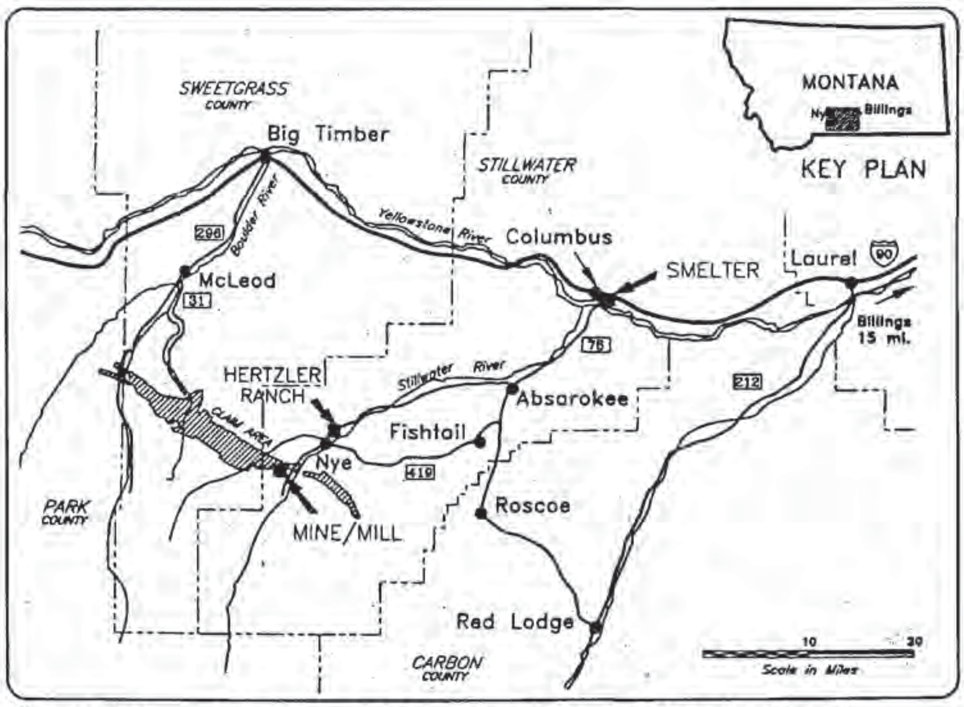


Figure 1–1 Location of Stillwater Mine and Hertzler Ranch

001 — Approved and permitted June 30, 1986. This amendment relocated mine and mill facilities. No increase in permit area or disturbed area resulted.

002 — Approved and permitted September 8, 1986. This amendment allowed excavation of a sand borrow area in the existing permit area. The disturbed area has been reclaimed.

003 — Approved and permitted January 8, 1987. This amendment allowed excavation of a second sand borrow area within the permit area and the disturbance has been reclaimed.

004 — Approved and permitted February 24, 1987. This amendment relocated the southern portion of the tailings impoundment toe dike to higher ground along Mountain View Creek on previously-disturbed land within the permit area.

005 — Approved and permitted March 2, 1989. This amendment was the first major amendment since the original permit was issued. It increased the permit area to 1,158 acres and permitted mining on the east side of the Stillwater River. The total allowable disturbance was increased by 72 acres.

006 — Approved and permitted July 21, 1989. This amendment allowed construction of a temporary sand slurry pipeline connecting the east and west sides of the mine area. No increase in permit area or disturbed area resulted.

007 — Approved and permitted November 15, 1990. This amendment allowed construction of the three Stillwater Valley Ranch percolation ponds and four monitoring wells. The permit area was increased 27 acres. The total allowable disturbance was increased by 7 acres.

008 — Approved and permitted on September 23, 1992. This amendment allowed production to increase from 1,000 tpd to 2,000 tpd. It also approved some expansion of support facilities, such as waste dumps, the mill, and the tailings impoundment.

009 — Approved and permitted February 28, 1996. This amendment allowed the construction of an underground connection between the east and west mining areas. No increase in permit area or disturbed area resulted.

Additionally, a minor amendment was approved to relocate the 5900 adit southward onto private land in order to reduce the visual effects due to development. The permit area was increased 48 acres and the total allowable disturbance was increased by 2 acres.

Currently, the total permit area is 1,340 acres and 255 acres are permitted for disturbance. However, only 120 acres have been disturbed by mining and exploration.

1.3 Decisions to be Made

The Director of the DEQ and the Supervisor of the CNF must make a decision on SMC's request to amend its permit. This decision will be documented in a Record of Decision (ROD). The process will lead to one of the following possible decisions:

1) approval of the proposed action amending the existing permit/plan of operations,

2) approval of an agency alternative to the proposed amendment,

3) approval of either the Proposed Action or an agency alternative subject to identified mitigation measures, or

4) denial of the proposed amendment (DEQ) or request for revision (CNF).

   - DEQ can deny the proposed amendment. The authority for denial originates from the Montana Metal Mine Reclamation Act (MMRA) and Montana's water quality and air quality statutes. In addition, since 1982 DEQ and the courts have interpreted the Montana Environmental Policy Act (MEPA) as supplementing the basis upon which an operating permit under MMRA can be conditioned or denied. This means that DEQ may also deny or modify the mine operating permit under MMRA in order to avoid or mitigate an impact that would significantly degrade the human environment. The operator then has the option of revising the plan.

   - The Forest Service is not granted the authority to deny a Plan of Operation or an amendment to a Plan of Operation (36 CFR 228, Subpart A). This finding is based on numerous court cases. If a proposed Plan of Operation or amendment to a Plan of Operation (amendment) is found to conflict with regulation, policy, or federal law, the Forest Service must notify the operator or claimant that a revision of the proposed Plan of Operation or amendment is required. The operator or claimant then has the option to either modify the Plan of Operation or amendment and resubmit it for approval or withdraw the Plan of Operation or amendment.

The proposal or an agency alternative, if approved, must comply with all applicable federal and state air and water quality laws and regulations.

1.4 Agencies' Roles and Responsibilities

The DEQ and Forest Service are the lead agencies for this Environmental Impact Statement (EIS). As discussed above, the Director of the DEQ and the Supervisor of the CNF are the officials responsible for making a decision on SMC's proposed amendment. A December 11, 1989, Memorandum of Understanding (MOU) between the State of Montana and the USDA Forest Service provides for the preparation of joint environmental analyses and the sharing of information, personnel, and funds. Each agency's role and responsibilities are described below.

1.4.1 Montana Department of Environmental Quality

DEQ oversees mining within the State of Montana. The DEQ's responsibilities originate from several acts and their implementing regulations. They are the Montana Metal Mine Reclamation Act (MMRA), Montana Environmental Policy Act (MEPA), Public Water Supply Act, Air Quality Act, and Water Quality Act (WQA). These are summarized below.

1.4.1.1 Montana Metal Mine Reclamation Act

DEQ administers the MMRA, under which SMC has applied for an amendment to its operating permit (#00118). The MMRA's purpose is to ensure the usefulness, productivity, and scenic values of all lands and surface waters involved in mining and exploration receive the greatest reasonable degree of protection and the lands are reclaimed to beneficial uses. The act and its rules set forth the steps to be taken in the issuance of an operating permit for and the reclamation of the applicant's proposed mine expansion.

A finding that the mining or reclamation plans would violate laws administered by the DEQ would be grounds for DEQ to deny the permit amendment. A permit also may be denied if a person or any firm or business association of which that person was a principal or controlling member has forfeited a bond or failed to reclaim an operation within two years after completion or abandonment of operations on any segment of a permit area, unless otherwise specified by the DEQ. SMC has not forfeited any bonds under the MMRA and has not failed in its reclamation obligations.

The DEQ also determines reclamation bonding under MMRA. Reclamation bonds are determined by computing costs to the State of Montana and CNF for reclaiming a site should the operator default. The State of Montana is required to review the amounts of bonds for all active and permitted mines at least every five years. If a bond is determined to be insufficient, the company is required to submit the additional amount. SMC's current bond for the Stillwater Mine is $3,174,000.

If this amendment is approved, the additional bond would be calculated using the specifications, stipulations, and mitigation measures of the approved amendment. The bond would include such costs as long-term maintenance of management practices, such as percolation ponds and diversion ditches, demolition of buildings and other structures, earth movement and soil replacement, seedbed preparation and revegetation. Bond must be submitted before the proposed amendment could be permitted.

A newly-approved hardrock operating permit or revisions to an approved permit cannot be implemented until several other associated permits and plans have been approved. This includes any new or revised water discharge or air quality permits regulated by DEQ and other permits or approvals required by other state or federal agencies, such as a 404 dredge and fill permit from the U.S. Army Corps of Engineers and a revised Hard Rock Impact Plan that has been approved by the Hard Rock Impact Board and the affected local governments.[1]

1.4.1.2 Montana Environmental Policy Act

Procedures governing state decision-making processes on state, federal, and private lands in Montana are defined in administrative rules implementing MEPA. If any action taken by a state agency may "significantly affect the quality of the human environment," this law requires the preparation of an EIS. The DEQ has determined that an EIS is appropriate for this project. This EIS has several purposes:

- It serves to ensure the agency uses the natural and social sciences and environmental design arts in planning and decision-making;
- It assists in the evaluation of reasonable alternatives and the development of conditions, stipulations, or modifications to be made part of a proposed action;

[1] *The proposed action triggers a revision in SMC's Hard Rock Impact Plan because the proposed employment level of 700 workers would exceed 15 percent of the employment level of 525 workers projected in its 1988 plan amendment.*

- It ensures the fullest appropriate opportunity for public review and comment on proposed actions, including alternatives and planned mitigation; and

- It examines and documents the effects of a proposed action on the quality of the human environment and provides the basis for public review and comment.

1.4.1.3 Water Quality Statutes

The DEQ is responsible for administering several water quality statutes, including the Public Water Supply Act and the WQA. The DEQ also administers several sections of the federal Clean Water Act pursuant to an agreement between the State of Montana and the Environmental Protection Agency (EPA). The State of Montana, through the DEQ, has been delegated authority for administering the Nonpoint Source Pollution Program, National Pollution Discharge Elimination System (NPDES), and Water Quality Standards.

The WQA provides a regulatory framework for protecting, maintaining, and improving the quality of water for beneficial uses. Pursuant to the WQA, the DEQ has developed water quality classifications and standards and a permit system to control discharges into state water. Mining operations must comply with Montana's regulations and standards for surface and ground waters. SMC currently holds a Montana Pollution Discharge Elimination System (MPDES) permit (MT–0024716) for discharge of excess adit water into the Stillwater River. This permit was revised on July 6, 1998 as part of the required 5-year permit review/renewal process.

DEQ also administers two other water-related permits SMC will need to obtain for the proposed project. They include the storm water discharge general permit and short-term exemption from Montana's surface water quality standards (3A authorization). Together, these permits will protect state waters from degradation associated with the construction of components of SMC's proposed project.

1.4.1.4 Air Quality Statutes

DEQ administers the Clean Air Act of Montana. A facility must obtain an air quality permit prior to construction or change in operation unless a permit is not required pursuant to Administrative Rules of Montana (ARM) 17.8.705. The owner or operator of a new or altered source for which an air quality permit is required shall install on the new or altered source the maximum air pollution control capability that is technically practicable and economically feasible, except that Best Available Control Technology (BACT) shall apply. The applicant must also demonstrate that the project would not violate Montana or Federal Ambient Air Quality Standards.

SMC operates the Stillwater Mine under an air quality permit issued by the State of Montana on April 17, 1997 (Air Quality Permit #2459–07). This permit limits SMC's mining and processing of ore to 730,000 tons per year and a maximum of 3,500 tons per day. Currently, SMC has applied for an alteration to its permit that would increase the rate of mining and processing of ore to 1,825,000 tons per year and a maximum of 5,000 tons per day (see **Appendix E**).

1.4.2 USDA Forest Service, Custer National Forest

The CNF administers SMC's current plan of operations, which correlates to the State's operating permit, and any amendments or revisions to the approved plan under the Forest Service's authority to regulate all activities and uses of National Forest System lands. Additionally, the Forest Service's policy is to encourage the exploration, development, and production of mineral resources on National Forest System lands open to mineral entry as directed by Congress via the 1970 Minerals Policy Act. The following sections summarize the primary direction for the CNF's regulation of SMC's Stillwater Mine.

1.4.2.1 Custer National Forest Lands and Resource Management Plan

According to its 1986 Land and Resource Management Plan, the CNF must consider how other resources and impacts from mining would be mitigated to the extent possible through standard operating procedures. Additionally, the CNF can prescribe mitigation measures to the Plan of Operations as necessary to manage key surface resources. Mineral development will not be precluded by these resource concerns within legal constraints. Efforts will be made to avoid or mitigate resource conflicts. If the responsible official determines that conflicts cannot be adequately mitigated, she/he will resolve the conflict in accordance with the management goal and, if necessary, in consultation with affected parties (Forest Service 1986a, page 58).

The area under consideration for SMC's proposal falls within Management Area E, which emphasizes the exploration, development, and production of mineral resources (Forest Service 1986a). The CNF's Land and Resource Management Plan (Forest Plan) did not analyze site-specific actions, such as SMC's current proposal. However, as an integrated management plan, it evaluated various alternatives for managing the Forest as a whole for a 10- to 15-year period. The Record of Decision (ROD) for the Forest Plan clearly states a site-specific project, such as SMC's current proposal, must undergo additional analysis under the National Environmental Policy Act (NEPA). This EIS documents this analysis.

1.4.2.2 Organic Administration Act of 1897

In 1891, Congress granted the President the authority to establish forest reserves (national forests) from the existing public domain lands. In the Organic Administration Act of 1897, Congress designated the purposes for the establishment of national forests and provided for their protection and management. These purposes were to improve and protect the forest within the national forests, or for the purpose of securing favorable water flows, and to furnish a continuous supply of timber for the use and needs of the citizens of the United States. However, it was not the purpose or intent of these provisions to authorize the inclusion of lands more valuable for their minerals or for agricultural purposes than for forest purposes (16 USC § 475). Thus, the Organic Administration Act does not allow the CNF to unreasonably circumscribe or prohibit reasonably necessary activities under the Mining Law of 1872 that are otherwise lawful.

1.4.2.3 36 CFR 228, Subpart A — Locatable Minerals

These regulations set forth the rules and procedures through which use of the surface of National Forest System lands can occur in connection with operations authorized by the United States' mining laws. These laws confer a statutory right to enter public lands to search for minerals. Because the Forest Service must abide by the mining laws, it developed its regulations for locatable minerals to ensure mining-related activities are conducted in a manner that minimizes adverse environmental effects on National Forest System's surface resources.

1.4.2.4 National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA) declares a national environmental policy and promotes consideration of environmental concerns by federal agencies. Procedures and regulations issued by the Council on Environmental Quality (CEQ), as authorized under NEPA, direct implementation of NEPA by federal agencies. The CEQ's regulations are promulgated at 40 CFR Parts 1500–1508. Additionally, the Forest Service's regulations pertaining to implementation of NEPA and CEQ regulations are contained in Chapter 20 of the Forest Service Handbook 1909.15 (Environmental Policy and Procedures). To meet its requirements under NEPA and its Forest Plan, the CNF has prepared this EIS in cooperation with DEQ.

1.5 Permits and Approvals Required from Other Agencies

In addition to approvals by the DEQ and CNF, several additional secondary permits, approvals, and consultations with other federal, state, and local agencies must be obtained before SMC could implement the changes proposed for its mine waste management operation. These additional permits, approvals, and consultations are identified and described in **Table 1–1**.

Table 1–1 Permits, Licenses, and Approvals Required for the Stillwater Amendment

Permit, License, or Approval	Purpose
U.S. Fish and Wildlife Service (UFWS)	
Biological Opinion (Endangered Species Act 50 CFR 402)	To ensure actions taken by federal agencies would not jeopardize the continued existence of threatened and endangered species or result in the destruction or modification of critical habitat. The CNF must consult with the FWS who issues its Biological Opinion following review of a Biological Assessment submitted by the CNF.
USDA Forest Service	
Plan of Operation	To ensure design, operation, closure, monitoring, and bonding of mining operations result in adequate reclamation for post-mining use. Coordinate with DEQ and other appropriate agencies.
U.S. Army Corps of Engineers	
Section 404 Nationwide Permit (Clean Water Act)	To control the discharge of dredged or fill material into waters of the U.S., including wetlands.
Department of Environmental Quality (DEQ)	
401 Certification (Montana Water Quality Act)	To certify that any activity requiring a Federal license or permit that may result in any discharge into State waters would not cause or contribute to a violation of State surface water quality standards.
Montana Pollution Discharge Elimination System (MPDES) Permit	To authorize SMC to discharge water from the Stillwater Mine's adits to the Stillwater River and groundwater adjacent to the Stillwater River. SMC's current MPDES permit (MT–0024716) is in the renewal process.
DEQ Hardrock Mining Permit (Metal Mine Reclamation Act)	To ensure design, operation, closure, monitoring, and bonding of mining operations result in adequate reclamation for post-mining use. Coordinate with the CNF and other appropriate agencies.
Storm Water Discharge General Permit	To prevent the degradation of state waters from pollutants, such as sediment, industrial chemicals or materials, heavy metals, and petroleum products.
Short-term Exemption from Montana's Surface Water Quality Standards (3A Authorization)	To allow for short-term increases in surface water turbidity during construction. Montana Department of Fish, Wildlife, and Parks (MDFWP) is consulted on this authorization.
State Historic Preservation Office	
Historic Resources Consultation (National Historic Preservation Act)	To obtain joint approval by land-managing agencies and concurrence by the State Historic Preservation Office (SHPO) before agency approval; reviewed by the Advisory Council on Historic Preservation
Stillwater County and Hard Rock Impact Board	
Hard Rock Impact Plan	To identify and mitigate future financial impacts in Stillwater County associated with the Stillwater Mine.
Stillwater Conservation District	
310 Permit (Montana Natural Streambed and Land Preservation Act	To protect and preserve streams and rivers in their natural or existing state. Application processed in consultation with the MDFWP.
Stillwater County Road Department	
Application to Perform Construction Work in a Right-of-way	To permit construction of the pipeline along County roads 419 and 420.
Stillwater County Sanitarian	
Floodplain Development Permit	To restrict floodplain areas to uses that will not be seriously damaged or present a hazard to life if flooded.

Note: More information on the permits, licenses, and approvals identified on this table is contained in previous permitting documents, including the 1985, 1992, and 1996 final EISs and the 1989 EA (see **Appendix A** for additional descriptions of these documents).

1.6 MEPA/NEPA Process, including Tiering

The National Environmental Policy Act (NEPA) and Montana Environmental Policy Act (MEPA) are Federal and State laws that direct the CNF and DEQ, respectively, to disclose the effects of proposed activities on Federal and State lands to the public and officials making decisions concerning the proposal.

The NEPA/MEPA process began when SMC proposed to amend its current operating permit/plan of operations. The agencies sought public input to help identify environmental issues and concerns through the process called "scoping." Scoping activities for this project included mailing a scoping document to parties interested in or potentially affected by the proposal, holding a public meeting in Absarokee, Montana, on September 24, 1996, and receiving the public's responses.

In addition to public scoping, the agencies reviewed SMC's proposal for "completeness." The purpose of this review was to ensure the information contained in the proposal is adequate to complete the agencies' environmental analysis under MMRA and to identify additional information needed to complete an environmental analysis under MEPA. The environmental analysis phase of the NEPA/MEPA process began after the proposal was declared "complete" on January 28, 1997.

The regulations implementing NEPA and MEPA encourage tiering in EISs. Tiering is the process of referencing information presented in other previously-prepared NEPA/MEPA documents, such as EISs, to minimize repetition. This EIS is specifically tiered to the documents identified in the following section.

1.6.1 Identification of Related Environmental Documents

Several environmental analyses have been prepared for the Stillwater Mine. They include the EIS prepared for the original operating permit/plan of operations and EISs and an environmental assessment (EA) prepared in support of amendments to that permit/plan of operations. This EIS is specifically tiered to the following environmental documents:

- Final Environmental Impact Statement, Stillwater Project, Stillwater County, Montana. Prepared by the Montana Department of State Lands and USDA Forest Service, Custer National Forest in 1985.
- Preliminary Environmental Review/Environmental Assessment (PER/EA), Stillwater Project East Side Adit Development. Prepared by the Montana

Department of State Lands and USDA Forest Service, Custer National Forest in 1989.

- Final Environmental Impact Statement, Stillwater Mine Expansion 2000 TPD, Application to Amend Plan of Operations and Permit No. 00118. Prepared by the Montana Department of State Lands, Montana Department of Health and Environmental Services, and USDA Forest Service in 1992.
- Final Environmental Impact Statement for the Stillwater Mining Company Underground Valley Crossing and Mine Plan. Application to Amend Plan of Operations, Permit No. 00118. Prepared by the Montana Department of Environmental Quality in 1996.

Appendix A contains a synopsis of each of these four documents. The documents are available for review at DEQ's offices in Helena and the Beartooth Ranger District's office in Red Lodge.

Chapter 2.0 — Public Participation, Issue Identification, and Alternative Development

Chapter 2.0 — Public Participation, Issue Identification, and Alternative Development

This chapter covers five primary topics. First, it describes the process used to obtain the public's concerns and identifies the issues raised by the public. Then, it describes the process used to develop the alternatives considered in this analysis. Third, it describes the project alternatives analyzed in detail. The specific features of these alternatives are fully described. Fourth, it identifies each alternative dropped from detailed consideration and briefly describes the reasoning for the exclusion. Finally, it summarily presents, in comparative form, the components and environmental effects of the alternatives analyzed in detail and identifies the agencies' preferred alternative.

2.1 Public Participation

2.1.1 Scoping

DEQ and CNF consider public participation a crucial component in defining the scope of the environmental analysis presented in this EIS. Consequently, the agencies worked to ensure the public was informed about SMC's proposal and the opportunities available for participating in the environmental process.

The agencies first informed the public of SMC's proposal when they mailed the project's Scoping Document to potentially interested or affected persons on August 27, 1996. This document described SMC's proposal, the agencies' responsibilities, and the permitting and environmental impact analysis process. It also requested scoping comments by October 31, 1996.

After release of the Scoping Document, additional public notices and activities occurred. News articles about SMC's proposal appeared in local and regional newspapers during the week of September 1, 1996. A Notice of Intent to prepare an EIS was published in the Federal Register on September 19, 1996. Subsequently, the DEQ and CNF held a public scoping meeting in Absarokee on September 24, 1996.

As a result of the September 24 scoping meeting, SMC offered to host public field trips to provide information to interested individuals. Two field trips were held on November 14 and 15, 1996. Fifty individuals attended these trips.

Finally, DEQ and CNF have been keeping the public informed of the analysis' status through periodic newsletters. Two newsletters have been distributed to date. The first newsletter, issued in March 1997, summarized the results of public scoping. It also identified the issues DEQ and CNF defined in response to comments received during the scoping period. The second newsletter, issued in September 1997, described the results of DEQ and CNF's selection of the third-party contractor and presented the team responsible for assisting in the preparation of the EIS.

2.1.2 Review of Draft EIS

In mid-March 1998, the draft EIS was distributed to the public. The distribution list included the agencies, companies, organizations, and individuals that had expressed an interest in the project during scoping. It also included several agencies and elected officials to whom DEQ and CNF commonly send EISs.

The draft EIS was available for public review and comment from March 20, 1998, through May 19, 1998. DEQ and CNF encouraged reviewers to submit written comments on the document during this period. In addition, DEQ and CNF held a public open house and hearing on the draft EIS on April 28, 1998, to answer questions and provide the public with the opportunity to submit written and verbal comments in person.

Reviewers of the draft EIS submitted a variety of comments. Most of the comments were contained in 45 letters. However, eleven individuals provided verbal comments at the public hearing. Overall, the comments focused on the nine issues identified in the draft EIS (**Section 2.2.1**) and the MEPA/NEPA process. **Appendix B** contains a summary of the comments received on the draft EIS, and DEQ and CNF's responses to those comments.

Those comments and responses resulted in numerous changes throughout the document. Quite a few of those changes were editorial in nature—spelling errors, making numbers consistent throughout the document, correcting titles or adding missing features on figures, and so on. Additional acronyms were added to the glossary and preface. Chapter 1 had only minor corrections. In Chapter 2, additional information was added to the issues not considered further and the description of reasonable alternatives was provided along with regulatory citations throughout the chapter. A description of an experimental paste backfill that SMC has recently initiated has been included as well as a brief description of SMC's recently renewed MPDES permit and additional information on some proposed facilities such as the pipeline system, power requirements and monitoring are provided. Estimated reclamation bond amounts for each action alternative have been calculated and included. Twelve new agency mitigations are described. The discussion on paste backfill and landfill in the alternatives considered but dismissed section and the rationale for dismissing some alternatives has been expanded. The zoning petition has been added as a project considered not reasonably foreseeable because the agencies do not know what the outcome of the petition would be. **Table 2–4** has been expanded to more fully show the differences between the environmental consequences of implementing alternatives A through D.

In Chapter 3, additional information focused primarily on water resources including precipitation data, flow data for Stillwater River and several springs, surface and ground water quality data, the recently revised MPDES permit, water rights, characteristics of the deposited materials at the Hertzler Ranch. Other changes included better defining civilian labor force numbers, identifying the maximum credible earthquake, and clarifying which cultural sites were in closest proximity to proposed facilities and incorporating the results of SHPO evaluation of identified cultural sites.

The greatest amount of changes in Chapter 4 occurred in Water Resources including analyses relative to MPDES permit limitations (loading rates, mixing zones), clarification on the HELP model, additional modeling of surface and ground water quality impacts (LAD, impoundment and waste rock storage site seepage), impacts on flows, impacts on persons with water rights, and impacts from a potential pipeline rupture. Other changes include a discussion on indirect impacts to bighorn sheep, information on the diffuser for discharging water into the Stillwater River, information regarding the proposed zoning petition, and a new section on regulatory restrictions on the use private property (the applicant's private property).

Several new appendices, in addition to that containing the comments and responses, have been included to provide additional details not included elsewhere. These include a listing of previously permitted mitigation, water balance calculations, the biological evaluation in addition to the biological assessment, and a technical appendix containing information on paste and cost calculations for various alternatives considered as well as those dismissed.

2.2 Issue Identification and Issue Statements

DEQ and CNF reviewed and analyzed the comments they received during the scoping process. Public response to SMC's proposal included 52 letters and about 20 phone calls. Additionally, six people visited the Beartooth Ranger District's office in Red Lodge.

The agencies' process for identifying issues involved three overall steps. First, specific comments were arranged into groups of common concerns. Next, a primary issue statement was prepared for each group of comments. Finally, the issue statements were evaluated for applicability to this MEPA/NEPA analysis.

The analysis of comments initially identified 11 issues. Nine of these 11 issues were identified as key or significant issues. NEPA and MEPA direct agencies to focus the analysis on significant issues and to dismiss nonsignificant issues (40 CFR 1500.4 (b), (c), and (g) and ARM 17.4.615 (2) (b) and (c)). These issues were used to define the scope of this MEPA/NEPA analysis. Nine key issues were used to analyze environmental effects, prescribe mitigation measures, or both. Issues are "significant or key" because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict. The determination of an issue's significance is different than and separate from any determination of the significance of an environmental consequence.

2.2.1 Issue Statements for Key Issues

Issue statements have been developed from public and agency comments to provide an understandable and measurable estimate of potential environmental consequences likely to occur if the Proposed Action or an alternative was permitted and implemented. The intent of the following issue statements is to clearly identify biological, physical, social, and economic resources that might be affected if one of the action alternatives analyzed in this EIS is permitted and implemented.

2.2.1.1 Water Quality and Quantity

Implementation of SMC's proposed plans for long-term waste management might change the existing water quality and quantity around the existing and proposed new waste management facilities. These changes could result from proposed increases in the development of the sub-surface ore body. The current sediment load, chemical constituency, and function of area waters might be affected by construction and operation of the pipeline system adjacent to the Stillwater River, increased Land Application Disposal for waste water nitrates, pipeline construction crossing the West Fork of the Stillwater River, and construction and operation of the new tailings impoundment about 7.8 miles northeast of the current mine.

In response to these concerns, environmental effects will be estimated through analysis of sediment loads and water chemistry changes, past experiences and monitoring results collected since the mine began operating, and professional interpretation of site-specific conditions. Potential environmental consequences will be estimated for both surface and sub-surface water in the potentially-affected areas.

2.2.1.2 Wildlife

Mule deer populations in the Stillwater Valley have declined significantly since 1991. The number of fawns born during the spring of 1996 state-wide was the lowest on record, suggesting further declines are imminent. The area surrounding the proposed waste rock storage facility and tailings impoundment currently serves as important winter and spring range for mule deer. "Some mule deer within this seasonal population spend summers in Yellowstone National Park. Therefore, this mule deer population could have national significance" (Montana Department of Fish, Wildlife, and Parks, September 17, 1996, letter to Randy Herzberg, Custer National Forest). Thus, potential effects to mule deer due to implementation of the Proposed Action are a concern.

To a lesser degree, the changes proposed by SMC might affect white-tailed deer and mountain lions that occupy the project area, the area between and including the existing mine, and the proposed impoundment site. The project area may also contain threatened, endangered, sensitive, or management indicator species.

Effects to wildlife will be estimated through identification of the type and location of existing wildlife uses within the potentially-affected habitats. Site-specific data collection, modeling, and professional interpretation also will be used.

2.2.1.3 Fisheries

SMC proposes to construct and operate 7.8 miles of pipeline adjacent to the Stillwater River and across the West Fork of the Stillwater River. The proposed tailings impoundment would be approximately 0.25 mile linear distance from the Stillwater River; however, the down-gradient distance from the tailings impoundment to the Stillwater River (the route surface or ground water would have to travel to reach the river) would be approximately 0.5 mile. Concerns related to the introduction of sediment and chemicals have been identified by the public. Currently, water from the Stillwater River provides high-quality habitat for trout in both the Stillwater and Yellowstone rivers.

Effects on fish will be estimated on the basis of data contained in the water quality and quantity section of the EIS and professional interpretation of site-specific conditions.

2.2.1.4 Air Quality

Air surrounding SMC's proposed tailings impoundment location currently is clean with low levels of particulates and odors. Particulate monitoring (PM_{10}) in the area of SMC's mining facilities south of Nye has not indicated any infraction of state air quality standards. Implementation of SMC's proposed impoundment and waste rock storage will increase the amount of ground disturbance and traffic in the project area, which might also increase PM_{10} in the project area.

Environmental effects will be estimated through comparison of existing air quality conditions with conditions predicted for the different alternatives.

2.2.1.5 Social/Economics

Many of the residents in the area adjacent to SMC's existing and proposed facilities have been drawn there because of the "high quality of life" afforded individuals in this mountainous setting. These individuals perceive the area to have a rural, quiet, non-industrial, and unhurried pace. Implementation of this project might change social and economic factors associated with this "high quality of life." For example, increased numbers of people might be hired and choose to live in the area. Increased demands to Stillwater County infrastructure might result if local populations increase. As a result, residents might experience a change in property values, taxation, housing costs, and the overall cost of living.

Potential social and economic effects will be estimated by comparison with data from the existing Hardrock Impact Plan.

2.2.1.6 Tailings Impoundment Stability

SMC proposes to use construction material consisting largely of glacial debris, including boulders, cobbles, sand, gravel, and large amounts of fine clay, to build a new tailings impoundment about 7.8 miles northeast of existing mine and milling facilities. Many comments received during scoping related to the use of this material for construction of the impoundment.

Site-specific engineering studies and field data will be used to determine the suitability of this glacial material for construction and the risk of failure. Engineers from the Forest Service, DEQ, and the third- party contractor will review construction plans for the proposed action and alternatives for adequacy.

2.2.1.7 Aesthetics

The area surrounding SMC's proposed impoundment location currently is characterized by substantial modifications for agricultural and other uses. Approval of this proposal might increase traffic, industrial activities, and refuse, as expressed in many scoping comments.

The severity of these impacts will be estimated on the basis of past experience with construction and operation of this type of impoundment.

2.2.1.8 Transportation

SMC's proposal includes construction of a pipeline corridor with several pipelines along the roads (Stillwater County roads 419 and 420) between the proposed tailings impoundment site near Nye and the existing mine and mill. Implementation of this action might disrupt traffic flow on these roads.

Changes in traffic flow patterns will be determined for each alternative based on data from the Montana Department of Transportation (MDOT).

2.2.1.9 Reclamation

About 423 acres of additional disturbance would be added to SMC's currently-permitted disturbance (255 acres), if this proposal is approved. Although most of this total (251 acres) would involve areas not disturbed by previous activities, some (172 acres) would involve areas disturbed by previous activities (redisturbance), such as chromium mining and the previously-interseeded LAD sites. Many commentors doubted SMC's ability to reclaim disturbed areas to required levels of stability and utility. Reclamation potential will be determined by comparing soil data, such as productivity, depth, structure, and location with planned disturbance size, slopes, and location. State reclamation standards will be addressed.

2.2.2 Issues Not Considered Further

Two issues were originally considered by DEQ and CNF, but were dismissed because there were no impacts or only minimal, short-term impacts. These issues are briefly described below, as well as the reason for their dismissal. Because they were dismissed and this document focuses on key issues, these issues are not discussed any further in chapters 3 and 4.

2.2.2.1 Human Health and Safety

Under SMC's proposal, the new tailings impoundment would be operated in conjunction with the existing impoundment. People commenting on the proposed action were concerned about the possible escape of chemical constituents in tailings impoundment waters. They were also concerned about possible negative effects of breathing or coming in contact with such constituents.

Long-term monitoring (1980 to 1997) of air quality for particulate matter, lead and sulfates, has not shown any concentrations of materials considered harmful or injurious to health. Wind-blown dust still can be an irritant on occasion, but generally it is not considered an impact on human health. Additionally, the effects of any of the alternatives would not be significantly different from one another, which is another reason for not carrying the issue through detailed analysis.

Water quality monitoring also has been conducted since 1980. The potential for water quality impacts of tailings escaping is addressed by the quality of the decant water sampled at surface monitoring site SMC–4 at the mill site and by the geochemical characterization of the tailings. These tests indicate the ore body is non-acid generating. The tailings have an acid-base potential of 76 tons of calcium carbonate ($CaCO_3$) per 1000 tons soil, or essentially no potential to form acid (SMC 1997e). Toxicity Characteristic Leaching Procedure (TCLP) tests also show that constituents of the tailings have a low possibility of mobilizing metals and that many constituents are below the detection limits and all constituents of the tailings are at levels below the standards. Finally, the effects of any of the alternatives would not be substantially different from one another, which is another reason for not carrying the issue through detailed analysis.

2.2.2.2 Utilities

Implementation of the proposal may require an additional 12 megawatts of electrical power currently available from Montana Power Company. Development of the proposed impoundment would include a one-mile extension of the existing three-phase power line from a point near the junction of Stillwater County roads 419 and 420. This extension would provide about 500 horsepower for operation of the new impoundment site.

The extension of utilities for the project would have potential effects only where actual powerline extensions would occur (see **Section 2.4.2.4** for a description non-disturbing upgrades of existing power lines). These effects would be construction oriented (short term) and would create minor land use changes. The power demands for the expansion are well within the capabilities of Montana Power Company to provide. Because these potential effects would be similar for all action alternatives and were considered minor, they were not carried through the full analysis.

2.3 Process Used to Develop Alternatives

The process of developing alternatives to SMC's proposal involved four steps. First, the DEQ and CNF conducted project scoping to identify the key issues of concern. This scoping involved both internal agency and public concerns. It also considered environmental and project-design elements.

The second step consisted of formulating alternatives to the proposal. Each alternative had to at least partially meet the purpose and need for the project. Typically, driving issues are identified that help the agencies define what changes need to be made to avoid, eliminate, reduce, minimize, or mitigate impacts that would result from implementing the Proposed Action. DEQ and CNF had identified water quality and quantity, tailings impoundment stability, and reclamation as the potential driving issues for this EIS. However, as the Proposed Action was analyzed, no significant impacts were identified that could be further reduced by other alternatives, siting locations, or mitigations relative to these issues. Nevertheless, both MEPA and NEPA require a reasonable range of alternatives that meet the purpose and need. DEQ and CNF looked at alternate locations for various facilities, modifying the size and storage capacity of the proposed and existing impoundments, timing of construction, and operational changes. The agencies also considered alternatives that would avoid building an impoundment at the Hertzler Ranch. The four alternatives being considered do show a range of impacts relative to all nine issues.

The third step involved screening the potential alternatives for reasonableness. The MEPA/NEPA process requires that alternatives evaluated in detail be reasonable. The regulations for implementing NEPA provide a discussion of the need for reasonable alternatives in the NEPA process (40 CFR 1500.1(e) and 1502.14). Also, CEQ's 40 Most Asked Questions about NEPA (Question 2a) state, in part, that "reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense…" (CEQ 1981).

Based on this direction, the agencies focused their screening alternatives on technical, environmental, and economic feasibility. Technical considerations included the feasibility of constructing and operating the facilities. Environmental considerations included the potential for significant impacts and the feasibility of successfully mitigating the impacts of the alternative. Economic considerations included potential costs and benefits of implementing the alternative.

Finally, unreasonable alternatives were dropped from detailed consideration. If an alternative did not pass the technical, environmental, and economic screening for feasibility, it was not considered any further in the analysis. **Section 2.5** summarizes these alternatives and explains why they were not considered further.

2.4 Alternatives Descriptions

Several alternatives were considered in this MEPA/NEPA analysis. They include a No Action alternative, SMC's Proposed Action, two modifications of SMC's Proposed Action, and a variety of alternatives considered but dropped from detailed evaluation. Each of these alternatives is described below.

The following sections describe the four alternatives evaluated in detail. The descriptions focus on waste rock production and management, tailings production and management, and water management and disposal, as appropriate. All nine key issues are addressed in each of the action alternatives in **Chapter 4**. However, three of these key issues (Water Quality/Quantity, Tailings Impoundment Stability, and Reclamation) were used as the basis of alternative development in order to provide discreet differences in environmental consequences, thereby providing a clear choice for decision makers, as directed by 40 CFR 1502.14 and MEPA (see **Table 2–1**). Since agency mitigations were not incorporated into the alternatives, **Table 2–1** also shows which issues are addressed by one or more agency mitigations.

Table 2–1 Key Issues Addressed by the Alternatives Considered in Detail

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Agency Mitigations
1. Water Quality and Quantity		✓	✓[1]	✓[1]	
2. Wildlife		✓	✓	✓	✓
3. Fisheries		✓	✓	✓	
4. Air Quality		✓	✓	✓	✓
5. Social/Economics		✓	✓	✓	
6. Tailings Impoundment Stability		✓	✓[1]	✓[1]	✓
7. Aesthetics		✓	✓	✓	✓
8. Transportation		✓	✓	✓	✓
9. Reclamation		✓	✓[1]	✓[1]	✓

Notes:
1. This issue was specifically used in the development of this alternative.

2.4.1 Alternative A — No Action

The No Action alternative is defined as the Stillwater Mining operation as currently permitted by DEQ and CNF (Permit #00118). This alternative was included to define the existing baseline conditions for comparison with the other alternatives considered in this analysis. Thus, this alternative reflects the existing conditions of the Stillwater Mine. Selection of this alternative would mean no additional changes would be allowed at this time at the Stillwater Mine, beyond those already permitted by DEQ and CNF through previous permitting processes and decisions. Previous analyses and decisions were documented in the 1985, 1992, and 1996 final EISs and their associated Records of Decision and the 1989 Environmental Assessment and its associated Decision Notice (see **Appendix A** for additional descriptions of these documents). The various mitigations and stipulations required as a result of these agency decisions and approvals are listed in **Appendix C**.

Implementation of this alternative would not meet the purpose of and need for the project as described in **Chapter 1**. For example, under this alternative, SMC's need for additional capacity for storage of tailings necessary for production to continue beyond 2003 would not be met. Also, the operational flexibility and long-term planning sought by SMC in managing wastes would not be met. Although the No Action alternative would not meet the purpose of and need for the project, its inclusion in the analysis is required by MEPA (ARM 17.4.601 to 17.4.636) and NEPA (40 CFR 1502.14(d)).

2.4.1.1 Waste Rock Production and Management

Mining at the Stillwater Mine generates waste rock. The volume of waste rock produced varies from year to year. Largely, the volume generated depends on the amount of development being conducted and the mine's overall economics.

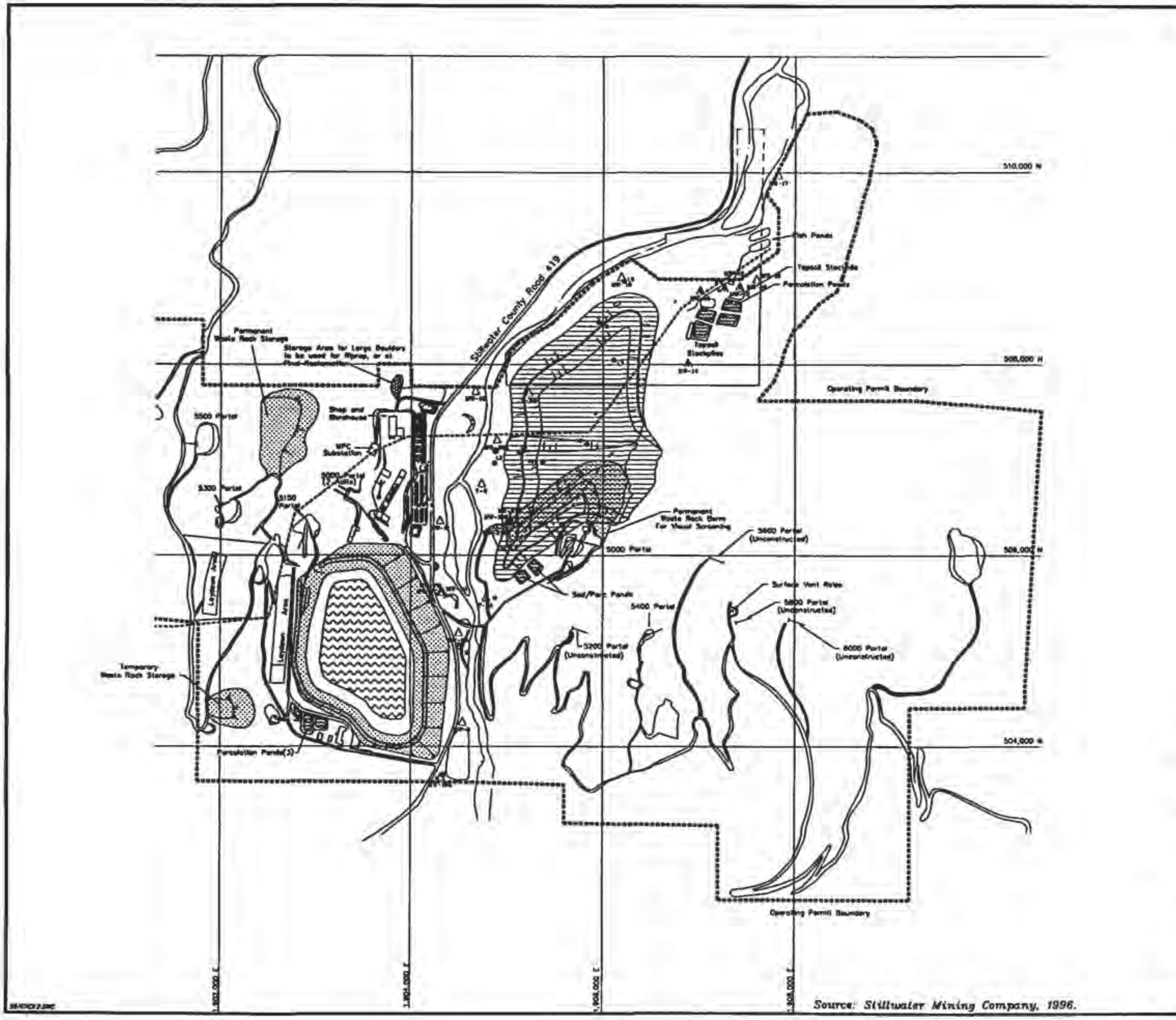
SMC disposes of waste rock both underground and aboveground. The volume of waste rock that remains underground depends upon access to SMC's facilities for handling waste and the quantity of ore produced in mining. Currently, about 20 percent of the waste rock produced in the mine remains underground and is primarily used for backfilling mined out stopes. Although some of the other 80 percent is used to construct facilities, such as portal pads and roads, most is used to construct the embankment of the existing tailings impoundment on the west side of the Stillwater River.

Currently, SMC is permitted to place mine waste rock in four areas. They are the embankment for existing tailings impoundment, a temporary storage area above the tailings impoundment, a permanent storage area near the 5300 west portal, and the permanent visual berm on the east site of the Stillwater River (**Figure 2–1**). Together, these areas can hold an additional 3,771,000 tons of waste rock.

2.4.1.2 Tailings Production and Management

The processing of ore in SMC's mill and concentrator produces tailings. For every 100 tons of ore fed to the mill, 99 tons of tailings are generated. These tailings are pumped from the concentrator to an underground sand plant where they are separated by cyclones into a coarse fraction (sandfill) and a fine fraction (slimes). The sandfill is used underground as backfill in the mine and the slimes are pumped into the existing tailings impoundment. About 58 percent of the tailings are used as backfill in mined out stopes. The slimes fraction, which represents about 42 percent of the total tailings, is pumped to the tailings impoundment. At times however, the entire bulk of the tailings stream may be pumped to the tailings impoundment.

The capacity of the existing tailings impoundment is limited. This impoundment, which occupies about 60 acres, has an engineered capacity of 3.5 million tons of tailings. At present rates of production, the impoundment will reach its capacity in 2003. Thus, SMC would have to stop production of platinum and palladium in 2003 under this alternative.



LEGEND
- East Side Waste Storage Site
- Permitted Waste Rock Storage Area
- Existing Roads
- Powerline Corridor
- Groundwater Monitoring Site

Stillwater Mine
Revised Waste Management Plan
and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

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Waste Rock Storage Areas
Figure 2-1

Experimental Paste Backfill

On April 30, 1998, SMC submitted requests to DEQ and CNF for approvals to construct and operate a cemented backfill plant at the Stillwater Mine. The purpose of this plant is to allow SMC to evaluate the use of paste backfill at the Stillwater Mine. In particular, SMC is trying to determine if paste backfill made from either whole tailings or the sand fraction of the tailings can provide the compressive strength needed to support SMC's method of mining at the mine, which involves backfilling mined out stopes. The backfilled stopes serve two purposes: to provide a footing for the next stoping effort and to provide internal support (ground control) and assistance in the prevention of subsidence.

The plant is considered a full-scale plant for that portion of the mine that it can reasonably supply with cemented paste backfill. The portion of the mine expected to receive backfill from the plant includes the area underneath the Stillwater valley, which is constrained by the need for lateral pumping. Pumping with gravity aids the distribution of backfill whereas pumping laterally is very limited due to friction between the tailings and the pipe. Considering the characteristics of the paste SMC would make and the 1,700-foot hydraulic head that would exist between the paste plant and the ultimate location for placing the experimental paste, the paste tailings are expected to spread laterally up to a maximum of 5,280 to about 8,000 feet (Gilbert 1998b, pers. comm.).

The plant will occupy an area of about approximately 200 feet by 200 feet at the 5150 west side portal area. Major pieces of equipment include a high density "deep well" thickener 50 feet tall and 35 feet in diameter; a belt filter 10 feet wide and 95 feet long; a cement silo 50 feet tall with a capacity of 200 tons, and a building with the dimensions of 65 feet by 125 feet by 50 feet tall (only the belt filter, paste mixer, distribution pumps, and control systems will be contained in the building). The plant will require about 1.5 megawatts of electricity to operate.

SMC intends to create two kinds of paste backfill at the cement plant. They are a low-compressive-strength backfill (30 psi) made from whole tailings and a high-compressive-strength backfill (300 psi) made from a 2:1 ratio of the coarse fraction to whole tailings. In the second case, the whole tailings will be cycloned with the finer fraction from that process rejected to the tailings pond.

Creation of the low-compressive-strength backfill will involve sending the whole tailings to the thickener. The overflow goes to the tailings pond and the underflow (approximately 72 percent solids) goes to the belt filter for additional dewatering. The product, which would be about 78 to 82 percent solids, would then be mixed with cement, conditioned to optimum moisture, conveyed to a positive displacement pump, and pumped to underground work areas.

Creation of the high-compressive-strength backfill will involve dividing the whole tailings so about one-third is sent to the thickener and two-thirds are sent to the cyclone. The overflows (fine fractions) from both these processes are sent to the tailings pond. The underflows (coarse fraction) go to the belt thickener, are then mixed with cement, and pumped underground to backfill areas.

Although results of the tests will not be available until later in 1999, a preliminary comparison of SMC's current sand backfilling with the experimental cement "paste" backfilling has been made. Slurried tailings, fine tailings paste, and whole tailings paste would have average dry densities of 70 pcf, 80 pcf, and 100 pcf, respectively. Thus, 100 pounds of slurried tailings, fine tailings paste, and whole tailings paste would occupy about 1.4 cubic feet, 1.25 cubic feet, and 1 cubic foot, respectively. The volume differences are a function of material density.

2.4.1.3 Water Management and Disposal

SMC handles two waste water streams at the Stillwater Mine. One stream is adit water, which is groundwater intercepted by the mine workings. The second stream is process and tailings water, which has been used in the milling and concentrating circuits and for slurrying tailings. Because the water in these streams is handled differently, they are discussed separately.

Adit Water

Mining and development of the mine's underground workings have intercepted, and will continue to intercept, groundwater. Inflows of groundwater increase with lateral development of the mine until an area is dewatered. SMC also seals abandoned workings to reduce inflows. Currently, discharges of adit water from all areas of the mine total about 1,000 gallons per minute (gpm). The Stillwater Mine Expansion 2000 TPD EIS (DSL, DHES, and Forest Service 1992) estimates these discharges may increase to as much as 2,020 gpm as SMC develops the mine further.

The adit water picks up suspended particulate matter and nitrogen compounds (nitrates) as it moves through the underground mine workings. The particulate matter also may contain low concentrations of metals that are present in the mineralized rocks. Residues of the blasting compounds used in the mining process are the source of the nitrates.

SMC has the option to discharge adit water directly into the Stillwater River without treatment under its MPDES permit. However, this is not the routing SMC prefers to use. SMC treats, and will continue to treat, the adit water before it uses or disposes of it. This treatment, which occurs on both the east and west sides of the operation, consists of clarification to remove fine particulates (slimes). Following clarification, SMC uses the treated water for irrigating reclaimed areas, pasture, and cropland; stabilizing soils; controlling dust; and adding to the mill process as make-up water. Most of the excess water is routed to the percolation ponds for disposal during the winter. During the growing season, SMC uses a Land Application Disposal (LAD) system to irrigate reclaimed areas, pasture, and cropland (hay fields) with clarified adit water.

SMC recently renewed its MPDES permit. In its renewal, SMC proposed to use an Anoxic Biotreatment Cell (ABC) system to remove nitrates from adit water. The ABC is a porous, media-filled, attached-growth denitrification reactor. Denitrification is a biologically-enhanced process in which nitrate is converted to nitrogen gas. The pilot project conducted during 1996 suggests SMC's ABC lowers concentrations of nitrates to 3 to 4 mg/L, a reduction ranging from 60 to 99 percent, while maintaining concentrations of phosphate below 0.1 mg/L. As a result of the tests, SMC's ABC was enlarged during 1997 to handle flows up to 500 gpm. Additional information on the ABC is available in DEQ's MPDES files.

During the growing season (generally April through October), excess adit water is routed to two east-side LAD pivots. SMC's records on its newest east side LAD pivot suggest volatilization, vegetation, and soils under the LAD pivots remove more than 80 percent of the nitrates dissolved in the adit water. Due to this effectiveness, application of adit water using the LAD pivots qualifies as secondary treatment for removing nutrients.

Tailings and Process Water

Process water includes water used within the mill and concentrating circuits. This water contains reagents SMC uses to separate metal concentrate from the ore. The reagents, which are mainly long-chain alcohols and organic compounds that readily breakdown in water, are used in small quantities. Consequently, they are highly diluted in the tailings water. However, some inorganic constituents, such as sulfate, may remain at high concentrations. The reagents used in milling are fully described in the 1985 Final EIS for the Stillwater Mine (DSL and Forest Service 1985, pgs VI–12 through VI–15). Although the reagents, at the concentrations present in the tailings water, pose no hazard to human health, SMC handles the water containing these reagents separately from adit water.

In addition to being used in the milling and concentrating circuits, process water also is used to transport tailings to the existing tailings impoundment through the slurry pipelines. In the impoundment, the tailings water either evaporates or is reclaimed and pumped back to the mill for reuse in the milling and concentrating circuits.

2.4.1.4 Power Requirements

Montana Power Company's power line servicing the mine is capable of providing up to 18 megawatts of power. Currently, the mine requires about 12 megawatts to mine and process 2,000 tpd of ore. Thus, no changes to the electrical utilities would occur with this alternative.

2.4.1.5 Roads and Traffic

Stillwater County roads 419 and 420 provide access to the Stillwater Mine. No changes would occur to these facilities under the No Action alternative. Thus, they would continue to experience the same level of use by SMC's employees and vendors in the future as they do now.

2.4.1.6 Workforce Requirements/Socioeconomics

Under this alternative, SMC's workforce demands would remain unchanged. As of December 31,1997, mineral development employment (employees and contractors) at the Stillwater Mine was 655 people (SMC 1998). Thus, employment at the mine would continue to be 655 workers until production at the mine shuts down.

2.4.1.7 Monitoring

Tailings and Waste Rock
Sampling of the ore body conducted for more than 20 years has shown no capacity for acid generation. Once each year, SMC combines samples from all mine waste rock storage sites for laboratory analysis to verify the lack of acid-generating potential of the materials. The tailings, which are sampled separately, also are tested for acid-generating potential. This sampling program would continue for the life of the mine as analyzed by the SMC 2,000 tpd EIS and as prescribed by the associated ROD.

Water Quality
SMC's MPDES permit (MT–0024716) requires monitoring of four authorized outfalls, five monitoring wells below percolation pond outfalls, and two surface water monitoring sites. Acute Whole Effluent Toxicity testing is required quarterly when SMC uses Outfall 001, alternating species each quarter of use. A Toxicity Reduction Evaluation and Toxicity Identification Evaluation will follow acute toxicity outcomes of Whole Effluent Toxicity testing. The permit also directs SMC to develop a biomonitoring program that includes periphyton sampling. To meet this requirement, SMC has begun annual, early fall, benthic and periphyton sampling on two to four sites along the Stillwater River.

Outfall 001 is a diffuser unit that discharges directly to the Stillwater River east of the current tailings impoundment. The diffuser is a 50-foot, 6-inch diameter pipe anchored by concrete blocks with three, one-inch diameter spigots located at 0.5-foot intervals. It is located in a reach of the channel that is 80 feet wide during low flow conditions.

Outfalls 002, 003, and 004 are three series of percolation ponds. Outfall 002 is located south of the east side waste storage site (proposed as part of Alternative B) on the east side of the river. Outfall 003 is northeast in the Stillwater Valley Ranch area. Outfall 004 is south of the current tailings impoundment on the west side of the river.

Sampling of Outfall 001 includes daily flow measurements and weekly sampling for metals and nutrients. Additionally, use of this outfall initiates a monthly nutrient sampling requirement of the upstream and downstream surface water stations at the mine site (SMC–1A and SMC–11). Monitoring of flow and nutrients occurs at the inlets of outfalls 002, 003 and 004 weekly during discharges. The five monitoring wells are monitored tri-annually for salinity and nitrogen compounds. The surface water stations are sampled quarterly regardless of use of Outfall 001.

SMC may directly discharge adit waters to the MPDES outfalls, if permit limits are met. Treatment for sediments is provided by a clarifier and reduction of nitrate concentrations is achieved with the ABC system. The MPDES permit restricts direct discharge to Outfall 001 to 2,000 gpm, with as much as 1,005 gpm being derived from clarifier and/or ABC pre-treatment. No flow limitations exist on the percolation ponds, as long as effluent limitations are met.

Stormwater containment measures and sampling would continue to follow SMC's Stormwater Pollution Prevention Plan, which has been approved by, and is on file with, the DEQ and CNF. In the event of a stormwater discharge to surface waters, SMC would sample and report the discharge as required by its approved stormwater MPDES permit. Ambient surface water and groundwater are monitored through the mine-wide water resources monitoring plan. SMC's operating permit (#00118) includes requirements for annual reporting and tri-annual monitoring of eight river or creek stations, one spring, 15 alluvial wells, two adit discharge sites and one mill decant water site. In addition, SMC monitors five wells 3 to 12 times per year and two springs twice per year. Water levels are acquired from three piezometers monthly. The requirements for SMC's water monitoring plan were provided in the 1985 and 1992 RODs for the 1985 Final Environmental Impact Statement, Stillwater Project and 1992 Final Environmental Impact Statement, Stillwater Mine Expansion 2000 Tons Per Day, respectively.

2.4.1.8 Reclamation

Reclamation of the existing tailings impoundment would occur concurrently to the extent practical. Reclamation is concurrent when a disturbance is reclaimed as soon as practical. For example, a lower lift of an embankment would be reclaimed as soon as it was constructed and at the same time as the next lift was being built.

The embankments would be reclaimed concurrently as lifts are completed. SMC would be continually adding tailings from the mill over the life of the mine. Consequently, final reclamation of the existing impoundment's surface would not occur until SMC stops tailings production and the impoundment is dewatered. All reclamation would be completed according to plans in the existing permit.

2.4.1.9 Bonding

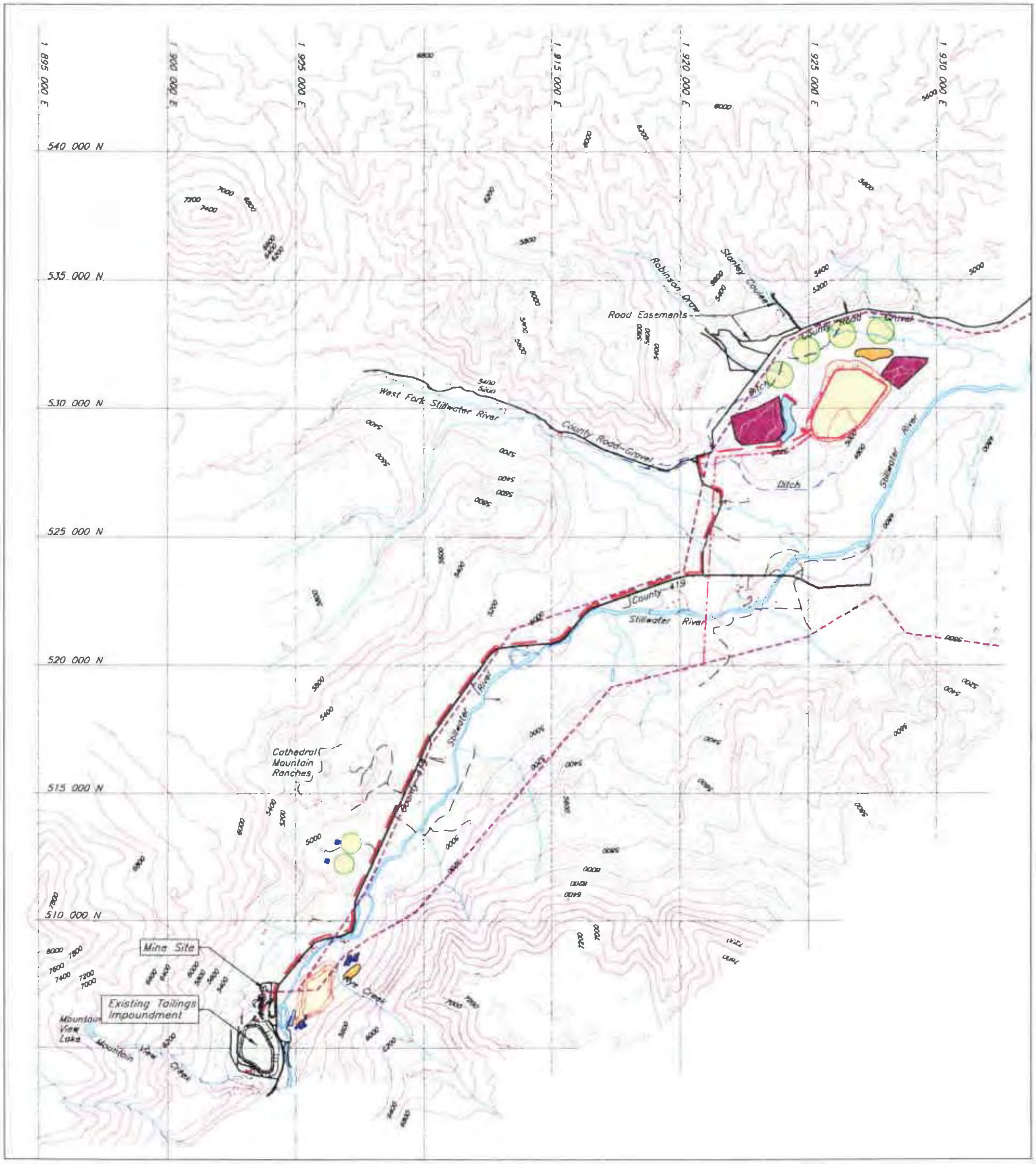
Reclamation bonds are determined by the agencies and are held by DEQ (the CNF may require additional bonds if it decides the state's bond is insufficient). The bonds are determined by computing costs to the state and CNF for reclaiming a site should the operator default. The state is required to review the bond at least every five years. If a bond is determined to be insufficient, it is recalculated and the company is required to submit the additional amount. SMC's current bond for the Stillwater Mine is $3,174,000.

If this alternative is selected, the bond would probably remain the same as it is now and be periodically adjusted for inflation. The bond includes costs for long-term maintenance of water management practices, such as percolation ponds and diversion ditches; demolition of buildings and other facilities; earth movement and soil replacement; seedbed preparation; and revegetation.

2.4.2 Alternative B — Proposed Action

SMC's proposal to change its mine waste management operation includes plans for waste rock and tailings production, management, and disposal as well as water management and disposal. The proposed changes are summarized below. **Figure 2–2** shows the overall locations of the primary facilities comprising the Proposed Action alternative. The application to amend Hard Rock Operating Permit #00118 (SMC 1996b) contains detailed discussions of these aspects and facilities.

In addition to changing SMC's mine waste management operation, implementation of the Proposed Action would remove the limitation on daily production (currently 2,000 tpd). If selected, SMC's Hard Rock Operating



LEGEND

- Proposed Pipeline Alignment
- Approximate Location of Overhead Power Line
- Approximate Location of Proposed Overhead Power Line
- Road
- Land Application Disposal Site
- Borrow Area
- Topsoil Stockpile
- Land Application Disposal Storage Pond
- Waste Rock Storage Area
- Hertzler Tailings Impoundment
- Sediment / Percolation Pond

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TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

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**Alternative B
Location of Primary Facilities
Comprising the Proposed Action
Figure 2-2**

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Permit (#00118) would be based on an approved "footprint" of surface disturbance, not a rate of production. SMC would be able to alter daily levels of production to respond to changing conditions in the market. The amendment discusses levels of production ranging up to 5,000 tpd, but an average of 3,000 tpd was used for preliminary design and analysis purposes. The proposed amendment (Proposed Action) and all information related to this EIS are on file with the DEQ and CNF (Beartooth District Office) for public review.

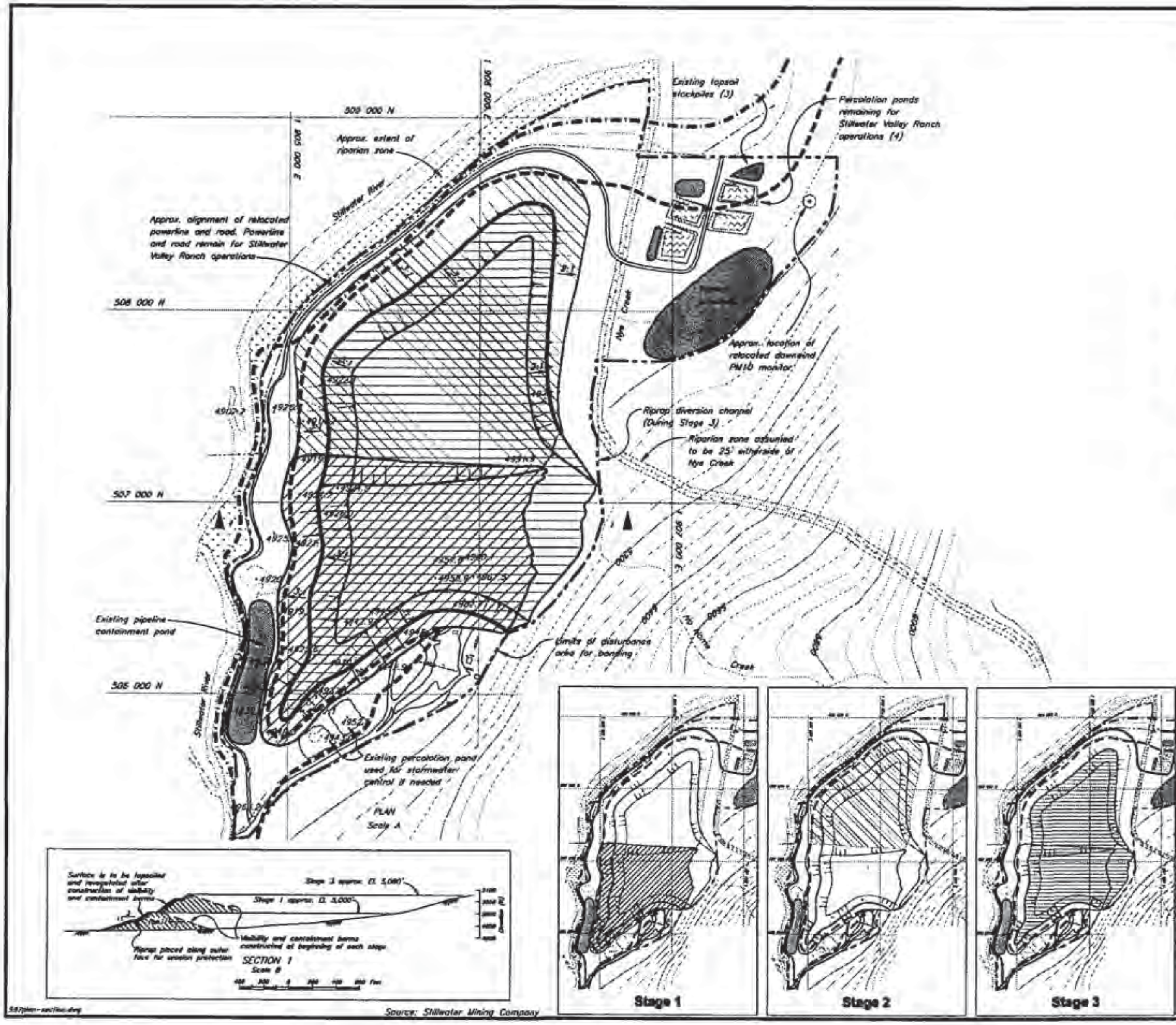
2.4.2.1 Waste Rock Production and Management

As is discussed under the No Action alternative, SMC is permitted to place mine waste rock in four areas (**Figure 2–1**). Together, these areas are capable of holding an additional 3,771,000 tons of waste rock. SMC needs additional capacity because this capacity is insufficient for the long term (17.5 million tons over 20 to 30 years).

SMC proposes to expand the visual berm on the east side of the Stillwater River into an east side waste storage site to obtain the additional capacity it needs for waste rock (**Figure 2–3**). This expansion would increase the storage site's areal extent to about 80 acres from the currently-permitted disturbance of 12 acres.

SMC would use trucks to haul the waste rock to the east side waste storage site. The trucks would use the existing access road and Stillwater River bridge located across Stillwater County Road 419 from the office/mill access. Because operational traffic patterns mandate that through traffic on Stillwater County Road 419 has the right-of-way, the haul trucks would yield right of way to traffic on County Road 419. After crossing the road, trucks would simply drive up ramps to access dumping points. No conveyors or lifts would be needed to place the waste rock (Gilbert 1998d, pers. comm.).

SMC may elect to use the 4400 level (under the river) connection between the west and east mining areas to move some of the trucks hauling waste rock without crossing County Road 419. In February 1996, DEQ approved and permitted the construction and operation of this under-the-river connection for this type of use (DEQ 1996). Some limited potential exists for waste rock from below the 5500 level to be hauled through the 4400 level connection, when it is completed at a future date. However, waste rock from higher levels would be transported aboveground and across County Road 419, which is the most efficient means to move the rock. To transport rock from these upper levels through the 4400 level connection, SMC would have to haul this rock out from the upper portals (no



LEGEND

- - - - Proposed Pipeline Alignment
═══ Road
Topsoil Stockpile
Pond
-·-·- Limit of 100 Year Water Level
- - - - Limit of PMF Water Level

NOTES

1. Construction Sequence:
   - Stage 1 - Placement of a visibility and containment berm to approximately El. 5000'.
   - Stage 2 - Extend visibility and containment berm northward.
   - Stage 3 - Extension of Stages 1 and 2 by raising to approximately El. 5050'.
2. Visibility and containment berm constructed to resemble a natural feature with vertical and horizontal relief varying in order to break up visual lines. Slope gradients to vary from 2H:1V to 3H:1V.
3. Toe of the visibility and containment berm to be placed a minimum of 100 feet from riparian zones. Exact location of riparian zones will be determined in the field by the Engineer.

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Plan and Section of the East Side Waste Storage Site
Figure 2-3

connections exist for hauling rock to the 4400 level completely underground) and then back underground to access the connection.

SMC would construct the east side waste storage site in three stages (**Figure 2–3**). In Stage 1, the storage site would be constructed south of Montana Power Company's high-voltage power line. During Stage 2, SMC would extend the storage site north to within 100 feet of the riparian area associated with Nye Creek. In Stage 3 SMC would raise the waste pile to an elevation of 5,080 feet with no lateral expansion.

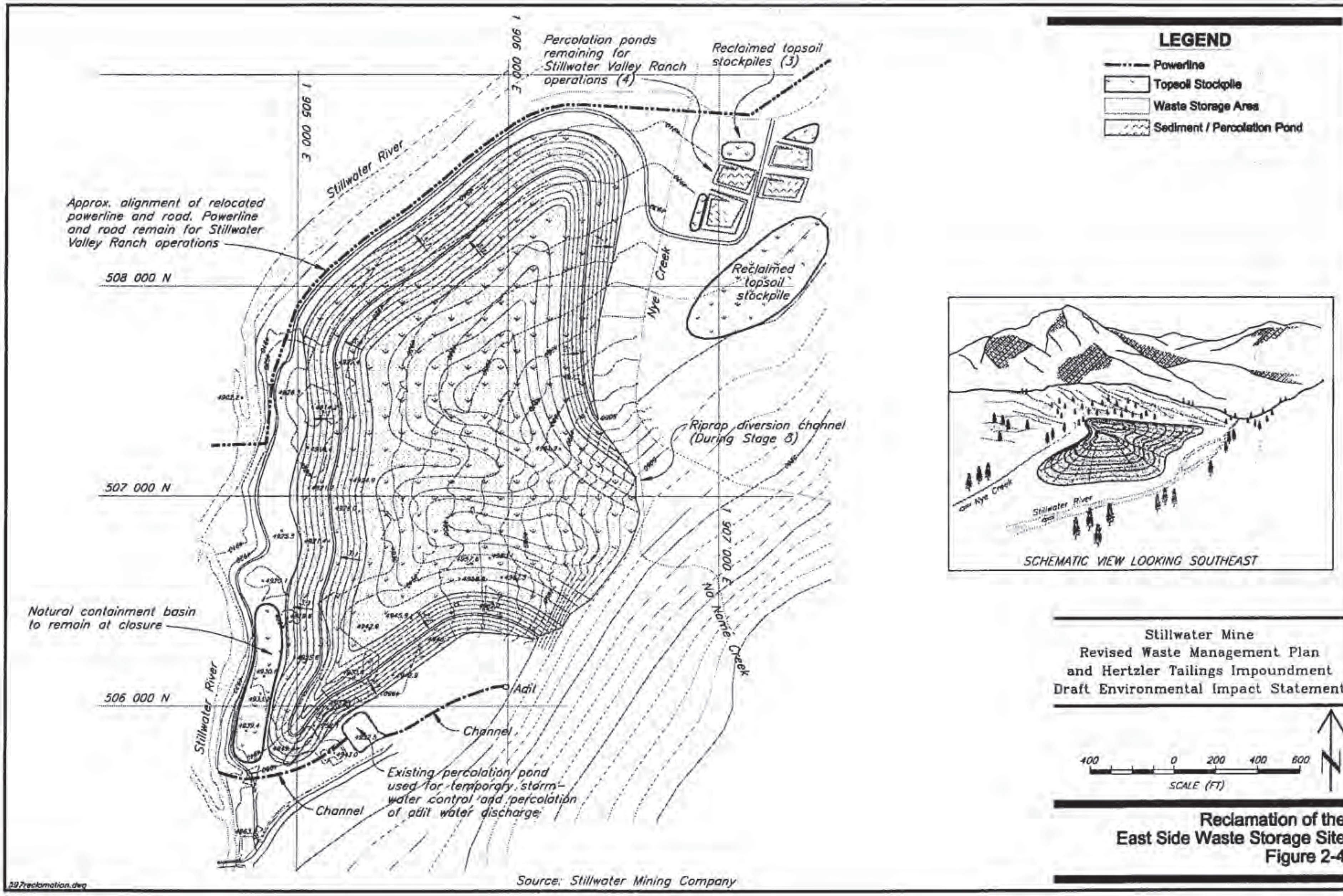
Facilities currently present at the east side waste storage site would be relocated or modified to accommodate the storage facility. Montana Power Company's high-voltage power line and Beartooth Electric's power line would be relocated to the downstream toe of the embankment. The LADs would be relocated to Hertzler Ranch, Stratton Ranch, or both, as discussed in the water management and disposal section below. Topsoil stockpiles and some sedimentation/ percolation ponds also would be relocated. Water monitoring facilities would be relocated or modified to accommodate the waste storage site. Additional monitoring wells also would be added, as needed.

Although constructed in stages, overall construction and reclamation of the east side waste storage site would incorporate several features to mitigate potential adverse effects. During the last years of construction, the top cap would be selectively shaped to sculpture the embankment about the 5,080-foot elevation. This shaping would result in an irregular surface that would help the embankment blend with the adjacent natural terrain (**Figure 2–4**). Embankment slopes would vary between 3:1 (three units of distance horizontally to one unit vertically) and 2:1. Lower slopes would be flattened to 3:1 to minimize erosion in case of a probable maximum flood (PMF). Additionally, final reclamation would involve establishing a mosaic of vegetation similar to that permitted for the existing tailings impoundment. This mosaic also would help the embankment blend with the adjacent terrain.

2.4.2.2 Tailings Production and Management

As discussed under the No Action alternative, the capacity of the existing tailings impoundment is limited. This impoundment is designed to hold 3.5 million tons of tailings. At present rates of production, the impoundment will reach its capacity in 2003. Thus, SMC needs additional capacity to continue operating the mine for an additional 20 to 30 years.

To provide the additional capacity for tailings needed for continued operation, SMC proposes to construct and operate a new impoundment at the former Hertzler Ranch. Tailings would be transported from the mine to this impoundment



Reclamation of the East Side Waste Storage Site
Figure 2-4

through two 8-inch high-density polyethylene-lined steel pipelines. Additionally, process water would be reclaimed from the impoundment and returned to the mill through a 10-inch diameter steel pipeline installed in the same rights-of-way as the two tailings pipelines. Adit water would be transported to the LADs through a steel pipeline installed with the other pipelines (the two water pipelines are discussed further in **Section 2.4.2.3**). Thus, all four pipelines would be buried in the same trench.

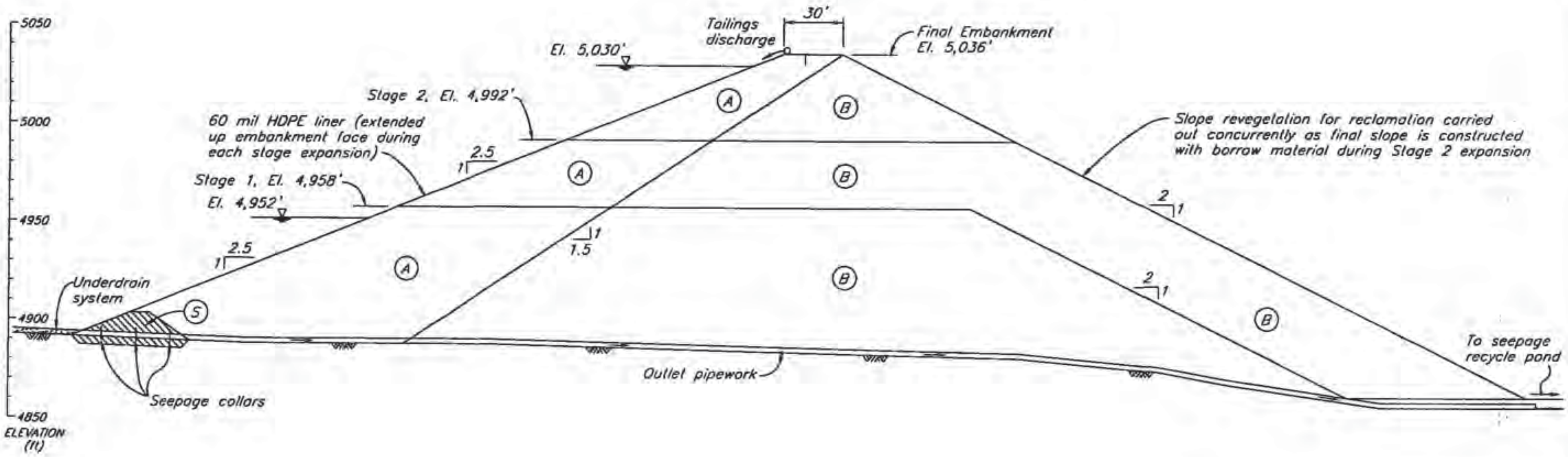
SMC plans to operate the Hertzler tailings impoundment in concert with the existing tailings impoundment to maximize operational flexibility. The integrated tailings transport system, as proposed, would allow SMC to pump tailings from the concentrator circuit or the underground sand plant to either tailings impoundment. It also would allow SMC to recover and transport tailings from the existing tailings impoundment to the Hertzler tailings impoundment. With this mode of operation, the operational life of the existing tailings impoundment could be extended. The impoundments could be operated in rotation or seasonally. Maintenance on sections of pipeline could occur without impeding production. Also, if problems arise with the buried pipelines or Hertzler tailings impoundment, the flow of tailings could be diverted to the existing impoundment until the problems are corrected.

Hertzler Tailings Impoundment

As proposed, the Hertzler tailings impoundment would have a final embankment height of about 156 feet (crest elevation of 5,036 feet) and would occupy 163 acres. With these dimensions, this impoundment would hold approximately 15 million tons of tailings. This capacity would allow SMC to continue operating the Stillwater Mine for at least another 30 years, at average production rates of 3,000 tons of ore per day.

The embankment for the impoundment would be constructed in three stages using the downstream method (**Figure 2–5**). Tailings and water piped from the mill would be deposited behind the embankment during each stage of development. The first stage would be constructed to a maximum height of 78 feet (crest elevation of 4,958 feet). Construction of stage 2 would raise the embankment's crest elevation to 4,992 feet, increasing the maximum height to 112 feet. The third stage would be constructed to the maximum height of 156 feet (crest elevation of 5,036 feet). With final slopes of 2:1 and 2.5:1 on the embankment's downstream and upstream faces, respectively, the total volume of borrow material needed for construction would be about 6.7 million cubic yards.

Because of the long haul distance from the mine, the embankment would be built from on-site borrow material rather than waste rock from the mine. Some of the material would be excavated from within the footprint of the impoundment during initial construction of the embankment and the impoundment's liner and



ZONE	MATERIAL TYPE
S	Low Permeability Glacial Till
A	Glacial Till
B	Random Fill

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Hertzler Impoundment Typical Cross Section of the Embankment
Figure 2-5

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Source: Stillwater Mining Company, 1996.

underdrain system. The rest of the material would be obtained from two borrow areas located near the impoundment (**Figure 2–2**).

The impoundment also would be designed to incorporate technology to minimize seepage and promote drainage of the tailings. The impoundment would be lined with a 60-mil thick, high-density polyethylene (HDPE) liner to reduce the amount of seepage to groundwater beneath the impoundment. Finer glacial till, which is a clayey material with a naturally-low permeability of at least 1×10^{-6} cm/sec, is available at Hertzler Ranch (Knight Piésold Ltd. 1996) and would be used as the bedding for the HDPE liner. The HDPE liner would have an effective permeability of at least 1×10^{-10} cm/sec.

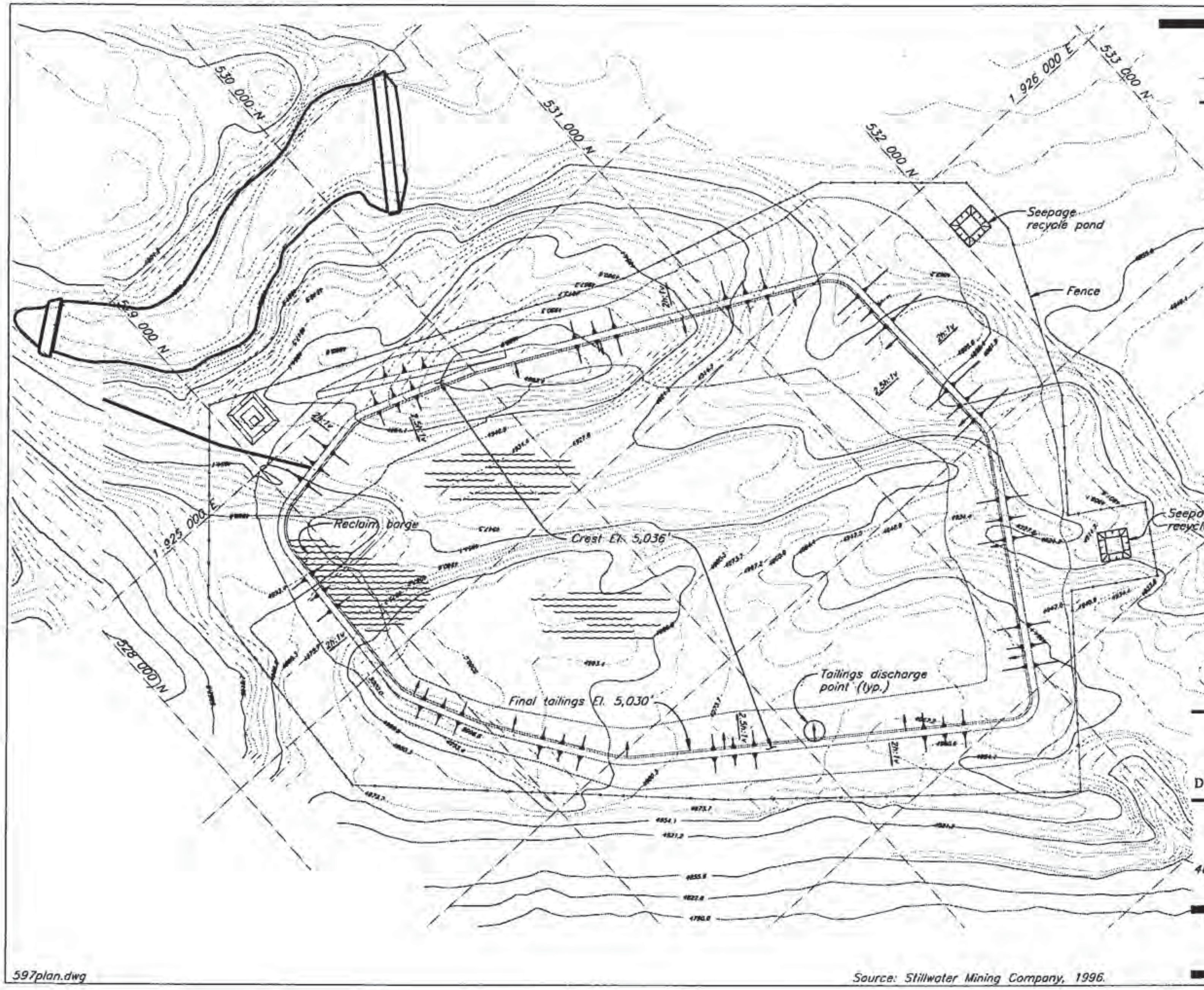
The seepage collection system would consist of underdrain pipes covered with a filter media (6-inch perforated corrugated polyethylene (CPT) pipe spaced a maximum of 300 feet apart in a 1-foot thick layer of sand) constructed on top of the HDPE liner and recycle ponds. The seepage collected by these underdrains would drain into HDPE-lined seepage recycle ponds located outside the impoundment (**Figure 2–6**). Seepage collected in these ponds would be pumped back into the tailings impoundment. Automated level-control switches would start pumping of the ponds when water in the ponds reaches a pre-determined level.

The tailings impoundment's design includes minimum freeboard, both during construction and normal operations, to ensure overtopping of the embankment does not occur. During construction, SMC would maintain sufficient freeboard to store the volume of a Probable Maximum Precipitation (PMP) event. This freeboard would contain internal runoff from storm events and the negligible external runoff that may enter the impoundment.

Tailings Pumping and Transmission Systems

The tailings pumping and transmission systems would consist of a series of facilities constructed to transport tailings from the concentrator, underground sand plant, or existing tailings impoundment to the new Hertzler impoundment. Components of this system include a tailings thickener plant, tailings reclaim system (to reclaim tailings from the existing impoundment), tailings pumping system, and tailings slurry pipelines. Each component is described below.

Slimes generated from the cycloning of bulk tailings would be directed to a process thickener in the tailings thickener plant. The process thickener would increase the solids content of the slimes being pumped to the Hertzler tailings impoundment. This increase in solids would reduce requirements for pumping and provide the flexibility to handle wide variations in input flows and densities. Thickened slimes extracted from the bottom of the process thickener would report to a tailings pumping facility for pumping to the Hertzler impoundment.



LEGEND

Fence
Slurry and Reclaim Pipeline

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Hertzler Tailings Impoundment Plan

Figure 2-6

A tailings reclaim system also would be constructed in association with the process thickener. This system would include a barge within the existing tailings impoundment, a bank of cyclones, and pipelines. The barge would dredge tailings from the existing impoundment under operational procedures that would ensure the impoundment's HDPE liner is not compromised. Tailings would be pumped to the bank of cyclones. The cyclone overflow (slimes fraction) would be directed to the process thickener. Sand generated in the process would be used as mine backfill or for other surface uses or returned to the tailings impoundment.

The tailings pumping facility would consist of a series of pumps that would move the tailings through the tailings slurry pipelines to the Hertzler impoundment. A similar series of backup pumps also would be constructed. The pumps would be electrically driven. Gravity-fed high-pressure water from the underground mine water reservoir at the 6,500-foot elevation would be available through the tailings pumping facility for emergency flushing of the pumping system during power failures, if flushing is needed.

The tailings slurry pipelines would extend about 41,000 feet (7.8 miles) from the tailings pumping facility at the mine to the Hertzler impoundment. Between the mill and the Hertzler impoundment, the pipelines would be buried in the rights-of-way of Stillwater County roads 419 and 420 (**Figure 2–2**). The pipelines would be buried about 5 feet deep, including under all streambeds, drainage crossings, and the West Fork of Stillwater River. Where possible, SMC proposes to bury the pipelines below the frost line. However, in some instances where the pipeline may not be buried below the frost line, such as within the roadway, SMC will *insulate the pipeline to prevent freezing* using the same technology currently being used on Alaskan pipelines. Both pipelines would be double walled, constructed of 8-inch steel pipe lined with an inner sleeve of HDPE.

2.4.2.3 Water Management and Disposal

As discussed under the No Action alternative, SMC handles two primary waste water streams at the Stillwater Mine. One stream is adit water, which is groundwater intercepted by the mine workings. The second stream is process and tailings water, which is the water used in the milling and concentrating circuits and pumping of the tailings. Under this alternative, SMC would continue to handle the water in these waste water streams differently.

Adit Water

Under this alternative, SMC would continue to handle adit water using the existing percolation ponds, the ABC, and LAD systems. SMC may double the capacity of the ABC treatment to handle up to 1,000 gpm. SMC also would add additional LAD systems at the Stratton and Hertzler ranches (**Figure 2–2**) when construction of the east side waste storage site forces SMC to move the east side LAD to these sites. An unlined steel pipeline buried with the slurry tailings pipelines (discussed above) would transport the adit water from the clarifiers to these sites. The capacity of the Hertzler LAD system could be designed to handle flows in excess of 2,000 gpm.

During the winter, excess adit water would be routed to the Stillwater Valley Ranch and mill site percolation ponds and to LAD storage ponds at the Stratton and Hertzler ranches (see **figures 2–1, 2–2, 2–3, 2–4, and 2–5**). The Hertzler LAD storage pond would have a capacity of about 80 million gallons of water. Materials used to construct the Hertzler LAD storage pond's foundation would consist of low-permeability, fine-grained, glacial till deposits that would minimize percolation (Knight Piésold 1996).

During the growing season (generally April through October), excess adit water and water stored in the Hertzler LAD storage pond would be routed to the LAD pivots at the Stratton and Hertzler ranches. SMC's records over the last 4 years on its east-side LAD suggest the LAD removes more than 80 percent of the nitrates dissolved in the adit water. Due to this effectiveness, application of adit water using the LAD qualifies as secondary treatment for removing nutrients.

Tailings and Process Water

Process water includes water used within the mill and concentrating circuits. This water contains reagents SMC uses to separate concentrate from the ore. The reagents, which are mainly long-chain alcohols and organic compounds that readily breakdown in water, are used in small quantities. Consequently, they are highly diluted in the tailings water. However, some inorganic constituents, such as sulfate, may remain at high concentrations. The reagents used in milling are fully described in the 1985 Final EIS for the Stillwater Mine (DSL and Forest Service 1985, pgs VI–12 through VI–15).

Although the reagents, at the concentrations present in the tailings water, pose no hazard to human health or the environment, SMC handles the water containing these reagents separately from adit water. In addition to being used in the milling and concentrating circuits, process water also would be used to transport tailings to the Hertzler tailings impoundment through the slurry pipelines. In the impoundment, the tailings water would either evaporate or would be reclaimed and pumped back to the mill for reuse in the milling and concentrating circuits.

To facilitate reclaiming tailings water, SMC would construct a reclaimed water pipeline between the mill and the Hertzler tailings impoundment. This 10-inch steel pipeline would be constructed and buried in the same rights-of-way as the tailings slurry and adit water pipelines. The pipeline would return tailings water from the Hertzler impoundment back to a process water head tank above the concentrator for reuse in the milling and flotation circuits.

2.4.2.4 Power Requirements

Montana Power Company's power line servicing the mine is capable of providing up to 25 megawatts of power (Cluett 1998). Currently, the mine requires about 12 megawatts to mine and process 2,000 tpd of ore. Although SMC plans to operate at an average production of 3000 tpd, production could peak as high as 5,000 tpd. Additional power of up to a total of 28 to 32 megawatts would be required for 5,000 tpd of ore production.

When the capacity of the existing 50 kV power line to the mine (18 to 25 megawatts) is unable to meet the mine's needs as production increases, improvements would have to be made to the existing line. Before production at the mine exceeds approximately 4,200 tpd, the existing line would have to be upgraded from 50 kV to 69 kV. Montana Power Company would accomplish this upgrade by replacing the insulators presently on the poles with heavier insulators and changing transformers at substations along the route. This upgrade (to 69 kV) is expected to be adequate for up to 5,000 tpd, depending upon the mining equipment SMC employees. If and when the demand for power exceeds the capacity of the 69 kV line, Montana Power Company would upgrade the line to 100 kV. This upgrade would involve stringing new conductors (wires) and upgrading transformers. Thus, in all cases, upgrades of the power line to the Stillwater Mine would involve improvements to the existing line as opposed to the construction of an additional line into the area Cluett 1998).

Development of the Hertzler impoundment would include about a one-mile extension of the existing three-phase power line from a point near the junction of Stillwater County roads 419 and 420. This extension would probably follow the existing road rights-of-way or the power line right-of-way. The new power line would provide for an operational power demand of about 500 horsepower at the Hertzler Ranch location.

2.4.2.5 Roads and Traffic

SMC proposes no modifications of existing and previously-approved permit-related roads within the permit boundary. Access roads to the Hertzler Ranch (Stillwater County roads 419 and 420) may be upgraded to allow for installation of the system of buried pipelines within the rights-of-way. SMC would negotiate an agreement with Stillwater County for the upgrades separate from SMC's Hard Rock Impact Plan (SMC 1998).

If SMC and Stillwater County were unable to negotiate an agreement for the rights-of-way along Stillwater County roads 419 and 420, SMC may consider use of the power of eminent domain to claim the use of the rights-of-way for installation of the pipelines. Montana statute defines eminent domain as "the right of the state to take private property for public use." (Montana Code Ann. § 70-30-101, 1995). The legislature; however, provided private individuals and corporations with the power of eminent domain for specific public uses (Montana Code Ann. § 70–30–102, 1995). Use of the statute by corporations, including mining companies, has occurred and provides a precedent for such an application of eminent domain.

Minor road extensions would be required from Stillwater County Road 420 to the Hertzler impoundment. These extensions would be constructed on property owned by SMC and would not be open to the public. Furthermore, they would be reclaimed after SMC closes and reclaims the impoundment.

2.4.2.6 Workforce Requirement/Socioeconomics

Present economic indicators and estimated reserves of ore suggest the operational life of the Stillwater Mine could be extended at least another 30 years. Workforce requirements for the operation depend on levels of production and the methods used for mining. Current projections are for employment (permanent employees and contractors) at SMC's mineral operations to increase from 655 employees on December 31, 1997 to 700 employees and contractors with implementation of this alternative and an average level of production of 3,000 tpd. SMC anticipates that future expansion of underground production would be accompanied by a shift toward mechanized mining, which is less labor intensive than conventional cut and fill mining methods. These potential shifts in mining methods would not be expected to reduce the present workforce requirement of 700 employees and contractors, but may reduce the need for expanding the workforce as production at the mine increases.

Recently (August 1998), SMC and affected units of local government agreed to an amendment of SMC's 1988 Amended Hard Rock Mining Impact Plan. The 1998 amendment was needed because SMC's employment had exceeded the threshold for amendment established in the 1988 amended plan. The affected units of local government involved in the 1998 amendment are Stillwater County, Town of Columbus, Columbus Elementary School District, Columbus High School District, Absarokee Elementary School District, Absarokee High School District, Fishtail Elementary School District, Nye Elementary School District, and Absarokee Water and Sewer District (SMC 1998). The "affected units of local government" are those units of local governments that would experience net impact costs during any one year of SMC's mining operation or a unit of government within which the mineral development is located.

2.4.2.7 Monitoring

Tailings and Waste Rock

Sampling of the ore body conducted for more than 20 years has shown no capacity for acid generation. Once each year, SMC combines samples from all mine waste rock storage sites for laboratory analysis to verify the lack of acid-generating potential of the materials as directed by previously-approved/required agency mitigations. The tailings, which are sampled separately, also are tested for acid-generating potential. The tailings at the Hertzler tailings impoundment would be included in this sampling program. The sampling program would continue for the life of the mine and would be expanded to include any new storage sites.

Pipeline Monitoring and Spill Contingency Plan

The Monitoring and Spill Contingency Plan for the pipelines (tailings slurry, reclaimed water, and mine water) is comprised of three elements. They are pipeline design, pipeline inspections, and pipeline leak detection and response. Each contributes to the overall monitoring and spill contingency plan.

All four pipelines have been designed to minimize the potential for leaks and to maximize the potential for localizing the effects of any leaks. The design includes burial of the pipelines to minimize the potential for freezing, vandalism, and damage from vehicles. Also, the pipelines would be installed within the western right-of-way of Stillwater County roads 419 and 420, which maximizes the potential to localize the effects of any rupture. Finally, the design incorporates several features specifically included to minimize the potential for leakage and contain any leakage that may occur.

SMC would conduct routine inspections of the pipelines. Inspections would be accomplished from access sites located along the path of the pipelines. Inspection vaults would be installed at five locations along the pipelines with access provided through man-hole entry points. Two inspection vaults would be installed at the crossings on the West Fork of the Stillwater River. Removable pipe spools would be located within the inspection vaults and the pump station. These pipe spools would be periodically unbolted and checked for wear. The inspectors would record the thickness of the pipe's wall and would document any unusual patterns of wear. Before any wear identified during the inspections threatens the integrity of the liner, SMC would shut down the transport of tailings, flush the pipeline to clear the tailings, and extract and replace the HDPE liner between the two vaults that encompass the section being removed. This extraction would not require any digging or disturbance to the rights-of-way. The liner is simply pulled out of the pipeline between access points and a new liner is pulled through and welded to the ends of the existing liner at each access point.

Inspections of the pipe spools would occur on specific schedules. During the first two years of the tailings slurry pipelines' operation, inspections would occur every six months. Inspections of the water lines would occur once per year. At the end of the initial two-year period, SMC may modify the inspection schedule, based on the results of the initial inspections.

SMC also would install an automated leak detection system during construction of the pipelines. This system would include sensors and a central control system. Sensors installed in the tailings and water pipelines at the main pump station, at the Hertzler terminal station, and in the five inspection vaults would continuously monitor flows and pressures. A rapid drop in pressure may indicate a rupture of the pipeline and a decrease in flows combined with a higher pressure may indicate a blockage in the pipeline. In addition, moisture sensors installed in the vaults would monitor the tailings pipelines for leaks. Leaks within the tailings pipelines would migrate up the line between the HDPE liner and the steel pipe and trigger the moisture sensors within the vault.

Information from the various sensors would be transmitted to the central control system in the main pump station for monitoring. The sensors would be connected to a computerized logic control system by a control cable conduit buried within the pipeline trench. The control system would monitor the operational parameters and sound an alarm should any significant deviation from normal operational values occur. An alarm would result in the shutdown and inspection of the pipelines.

If a leak is detected in a pipeline, the line would be flushed before repairs are made. Water and slurry materials flushed from the pipelines would be directed to the Hertzler tailings impoundment. If flushing must occur during a power outage, SMC would use a diesel generator or a high-pressure, gravity connection from an underground mine water storage reservoir located on the 6500 level to flush the lines. When constructed, the size of this reservoir would be sufficient to contain enough water to flush both tailings pipelines of all tailings. The tailings would be flushed into the Hertzler impoundment.

Should a rupture occur, SMC would respond immediately and make every effort to keep the contents of the pipeline from entering adjacent surface waters. If a rupture occurs at the Hertzler terminal station where the pipelines make the transition from underground to aboveground, the contents would be transferred to the terminal station containment pond. From this pond, the contents would be pumped into the impoundment. Ruptures along other locations of the pipeline would be handled as appropriate. In any case, SMC would notify DEQ, CNF, and Stillwater County of any rupture and inform all parties of conditions at the site of the rupture and cleanup efforts underway.

Water Quality

The program for monitoring water quality would be the same as that described under Alternative A because the same MPDES permit would exist under this alternative. Thus, sampling for nutrients at and below the percolation pond outfalls would occur and specific limitations on nitrate and phosphate loading would exist. Direct discharge of adit water to the Stillwater River through Outfall 001 would initiate sampling of metals and nutrients in surface water upstream and downstream of the mine. Biomonitoring of this directly-discharged water also would occur.

Stormwater containment measures and sampling would follow SMC's Stormwater Pollution Prevention Plan, which has been approved by, and is on file with, the DEQ and CNF. In the event of a stormwater discharge to surface waters, SMC would sample and report the discharge as required by its approved stormwater MPDES permit.

If this alternative is approved, SMC would be required to modify its water monitoring plan and submit it to DEQ for approval. This plan would incorporate the placement of additional monitoring wells in the areas proposed for development and would specify the sampling intervals and parameters for testing. These areas would include the Hertzler tailings impoundment site, the east side waste rock storage site, and any areas upon which LAD or percolation ponds are constructed.

The water quality monitoring plan for the impoundment, which must be approved by the agencies, would specifically include the following components:

- sampling of process water in the tailings pond and seepage recycle ponds for water quality analyses;
- sampling of groundwater in monitoring wells;
- sampling of surface water quality down gradient of the impoundment; and
- flow monitoring in the seepage collection system within the impoundment.

2.4.2.8 Reclamation

Reclamation procedures have been defined for the tailings impoundments, east side waste rock storage site, and pipelines. These procedures are discussed below.

Existing Tailings Impoundment

Reclamation of the tailings impoundment would occur concurrently to the extent practical. Reclamation is concurrent when a disturbance is reclaimed as soon as practical. For example, a lower lift of an embankment might be reclaimed as soon as it was constructed and at the same time as the next lift was being built.

The embankments would be reclaimed concurrently as lifts are completed. SMC would be continually adding tailings from the mill and removing and pumping tailings to both impoundments over the life of the mine. Consequently, final reclamation of both impoundments' surface would not occur until SMC stops tailings production and the impoundments are dewatered. All reclamation would be completed according to plans in the existing permit.

Hertzler Tailings Impoundment

The outer slope of the tailings embankment would be reclaimed concurrently with the facility's operation in stage 1. It would be redisturbed again in stage 2 and reclaimed again. The primary purpose of this concurrent reclamation is to minimize visual effects and fugitive dust. A minimum of 12 inches of growth media (soil, soil substitute, or both) would be placed on the outer surface of the embankment and revegetated with an approved seed mix.

Growth media for use in reclaiming the tailings impoundment would originate from one of two sources. The top 12 inches of topsoil and subsoil ("soil") within the Hertzler impoundment site would be salvaged. This soil would be used immediately in concurrent reclamation of the embankment or stored in topsoil stockpiles (**Figure 2–2**) for use in final reclamation of the impoundment. The second source of growth media would be borrow material obtained within the Hertzler Ranch area (**Figure 2–2**) that SMC would use as "soil substitute." This borrow material would consist of alluvial and glacial till subsoils.

Although this borrow material lacks some characteristics of topsoil, several characteristics make it a suitable growth medium. The gravel content of this material makes it less erosive than topsoil alone, which has made similar borrow material within the permit area suitable for use on the existing impoundment and waste rock storage embankment slopes within the permit area. Volumes of the borrow material present in the area are sufficient to compensate for the relatively shallow soils that exist at the Hertzler Ranch. The extra volumes of material have made it possible to reclaim areas where existing soils are very shallow. Also, because this material would be used to construct the embankment, the primary requirement for soil would be the amount needed to reclaim the surface of the impoundment upon closure.

Final reclamation, revegetation, and closure of the impoundment would follow the same procedures specified in SMC's plan for the existing tailings impoundment, which DEQ and CNF approved previously. The surface of the impoundment may settle between 1 and 10 feet, depending on the distribution and thickness of the tailings. An average cap of 5 feet (including a minimum of 24 inches of soil or soil substitute) would be placed on the impoundment surface after dewatering and regrading.

Before closure, SMC would conduct a capping study of the in-situ tailings to determine the degree of consolidation and settlement. This information would be used by the agencies and SMC to determine potential long-term settling that might compromise the reclamation cap, cause a safety hazard, create ponding of stormwater on the surface, or create pathways for surface water pollution. They also would incorporate this information into final plans for surface regrading.

East Side Waste Rock Storage Site

During each of the three stages of construction, the visibility and containment berms would be regraded, covered with topsoil, and revegetated. The outer edges of each lift of the waste rock storage site would be reclaimed concurrently as the lifts are completed. After Stage 3 is completed, the waste rock storage site would be regraded to blend with the surrounding natural terrain, capped with subsoil, covered with 12 inches of topsoil, and revegetated. Riprap and permanent stormwater drainage diversions would be installed along the east and northeast sections of the storage site between the No Name and Nye Creek drainages, if necessary.

Pipeline System

The surface disturbance along the pipeline route would be reclaimed immediately after the pipelines are installed. Twelve inches of salvaged soil would be placed over the compacted fill above the pipelines. The surface would then be revegetated with an approved seed mix.

Following closure of the Hertzler tailings impoundment, the inspection vaults and man-hole entries would either be removed or filled with concrete. The surface would then be regraded, covered with 12 inches of topsoil, and revegetated. The pipelines would remain buried in the ground.

2.4.2.9 Bonding

If this alternative is selected, the additional bond would be calculated using the specifications, stipulations, and mitigation measures contained in the approved and permitted amendment. The bond would include costs for long-term maintenance of water management practices, such as percolation ponds and diversion ditches; demolition of buildings and other facilities; earth movement and soil replacement; seedbed preparation; and revegetation. SMC could not begin constructing any of the facilities comprising this alternative until the additional bond has been transferred to DEQ.

DEQ has developed an approximate estimate of the range in which the new bond amount would be, if this alternative is selected. Bond for SMC's operations would increase from slightly more than $3 million to $11 to $13 million dollars.

Additionally, if DEQ decides long-term water treatment is necessary at closure, the bond for this alternative would increase to $20 to $25 million.

2.4.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

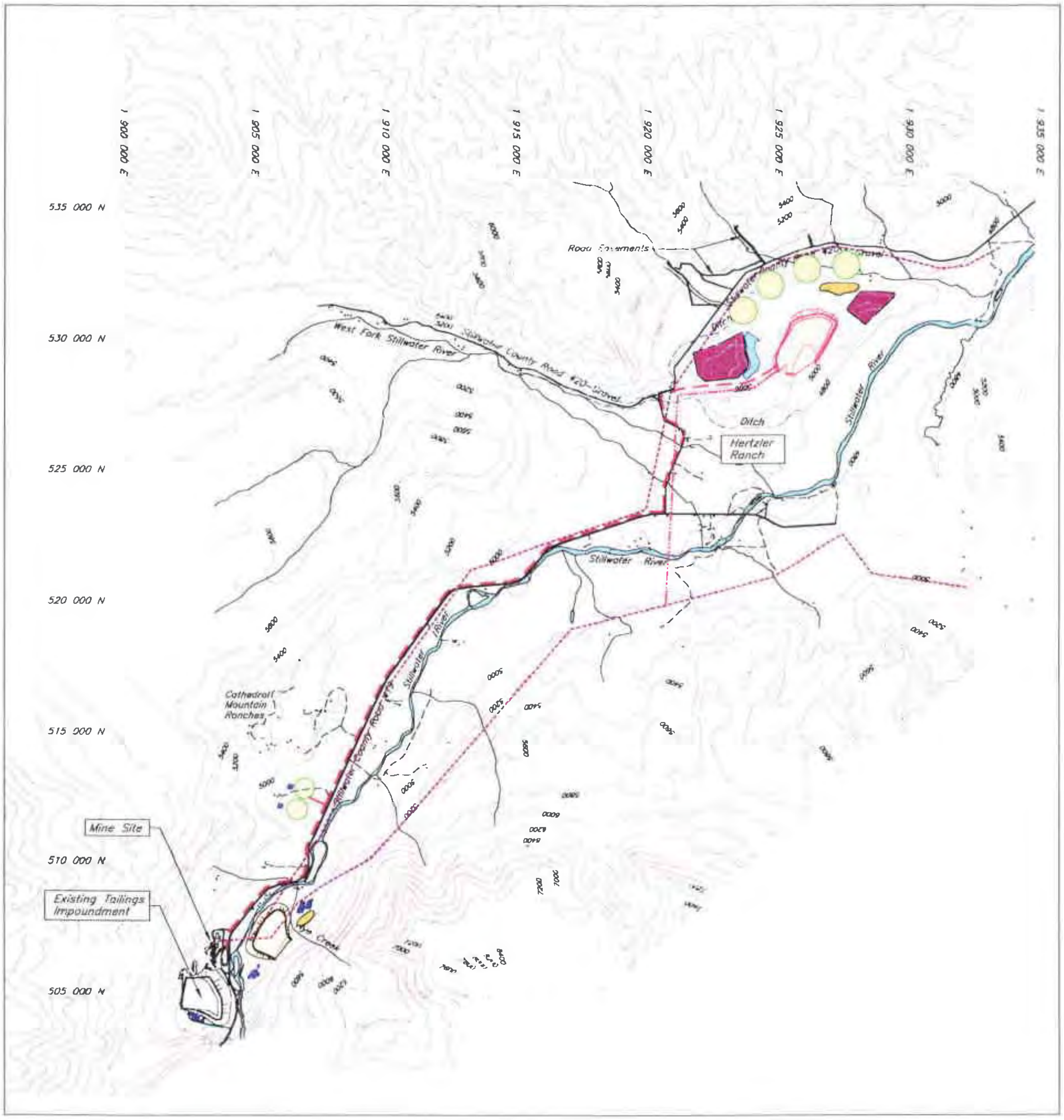
Under this alternative, SMC would expand the existing tailings impoundment and construct a new impoundment at Hertzler Ranch. SMC also would then later construct a waste rock storage facility on the east side of the Stillwater River and develop additional facilities for LAD. **Figure 2–7** shows the distribution of the primary facilities comprising this alternative. The primary facilities are described below.

Implementation of this alternative would result in a smaller impoundment at Hertzler Ranch than would be constructed under the Proposed Action (Alternative B). This smaller impoundment would be 42 feet lower than the Proposed Action's impoundment and less visible. Also, the areal extent of surface disturbance would be about 40 percent less than what would occur under the Proposed Action.

Selection and implementation of this alternative also would remove the limitation on daily production (currently at 2,000 tpd). The permit would be based on an approved "footprint" of surface disturbance, not a rate of production. SMC would be able to alter daily levels of production to respond to changing conditions in the market, as described under the Proposed Action.

2.4.3.1 Waste Rock Production and Management

Under this alternative, SMC would have the capacity to dispose of an additional 21.271 million tons of waste rock. First, 1,630,000 tons of waste rock would be placed in the temporary and permanent storage areas already permitted by DEQ and CNF for waste rock **(Figure 2–1)**. Another 1,755,000 tons of waste rock would be incorporated into the embankments of the existing tailings impoundment as it is completed to its currently-permitted configuration. About 2,660,000 tons of waste rock then would be incorporated into the embankments of the existing tailings impoundment as it is expanded from its currently-permitted configuration. The remaining 15,226,000 tons of waste rock would be placed in the east side waste storage site **(Figure 2–3)**. The east side waste storage site would be constructed and located as described under Alternative B — Proposed Action.



LEGEND

- Proposed Pipeline Alignment
- Approximate Location of Overhead Power Line
- Approximate Location of Proposed Overhead Power Line
- Road
- Land Application Disposal Site
- Borrow Area
- Topsoil Stockpile
- Land Application Disposal Storage Pond
- Waste Rock Storage Area
- Hertzler Tailings Impoundment
- Sediment / Percolation Pond

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Location of Primary Facilities Comprising Alternative C - Modified Centerline Expansion and Hertzler Tailings Impoundment
Figure 2-7

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2.4.3.2 Tailings Production and Management

SMC would split the disposal of tailings generated during the next 20 to 30 years between the existing impoundment and a new tailings impoundment constructed at the Hertzler Ranch. The first 6,450,000 tons of tailings generated would be placed in the existing tailings impoundment. The next 10,150,000 tons of tailings would be placed in the new Hertzler impoundment. Thus, construction of the pipelines and Hertzler tailings impoundment would occur about 10 to 15 years into the 20- to 30- year period.

Existing Tailings Impoundment

The existing tailings impoundment contains 1,900,000 tons of tailings today and can accommodate another 1,600,000 tons of tailings in its currently-permitted configuration. It then would be expanded by modified centerline construction to accommodate another 4,850,000 tons of tailings. This expansion would increase the total capacity of the existing tailings impoundment to 8,350,000 tons and increase the areal extent of the tailings impoundment from 60 acres to 68 acres. Also, the final crest elevation of the impoundment would increase 64 feet, from 5,111 feet to 5,175 feet (**Figure 2–8**).

Hertzler Tailings Impoundment

The tailings impoundment constructed at Hertzler Ranch under this alternative would be smaller than that under the Proposed Action. This impoundment would cover about 129 acres of Hertzler Ranch. The impoundment would be constructed in three phases, with the final crest elevation at 5,007 feet. By comparison, the Hertzler impoundment of the Proposed Action would cover 163 acres and have a crest elevation of 5,036 feet. **Figure 2–9** shows the plan and cross section of the Hertzler impoundment that would be constructed under this alternative.

The Hertzler tailings impoundment would be constructed similarly to the Proposed Action's impoundment. The embankment would be built from on-site borrow material excavated from within the footprint of the impoundment and from one or two borrow areas located near the impoundment. The impoundment would be lined with a 60-mil thick HDPE liner. A seepage collection system consisting of underdrains constructed on top of the HDPE liner and recycle ponds would be included. Finally, the impoundment's design includes minimum freeboard to ensure overtopping of the embankment would not occur.

Tailings Pumping and Transmission Systems

The tailings pumping and transmission system would be the same as described for the Proposed Action. Thus, it would consist of the same series of facilities constructed to transport tailings from the concentrator, underground sand plant,

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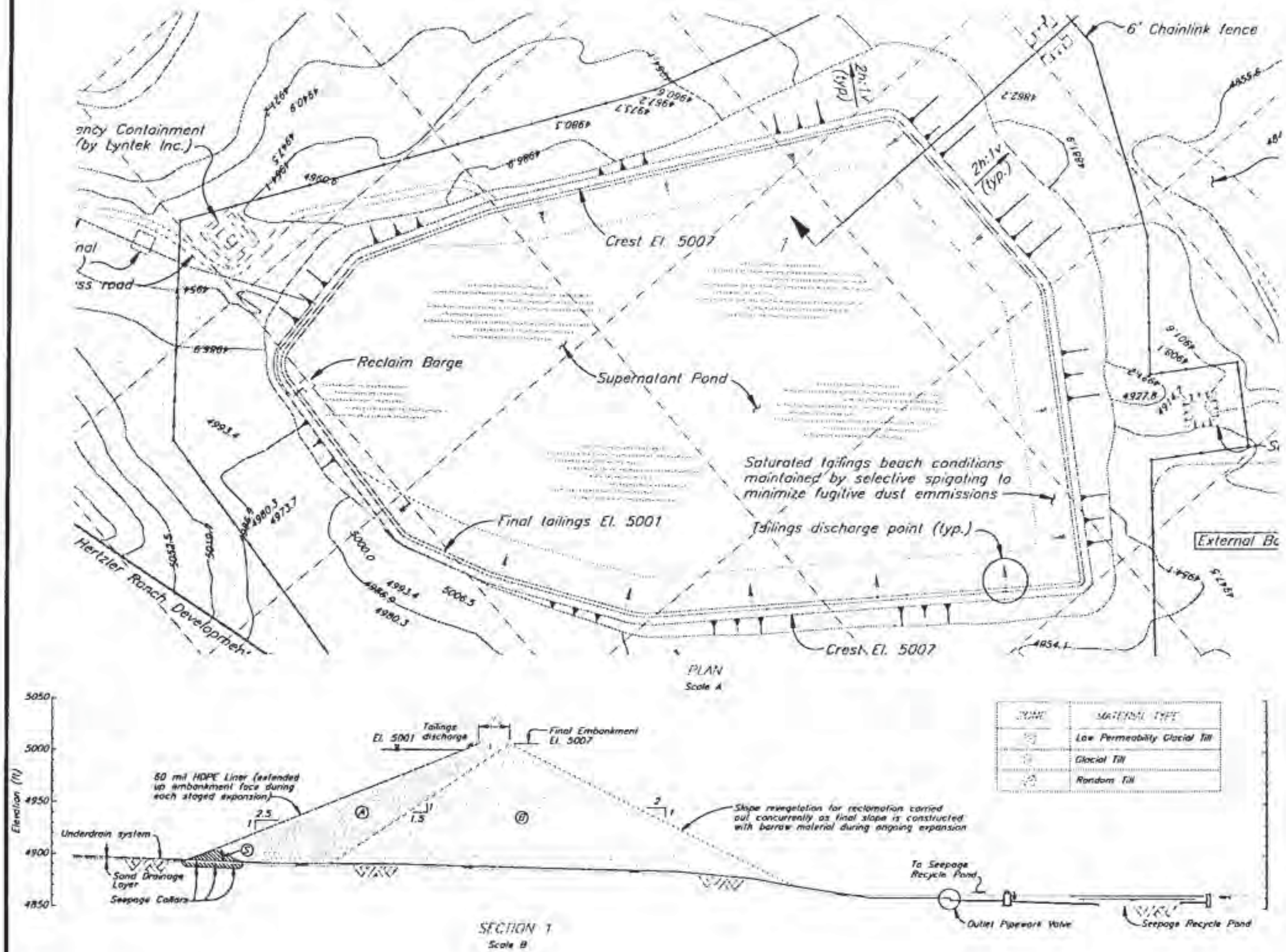
Modified Centerline Expansion of the Existing Tailings Impoundment
Figure 2-8



Source: Knight & Piesold, 1996.

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Plan and Section of the Hertzler Tailings Impoundment Under Alternative C
Figure 2-9

or the expansion of the existing tailings impoundment to the new Hertzler impoundment. Components of the system include a tailings thickener plant, tailings reclaim system (to reclaim tailings from the existing impoundment), tailings pumping system, and tailings slurry pipelines. Each component is described in detail under the Proposed Action. Construction of the tailings pumping and transmission systems would occur during the initial construction of the new Hertzler impoundment, 10 to 15 years into the 20- to 30-year extension of the Stillwater Mine's operations.

2.4.3.3 Water Management and Disposal

Under this alternative, SMC would continue to handle the adit water and process and tailings water separately. SMC would dispose of adit water using existing percolation ponds, the ABC, and LAD systems as discussed for the Proposed Action. SMC would add LAD systems at the Stratton and Hertzler ranches **(Figure 2–8)** when construction of the east side waste storage site forces SMC to move the east side LAD to these sites. A pipeline buried with the slurry tailings pipelines would transport the adit water from the clarifiers to these sites.

SMC would handle tailings or process water under this alternative in the same manner as described for the Proposed Action. The water would continue to be used in the milling and concentrating circuits and to transport tailings to the tailings impoundments. In the impoundments, the water would either evaporate or would be reclaimed and pumped back to the mill for reuse in the milling and concentrating circuits.

2.4.3.4 Power Requirements

The requirements for power for this alternative would be similar to those of the Proposed Action. Montana Power Company would supply the power to the main Stillwater Mine using its existing line. A one-mile extension of that line to the Hertzler Ranch impoundment to provide the 500 horsepower to meet the operational demands of this impoundment. The extension would probably follow the existing road rights-of-way or power line right-of-way.

2.4.3.5 Roads and Traffic

No modifications of existing and previously-approved permit-related roads within the permit boundary would occur. Access roads to the Hertzler Ranch may be upgraded to allow for installation of the system of buried pipelines within the rights-of-way. Minor road extensions would be required from Stillwater County Road 420 to the Hertzler impoundment.

2.4.3.6 Workforce Requirements/Socioeconomics

Essentially, the workforce requirements and socioeconomics of this alternative would be the same as those described for the Proposed Action. Thus, the number of SMC's employees at the Stillwater Mine would increase from about 655 (December 31, 1997) to 700. Forty to 45 percent of the additional workers are expected to be local residents.

2.4.3.7 Monitoring

The monitoring program for this alternative would be identical to that described for the Proposed Action. SMC would continue to monitor annually the acid-generating potential of tailings and waste rock. The pipelines would be monitored according to the Pipeline Monitoring and Spill Contingency Plan developed by SMC. Monitoring of water quality would continue as directed by SMC's MPDES permit and operating permit. Stormwater containment measures and sampling would follow SMC's Stormwater Pollution Prevention Plan. Finally, if this alternative is selected, SMC would modify its water monitoring plan and submit it to DEQ for approval.

2.4.3.8 Reclamation

Reclamation procedures have been defined for the tailings impoundments, east side waste rock storage site, and pipelines. These procedures are the same as those described under the Proposed Action.

2.4.3.9 Bonding

If this alternative is selected, the additional bond would be calculated using the specifications, stipulations, and mitigations contained in the approved and permitted amendment. The bond would include costs for long-term maintenance of water management practices, such as percolation ponds and diversion ditches; demolition of buildings and other facilities; earth movement and soil replacement; seeded preparation; and revegetation.

DEQ has developed an approximate estimate of the range in which the new bond amount would be, if this alternative is selected. Bond for SMC's operations would increase from slightly more than $3 million to $10 to $12 million dollars. Additionally, if DEQ decides long-term water treatment is necessary at closure, the bond for this alternative would increase to $19 to $24 million.

2.4.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impundment

Under this alternative, SMC would expand the existing tailings impoundment and construct a new impoundment on the east side of the Stillwater River. SMC also would construct a small waste rock storage facility on the east side of the Stillwater River and develop additional facilities for LAD. **Figure 2–10** shows the distribution of the primary facilities comprising this alternative. The primary facilities are described below.

Implementation of this alternative would result in no development at Hertzler Ranch. All new facilities would be concentrated in the general vicinity of the Stillwater Mine and Stratton Ranch.

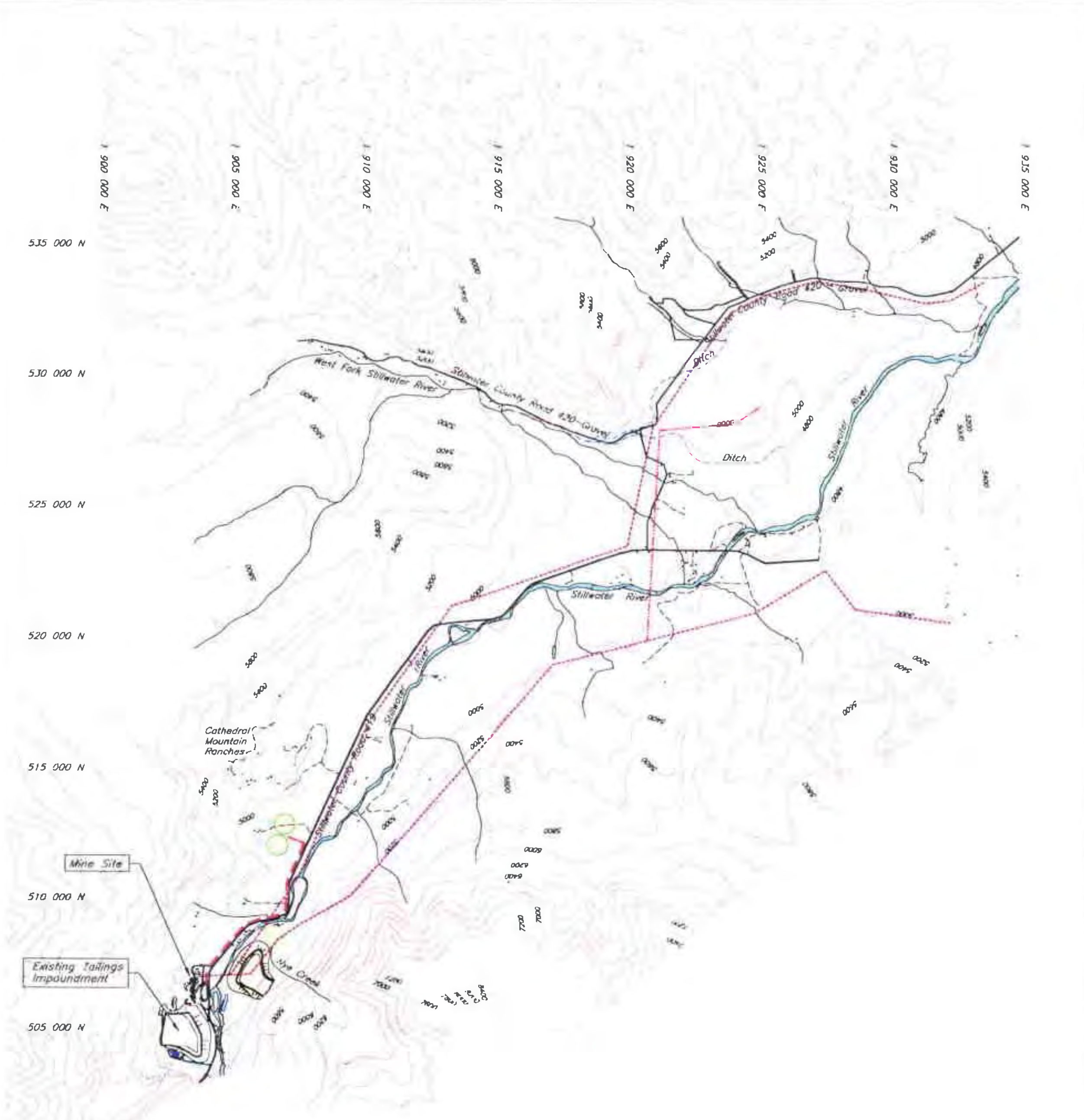
Selection and implementation of this alternative also would remove the limitation on daily production (currently at 2,000 tpd). The permit would be based on an approved "footprint" of surface disturbance, not a rate of production. SMC would be able to alter daily levels of production to respond to changing conditions in the market, as described under the Proposed Action. However, under Alternative D, only 15,885,000 tons of waste rock and 11,390,000 tons of tailings could be stored in the two tailings impoundments, thus reducing the life of these facilities from 30 to 23 years at 3,000 tpd. SMC would need to submit a revision for a third impoundment to continue operating beyond this 23-year period.

2.4.4.1 Waste Rock Production and Management

Under this alternative, SMC would have the capacity to dispose of almost 15.9 million tons of waste rock. First, 1,630,000 tons of waste rock would be placed in the temporary and permanent storage areas already permitted by DEQ and CNF for waste rock (**Figure 2–1**). Another 1,755,000 tons of waste rock would be incorporated into the embankments of the existing tailings impoundment as it is completed to its currently-permitted configuration. About 2,660,000 tons of waste rock would be incorporated into the embankments of the existing tailings impoundment as it is expanded from its currently-permitted configuration. The remaining 9,840,000 tons would be incorporated into the embankments of the East Stillwater tailings impoundment.

2.4.4.2 Tailings Production and Management

SMC would split the disposal of tailings generated during the next 20 to 30 years between the existing impoundment and a new tailings impoundment constructed at the east Stillwater site. About 6,450,000 tons of additional tailings could be



LEGEND

- Proposed Pipeline Alignment
- Approximate Location of Overhead Power Line
- Approximate Location of Proposed Overhead Power Line
- Road
- Land Application Disposal Site
- Borrow Area
- Topsoil Stockpile
- Land Application Disposal Storage Pond
- Waste Rock Storage Area
- Tailings Impoundment

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Location of Primary Facilities Comprising Alternative D - Modified Centerline Expansion and East Side Tailings Impoundment
Figure 2-10

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placed in the existing tailings impoundment. Another 4,940,000 tons of tailings would be placed in the new East Stillwater impoundment. Construction of the pipelines and East Stillwater tailings impoundment would occur immediately upon approval to facilitate the use of both impoundments.

Existing Tailings Impoundment

The existing tailings impoundment contains 1,900,000 tons of tailings today and can accommodate another 1,600,000 tons of tailings in its currently-permitted configuration. It then would be expanded by modified centerline construction to accommodate another 4,850,000 tons of tailings. This expansion would increase the total capacity of the existing tailings impoundment to 8,350,000 tons and increase the areal extent of the tailings impoundment from 60 acres to 68 acres. Also, the final crest elevation of the impoundment would increase 64 feet, from 5,111 feet to 5,175 feet **(Figure 2–8)**.

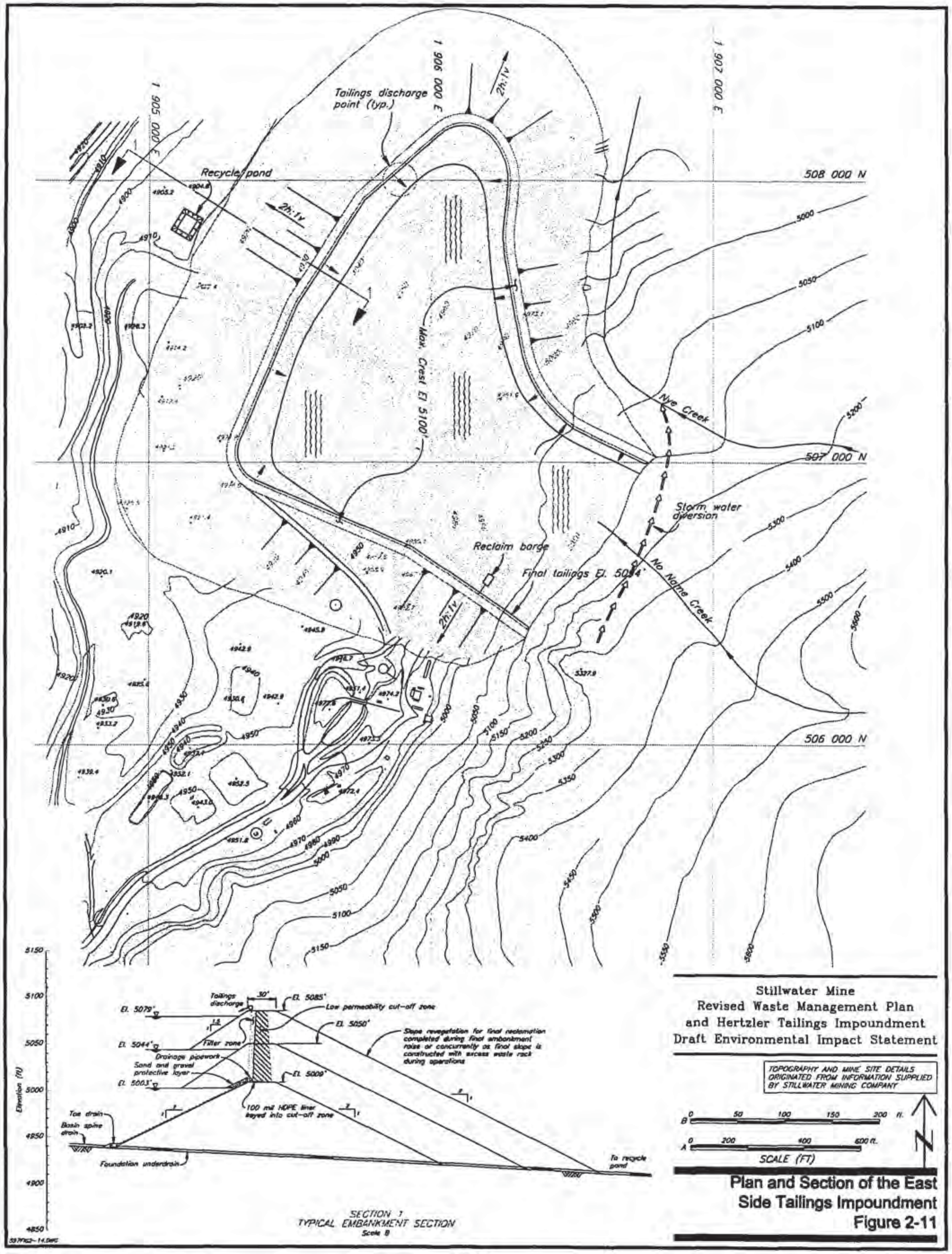
East Stillwater Impoundment

The tailings impoundment constructed on the east side of the Stillwater River under this alternative would be slightly higher than the east side waste rock storage facility included in alternatives B and C. This impoundment would cover about 72 acres, 8 acres less than the what the east side waste storage facility would cover. The impoundment would be constructed in three phases with the final crest elevation at 5,085 feet. By comparison, the east side storage site associated with the other action alternatives would have a crest elevation of 5,080 feet. **Figure 2–11** shows the plan and cross section of the East Stillwater impoundment that would be constructed under this alternative.

Except for one feature, the East Stillwater tailings impoundment would be constructed similarly to the Hertzler impoundment. Instead of using on-site borrow material excavated from within the footprint of the impoundment and borrow areas located near the impoundment, the embankment would be built using waste rock from the mine. Also, the impoundment would be lined with a 100-mil thick HDPE liner. The rest of the construction would be similar to that described under the Proposed Action. A seepage collection system consisting of underdrains constructed on top of the HDPE liner and recycle ponds would be included. Finally, the impoundment's design includes minimum freeboard to ensure overtopping of the embankment would not occur.

Tailings Pumping and Transmission Systems

The tailings pumping and transmission system would be the same as described for the Proposed Action, except it would be substantially shorter. It would consist of the same series of facilities constructed to transport tailings from the concentrator, underground sand plant, or the expansion of the existing tailings



Plan and Section of the East Side Tailings Impoundment
Figure 2-11

impoundment to the new east side impoundment. Components of the system include a tailings thickener plant, tailings reclaim system (to reclaim tailings from the existing impoundment), tailings pumping system, and tailings slurry pipelines. Each component is described in detail under the Proposed Action.

Due to constraints in crossing the Stillwater River, the pipelines would be suspended across the river or attached to the bridge it could not be buried under the river.

2.4.4.3 Water Management and Disposal

Under this alternative, SMC would continue to handle the adit water and process and tailings water separately. SMC would dispose of adit water using percolation ponds, the ABC, and LAD systems as discussed for the Proposed Action. SMC would construct additional percolation ponds and LAD systems on the east side of the Stillwater River and at the Stratton Ranch (**Figure 2–10**) when construction of the east side waste storage site forces SMC to move its existing LAD facilities. A pipeline suspended with the slurry tailings pipelines across the Stillwater River and a separate pipeline to Stratton Ranch would transport the adit water from the clarifiers to these sites.

SMC would handle tailings or process water under this alternative in the same manner as described for the Proposed Action. The water would continue to be used in the milling and concentrating circuits and to transport tailings to the tailings impoundments. In the impoundments, the water would either evaporate or would be reclaimed and pumped back to the mill for reuse in the milling and concentrating circuits. The water resource monitoring plan would be modified.

2.4.4.4 Power Requirements

The requirements for power for this alternative would be similar to those of the Proposed Action. Montana Power Company would supply the power to the main Stillwater Mine using its existing line. A short extension of that line to the East Stillwater tailings impoundment would be constructed to provide the 500 horsepower to meet the operational demands of this impoundment.

2.4.4.5 Roads and Traffic

No modifications of existing and previously-approved permit-related roads within the permit boundary would occur. Stillwater County Road 419 may be upgraded between the Stillwater Mine and Stratton Ranch to allow for installation of the buried pipeline within the rights-of-way.

2.4.4.6 Workforce Requirements/Socioeconomics

Essentially, the workforce requirements and socioeconomics of this alternative would be the same as those described for the Proposed Action. Thus, the number of SMC's employees at the Stillwater Mine would increase from about 655 (December 31, 1997) to about 700. Forty to 45 percent of the additional workers are expected to be local residents.

2.4.4.7 Monitoring

The monitoring program for this alternative would be identical to that described for the Proposed Action. SMC would continue to monitor annually the acid-generating potential of tailings and waste rock. The pipelines would be monitored according to the Pipeline Monitoring and Spill Contingency Plan developed by SMC. Monitoring of water quality would continue as directed by SMC's MPDES permit and operating permit. Stormwater containment measures and sampling would follow SMC's Stormwater Pollution Prevention Plan. Finally, if this alternative is selected, SMC would modify its water monitoring plan and submit it to DEQ for approval.

2.4.4.8 Reclamation

Reclamation procedures have been defined for the tailings impoundments, east side waste rock storage site, and pipelines. These procedures are the same as those described under the Proposed Action.

2.4.4.9 Bonding

If this alternative is selected, the additional bond would be calculated using the specifications and stipulations contained in the approved and permitted amendment. The bond would include costs for long-term maintenance of water management practices, such as percolation ponds and diversion ditches; demolition of buildings and other facilities; earth movement and soil replacement; seed bed preparation; and revegetation.

DEQ has developed an approximate estimate of the range in which the new bond amount would be, if this alternative is selected. Bond for SMC's operations would increase from slightly more than $3 million to $5 to $7 million dollars. Additionally, if DEQ decides long-term water treatment is necessary at closure, the bond for this alternative would increase to $14 to $19 million.

2.4.5 Agency Mitigations

DEQ and CNF's decisions on the previous environmental analyses (1985 through 1996) required SMC to implement a variety of mitigation measures. Many of these measures are ongoing or annual requirements. Consequently, SMC must continue to implement them, regardless of the decision made on this analysis. A summary of the mitigation measures required in the previous decisions is included as **Appendix C**.

Through the analysis of environmental consequences, DEQ and CNF identified additional mitigation measures relative to this proposed action or the action alternatives discussed in this EIS. These measures are:

1) The agencies would require testing and monitoring of the permeability of the clay liner or compacted base on which the HDPE liner would be placed. If this testing showed that the material does not meet the minimum permeability requirement of 1x10-6 cm/sec, then additional clay material would need to be brought in to reduce the permeability. The actual cost of obtaining this material would vary depending upon how much material was needed and how far it had to be hauled to get to the site, because this affects the cost of purchasing the material and the amount of work involved in transporting the material to and placing the material at the site. SMC could also investigate other options of achieving the desired permeability. There are too many variables to determine what this cost might entail. If the monitoring showed that required permeabilities were obtained, SMC would noot incur costs for obtaining the additional clay material. No less restrictive method of protecting ground water has been identified.

2) SMC would be required to monitor ground water at the Hertzler Ranch to determine effects of seepage from the impoundment. The agencies would require an additional mitigation measure based on the results of the ground water monitoring. If ground water monitoring at the Hertzler Ranch indicated that nitrates or other contaminants were migrating at concentrations that would cause increases above the trigger level in the Stillwater River, SMC would be required to conduct biological monitoring of periphyton and macroinvertebrates above and below the site twice a year. This mitigation measure, if implemented, would require SMC pay for additional monitoring and testing. This type of monitoring and testing costs approximately $30,000 per year. The number of years of testing required would depend upon when ground water monitoring indicated biological monitoring was necessary. The additional monitoring would be required to comply with both MMRA and the Montana Clean Water Act.

3) If monitoring at Hertzler Ranch showed that groundwater quality exceeded nondegradation standards outside of the mixing zone then SMC would be required to identify, collect baseline data prior to construction of the pipeline and Hertzler impoundment from, and monitor nearby down-gradient residential wells that could potentially be affected by seepage from the Hertzler impoundment. SMC would be required to pay for the collection and testing of water samples. Typical collection and laboratory costs for a single sample range between $35.00 and $330.00 for nitrates and a full range of the constituents specified in SMC's ground water monitoring plan respectively. The total cost would depend upon the number of wells being sampled. This sampling would ensure that down-gradient water users would be identified and help determine if their water supplies became contaminated as a result of the Hertzler impoundment. If that occurred, then SMC would provide replacement water sources as required under MMRA. No less restrictive means of ensuring long term compliance is available.

4) SMC would be required to purchase a 250 kW backup generator to ensure pipeline leak detection sensor function and operation during power failures or partial power outages. This would cost SMC approximately $50,000 to purchase and $32.00 per hour to operate; it would take about 4 hours of pumping to vacate the tailings pipeline. However, if a power outage resulted in undetected leaks or ruptures of the pipeline, the cost of fines, penalties, and repairs could potentially exceed that amount. SMC proposes to construct an underground water storage reservoir at the 6400 foot level, however, it may not be constructed immediately and it would take time for it to fill up with enough water to provide sufficient volume to flush the pipelines by gravity feed alone. There may also be times during mine life when there was insufficient volume of water in the storage reservoir. Therefore, there is no less restrictive means of ensuring that the pipelines could be flushed in the event of a rupture during a power failure although a smaller generator would be sufficient to supply enough power to keep the leak detection system function.

5) If, after 2 years, agency review of pipeline monitoring data resulted in a decision to continue the monitoring of the tailings pipelines every six months and the water pipelines annually, there would be a continuing cost of monitoring the pipelines more frequently than SMC might want to specify. If the agency determined that pipeline monitoring frequency could be reduced, costs to SMC would be reduced slightly. No less restrictive means of ensuring pipeline failure does not occur has been identified.

6) SMC, DEQ, and CNF would re-evaluate paste technology applicability for use at the Stillwater Mine after 5 years of operations. There would be some costs for engineering studies. If the evaluation resulted in implementation of paste technology, there might be increases in construction and operational costs over more traditional mining and waste storage methods proposed under Alternative B. Those costs cannot be estimated at this time. No less restrictive means of providing a denser, and thus potentially smaller impoundment, which also retains less water and can be reclaimed in a shorter period of time has been identified. However, DEQ will make this evaluation again when paste technology is re-evaluated.

7) SMC would be required to work with the Stillwater Valley Bighorn Management Committee to explore options for mitigating indirect impacts to bighorn sheep. The company's main involvement would be attending meetings, developing mitigations, and implementing those mitigations. SMC currently works with the committee as required in their operating permit so no additional costs would be incurred for attending the meetings. No costs of mitigation implementation can be determined at this time because the plans have not be developed; the costs are not expected to be substantial. Furthermore, whether less restrictive means are available will be evaluated before a mitigation is imposed.

8) The agencies would require SMC to replace creeping meadow foxtail with a more palatable native species in the reclamation seed mix for the LADs. There would be virtually no difference in costs to SMC for implementing this mitigation measure.

9) SMC currently has a dust abatement program for the existing impoundment. As mitigation, the agencies would require that program be extended to the Hertzler or east side impoundments, depending upon the alternative implemented. The dust abatement program would be implemented whenever one of the impoundments was not in use as well as when both were inactive. This mitigation would result in a slight increase in operating costs to keep both surfaces wet. This mitigation would be required under the air quality permit to comply with the Montana Air Quality Act.

10) During final design development of the Hertzler tailings impoundment, SMC would be required to conduct stability modeling and analyses on the Colorado Shale Unit for deep foundation failures. The agencies would also require that a professional engineering geologist or geotechnical engineer would observe the excavation of the Hertzler Ranch impoundment foundation and borrow areas to determine if any geomorphological features were exposed that would indicate ancient

mass failure. If such features were observed or if the modeling indicated a potential for mass failure, then SMC would be required to develop a plan for a detailed bedrock drilling program and analysis. The plan would be subject to agency review and approval prior to implementation. Necessary changes to the design of the impoundment would be developed, reviewed and approved by the agencies, and implemented to resolve any problems identified by the drilling and bedrock analysis. There would be a slight increased cost for running the additional stability modeling during final design ($2,000 to $5,000). Since SMC typically has a professional engineer on hand during construction for quality control purposes, there would be no additional cost for the engineer to look for signs of mass failure. The costs associated with drilling and bedrock analysis and any resulting engineering designs and construction changes cannot be determined at this time. This mitigation would confirm that the shale bedrock and glacial till had not been affected by past mass movement and that the glacial till would provide a suitable foundation for the impoundment. This requirement would be required under MMRA and no less restrictive means of ensuring that the impoundment would not be subject to mass failure has been identified.

11) The agencies would require SMC to develop incentives for employee carpooling. This requirement is based on the need for minimizing the potential for accidents on road segments in need of resurfacing. Incentives could have varying costs to SMC depending upon what SMC included in their plan and how many employees take advantage of the incentives. These costs cannot be estimated at this time. This analysis of restriction would be reevaluated when a plan is submitted to the agencies. The need for this stipulation may be eliminated through the Hard Rock Impact Plan.

12) The agencies would require SMC to extend the first lift of the proposed Hertzler tailings impoundment to the full footprint so that the outer slopes can be reclaimed once and not redisturbed during construction of the second lift. This could increase construction costs of the embankment of the first lift by approximately $1.2 million, but it would eliminate the need to reclaim that portion of the embankment a second time under alternatives B and C (there would be no impoundment at Hertzler Ranch under Alternative D). The cost for stage two would be reduced by $1.2 and so there would be no net increase in cost of constructing the impoundment Interim revegetation of the first left as planned under Alternative B would mitigate visual impacts and provide for slope stabilization, but the slope would be redisturbed when the second lift was constructed and require revegetation for a second time. There are no other ways to provide for final revegetation of the outer slope of the first lift and eliminate

redisturbance of the slope. SMC could investigate modifying the final design so that there is no net increase in volume of borrow needed to build the first lift out to the final footprint, it is anticipated that this would reduce the height of the first lift which would be made upp in the second lift; this could reduce the up front capital needed to construct the first lift. This mitigation is more restrictive than that proposed under Alternative B.

13) SMC specified in its revision application that the outer slopes of the Hertzler impoundment and east side waste rock storage site would be reclaimed with a mosaic of vegetation and rock. SMC did not specify how long the soiled and vegetated slopes would be. The agencies would require a mitigation measure to specify that revegetated slopes would not exceed 150 feet in length before being intercepted by a rocky zone. This rocky zone or armor would be placed asymmetrically across the slope. This would not result in any additional costs to SMC and is an extension of a mitigation for the existing required under the 1992 ROD on the 2,000 tpd EIS. This mitigation would be necessary to ensure successful reclamation of these slopes, to reduce erosion, and comply with MMRA.

14) SMC would be required to have a professional archeologist present during construction of the pipeline and the embankments for the first lift of the Hertzler impoundment when construction of these facilities approaches identified and potential cultural sites. The archeologist would be responsible for identifying any cultural material that might be exposed during construction. This would result in additional costs of paying for those services. Current rates for a professional archeologist range between $25.00 and $50.00 an hour; SMC would also need to cover lodging and meals for the person hired for this purpose. The total cost would depend upon on how long construction took and on any needed mitigations. This restriction would be required to comply with the various federal laws pertaining to cultural, historic, and archeological resources. No less restrictive means of protecting archeological resources has been identified.

2.5 Alternatives Considered but Eliminated (& rationale)

Several potential alternatives were considered for this analysis, but were dropped from detailed study for various reasons. These alternatives are listed below and the reasons they were excluded from further consideration are summarized. Addition information on these alternatives is included as **Appendix H**.

When reviewing the alternatives presented in this section, the reader must keep in mind the MEPA/NEPA process requires that alternatives evaluated in detail be implementable (i.e., something that could be developed if approved). Moreover, economic feasibility in part defines whether or not something could go forward or is reasonable. The intent that economic feasibility is to be included in the determination of the reasonableness of alternatives is expressed in CEQ's memorandum on the 40 Most Asked Questions about NEPA. In part, CEQ's answers to these questions state *"reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense... "* (CEQ 1981). In response to this direction, DEQ and CNF considered economic feasibility or cost in their determination of the reasonableness of the alternatives developed for this MEPA/NEPA analysis.

2.5.1 1985 Tailings Facilities Sites

During the initial permitting of the Stillwater Mine, the DSL and CNF evaluated 18 possible locations for a tailings impoundment within a reasonable distance of the Stillwater Mine (DSL and Forest Service 1985; Appendix B). All but three sites were eliminated in the two-step selection process. The three sites not eliminated were the mine site, Stratton Ranch, and Hertzler Ranch (DSL and Forest Service 1983, 1985).

During the current MEPA/NEPA process, DEQ and CNF reexamined 17 of the 18 sites to determine if the previous reasons for eliminating the sites from evaluation are still valid or if new information or technologies make some of the sites viable now. The 18th site was the Mine Site, which was selected as the preferred option in 1985. SMC constructed this facility and has operated it for the last nine years.

Table 2–2 summarizes the results of the reevaluation of the 1985 sites. Of the 17 sites reconsidered, all but the Hertzler Ranch sites (Sites B, C, and D) and the Old Tailing Mine (Site I) were eliminated from detailed consideration in this MEPA/NEPA analysis (at least one of the action alternatives analyzed in detail involves these sites). For all but Site G (Stratton Ranch), Site K (Beartooth Ranch), and Site M (Horseman Flats), the reevaluation found the rationale used in 1985 to eliminate the sites was still valid (**Table 2 –2**). Sites I, K, and M were eliminated for reasons other than those identified in 1985. The following discussion presents the reasons for which these three alternative sites for a tailings impoundment were dropped from detailed consideration in this EIS.

Table 2–2 Results of Reevaluation of 1985 Tailings Facilities Sites

Site ID	Name	Status	Reasoning
A	Robinson Draw	eliminated	1985 decision to eliminate due to failed floodplains test is still valid.
B	Hertzler Ranch	under consideration	SMC's present proposal involves Hertzler Ranch.
C	Hertzler Ranch	under consideration	SMC's present proposal involves Hertzler Ranch.
D	Hertzler Ranch	under consideration	SMC's present proposal involves Hertzler Ranch.
E	Stanley Coulee	eliminated	1985 decision to eliminate due to failed floodplains test is still valid.
F	Prairie Creek	eliminated	1985 decision to eliminate due to failed floodplains test is still valid.
G	Stratton Ranch	eliminated	1985 decision was to retain this site. However, more recent information suggests geologic stability and high groundwater table are concerns.
H	Limestone Cave	eliminated	1985 decision to eliminate due to concerns about geological stability and high groundwater are still valid. Also, to use this site, SMC would have to acquire private property and relocate individuals living there.
I	Old Tailing Mine	under consideration	This site is the East Stillwater site that is part of Alternative D.
J	Mine Site	eliminated	This site already is occupied by SMC's present tailings impoundment.
K	Beartooth Ranch	eliminated	This site was reevaluated for inclusion in action alternative as discussed in the narrative.
L	Mountain View	eliminated	1985 decision to eliminate due to concerns about geological stability is still valid. Also, pumping tailings for backfilling several mine sites is not economically feasible.
M	Horseman Flats	eliminated	This site was reevaluated for inclusion in an action alternative as discussed in the narrative.
N	Horseman Flats	eliminated	1985 decision to eliminate due to concerns about geological stability and the need to acquire privately-owned land is still valid.
O	Cathedral Mountain	eliminated	1985 decision to eliminate due to concerns about geological stability and the need to acquire the privately-owned lands is still valid.
P	Buffalo Jump	eliminated	1985 decision to eliminate due to concerns about geological stability is still valid.
Q	Ranch Creek	eliminated	1985 decision to eliminate due to concerns about geological stability and violations of Stillwater County's zoning regulations is still valid.
R	Horseman Flats	eliminated	1985 decision to eliminate due to the need to acquire privately-owned lands and concerns about geological stability is still valid.

Alternative Considered:	Tailings impoundment at Stratton Ranch (Site G on **Table 2–2**).
Reasons Considered:	The 1985 analysis determined this site was reasonable for construction of a tailings impoundment. Use of this site may have eliminated the water-related concerns and potential effects associated with a tailings impoundment at Hertzler Ranch and the 7.8-mile long pipelines needed to support an impoundment at Hertzler Ranch.
Reasons Dropped:	Current information suggests much of the Stratton Ranch site is geotechnically unstable and unsuitable as a foundation for a tailings impoundment. A potential landslide area exists on the site's western margin. Because the site has shallow groundwater and wetlands, extensive diversion of surface water would be necessary as part of any attempt to stabilize the site. Also, the facility would be highly visible.

Alternative Considered:	Tailings impoundment at Beartooth Ranch (Site K on **Table 2–2**) developed in conjunction with the East Stillwater impoundment to provide the necessary capacity for tailings.
Reasons Considered:	This site is close to the Stillwater Mine. It also involves private lands owned by SMC and federal lands administered by the Forest Service, so acquisition of the site is possible. In conjunction with the East Stillwater impoundment, it would eliminate the near-term need for a tailings impoundment at Hertzler Ranch.
Reasons Dropped:	Compared to the other alternatives available, technical, environmental, and economical concerns rendered this alternative unreasonable. Development of a tailings impoundment at the site also would present technical challenges. The site is within the floodplain of the Stillwater River and would require significant floodproofing of the tailings retention structure and possibly modification of the drainage channel to accommodate design stream flows. There is a high potential for soft, unstable foundation conditions

in the floodplain soil deposits, requiring flatter embankment slopes or a reduced level of stability.

Use of this site would force the relocation of individuals and a working ranch, would remove winter range occupied by the Stillwater Valley's herd of bighorn, and would establish a large tailings impoundment near the wilderness boundary. The location within a riparian environment also may result in wetlands disturbance requiring additional mitigation measures. The shallow depth to groundwater would increase the risk of water quality impacts due to any seepage incidences.

Additional disturbance would occur because SMC would have to construct a single pipeline to Stratton Ranch to transport adit water to LAD systems installed here. However, even with LADs at Stratton Ranch, SMC probably would not be able to dispose of all the adit water it would produce as production is increased.

An initial estimate of the costs for operation of a tailings impoundment at the Beartooth Ranch site suggests costs would be on the order of $3.88 per ton of tailings, or almost 19 percent higher than similarly-based costs for Alternative B ($3.27 per ton of tailings). The primary reason for these increased costs is the increased capital costs to develop a second impoundment site with associated tailings pipeline and water reclaim lines as well as the requirement to pump tailings 1.5 miles to a site that is 300 feet above the Stillwater Mine's mill.

Alternative Considered: Tailings impoundment on Horseman Flats (Site M on **Table 2–2**) developed in conjunction with the East Stillwater impoundment to provide the necessary capacity for tailings.

Reasons Considered: This site is comparatively close to the Stillwater Mine. It also involves federal lands administered by the Forest Service so acquisition of the site is possible. In conjunction with the East Stillwater impoundment, it would eliminate the near-term need for a tailings impoundment at Hertzler Ranch.

Reasons Dropped:

The primary concern with the Horseman Flats site is associated with the risk involved in pumping the tailings long distances under high pressure. The Horseman Flats Site is located about 2.5 miles away and 1,100 feet higher than the existing mill facility. Access to the site could be achieved by existing roads, however improvement would be required to allow all-weather access from the mill site. Several pumping schemes are conceptually viable; however, from considerations of surface disturbance, operational reliability, and overall efficiency, the economic analysis considered that future tailings would be pumped by high horsepower, positive displacement pumps located at the existing mill facility. The tailings would be conveyed through a HDPE lined, steel pipe with secondary containment. The high pumping pressures and resulting pipe friction and abrasion would require a high level of pipeline maintenance. Accordingly, this pipeline would need to be at the surface to allow monitoring and maintenance access.

Alternative methods of transporting slurry tailings to the impoundment site such as trough conveyors or bucket conveyors are not considered feasible. Trough conveyors are limited by the gradation and consistency of the material that can be conveyed and would not allow transport of even dewatered or thickened tailings. Bucket conveyor systems would require specialized containment provisions to transport slurry. Either system would be considered non-traditional with limited, if any, demonstrated use in long-distance tailings transport.

The potential for accidental discharge of tailings is very likely over the operational life of the facility. Due to the tailings pipeline being above grade and extending up the valley slope, there would be a high visual impact. The risk of surface and ground water quality impacts, while not as high as the Beartooth site, would still be an issue. There are several downstream water users that would be affected by any water quality impacts. The upper portion of Horseman Creek would require diversion around the impoundment.

This site and its environs are used heavily for recreation and a substantial number of identified sources of domestic water occur up and down gradient of the site and elsewhere on Horseman Flats. These sources supply water to residents of the Cathedral Mountain Ranch subdivision.

Additional disturbance would occur because SMC would still have to construct a single pipeline to Stratton Ranch to transport adit water to LAD systems installed here. However, even with LADs at Stratton Ranch, SMC probably would not be able to dispose of all the adit water it would produce as production is increased.

An initial estimate of the costs for operation of a tailings impoundment at the Horseman Flats site suggests costs would be on the order of $3.94 per ton of tailings, or almost 21 percent higher than similarly-based costs for Alternative B ($3.27 per ton of tailings). The primary reason for the higher costs associated with this alternative is the increased capital costs to develop the second impoundment site at Horseman Flats with associated tailings pipeline and water reclaim lines as well as the requirement to pump tailings 2.5 miles to a site that is about 1,100 feet above the Stillwater Mine's mill.

2.5.2 1997 Alternatives Considered but Eliminated

Several new alternatives also were developed for consideration in the current MEPA/NEPA analysis, based on public input during scoping or public review of the draft EIS (40 CFR 1502.9 (b) and ARM 17.4.603 (10) (b)). Although the alternatives discussed below were initially developed for consideration, they were dropped from detailed analysis for the reasons identified.

Alternative Considered: A tailings impoundment in the Nye Creek drainage east of SMC's east side operation.

Reason Considered: This alternative location for the Hertzler tailings impoundment was suggested by a member of the public. The Nye Creek site is located approximately 1 mile east of the mill facility and is approximately 1,600 feet higher than the mill site. There is sufficient capacity within the drainage to impound in excess of 6 million tons of tailings; however, a dam that is more than 160 feet high would be required. Access to the site would require a major upgrades of existing four-wheel drive trails.

Reason Dropped: Compared to the other alternatives available, technical, environmental, and economical concerns rendered this alternative unreasonable. The accessibility to the site during winter would be restricted and any closure of the access road would prohibit operational access to the tailings impoundment and water reclaim system. To develop the required impoundment capacity, the required dam would be almost twice as high as required at either the Beartooth or Horseman Flats sites. This increases the risk of failure and the consequences of a failure. The potential for accidental discharge of tailings from the tailings transport pipeline would be very likely over the operational life of the facility. Due to the tailings pipeline being above grade and extending up the valley slope, there would be a high visual impact. Development of the tailings impoundment would require diversion of the Nye Creek drainage, which, considering the steep topography of the drainage basin, would be very disruptive to normal stream flows. The proximity of the Stillwater River increases the risk of any release of tailings or discharge of water causing a water quality impact. This would include both releases from the impoundment and accidental releases due to failure of pipelines leading to and from the impoundment.

Established technology for transport of the tailings to the impoundment would consist of either a multiple stage pumping system consisting of a series of pumps with surge tanks and reclaim ponds or a single stage pumping system and a high pressure pipeline. Use of multiple pumps would require significant site disturbance to develop each pumping station, provide all-weather vehicle access, provide a surge tank, provide electrical power, and provide emergency containment. Capital and operating costs would increase with each additional pump station installed. Accordingly, it was assumed that a single pumping stage would be used, with the pump station constructed near the existing mill facility.

The high horsepower, positive displacement pumps this alternative would require would cause substantial wear on the pipeline necessitating high maintenance and frequent access to the pipe. Consequently, the pipeline would have to be placed on the surface rather than be buried. During the course of operation, there would be a high probability that at some point, the pipeline would fail resulting in discharge of tailings to the environment. Secondary containment would be required in the pipeline design to control this discharge.

An initial estimate of the costs for operation of a tailings impoundment at the Nye Creek site suggests costs would be on the order of $4.09 per ton of tailings, or about 25 percent higher than similarly-based costs for Alternative B ($3.27 per ton of tailings). The primary reason for the higher costs associated with this alternative is the increased capital costs to develop the impoundment site at Nye Creek with associated tailings pipeline and water reclaim lines as well as the requirement to pump tailings 1 mile to a site that is about 1,600 feet above the Stillwater Mine's mill.

Alternative methods of transporting slurry tailings to the impoundment site, such as trough conveyors or bucket conveyors, are not considered feasible. Trough conveyors are limited by the gradation and consistency of the material that can be conveyed and would not allow transport of even dewatered or thickened tailings. Bucket conveyor systems would require specialized containment provisions

	to transport slurry. Either system would be considered non-traditional with limited, if any demonstrated use in long-distance tailings transport. This alternative also would require construction of a significant catchment basin at the mine site for surge control and to capture spills and drawdowns for accidents or maintenance.
Alternative Considered:	Disposal of tailings in the abandoned Benbow mining facilities instead of in a new tailings impoundment. These facilities are in the upper part of the Little Rocky Creek drainage just below the ridge that divides the Nye Creek and Little Rocky Creek watersheds.
Reason Considered:	This alternative was suggested by members of the public.
Reason Dropped:	This alternative was determined to be unreasonable because implementation would be technically unfeasible. This alternative would require pumping tailings from the Stillwater Mine up the Nye Creek drainage and over the 8,800-foot high drainage divide, a vertical gain in elevation of more than 3,500 feet. Established technology for transport of the tailings to the disposal site would consist of either a multiple stage pumping system consisting of a series of pumps with surge tanks and reclaim ponds or a single stage pumping system and a high pressure pipeline. Use of multiple pumps would require significant site disturbance to develop each pumping station, provide all-weather vehicle access, provide a surge tank, provide electrical power, and provide emergency containment. Capital and operating costs would increase with each additional pump station installed. Accordingly, it was assumed that a single pumping stage would be used, with the pump station constructed near the existing mill facility. The high horsepower, positive displacement pumps this alternative would require would cause substantial wear on the pipeline necessitating high maintenance and frequent access to the pipe. Consequently, the pipeline would have to be

placed on the surface rather than be buried. During the course of operation, there would be a high probability that at some point, the pipeline would fail resulting in discharge of tailings to the environment. Secondary containment would be required in the pipeline design to control this discharge.

Alternative methods of transporting slurry tailings to the impoundment site such as trough conveyors or bucket conveyors are not considered feasible. Trough conveyors are limited by the gradation and consistency of the material that can be conveyed and would not allow transport of even dewatered or thickened tailings. Bucket conveyor systems would require specialized containment provisions to transport slurry. Either system would be considered non-traditional with limited, if any, demonstrated use in long-distance tailings transport.

At this time, it is unknown if there is sufficient volume to dispose of the tailings in existing underground mine workings because the extent and condition of the underground workings is undefined. There is a high risk that there would not be sufficient volume and that development of surface disposal facilities would be required at some point in the future. The immediate site area does not readily allow development of an impoundment, requiring development at one of the other alternative sites. Further, the potential for groundwater impacts from seepage resulting from the subsurface tailings disposal would be very difficult to predict or control. Additionally, this alternative would require construction of a significant catchment basin at the mill site for surge control and to capture spills and drawdowns for accidents or maintenance.

Alternative Considered: Total Tailings Paste Backfill and Landfill (backfill and landfill were considered together because if SMC does not implement total tailings paste backfill, total tailings paste landfill would not be possible — SMC would be removing the sand fraction for backfilling in the mine.)

Reason Considered:

Total tailings paste backfilling is one of the new emerging technologies for handling and disposing of tailings. Depositing the paste as backfill in underground mining areas involves the placement of tailings in abandoned mine shafts and workings. This method of disposal could eliminate the placement of at least some of the tailings on the surface.

Paste landfilling involves the placement on the ground surface of a tailings paste that consists of tailings that have a low moisture content. The paste retains moisture in a manner similar to wet concrete. Thus, the moisture does not separate when the paste is allowed to rest. Paste properties allow the tailings paste to be placed on the surface as an engineered fill, rather than as a wet slurry placed behind a dam. Use of paste also may decrease the time required for the tailings mass to achieve its ultimate density and volume.

Reason Dropped:

The agencies determined implementation of total tailings paste backfill at the Stillwater Mine is not reasonable at this time. Several considerations formed the foundation for this conclusion. First, this technology has only recently been implemented in a full-scale, operational mode in other underground mines and critical issues remain unresolved. For example, no one knows:

- if SMC's tailings can be dewatered by a paste plant effectively,
- the amount of cementing materials that need to be added to provide the strength necessary for safe mining,
- the amount of time required for the paste backfill to gain strength,
- if the amount of time needed to gain strength can be accommodated by the mine's production schedule,
- the distance the paste can be pumped, and
- the requirements for adding any additional natural sand materials to provide a suitable backfill.

Second, implementation of a total tailings paste backfill system would not eliminate the need for additional aboveground storage for tailings. The increase (swell) in volume of rock resulting from mining and processing of the ore combined with the necessity for maintaining certain areas of the mine open for access indefinitely ensure that all tailings cannot be placed underground. SMC would have to store this excess volume somewhere on the surface. (Considerations of surface disposal are discussed under total tailings landfill).

If whole tailings paste backfill was implemented, about 68 percent of the tailings would be used as paste backfill in place of the current sand system and 32 percent of the would have to report to the surface for disposal. Under SMC's current system, 58 percent of the tailings report as backfill in the mine and 42 percent report as slurried tailings to the tailings impoundment. Consequently, the volume of whole tailings paste reporting to a surface impoundment would not reduce the size of the impoundment required for storage much over that needed for slurried tailings. For example, to store the same volume of tailings as addressed by Alternative B, an impoundment built at Hertzler using whole tailings paste would cover about 150 acres (compared with 163 acres for Alternative B) and would have a final embankment elevation of 4,996 feet (compared to 5,036 feet for Alternative B). Placing total tailings paste on the east side of the Stillwater River, would require an impoundment that would cover about 80 acres of surface area with a final crest elevation of 5,060 feet.

Transport of the total tailings paste to the landfill site would be a substantial problem, technically. As discussed below, the paste plants would be at the mine site. However, pipeline transport of total tailings paste is not technically feasible because the paste would have to be re-slurried for delivery to the landfill site and then dewatered again to reestablish a paste for disposal. A conveyor system to move the volume of tailings generated from a 3,000 to 5,000 tpd operation would be prohibitively large and inefficient. Also, transporting the paste by trucks at these production levels would substantially increase the volume of traffic on Stillwater County roads.

Third, construction of an overall paste backfill system would generate a surprisingly large amount of new disturbances. With present knowledge, it appears that SMC would have to construct 3 or 4 paste plants similar to the experimental plant SMC is constructing now (however, tailings production would support the operation of only three or four plants at any single time) and move them to 9 or 10 sites over the next 20 to 30 years. They would have to be constructed near portals due to limitations on distances the paste can be pumped. SMC would have to construct a 200-foot by 200-foot (0.9 acre) pad at each of the 9 to 10 portals. Due to the steep slopes and the need for cut-and-fill construction, disturbance for the pads would encompass much more than one acre (and at least some of the waste rock generated by construction would have to be stored somewhere). The overall slopes on SMC's present system of roads to the upper portals are too steep for loaded cement trucks to negotiate. Each paste plant would require at least 2 truck loads of cement daily (6 to 8 trucks total). Thus, SMC would have to construct a new system of roads with shallower slopes for the cement trucks. If SMC did construct a new network of roads, it's still questionable if the cement trucks could access the plants during the winter.

Fourth, the addition of the paste backfill system would substantially, increase the requirements for electrical power. Each plant would require about 1.5 megawatts of power. Currently, Montana Power Company's distribution lines supplying the Stillwater Mine and Stillwater Valley could not provide that much power when the other demands of increasing production, even with the upgrades discussed earlier. The power lines may have to be completely reconstructed back to Billings before the power for the paste plants and the rest of the mine could be supplied.

Fifth, the paste backfill system would substantially affect the visual characteristics of the mountain above the mine. The additional disturbances at the portals, the 200-foot long by 65-foot wide, by 50-foot tall paste plants, new roads, and power lines all would be visible from the valley.

Finally, the addition of the paste backfill system would require a substantial financial investment. Each paste plant would cost about $7 to $10 million dollars to construct. At 3 to 4 plants, the total cost would approach $40 million just for the paste plant facilities, exclusive of roads, pumps, pipes, etc. An initial estimate of the costs for operating a whole tailings paste backfill and landfill operation at the Stillwater Mine suggests costs would be on the order of $6.77 to $6.88 per ton of tailings, or about 107 to 110 percent higher than similarly-based costs for Alternative B ($3.27 per ton of tailings).

As a result of these considerations, DEQ and CNF determined this alternative is not currently feasible. Under MEPA/NEPA, all alternatives considered in detail must be reasonable ((CEQ 1981, 40 CFR 1502.14, and ARM 17.4.603 (2) (b)). This alternative does not meet the technology test for feasibility (CEQ 1981 and ARM 17.4.603 (2) (b)). It would require re-engineering and excessive cost to redo the mine, therefore, not meeting the economic test for feasibility (CEQ 1981). Therefore, this alternative was not included for consideration in detail.

However, the agencies recognize that the results of SMC's experimental paste plant and advancing technology may alter the feasibility in the future. They also recognize the need for aboveground storage of tailings would still be required and that any of the waste management facilities comprising the alternatives considered in detail could be converted to total tailings paste backfill and landfill should the technology be demonstrated feasible in the future. Thus, DEQ and CNF proposed an additional mitigation measure to reconsider paste technology within five years of the decision makers' signing the RODs.

Alternative Considered: Slimes Tailings Paste Landfill (slimes tailings were not considered for backfilling because it is unlikely slimes tailings paste would have the structural strength needed in SMC's backfilling operations).

Reason Considered: Paste landfilling is one of the new emerging technologies for handling and disposing of tailings. Paste landfilling involves the placement on the ground surface of a tailings paste that consists of tailings that have a low moisture content. The paste retains moisture in a manner similar to wet concrete. Thus, the moisture does not separate when the paste is allowed to rest. Paste properties allow the tailings paste to be placed on the surface as an engineered fill, rather than as a wet slurry placed behind a dam. Use of paste also may decrease the time required for the tailings mass to achieve its ultimate density and volume.

Reason Dropped: Implementation of slimes tailings paste landfill at the Stillwater Mine is not a reasonable alternative at this time. Several considerations formed the foundation for this conclusion. The volume of slimes tailings paste reporting to a surface impoundment would not reduce the size of the impoundment much over that needed for slurried tailings. For example, to store the same volume of tailings as addressed by Alternative B, an impoundment built at Hertzler using slimes tailings paste would cover about 150 acres (compared with 163 acres for Alternative B) and would have a final embankment elevation of 5,025 feet (compared to 5,036 feet for Alternative B). To dispose of slimes paste tailings on the east side of the Stillwater River, the impoundment would cover slightly more than 80 acres (compared to 72 acres for Alternative D) and would have a final crest elevation of 5,120 feet (compared to 5,085 feet for Alternative D). With a final height of more than 150 feet, the static and seismic stability of such a slimes tailings paste impoundment would be a concern because slimes tailings paste is likely to remain saturated and susceptible to liquefaction during earthquakes.

During June 1995, pilot tests were conducted at the Stillwater Mine to determine the efficiency and ability of dewatering Stillwater slimes tailings. The results of this analysis on the potential use of slimes-based paste for landfilling suggest the use of this technology would not substantially reduce SMC's requirements for storage of the tailings, would not provide any substantive environmental benefits, and would not provide any advantages for concurrent reclamation over slurried tailings disposal.

More than 70 percent of SMC's tailings (by weight) is finer than 20 microns. With this level of solids, the paste would be fully saturated, would have low strength characteristics, and could liquify under seismic loading conditions. To ensure stability, SMC would have to contain the paste by constructing a perimeter embankment from local borrow materials or using cement-amended paste to create a structural zone around the tailings paste. If a perimeter embankment is constructed, the final structure would be almost the same size as that of the Hertzler impoundment proposed by SMC. Little information is available on the behavior of paste amended with less than three percent of cement by weight (the amount needed to achieve the desired increase in strength).

Use of slimes tailings paste disposal also is not projected to provide any substantive improvement on the loss of seepage to groundwater over that projected for a slurried tailings impoundment. Due to the fine-grained nature of SMC's tailings, the paste produced likely would have a high water content and remain fully saturated. Although dewatering of the tailings to form the paste would eliminate the initial settling and consolidation of the slurry, seepage from the paste would still occur. Initial seepage from the paste would be less than that from slurried tailings. However, on-going seepage from the tailings paste would be similar to that from slurried tailings that have completed the initial settling and consolidation. Thus, SMC would still have to construct a liner and underdrain system for paste disposal.

Because slimes tailings paste would most likely be placed in a saturated condition, it will have low strength and correspondingly poor trafficability. Thus, concurrent reclamation would not be possible without the use of a surface layer of cement-amended paste to provide adequate support for reclamation activities.

The addition of the slimes paste landfill system would require a substantial financial investment. The paste plant would cost about $7 to $10 million dollars to construct. An initial estimate of the costs for operating a slimes tailings paste landfill operation at the Stillwater Mine suggests costs would be on the order of $5.72 to $5.83 per ton of tailings, or about 75 to 78 percent higher than similarly-based costs for Alternative B ($3.27 per ton of tailings).

As a result of these considerations, this alternative is not currently reasonable. Under MEPA/NEPA, all alternatives considered in detail must be reasonable (CEQ 1981, 40 CFR 1502.14, and ARM 17.4.603 (2) (b)). Therefore, this alternative was not included for consideration in detail.

However, the agencies recognize that the results of SMC's experimental paste plant and advancing technology may alter the feasibility of this alternative in the future. They also recognize the need for aboveground storage of tailings would still be required and that any of the waste management facilities comprising the alternatives considered in detail could be converted to paste landfill should the technology be demonstrated feasible in the future. Thus, DEQ and CNF proposed an additional mitigation measure to reconsider paste technology within five years of the decision makers' signing the RODs.

Alternative Considered:	Tailings impoundment at Hertzler Ranch with additional lining (e.g., thicker liners [100 mil] or a second liner).
Reason Considered:	This alternative was considered to address concerns about the potential for seepage from the tailings to contaminate groundwater at Hertzler Ranch. Also, a 100-mil liner was used in the existing tailings impoundment.
Reason Dropped:	This alternative was dropped because a review of the characteristics of SMC's proposed Hertzler tailings impoundment suggested additional liners or a thicker liner would not provide any substantive decrease in the potential for seepage to reach groundwater. The proposed 60-mil thick HDPE liner, liner bedding material, and underdrain system provide a better system of protection. The HDPE liner and the compacted soil liner together provide as low or lower transmissivity as a 100-mil liner by itself (a 100-mil liner is not installed with a compacted soil liner). Additionally, 60-mil liners are easier to handle during installation than the thicker and heavier 100-mil liners, which results in fewer chances for problems, such as tears. The 60-mil liners lie flat and sit tight on the soil liner, whereas 100-mil liners (due to their thickness) tend to bridge over the soil resulting in a poorer fit over the soil. Finally, although a 100-mil liner was used in the existing tailings impoundment, a 60-mil liner was determined to be adequate for protecting ground-water and was initially approved. However, winds at the mine were too high for the 60-mil liner. They pulled the liner up where it was exposed or had a thin cover. These same winds could not move the 100-mil liner. Because the valley at Hertzler is wider, the winds are not as strong as at the mine and a 100-mil liner would not be needed to resist the stronger winds.

Alternative Considered:	Centerline expansion of the existing tailings impoundment combined with a new impoundment at Hertzler Ranch.

Reason Considered:	Implementation of this alternative would result in a smaller impoundment at Hertzler Ranch than would be constructed under the Proposed Action. The smaller impoundment would be less visible and its areal extent would be less than what would occur under the Proposed Action.
Reason Dropped:	Expansion of the existing tailings impoundment would push the impoundment's toe farther into the PMF flood plain. This extension of the toe is unacceptable to DEQ and CNF. Also, this alternative would be substantially redundant with Alternative C, which was carried through the analysis.

Alternative Considered:	Alternate routes for the pipelines that would connect the mill and concentrating circuits at the Stillwater Mine to the proposed Hertzler tailings impoundment.
Reason Considered:	Alternative routes might offer more environmentally-acceptable means for connecting the mill and concentrating circuits to the proposed Hertzler tailings impoundment.
Reason Dropped:	Alternative routes would not offer more environmentally-acceptable means for connecting the mill and concentrating circuits to the proposed Hertzler tailings impoundment. Alternative routes would generate more disturbance because they would traverse undisturbed private lands. Construction and reclamation of these routes would be more difficult due to the irregular topography the routes would have to cross. In contrast, the proposed route along the rights-of-way of Stillwater County roads 419 and 420 is already disturbed and readily reclaimed to its present use and conditions.

2.6 Reasonably Foreseeable Projects

Effects resulting from implementation of the following projects may, to some degree, combine cumulatively with the effects of the alternatives considered in detail in this analysis. Several reasonably foreseeable projects have been identified for this analysis. They are discussed below and shown on **Figure 2–12**.

2.6.1 Custer National Forest Projects

Two projects proposed for the Beartooth District of the CNF were identified as reasonably foreseeable projects. They are:

- *Woodbine Campground Reconstruction* — Modernization and increased capacity of Woodbine Campground has been completed (Pierson 1998, pers. comm.). Watershed concerns will be addressed in this project through the paving of roads and spurs. The project should occur in the near future. With the recent reconstruction of County Road 419 from Highway 78, recreational opportunities in the Stillwater Valley, use of the campground, and traffic are expected to increase.

- *Horseman Flats Prescribed Burn* — The CNF is planning to conduct a prescribed burn of Forest Service system lands on Horseman Flat to increase the amount of forage available for wildlife. Currently, the CNF plans to conduct the burn in 1999.

2.6.2 Other Projects

Several residential subdivision projects were identified within the general project area for one or more resources. They are:

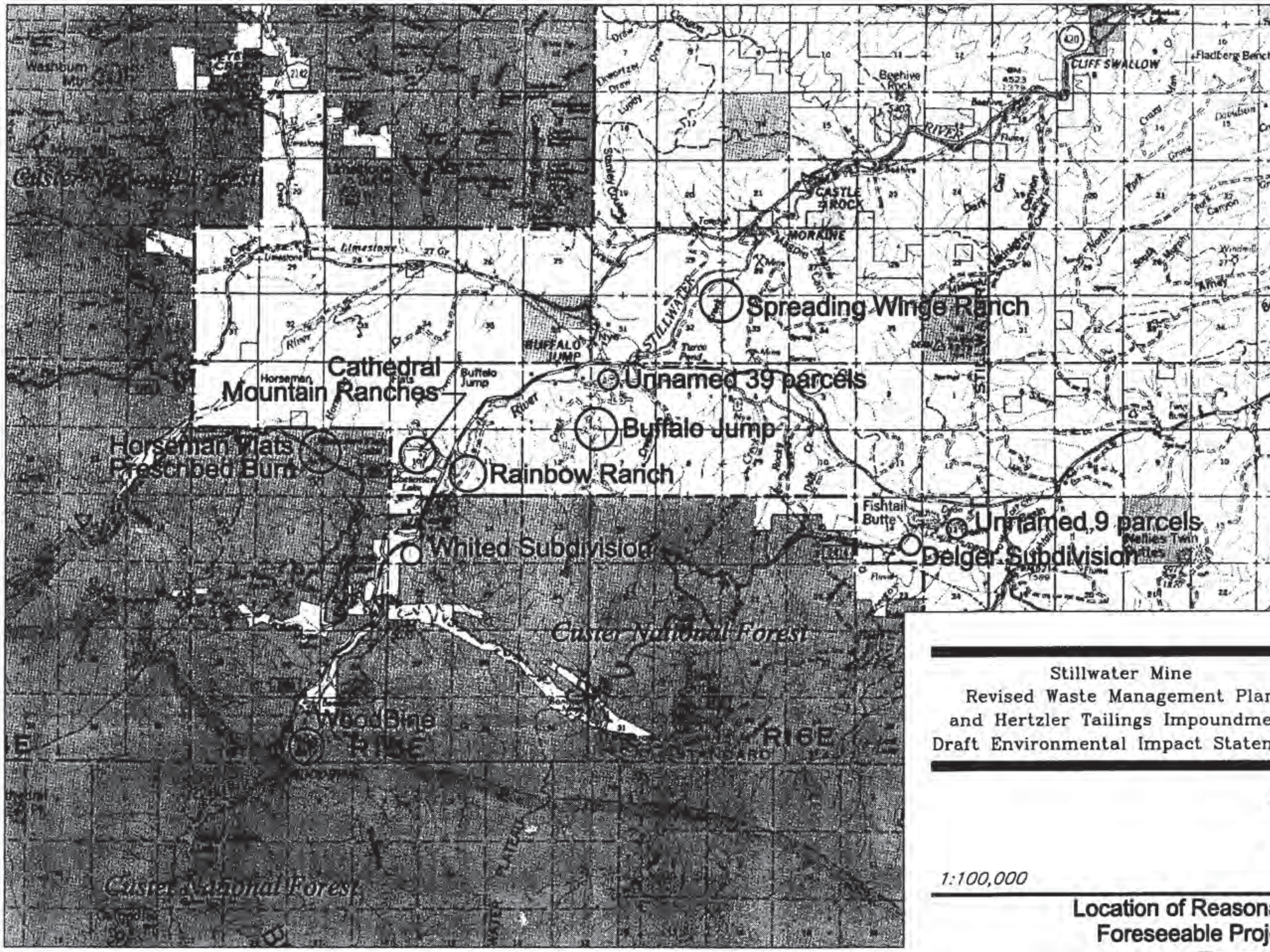
- *Cathedral Mountain Ranch*. Located west of the Stillwater River and adjacent to the Custer National Forest boundary in Sections 3, 10, and 11, T5S, R15E. Platted areas comprise approximately 600 acres.

- *Rainbow Ranch*. Located adjacent to the Stillwater River and the Custer National Forest Boundary in Sections 10 and 11, T5S, R15E. Platted areas comprise approximately 240 acres.

- *Buffalo Jump*. Located one mile south-southeast of Nye, Montana, in Sections 1 and 12 in T5S, R15E; Sections 31 and 32 in T4S, R16E; and Sections 5, 6, and 7 in T5S, R16E. Platted areas comprise approximately 300 acres.

- *Whited Subdivision*. Located east of the Stillwater River in Section 15, T5S, R15E. Platted areas comprise approximately 40 acres.

- *Delger Subdivision*. Located west of Dean, Montana, in Section 14, T5S, R16E. Platted areas comprise approximately 40 acres. The plat map dated September 15, 1970 shows 22 lots.



Stillwater Mine
Revised Waste Management Plan
and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

1:100,000

Location of Reasonably Foreseeable Projects
Figure 2-12

597forsee.dwg

- An unnamed plat of nine parcels including the Dean Community Club property west of Dean, Montana, in Section 13, T5S, R16E. Platted areas comprise approximately 45 acres.

- An unnamed plat of 39 parcels, 17 of which are on the Stillwater River southwest of the County Road 419 bridge over the Stillwater River. All located in Section 6, T5S, R16E.

- *Spreading Winge Ranch*. Located in Sections 28, 29, 32, and 33 in T4S, R16E, and Sections 4 and 5 in T5S, R16E east of Nye, Montana. The plat shows 61 tracts, 27 of which were on the Stillwater River.

2.7 Projects Not Considered Reasonably Foreseeable at This Time

2.7.1 Future Mine Expansion

Given the continued worldwide demand for platinum and palladium and that the ore body owned or controlled by SMC extends 27 miles between the Stillwater Mine and the unconstructed East Boulder Mine, it is possible that the Stillwater Mine would continue to operate beyond 30 years. The extent and duration of future operation and expansion cannot be predicted at this time and will depend upon the market for these metals, operational costs, and mining and milling technologies. If SMC decided to continue its operations, the company would be required to submit a revision that would undergo full environmental analysis and disclosure under the NEPA/MEPA process.

If SMC decided to continue operations, future expansion would most likely require additional mine waste storage facilities, such as have been proposed for this project being analyzed. Future storage space could be achieved by expanding approved facilities (the existing facilities and any that might be approved per the current proposed permit revision), constructing new facilities in different locations, or developing more efficient means of storing mine waste underground or finding an offsite beneficial use for the waste products that would not require long-term storage in the vicinity of the mine.

It is possible that Hertzler Ranch could store additional tailings in the future if more capacity is needed. However, storage beyond the Hertzler impoundment as proposed has not been looked at in detail. A preliminary review of the property and Hertzler tailings impoundment (as proposed in Alternative B) suggests some additional capacity exists. The Hertzler tailings impoundment could be raised using modified centerline construction from the proposed crest elevation of 5,036 feet to 5,065 feet, which would provide capacity for an additional 5 million tons of tailings (Greenaway 1998). Additionally, a new impoundment could be constructed in the drainage where the LAD storage pond is proposed and where the southwestern borrow area would be located (see **Figure 2–2**). An impoundment at this location would probably encompass an area similar in areal extent to the 163 acres that the Hertzler impoundment would encompass and could have a capacity similar to that proposed under Alternative B. However, without detailed analysis, one cannot determine if sufficient fill material exists on Hertzler to construct another tailings impoundment. If sufficient fill material does not exist at Hertzler, then the feasibility of another impoundment would depend, in part, on the availability of a suitable supply of fill material.

As the discussion above suggests, many variables and unknowns exist relative to the possibilities for future expansion of the Stillwater Mine. Consequently, inclusion of a possible expansion scenario into the cumulative impact analysis at this time could not be made reasonably and was not evaluated.

2.7.2 Stillwater River Corridor Zoning Petition

The Stillwater River Corridor Zoning Petition has been formally accepted with the necessary signatures and, pursuant to Montana State Code, the Stillwater River Corridor Planning and Zoning District was recently formed. Additionally, a zoning commission also has been established (Beaudry 1998). To date (September 1998), the commission has not approved any formal land use or development density changes for the corridor, which includes a portion of the Hertzler Ranch site. Until the time when such zoning changes are formally approved by the commission, these zoning restriction cannot be considered a reasonably foreseeable project for this analysis.

2.8 Summary of Alternatives and Environmental Consequences

The following tables summarize the alternatives considered in detail and the likely environmental consequences of each alternative. **Table 2–3** contains the summary of alternatives. This table contrasts the four alternatives in terms of their physical characteristics and requirements for such items as power, workforce, and monitoring. For example, one can readily compare the alternatives to see how many tons of waste rock and tailings each alternative accommodates and what facilities would be involved in storing waste rock and tailings. Additionally, the areal extents of facilities are presented. Finally, the table summarizes the amount of physical disturbance that would occur under each alternative and how much of that disturbance involves areas that are already disturbed. **Table 2–4** contains the summary of environmental consequences. Chapter 4 presents the consequences identified in **Table 2–4** in more detail.

2.9 Preferred Alternative

The agencies' preferred alternative is Alternative B, the Proposed Action, with the mitigations listed in **Section 2.4.5**. Alternative B would result in the construction of a second tailings impoundment at the Hertzler Ranch site, construction of a 7.8-mile long pipeline corridor along Stillwater County roads 419 and 420 between the mill and the new impoundment, construction of a waste rock storage facility on the east side of the river across from the mill, additional LAD sites at the Stratton and Hertzler ranch sites, and removal of the production cap.

Table 2–3 Comparison of Alternatives Considered in Detail

Parameter	Alternative A	Alternative B	Alternative C	Alternative D
Waste Rock Production and Management				
Capacity (tons)				
Temp. & Permanent Storage Areas[1]	1,630,000	1,630,000	1,630,000	1,630,000
Completion of Existing Impoundment[1]	1,755,000	1,755,000	1,755,000	1,755,000
Expansion of Existing Impoundment	na[2]	na	2,660,000	2,660,000
East Side Visual Berm[1]	386,000	na	na	na
East Side Storage Site	na	17,886,000	15,226,000	na
East Stillwater Impoundment	na	na	na	9,840,000
Total	3,771,002	21,271,000	21,271,000	15,885,000
Areal Extent of Coverage (acres)				
Temp. & Permanent Storage Areas	18	18	18	18
Complete Existing Impoundment Embankment	15	15	15	15
Expansion of Existing Embankment	na	na	8	8
East Side Visual Berm	12	na	na	na
East Side Storage Site	na	80	80	na
East Stillwater Impoundment	na	na	na	72
Total	45	113	121	113
Tailings Production and Management				
Capacity (tons)				
Existing Impoundment (present day)	1,900,000	1,900,000	1,900,000	1,900,000
Existing Impoundment (additional)	1,600,000	1,600,000	1,600,000	1,600,000
Expansion of Existing Impoundment	na	na	4,850,000	4,850,000
Hertzler Ranch Impoundment	na	15,000,000	10,150,000	na
East Stillwater Impoundment	na	na	na	4,940,000
Total Capacity	3,500,000	18,500,000	18,500,000	13,290,000
Areal Extent of Coverage (acres)				
Existing Impoundment	45	45	45	45
Expansion of Existing Impoundment	na	na	8	8
Hertzler Ranch Impoundment	na	163	129	na
East Stillwater Impoundment	na	na	na	72
Total	45	208	182	125
Final Crest Elevations (feet)				
Existing Impoundment	5,111	5,111	5,175	5,175
Hertzler Ranch Impoundment	na	5,036	5,007	na
East Stillwater Impoundment	na	na	na	5,085
Water Management and Disposal				
LADs (acres)	24	104	104	40
LAD storage ponds (acres)	2	17	17	2
Tailings/Process water	evaporate/reuse	evaporate/reuse	evaporate/reuse	evaporate/reuse
Power Requirements (MW)	12	16	16	16
Roads and Traffic	no change	additional traffic	additional traffic	additional traffic
Workforce (# employees)	655	700	700	700
Monitoring	no change	program would expand	program would expand	program would expand
Reclamation	no change	revise accepted plan	revise accepted plan	revise accepted plan
Currently-permitted disturbance (acres)	255	255	255	255
Existing Non-SMC disturbance[2] (acres)	0	172	172	84
New SMC disturbance (acres)	0	251	217	1
Total disturbance (acres)	255	678	644	340
Bonding	no change	increase	increase	increase

Notes:

1. Placement of waste rock in the temporary and permanent storage areas, embankment to complete the existing tailings impoundment, and east side visual berm has been permitted by DEQ and CNF. No waste rock has been placed in the east side visual berm.. If an alternative with the east side storage site or East Stillwater impoundment is selected, the east side visual berm would not be constructed. Instead, its capacity would be absorbed into the east side storage site or East Stillwater impoundment.
2. Existing non-SMC disturbance includes 80 acres of pastureland at Hertzler Ranch and portions of the east side where chrome tailings were previously deposited. Neither of these locations has a cover of native species.

Table 2–4 Summary Comparison of Impacts by Alternative

Issue or Resource	Indicator Units	Alternative: A — No Action	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Purpose and Need		Does not meet Purpose and Need	Does meet Purpose and Need	Does meet Purpose and Need	Partially meets Purpose and Need
Physical Size	Acres	255	678	644	340
Water Resources	Groundwater Quantity	Aquifers are localized and highly variable. Overall mine discharges may reach 1,061 gpm.	Recharge as much as 2,000 gpm at Stratton and Hertzler Ranch by LAD in summer. Overall mine discharges may reach 1,342 gpm at an average production rate of 3,000 tpd.	Same as B, but effects at Hertzler Ranch delayed.	Recharge only at Stratton Ranch. Overall mine discharges may reach 1,277 gpm at an average production rate of 3,000 tpd.
	Groundwater Quality	Generally good. No change would occur.	Localized increase in nitrates near LADs at Stratton and Hertzler Ranches and the waste rock storage facility (approx. loading of 13.6 lbs/day).	Same as B, but effects at Hertzler Ranch delayed.	Localized increase in nitrates near LADs at Stratton Ranch and east side tailings impoundment. Loading of nitrates from east side tailings impoundment would be less than the 13.6 lbs/day that would occur with waste rock facility.
	Tailings Pollutant From Pipeline Accident	Not applicable	No long-term effects, but short-term effects from increased sediment would be primarily contained within the borrow ditch.	Same effects as B, but slightly shorter period than B.	Slightly higher risk than B due to exposed pipelines suspended over the Stillwater River.
	Surface Water Quantity	No change.	Small, short-term increase in runoff	Slightly less risk than B	Least runoff
	Surface Water Quality	Good to excellent. No change.	Minor change due to increased water discharges	Same as B	Slightly better than B due to a lower increase in water discharges
	Tailings Pollutant from Impoundment Failure	Only tailings from existing impoundment would possibly reach the river.	Same as A, only tailings from existing impoundment would reach the river if it failed Hertzler is ≥½ mile upgradient from Stillwater River.	Greater risk than B because more tailings would possibly reach the river if the modified, existing tailings impoundment failed	Greater risk than B or C. All tailings from two impoundments would reach the river if the impoundments failed

Table 2–4 Summary Comparison of Impacts by Alternative, Con't.

		Alternative			
Issue or Resource	Indicator Units	A — No Action	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Water Resources	Nitrates in Stillwater River	No change	Remain below Std. (an increase of 0.02 to 0.05 mg/L)	Same as B	Same as B
	Sedimentation	247 TDS mean adit water and 1,500 TDS mean process water. No change.	Sediment from pipeline construction would be contained within the borrow ditch. Sediment from Hertzler would have to travel about ½ mile to reach the river. No more than small, short-term increases during construction.	Modification of the existing impoundment would occur less than ¼ mile from the river. However, most sediment from this construction should be captured by SMC's stormwater containment system.	Same as C for the existing impoundment. Sediment would be generate from construction of the new impoundment less than ¼ mile from the river. However, most sediment from this construction should be captured by a new stormwater containment system.
	Heavy Metals	Some metals (cadmium, copper, lead, and zinc) have exceeded standards. on one or more occasions (from natural sources). No change.	Same as A.	Same as B.	Same as B.
	Water Wells	No effect.	No effect.	Same as B.	Same as B.
	Waters of the U.S.	None.	1.5 acres affected. Permitted under Nationwide Permits.	Same as B. Permitted under Nationwide Permits.	Less than 1 acre affected. Permitted under Nationwide Permits.

Table 2–4 Summary Comparison of Impacts by Alternative, Con't.

Issue or Resource	Indicator Units	Alternative: A — No Action	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Wildlife	General Habitats Affected (acres)	No change from approved.	678 acres	644 — affects at Hertzler delayed up to 10 years.	340
	Winter Range Affected (acres)	No change from approved	678 acres of mule deer winter range affected (255 acres previously-permitted disturbance, 251 acres new disturbance, 68 acres previously disturbed, and 104 acres under LADs). No bighorn sheep habitat directly affected, but potential indirect effects to bighorn sheep from competition for forage from mule deer displacement.	644 acres of mule deer winter range affected (255 acres previously-permitted disturbance, 217 acres new disturbance, 68 acres previously disturbed, and 104 acres under LADs). 8 acres of bighorn sheep habitat directly affected. Same indirect effects to bighorn sheep as B.	340 acres of mule deer winter range affected (255 acres previously-permitted disturbance, 1 acre new disturbance, 60 acres previously disturbed, and 24 acres under LADs). 8 acres of bighorn sheep habitat affected. Same indirect effects to bighorn as B.
	T&E Impacts	No effect.	No effect.	Same as B.	Same as B.
Fisheries	Change in Stream Flow	No change.	No change.	Same as B.	Same as B.
	Increased Sedimentation	No change	No change.	Same as B	Same as B.
	Increased Nutrients	No change	No change	Same as B	Same as B
Air Quality	Criteria Pollutants Above Standards	None. (from 7 percent to 30 percent of NAAQS).	None.	Same as B slightly less dust.	Similar to B, but increased potential for dust with two impoundments in a high-wind area.
Social Economics	Population	No change (7,653 persons in the county).	456 new residents.	Same as B.	Same as B.
	Employment	No change (3,879 persons employed in the county).	45 additional people (a combination of permanent employees and contractors).	Same as B.	Same as B.
	Property Values	Would continue to increase.	Same as A, but some individual properties may loose value	Same as B, but delayed in time at Hertzler.	Similar to B. Any adverse effects are concentrated at the current mine site and new impoundment site.

Table 2–4 Summary Comparison of Impacts by Alternative, Con't.

		Alternative			
Issue or Resource	Indicator Units	A — No Action	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Social Economics	Proximity of Residences to Mine Facilities	22 within 1 mile and 109 within 5 miles of existing impoundment	Same number of residences in proximity to existing impoundment. 33 within 1 mile and 158 within 5 miles of Hertzler	Same as B, but delayed activity at Hertzler.	Same as A, but increased amount of activity at existing mine site.
	New Students	No change (957 students).	34 new elementary students.	Same as B.	Same as B.
Tailings Impoundment Stability	Exceed Safety Factor of 1.0	Yes	Yes	Yes	Yes
	Risk of Failure and Consequences	No change.	Somewhat higher risk than A due because two impoundments would exist. Only failure of existing impoundment could discharge tailings directly into the Stillwater River.	Higher risk than B because existing impoundment would be expanded above the original design elevation. Only failure of existing impoundment could discharge tailings directly into the Stillwater River.	Risk about the same as B because existing impoundment would be expanded above the original design elevation. Failure of existing impoundment and new impoundment could discharge tailings directly into the Stillwater River.
Visual Quality	Meets Visual Quality Objectives for National Forest System lands.	Yes, no change.	Yes	Yes	Yes
Noise	Increased Noise Levels.	Yes, if production increases.	Yes, slightly at new locations.	Less than B, but effects at Hertzler Ranch delayed.	No noise effects at Hertzler, increased noise at mine site and east side, which would affect a larger number of residences because more homes exist around the mine site.
Lights and Lighting	Changes in the amount of lighting.	No change.	Minor additions of shaded lights.	Same as B, but effects at Hertzler Ranch delayed.	No lights at Hertzler Ranch, but increased lights at mine site and east side
Transportation	ADTs on County Road 419.	803	906	Same as B.	Same as B.

Table 2–4 Summary Comparison of Impacts by Alternative, Con't.

Issue or Resource	Indicator Units	Alternative: A — No Action	Alternative: B — Proposed Action	Alternative: C — Modified Expansion and Hertzler	Alternative: D — Modified Expansion and East Side Impoundment
Reclamation Potential	Sufficient Topsoil for Reclamation	Yes, 4,000 cubic yards	Yes, 142,500 cubic yards	Same as B, but disturbance delayed up to 10 years.	Cubic yards would be different, source would be the same.
	Suitable Revegetation Plan	Yes	Yes	Same as B.	Same as B.
	Microclimate	High winds drive dust and blast revegetation.	Less winds to affect revegetation at Hertzler.	Same as B, but delayed revegetation due to construction delay.	Same as A, but two impoundments and revegetation efforts would be subject to high winds.
	Vegetation Disturbance (acres)				
	Currently-permitted disturb.	255	255	255	255
	Existing non-SMC disturb.[1]	0	172	172	84
	New SMC Disturbance	0	251	217[2]	1
	Total disturbance	255	678	644	340
Cultural Resources	Sites Affected	None	None	Same as B.	Same as B.

Note:
1. Existing non-SMC disturbance includes 80 acres of pastureland at Hertzler Ranch and portions of the east side where chrome tailings were previously deposited. Neither of these locations has a cover of native species.
2. Disturbance at Hertzler Ranch would be delayed up to 10 years relative to Alternative B.

Abbreviations in Table:
- ADT Average Daily Trips
- APE Area of Potential Effect
- BMP Best Management Practice
- KOP Key Observation Point
- LAD Land Application Disposal
- T&E Threatened and Endangered Species

Chapter 3.0 — Affected Environment

Chapter 3.0 — Affected Environment

This chapter describes the affected environment for the project alternatives. The affected environment is the portion of the existing environment that could be affected by the project. The information presented here focuses on issues identified through the scoping process and interdisciplinary analyses (Chapter 2, **Section 2.2.1**).

The affected environment varies for each issue. This variation is dictated by both the nature of the issue and components of the proposed project and alternatives. Considerable information has been published about the Stillwater Mine in several environmental analysis documents (**Appendix A**). As discussed in Chapter 1 (**Section 1.6.1**), this EIS tiers off those environmental documents. Consequently, the following sections concentrate on providing only the specific environmental information necessary to assess the potential effects of the Proposed Action and alternatives. Summaries of the primary documents to which this EIS tiers are included in **Appendix A**.

The numerous comments on the draft EIS have resulted in additional information being incorporated into this chapter of the final EIS. Additional information focused primarily on water resources including precipitation data, flow data for Stillwater River and several springs, surface and ground water quality data, the recently revised MPDES permit, water rights, characteristics of the deposited materials at the Hertzler Ranch. Other changes included better defining civilian labor force numbers, identifying the maximum credible earthquake, and clarifying which cultural sites were in closest proximity to proposed facilities and incorporating the results of SHPO evaluation of identified cultural sites.

3.1 Water Resources

3.1.1 Surface Water Quantity

Surface water features present in the project area remain comparatively unchanged since the initial studies were conducted for the Stillwater Mine in the early 1980s. Consequently, the discussion below is a brief summary of surface water features. Additional information is available in the 1985 final EIS for the original project (DSL and Forest Service 1985) and subsequent documents.

3.1.1.1 Stillwater Mine Site

Stillwater River

The Stillwater River, which drains the northwest portion of the Beartooth Mountains, is the primary surface water feature in the project area **(Figures 3–1** and **3–2)**. The Stillwater River flows within one-quarter mile of the mine/mill site.

The Stillwater River is a fourth and fifth order stream that drains an area of 371 square miles at USGS gage 06202610 at Beehive, Montana. Peak flows occur during June and July as a result of snowmelt and spring precipitation. Approximately 75 percent of the annual runoff occurs in May, June, and July (Camp Dresser and McKee, Inc. (CDM) 1981). Precipitation at the mine site averages 18.3 inches on data collected between 1950 and 1958 and 1981 to present (Western Regional Climate Center, 1998). The average snowfall is 102.2 inches, yielding six of the eighteen inches of precipitation. The precipitation regime, combined with substantial topographic relief, thin soil, and low headwater storage capacity account for large variations in flow rates. Stream channel gradients are 254 feet per mile in the upper reaches and 16 feet per mile in the lower reaches of the Stillwater River. Flow measurements taken during a 7-year period from the USGS' gage 06202510 near Nye, Montana, indicate that the maximum and minimum instantaneous discharges were 6,400 cfs and 16 cfs, respectively. Mean annual flows for the period of November 1979 to September 1991 averaged 373 cfs on the 193-square mile watershed (Shields, et al. 1992). The sustained low flow at a site is reflected by statistical determination of the seven-day, ten-year low flow, or the 7Q10. At the mine site, this value has been estimated at 31.1 cfs over the course of the year. The 7Q10 for July, August and September is 87 cfs (Thompson 1998, pers. comm.).

Floodplain data have been used to delineate flood-prone areas in the project area. The existing mine facilities and the proposed facilities lie outside both the 100-year flood zone and the PMF zone (**Figure 3–1** and **Figure 3–2**). Only the Stratton Ranch site lies within the PMF zone.

Other Surface Water Features

Several local tributaries of the Stillwater River occur within or near the Stillwater Mine. They include Nye Creek, No Name Creek, and Mountain View Creek. All three are subalpine to alpine creeks that flow during most of the year in their upper reaches, but may dry up in their lower reaches.

Nye Creek is a first order tributary located directly across the river from the SMC mine tailings impoundment and drains an area of about 3.7 square miles. Flows from June 1980 through June 1981 ranged from 0 to 0.60 cfs (CDM 1981). Flows acquired two to three times per year between May 1992 and

Page 3-3 to 3-7 missing from original.

December 1996 exhibited flows between 0.32 and 7.23 cfs (Hydrometrics 1996b).

No Name Creek is the small drainage immediately south of Nye Creek, east of the Stillwater River at the Stillwater Mine site. The flow of this creek was severely reduced during the development of the east side adit.

Mountain View Creek flows due east from Mountain View Lake and skirts SMC's existing tailings impoundment on the south. The stream gradient is steep and the drainage area is small (1.37 square miles). Thus, the creek has low peak flows. Baseline monitoring from June 1980 through June 1981 at MV–1 (Mountain View Lake surface water sampling location No. 1) noted flows ranging from 0.01 to 0.09 cfs (CDM 1981). Operational monitoring at SMC–6 between May 1992 and December 1996 showed flows between 0.34 and 2.32 cfs (Hydrometrics 1996b).

3.1.1.2 Stratton Ranch

The Stillwater River lies one quarter of a mile east of Stratton Ranch. The river tends to lose water to the aquifer in this reach. A small perennial creek flows due east off the uplands above the ranch and disappears in alluvial fan material deposits on the ranch. The creek flows all year above the alluvial fan. There are several perennial ponds in the area. One is man-made and the others occur naturally in the hummocky terrain of the old landslide on the northwest side of the area. A depression west of County Road 419 was created by aggregate extraction.

3.1.1.3 Hertzler Ranch

The Stillwater River lies east of Hertzler Ranch and the West Fork of the Stillwater River lies southwest of the ranch. Hydrometrics (Thompson 1998; pers. comm.) has conservatively estimated that low flows on the Stillwater River south of Hertzler are fifty percent higher than at the mine site. The 7-day, 10-year low flow (7Q10) has been estimated as 46.65 cfs in this location.

The West Fork of the Stillwater River is a fourth order tributary draining 122 square miles at the discontinued USGS gage 06202598 near Nye, below Castle Creek. It runs approximately parallel to, and is located west of, the Stillwater River. The West Fork of the Stillwater River is separated from the upper reaches of the Stillwater River by a ridge and flows into it five miles downstream of the mine site, near Nye. The West Fork of the Stillwater River is split into two channels in the last mile. The southern or western channel does not flow year-round. Monthly flow monitoring between June 1980 and June 1981 showed flows ranging from 23.3 to 514.26 cfs (CDM 1981).

Two small, poorly-developed coulees with no distinct drainage channels drain the Hertzler Ranch (**Figure 3–1**). Both drainages start at the base of Bush Mountain and end in Hertzler Valley. The two drainages rarely, if ever, carry runoff. Rainfall and snowmelt falling on the site infiltrate into the glacial material and are either consumed by vegetation or become part of the groundwater system. An unnamed drainage flows down the center of the Hertzler Valley and has a small, indistinct channel. An irrigation ditch that brings water from the West Fork of the Stillwater River does fill the channel (near the Hertzler homestead) during the irrigation season, but the channel is normally dry.

Runoff flowing into the Hertzler Valley from the north (Robinson Draw, Stanley Coulee, and Tandy Coal Mine Draw) appears to flow into the irrigation ditch, rather than reaching the main Hertzler valley. All three drainages are ephemeral, meaning they flow only in response to rapid snowmelt or intense rainstorm events. Monitoring between June 1980 and June 1981 at surface water station RD–1 in Robinson Draw noted flows ranging from 0 to 8.88 cfs (CDM 1981). Monitoring of Stanley Coulee at surface water station SC–1 during the same time period showed flows ranging from 0.007 to 5.77 cfs. Monitoring of Tandy Coal Mine Draw (TC–1) had flows ranging from <0.01 to 0.972 cfs.

3.1.2 Surface Water Quality

3.1.2.1 Stillwater Mine Site

The following discussion describes general characteristics of water quality, ranges in concentrations, and departures from numeric water quality standards. The State of Montana has use-based standards and differentiates between acceptable water quality for aquatic organisms and humans. Aquatic life standards are based on exposure. Data suggests that aquatic life can better tolerate a short duration elevated concentration than long-term, slightly lower concentrations. Aquatic life are more vulnerable to metals under low concentrations of hardness as found in the Stillwater River. Thus, review of the water quality tables will reveal that the lowest standards are for chronic aquatic life and the highest standards are for human health. Many water quality standards are set in order of magnitude below reported toxicity levels. Montana's groundwaters are only subject to human health standards.

Complicating the review of historic data are the analytical difficulties of perceiving low concentrations, due both to the instrumentation and the surrounding chemical matrix. Highly sensitive, low level analyses are costly, and analytical breakthroughs have been preceded by the rush to protect biota. Thus, results which include analyses that are less than detection limits may still exceed the aquatic standards.

There is substantial discussion throughout the rest of the document about the nutrients, phosphorus, and nitrogen. These nutrients can stimulate algal growth during the growing season. Phosphorus concentrations are too low to support algal growth at this time, but SMC will release some through the anoxic biotreatment cell. Concentrations in the river are 0.045 mg/L under low summer flows. The MPDES permit regulates phosphorus loading up to 1.1 pounds per day. Nitrogen is present in natural waters as nitrate, nitrite, and unionized ammonia, in order of concentration. The human health standard for nitrate is 10 mg/L. The background concentration is 0.4 mg/L and the MPDES permit allows an increase of 0.6 mg/L to 1 mg/L using a daily loading of 100 pounds nitrogen per day. The loading limits for phosphorus and nitrogen are engineered to prevent unwanted algal growth and discharge concentrations below the mixing zones do not represent levels that pose human health concerns.

Water quality standards are used to evaluate discharges into a water body and to determine the suitability of a water for a specific use. The water quality standards for waters whose baseline characteristics statistically significantly exceed the numeric water quality standard are the baseline conditions.

Stillwater River

A 1978 water quality assessment (Mid-Yellowstone Areawide Planning Organization 1978) classified the quality of the water in the Stillwater River as good to excellent, reflecting the low level of development in the area. Over the last 20 years, and since the mine's development, the quality of water in the Stillwater River has been maintained at that quality. DEQ has classified the Stillwater River as a B–1 type, meaning the river's water is generally suitable, after conventional water treatment, for drinking, cooking, and food processing. The water may be used without further treatment for bathing; swimming; recreating; growth and propagation of trout fisheries and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply (DEQ 1996). Metals periodically exceed water quality standards for domestic use (**Table 3–1**). Beneficial use of waters from the Stillwater River include industrial, commercial, domestic, irrigation, stock watering, and fish and wildlife uses.

Stillwater River water has a calcium-bicarbonate composition, is generally soft, is low in total dissolved solids, and has pH values ranging from 6.6 to 8.0 (**Table 3–1**) (Hydrometrics 1996b and 1997). Turbidity and total suspended solids are typically low. Seasonal variations in total dissolved solids typically occur in an inverse response to flow, with elevated concentrations occurring during periods of high flow, such as snowmelt or thunderstorms. Water temperature ranges from 0.5°C to 14.5°C. These temperatures, coupled with the moderately-high altitude, result in values of dissolved oxygen that are close to saturation (Hydrometrics 1996b, Karp, et al. 1975).

Table 3–1 Water Quality of Surface Water Sites near the Stillwater Mine

	Upstream SMC Complex, Stillwater River				Downstream SMC Complex, Stillwater River				Standards		
	Site SMC-1A				Site SMC-11				Aquatic		Human Health
Parameters[1]	Minimum	Maximum	Mean[2]	N[3]	Minimum	Maximum	Mean[2]	N[3]	Acute[4]	Chronic[4]	
Flow	0	2840	461	10	50.89	243.73	124.70	8			
pH (s.u.)	6.6	7.8	7.2	25	7.1	8	7	16		Narrative	
Specific Conductance (umhos/cm at 25 C)	30	123	50	25	30	113	68	16			
TDS (Measured at 180° C)	10	69	29	25	14	77	41	16		Narrative	
Total Suspended Solids	<1	26	<5	19	<1	8	<3	12			
Water Temperature (° C) (Field)	0	14.5	6	19	1	11	6	15			
Total Hardness as $CaCO_3$	12	61	20	24	13	53	28	15		Narrative	
Calcium (Ca)	3	11	5	24	4	13	7	15			
Magnesium (Mg)	<1	8	<2	24	1	5	2	15			
Sodium (Na)	<1	2	<2	21	<1	3	<2	12			
Potassium (K)	<1	1	<1	20	<1	1	<1	11			
Total Alkalinity as $CaCO_3$	9	67	21	23	13	44	26	15			
Bicarbonate (HCO_3)	10	82	26	22	18	54	34	13			
Carbonate as CO_3	0	0	0	22	0	0	0	13			
Sulfate (SO_4)	2	7	4	24	2	13	7	15		Narrative	
Chloride (Cl)	<1	3	<1	21	<1	1	<1	12	860	230	
Fluoride (F)	<0.10	<0.10	<0.05	20	<0.10	<0.10	<0.05	11			4.00
Total Ammonia (NH_3+NH_4 as N)	<0.05	<0.10	<0.05	29	<0.05	<0.10	<0.05	23			Note 5
Total Kjeldahl Nitrogen as N	<0.1	0.5	<0.1	34	<0.1	0.3	<0.1	29			
Nitrate + Nitrite as N	<0.05	0.4	<0.1	35	0.06	0.55	0.24	31			10
Total Nitrogen as N	0.2	0.7	0.4	9							
Phosphorus (P)	0.001	0.11	0.04	34	<0.001	0.14	<0.05	31			
Cadmium (Cd)	<0.0001	0.002	<0.0004	25	<0.0001	<0.0010	<0.0004	15	0.0008	0.0004	0.005
Chromium (Cr)	<0.001	<0.020	<0.003	25	<0.001	0.002	<0.001	15	0.558	0.067	0.1
Copper (Cu)	<0.001	0.013	<0.004	24	<0.001	0.007	<0.002	12	0.0048	0.0036	1.0
Iron (Fe)	<0.03	0.42	<0.14	12	<0.03	0.17	<0.05	12		1.0	0.3
Lead (Pb)	<0.002	0.02	<0.003	27	<0.002	<0.003	<0.001	15	0.014	0.0005	0.015
Manganese (Mn)	<0.005	0.02	<0.01	13	<0.005	<0.010	<0.005	12			0.05
Nickel (Ni)	<0.005	<0.030	<0.007	21	<0.005	<0.005	<0.003	11	0.439	0.049	0.1
Zinc (Zn)	<0.01	0.07	<0.01	22	<0.01	0.03	<0.02	12	0.036	0.033	5.0

Notes:

1. All results mg/L unless stated otherwise, metals concentrations are total recoverable.
2. Calculations of means used 0.5 times the detection limit in the calculations.
3. N = number of samples in data set.
4. Acute and chronic aquatic standards assume a hardness of 25 mg/L.
5. Ammonia standards vary by sample event, instantaneous flow, and pH.

Sources: DEQ 1995 (Standards) and Hydrometrics 1997 (data).

Alkalinity is typically low. Thus, the water has a limited buffering capability. The low alkalinity is typical of water that drains a mostly gneissic, granitic terrain. As the Stillwater River flows through the limestones found in the lower river valley, its alkalinity increases.

Concentrations of cadmium, copper, iron, lead, and zinc at sites upstream and downstream of the mine site have been above water quality standards set by DEQ (Hydrometrics 1997). This is believed to result form natural base line conditions influenced by both Nye and Verdegris Creek. For example, the maximum concentrations of cadmium, copper, lead, and zinc observed at the upstream site exceed the chronic aquatic standard on one or more occasions (**Table 3–1**). The average concentration of copper at the upstream site exceeds the chronic aquatic standard. The maximum concentration of iron exceeds the human health standards. The maximum concentrations of cadmium and copper exceed the chronic aquatic standard at the downstream site. The maximum concentration of copper also exceeds the acute standard at the downstream site. Mean concentrations of specific conductance, total dissolved solids (TDS), hardness, bicarbonate, sulfate, nitrate, and phosphorus are mildly elevated at the downstream surface water site, SMC–11, on the Stillwater River compared with the upstream surface water site, SMC–1A. These elevated levels of metals are a result of the weathering of ultrabasic rocks of the Stillwater Complex and the elevated nitrate concentrations are a result of LAD application of adit water enriched in nitrate.

Other Surface Water Features

Nye Creek contains magnesium bicarbonate waters of low salinity (TDS ranges from 49 to 84 mg/L) low hardness (47 to 67 mg/L $CaCO_3$), and slightly alkaline pH (7.1 to 8.0) (Hydrometrics 1996c). There are two water rights filings on Nye Creek for commercial and irrigation uses. SMC is monitoring two sites on Nye Creek to examine the impacts of the East Side percolation ponds. The upstream site, SMC–7, has TDS values 2 to 3 mg/L lower on average than the downstream site (SMC–7D). There is no significant difference in any of the nutrients (ammonia, Kjeldahl nitrogen, nitrate and nitrite, or phosphorus) between the upstream and downstream sites. Total chromium values ranged from 0.007 to 0.012 mg/L at SMC–7 and from 0.011 to 0.019 mg/L at SMC–7D (Hydrometrics 1996c). The weathering of the local rocks creates concentrations of chromium, iron, and manganese that are, at times, well above the Montana human health standards (DEQ 1995).

On Mountain View Creek, SMC monitors surface water sites SMC–5, upstream of the facilities area, and SMC–6, which is located below the percolation ponds and drainage from the western portion of the facilities area near the tailings pile. These two sites vary from one another periodically, but not in a statistically significant manner. Consequently, the quality of water is virtually the same for both sites (Hydrometrics 1996b). Water samples have always been within

Montana human health standards (DEQ 1995); however, chromium levels have been shown to be somewhat elevated. There is a single water rights filing on Mountain View Creek for fish and wildlife purposes.

Tailings Decant Water

Tailings impoundment decant water is represented by SMC–4 (SMC's surface monitoring sampling location No. 4), water that is collected at the mill. In 1996, this site had TDS values ranging from 1,760 to 2,280 mg/L and sulfate concentrations ranging from 958 to 1,390 mg/L (Hydrometrics, 1996a). Nitrate plus nitrite had values ranging from 23.3 to 26.2 mg/L, total Kjeldahl nitrogen had concentrations ranging from 0.9 to 4.0 mg/L, ammonia concentrations were 0.55 mg/L, and phosphate concentrations were 0.35 to 0.8 mg/L. Actual heavy metal exceedances have occurred infrequently and may be laboratory artifacts. Through September 1995, SMC's laboratory had a cadmium detection limit of 0.001 mg/L, exceeding the acute and chronic standards of 0.0008 and 0.0004 mg/L, respectively. There was one sampling event at SMC–4 in which 0.002 mg/L dissolved cadmium was recorded. Two of 15 samples of the mill decant stream (SMC–4) exhibited concentrations exceeding the acute and chronic aquatic standards of 0.036 and 0.33 mg/L, respectively. This water is recycled through the mill.

Geochemical Characterization

The granitic Stillwater Complex is a non-acid generating ore body. Although low concentrations of sulfur exist, annual testing of the acid-base potential conducted since the mine was developed have never identified zones of elevated acid potential. Results from the most recent sampling of waste rock and tailings are shown in **Table 3–2**. Generally, values of acid potential less than 20 tons $CaCO_3$ equivalents per 1000 tons of waste material reflect a neutral geochemistry. The acid-base potential of the samples confirm the low potential to generate acid.

A low potential for generation of acid typically suggests that the solubility and the subsequent migration of metals would be low. Nevertheless, SMC annually performs a Toxicity Characteristic Leaching Procedure (TCLP) on three composite samples: one each of ore, waste rock, and tailings (SMC 1997e). This test is used to evaluate the mobility of metals in liquid, solid, and multiphasic wastes and to determine whether the material is hazardous as identified in 40 CFR, Part 261.3. Mine wastes are exempt from these regulations. Arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver were analyzed in 1997 and many of the parameters never exceeded detection limits. All of the parameters were at least two orders of magnitude lower than standards.

Table 3–2 Acid-Base Evaluation Waste: Rock and Tailings (March 22, 1996)

Location	SMC Waste Rock Composite 96-0-112	SMC Tailings Composite 96-0-113
Sample Number	96-21286	96-21287
Lime as $CaCO_3$ (percent)	5.1	7.7
Neutralization Potential, T/1000 Tons[1]	51	77
Acid Potential, T/1000 Tons[1]	0	1
Acid-Base Potential, T/1000 Tons[1]	51	76
Non-Sulfate Sulfur (percent)	<0.01	0.04

Notes:
1. T $CaCO_3$/1000 Tons Soil
An acid-base potential equal to or greater than zero indicates that the material sampled has no potential to form acid. A result less than zero indicates the potential to form acid.
Source: SMC 1997e

3.1.2.2 Stratton Ranch

SMC's monitoring of surface water resources along the Stillwater River is summarized in its recent monitoring report on Stratton Ranch (SMC 1997d). Monitoring occurs upstream at surface water site SMC–11 near the permit boundary and downstream at Redman's Bridge at surface water site SMC–15. The water is a soft, slightly basic calcium bicarbonate liquid of low dissolved solids. Concentrations of nitrate plus nitrite ranged from 0.06 to 0.55 mg/L between 1993 and 1997 (Hydrometrics 1997) at SMC–11 and 0.14–0.24 mg/L at SMC–15 for sampling done in 1996. Metal concentrations were low.

Surface water monitoring site SW–11 is located in the vicinity of Stratton Ranch on the Stillwater River and is a calcium bicarbonate water of low hardness, slightly alkaline character. This site is approximately one-half a mile below the mine site. TDS has ranged from 25 to 77 mg/L (data collected from September 12, 1992 through December 13, 1996) (Hydrometrics 1996a). Sulfate concentrations range from 5 to 13 mg/L, nitrate plus nitrite levels have ranged from 0.06 through 0.55 mg/L and phosphate values have ranged from <0.001 through 0.14 mg/L. Concentrations of aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, silver and zinc are all below Montana human health standards.

3.1.2.3 Hertzler Ranch

Surrounding surface water sites include SMC–14 located upstream on the West Fork of the Stillwater River, SMC–12, located upstream on the Stillwater River and SMC–13, located downstream on the Stillwater River. All waters were monitored in 1996 and exhibited soft to moderately hard, neutral to slightly basic pH, calcium bicarbonate characteristics with low dissolved solids. Nutrient and metals concentrations were low or below laboratory detection limits (SMC 1997c).

The quality of water in the West Fork of the Stillwater River is generally good. This water is a calcium-carbonate type with low average total dissolved solids (60 mg/L) and a low average alkalinity of 29 mg/L of $CaCO_3$ (Botz 1976). The presence of sensitive aquatic invertebrates in the West Fork of the Stillwater River also suggests the quality of water in the river is good. The DNRC identifies water uses of domestic stock watering, and irrigation within the west fork of the Stillwater River water rights.

Baseline water quality data in the three small, poorly-developed drainages, Robinson Draw, Stanley Coulee, and Tandy Coulee were collected monthly from June 1980 through June 1981 (CDM 1981). Four samples from Tandy Coulee exceed human health drinking water quality standards for fecal coliform. Additionally, runoff from Tandy Coulee always exceeded the federal secondary domestic standards and Montana human health standard for iron. Single sampling events in February 1981 in Stanley and Tandy Coulees exhibited 0.02 gm/l cadmium, which exceeds the human health standard of 0.01 mg/L. The bedrock (Eagle Formation) underneath these drainages contains sulfide metal complexes that slightly acidify runoff waters and probably are the reason for the elevated cadmium and iron values. Even though these waters are unsuitable for human consumption, they are of acceptable quality for irrigation and stock watering, their primary uses.

3.1.3 Groundwater

3.1.3.1 Stillwater Mine Site

Groundwater is contained in bedrock of the Stillwater Complex within the area of the mine site, landslide deposits, colluvium (sheetwash deposits), and unconsolidated alluvium (stream deposits) landslide deposits.

The bedrock aquifers may be found in zones of secondary permeability associated with either the Precambrian ultrabasic rocks of the Stillwater Complex, metamorphic or meta-igneous units of gneiss, schist or hornfels, or quartz monzonite intrusives (CDM 1981). These are located in the southern part of the study area. To the north are Paleozoic to Mesozoic sedimentary formations consisting of the Madison limestone, the Colorado Group shale, and the Montana Group sandstone, siltstone, shale and carbonaceous units. The bedrock aquifers are recharged mainly by snowmelt water at higher elevations. Water is stored in fractures, faults, joints and other breaks in the bedrock, which essentially has zero effective matrix permeability and porosity. Because the occurrence and density of fractures is variable and hard to predict, the discharge rates of the bedrock are localized and vary greatly. In many instances, however, new mine development into fractured aquifers result in initial inflows that decline rapidly and level out at low sustained rates (Hydrometrics 1997).

Water-bearing zones encountered during adit development give an indication of bedrock aquifer flows. The total water output of the mines varies with time as new zones are encountered and old zones decline. Between 1992 and 1994, the adit discharge for the west side ranged from 105 to 416 gpm, whereas discharges from the east side ranged from 286 to 1,940 gpm (Hydrometrics 1996a) averaging 500 to 700 gpm total (HKM Associates 1994). Groundwater is discharged from the bedrock aquifer into springs, creeks, the unconsolidated aquifers, and directly into the Stillwater River, as well as the mine adits. Bedrock groundwater generally flows toward the Stillwater River.

No wells are known to be completed in the Precambrian crystalline metamorphic rock. Five springs were observed to discharge from these geologic formations in the area (CDM 1981). SMC currently monitors three springs (SMC 1996a). Upper Jones Spring is located 2.2 miles northwest of the mine site and southwest of Horseman Flats. Flows have averaged 8 gpm in annual fall monitoring. Buffalo Jump Spring (SP-2 is located 3.2 miles northeast of the mine site, approximately halfway between Stratton and Hertzler. Flows average 3.8 gpm. The East Side Spring (SP-3) is located 400 feet east of the eastside clarifier and has been dry since 1994. Historic springs in that area (SPF-S, CV-S) had flows of 179 gpm (CDM 1981).

Groundwater quality remains generally good in the area of the SMC project. The most common water composition from the igneous and metamorphic formation is calcium-magnesium bicarbonate. The sedimentary formations produce more variable types ranging from a calcium sulfate to calcium bicarbonate to sodium bicarbonate waters reflecting the chemical composition of the host rock in the area. Groundwater is generally of drinking-water quality in the bedrock immediately surrounding the platinum-group mineralized zone. In contrast, the basal zone of the Stillwater Complex contains considerably higher amounts of sulfides; therefore, groundwater passing through these areas is expected to have higher metal values than most of the groundwater in the upper Stillwater River basin.

Table 3–3 shows a composite quality of water discharged from the SMC West Side Adit (SMC–3) and the SMC East Side Adit (SMC–9) between March 21, 1990 and June 10, 1997 (Hydrometrics 1997). Maximum concentrations of dissolved cadmium, copper, manganese and zinc and total recoverable cadmium, copper and lead exceed either aquatic or Montana's human health water quality standards. SMC's laboratory had a cadmium detection limit of 0.001 mg/L exceeding the acute and chronic standards of 0.0008 and 0.0004 mg/L through September of 1995. There were three sampling events at SMC-9 in which

Table 3–3 Surface Water Discharge Water Quality

	Adit Water Merged: SMC-3 and SMC-9				Process Water SMC-4				Standards		
									Aquatic		
Parameters[1]	Minimum	Maximum	Mean[2]	N[3]	Minimum	Maximum	Mean[2]	N[3]	Acute[4]	Chronic[4]	Human Health
Flow	105	2940	468	18							
pH (s.u.)	6.6	10.9	8	57	6.6	9	7.4	24		Narrative	
Specific Conductance (μmhos/cm at 25° C)	189	2640	382	57	642	2640	1809	24			
TDS (Measured at 180° C)	110	2280	247	57	467	2280	1520	24		Narrative	
Total Suspended Solids	8	240	96	10	21	106	50	3			
Water Temperature (°C) (Field)	2	25	11	18	2	25	13	9			
Total Hardness as $CaCO_3$	46	1160	133	57	242	1160	768	24		Narrative	
Calcium (Ca) - Dissolved	18	390	44	57	76	390	258	24			
Magnesium (Mg) - Dissolved	<1	46	<6	57	13	46	30	24			
Sodium (Na) - Dissolved	7	179	26	51	54	179	130	21			
Potassium (K) - Dissolved	<1	7	<1	49	3	7	5	20			
Total Alkalinity as $CaCO_3$	17	106	66	54	17	76	39	24			
Bicarbonate (HCO_3)	0	110	79	53	18	93	48	22			
Carbonate as CO_3	0	32	1	53	0	6	0	22			
Sulfate (SO_4)	11	292	87	57	253	1390	848	24		Narrative	
Chloride (Cl)	1	59	5	51	11	59	32	21	860	230	
Fluoride (F)	<0.10	0.17	<0.07	47	<0.1000	<0.1000	<0.0005	19			4.00
Total Ammonia (NH_3+NH_4 as N)	<0.05	8.70	<1.1	50	<0.1000	8.7	<3	21			Note 5
Total Kjeldahl Nitrogen as N	<0.1	9.2	1	57	<0.1000	9.2	<3.3083	24			
Nitrate + Nitrite as N	0.7	54.7	8	57	7.86	54.7	31.06	24			10.0
Phosphorus (P)	0.002	2.000	0	35	0.35	2	0.72	15			
Cadmium (Cd) - Dissolved	<0.0001	0.001	<0.0004	55	<0.0001	0.002	<0.0005	23	0.0008	0.0004	0.005
Cadmium (Cd) - TRC	<0.0010	<0.0010	<0.0003	9	<0.0010	<0.0010	<0.0005	2	0.0008	0.0004	0.005
Chromium (Cr) - Dissolved	<0.001	<0.002	<0.006	54	<0.0010	<0.0200	<0.0036	23	0.558	0.067	0.10
Chromium (Cr) - TRC	0.003	0.030	0.011	9	<0.020	<0.020	<0.010	2	0.558	0.067	0.10
Copper (Cu) - Dissolved	<0.0005	0.021	<0.0032	50	<0.0010	0.021	<0.0042	22	0.0048	0.0036	1.0
Copper (Cu) - TRC	0.0029	0.0800	0.0127	15	<0.0100	0.014	<0.0086	4	0.0048	0.0036	1.0
Iron (Fe) - Dissolved	<0.01	0.12	<0.02	23	<0.01	0.12	<0.02	11		1.00	0.30
Lead (Pb) - Dissolved	<0.0005	0.020	<0.0033	58	<0.0020	0.01	<0.0033	25	0.014	0.00005	0.015
Lead (Pb) - TRC	<0.002	0.021	<0.008	13	0.0035	<0.0100	<0.0046	4	0.014	0.00005	0.015
Manganese (Mn) - Dissolved	<0.01	0.09	<0.02	37	<0.01	0.04	<0.015	12			0.05
Mercury (Hg) - TRC	<0.0002	<0.0010	<0.0003	8	<0.0002	<0.0010	<0.0002	3	0.0024	0.00012	0.00014
Nickel (Ni) - Dissolved	<0.005	<0.030	<0.009	44	<0.005	<0.030	<0.009	19	0.439	0.049	0.10
Zinc (Zn) - Dissolved	<0.01	0.04	<0.01	46	<0.01	0.54	<0.06	20	0.036	0.033	5.0

Notes:

1. All results mg/L unless stated otherwise, metals concentrations are total recoverable.
2. Calculations of means of detection limit values used 0.5 times the detection limit in the calculations.
3. N = number of samples in data set.
4. Acute and chronic aquatic standards assume a hardness of 25 mg/L.
5. Ammonia standards vary by sample event, instantaneous flow, and pH.

Sources: DEQ 1995 (Standards) and Hydrometrics 1997 (data).

0.001 mg/L were noted. The mean concentrations of total recoverable copper from the adits exceed both chronic and acute aquatic standards. Copper had similar detection limit problems as cadmium with a detection limit of 0.01 mg/L. One sampling event had a copper concentration of 0.006 mg/L, exceeding the acute and chronic standards of 0.0048 and 0.0036 mg/L respectively. Three of the ten sampling events dissolved manganese at SMC-3 exceeded the secondary human health standard of 0.05 mg/L. Other maximum concentrations were one time exceedances. The mean concentration of all other parameters are within water quality standards suggesting that the adit and process waters are typically very good quality and exceedances occur infrequently.

Nitrogen concentrations in adit discharge water continue to be much higher than natural levels. These increases are the result of using nitrogen-based blasting agents in the mining operations. Elevated nitrogen values are found in the monitoring wells downgradient of the west side percolation ponds and increases have been detected between the upstream and downstream sites in the Stillwater River (Gurrieri 1997, pers. comm.). Nitrate levels in water sampled from wells upgradient and downgradient of the eastside percolation ponds are summarized in **Table 3–4**. Nitrate plus nitrite ranges from 0.3 to 3.36 mg/L upgradient and <0.05 to 22.1 mg/L downgradient. The newly reissued MPDES permit identifies a compliance level of 8 mg/L at designated wells below the groundwater mixing zones of percolation pond discharge outfalls. The human health standard for nitrate in groundwater is 10 mg/L outside of a permitted mixing zone.

Unconsolidated aquifers are found on the steep valley walls as well as in the valley floor of the Stillwater River. These heterogeneous materials have a highly variable hydrologic character. No known wells are found in these colluvial materials but minor springs and seeps are present within drainages and in association with larger landslide deposits.

The most significant aquifer is the Stillwater River alluvial aquifer in the valley floor. This aquifer generally consists of two layers: a lower layer of coarse gravel with high permeability, overlain by a second layer of lower permeability. The hydraulic conductivity of the upper and lower layers is 5 gallons per day per square foot and 200 to 400 gallons per day per square foot, respectively, with flow direction generally parallel to the river. The Stillwater River loses water to the aquifer upstream of the USGS's gaging station (**Figure 3–2**). Downstream from the gaging station, the river gains water from the aquifer. Local variations in aquifer thickness range from 50 to 250 feet, with an average of 100 feet. This aquifer is capable of producing a sustained flow of more than several hundred gallons per minute. The alluvial aquifers are recharged predominantly from the Stillwater River with some additional water coming from the bedrock aquifer.

In general, the alluvial aquifer has better quality water than the crystalline bedrock aquifer. This aquifer is classified by the State of Montana as a Class I groundwater; it is generally suitable for all beneficial uses with little or no

Table 3–4 Alluvial Monitoring Wells Associated with Percolation Ponds

	Upgradient Percolation Ponds Merge: MW-14A, MW-T1A				Downgradient Percolation Ponds Merge: MW-12A, 13A, 15A, 16A, 17A				Standards
Parameter[1]	Minimum	Maximum	Mean[2]	N[3]	Minimum	Maximum	Mean[2]	N[3]	Human Health
Depth to Water Level (Feet)	40.15	79.5	66.7	87	10.05	46.3	19.0	251	
pH (s.u.)	6.8	7.7	7.3	62	6.6	7.7	7.1	144	
Specific Conductance (umhos/cm at 25° C)	116	291	205	62	112	582	260	144	
TDS (Measured at 180° C)	21	204	130	84	14	382	162	250	
Water Temperature (° C) (Field)	7	10	8	57	3	18	9	188	
Total Hardness as $CaCO_3$	63	135	95	52	8	231	94	99	
Calcium (Ca) - Dissolved	11	28	17	52	10	42	18	99	
Magnesium (Mg) - Dissolved	9	20	13	52	7	31	12	99	
Sodium (Na) - Dissolved	3	8	4	46	2	37	8	84	
Potassium (K) - Dissolved	<1	2	<1	44	<1	2	<1	79	
Total Alkalinity as $CaCO_3$	63	108	80	52	54	101	67	99	
Bicarbonate (HCO_3)	77	132	98	48	66	123	82	89	
Carbonate as CO_3	0	0	0	48	0	0	0	89	
Sulfate (SO_4)	4	41	17	52	4	148	33	99	
Chloride (Cl)	<1	7	<2	46	<1	30	<3	84	
Fluoride (F)	<0.10	0.12	<0.05	42	<0.10	0.11	<0.05	76	4.00
Total Ammonia (NH_3+NH_4 as N)	<0.05	<0.10	<0.05	63	<0.05	<0.10	<0.05	168	Note 4
Total Kjeldahl Nitrogen as N	<0.1	0.7	<0.1	83	<0.1	0.8	<0.1	248	
Nitrate + Nitrite as N	0.31	3.36	1.71	84	<0.05	22.10	<3.8	250	10
Phosphorus (P)	0.010	0.160	0.068	58	0.002	0.200	0.075	212	
Cadmium (Cd) - Dissolved	<0.0001	<0.0100	<0.0004	53	<0.0001	0.0010	<0.0004	102	0.005
Chromium (Cr) - Dissolved	0.004	<0.050	<0.008	51	0.001	0.010	0.005	96	0.0
Copper (Cu) - Dissolved	<0.0005	<0.02	<0.004	47	<0.0005	0.010	<0.003	89	1.0
Iron (Fe) - Dissolved	<0.01	<0.03	<0.01	23	<0.01	0.08	<0.02	55	0.3
Lead (Pb) - Dissolved	<0.0020	0.0200	<0.004	54	0.0007	0.020	<0.003	107	0.015
Manganese (Mn) - Dissolved	<0.005	<0.020	<0.006	25	<0.005	<0.020	<0.006	58	0.05
Nickel (Ni) - Dissolved	<0.005	<0.030	<0.008	42	<0.005	<0.030	<0.006	73	0.10
Zinc (Zn) - Dissolved	<0.01	0.05	<0.01	46	<0.01	0.05	<0.01	84	5.0

Notes:

1. All results mg/L unless stated otherwise, metals concentrations are total recoverable.
2. Calculations of means of detection limit values used 0.5 times the detection limit in the calculations.
3. N = number of samples in data set.
4. Ammonia standards vary by sample event, instantaneous flow, and pH.

Sources: DEQ 1995 (Standards) and Hydrometrics 1997 (data).

treatment. Water data in the alluvial aquifer mainly come from drinking water wells and monitoring wells. The water most common to this aquifer has a calcium bicarbonate composition. Other compositions are calcium-magnesium bicarbonate and calcium-magnesium-sodium bicarbonate. The calcium and magnesium concentrations and the pH generally increase downgradient along the Stillwater River.

Five alluvial well locations currently being monitored are near the Stillwater River and are downgradient of the current tailings impoundment and westside percolation ponds (**Table 3–5**). These wells have good quality water and have never exceeded human health water quality standards for any metals (Hydrometrics 1989), except dissolved chromium (Hydrometrics 1997). The three wells in the old chromite tailings area on the east side of the river have, at times, had elevated concentrations of one or more of the following: iron, lead, chromium, manganese, or cadmium, which were above human health water quality standards.

Table 3–6 compares water quality at alluvial wells upgradient and downgradient of the current LAD sites, which adjoin historic dumps of chromium tailings. Dissolved chromium concentrations regularly exceed the human health standard at all sites, with slightly lower concentrations at the downgradient site. Slight elevations of sulfate, chloride, phosphorus, cadmium, iron, and zinc concentrations are observed in the downgradient sites compared with the upgradient sites. In some cases, this may reflect a laboratory artifact of varying detection limits rather than increases associated with the LAD.

Monitoring well MW–3TA has shown the highest levels of TDS recorded on the site, 370 mg/L. This site reflects water quality associated with ponded water on uncompacted waste rock, as well as impacts for the LAD. Sulfate concentrations have ranged from 10 to 93 mg/L. Total ammonia is at levels lower than 0.1 mg/L and total Kjeldahl nitrogen ranges from <0.1 to 0.7 mg/L. Nitrate plus nitrite has ranged from 1.27 to 23.4 mg/L in readings noted in 1994. Values of this parameter at this site in 1995 and 1996 ranged from 3.15 to 15.3 mg/L, but were typically less than the standard of 10 mg/L. Elevated concentrations appear to occur during situations when there is deep leaching, typically in conjunction with natural storm events.

Groundwater beneath the percolation ponds on the east side of the river has shown higher concentrations of ammonia, nitrate, sulfate, and TDS than groundwater elsewhere in the facilities area. Dilution of pond seepage water in the alluvial groundwater downstream of the mine is believed to render all but nitrates undetectable from baseline conditions. The elevated nitrate concentrations outside the defined mixing zones permitted by MPDES Permit MT–0024716 (approved August 1, 1998) are within compliance of human health water quality standards and would not preclude the use of the groundwater for drinking water or other purposes.

Table 3–5 Alluvial Monitoring Wells Downgradient of the Tailings Impoundment

	Merge: MW-7A, 7B, 7C, 9A, 11A				Standards
Parameter[1]	Minimum	Maximum	Mean[2]	N[3]	Human Health
Depth to Water Level (Feet)	35.9	55.8	47.8	143	
pH (s.u.)	6.8	8	8	129	
Specific Conductance (umhos/cm at 25° C)	92	401	222	129	
TDS (Measured at 180° C)	17	244	126	129	
Water Temperature (°C) (Field)	6.5	10	8	71	
Total Hardness as $CaCO_3$	39	182	106	129	
Calcium (Ca) - Dissolved	10	29	17	128	
Magnesium (Mg) - Dissolved	4	27	15	128	
Sodium (Na) - Dissolved	3	11	6	113	
Potassium (K) - Dissolved	<1	5	<2	108	
Total Alkalinity as $CaCO_3$	48	127	87	127	
Bicarbonate (HCO_3)	58	155	107	119	
Carbonate as CO_3	0	0	0	119	
Sulfate (SO_4)	6	61	20	129	
Chloride (Cl)	<1	33	<4	114	
Fluoride (F)	<0.01	0.13	<0.08	104	4.00
Total Ammonia (NH_3+NH_4 as N)	<0.05	0.30	<0.1	112	Note 4
Total Kjeldahl Nitrogen as N	<0.1	0.5	<0.1	129	
Nitrate + Nitrite as N	<0.05	5.82	<1.3	129	10
Phosphorus (P)	<0.001	0.200	<0.1	64	
Cadmium (Cd) - Dissolved	<0.0001	0.0020	<0.0005	130	0.005
Chromium (Cr) - Dissolved	<0.001	0.060	<0.020	130	0.1
Copper (Cu) - Dissolved	<0.001	<0.010	<0.003	114	1.0
Iron (Fe) - Dissolved	0.01	0.06	<0.03	45	0.30
Lead (Pb) - Dissolved	<0.002	0.060	<0.004	130	0.015
Manganese (Mn) - Dissolved	<0.005	<0.020	<0.005	49	0.05
Nickel (Ni) - Dissolved	<0.005	<0.030	<0.008	109	0.1
Zinc (Zn) - Dissolved	<0.01	0.07	<0.03	114	5.0

Notes:

1. All results mg/L unless stated otherwise, metals concentrations are total recoverable.
2. Calculations of means of detection limit values used 0.5 times the detection limit in the calculations.
3. N = number of samples in data set.
4. Ammonia standards vary by sample event, instantaneous flow, and pH.

Sources: DEQ 1995 (Standards) and Hydrometrics 1997 (data).

Table 3–6 Alluvial Sites Associated with Land Application Disposal (LAD)

Parameter[1]	Upgradient LAD Sites Merge: MW-T1A, MW-14A				Downgradient LAD Sites MW-18A				Standards	
	Minimum	Maximum	Mean[2]	N[3]	Minimum	Maximum	Mean[2]	N[3]	Chronic[4]	Human Health
Depth to Water Level (Feet)	40.15	79.5	66.7	87	20.44	24.51	23.17	11		
pH (s.u.)	6.8	7.7	7.3	62	6.7	7.3	7.0	11	Narrative	
Specific Conductance (umhos/cm at 25 C)	116	291	205	62	168	234	189	11		
TDS (Measured at 180° C)	21	204	130	84	90	138	108	11	Narrative	
Water Temperature (°C) (Field)	7	10	8	57	7.5	10	8	10		
Total Hardness as $CaCO_3$	63	135	95	52	79	120	90	11	Narrative	
Calcium (Ca) - Dissolved	11	28	17	52	16	25	19	11		
Magnesium (Mg) - Dissolved	9	20	13	52	9	14	10	11		
Sodium (Na) - Dissolved	3	8	4	46	3	5	4	8		
Potassium (K) - Dissolved	<1	2	<1	44	<1	1	<1	7		
Total Alkalinity as $CaCO_3$	63	108	80	52	61	80	69	11		
Bicarbonate (HCO_3)	77	132	98	48	75	97	83	9		
Carbonate as CO_3	0	0	0	48	0	0	0	9		
Sulfate (SO_4)	4	41	17	52	12	23	18	11	Narrative	
Chloride (Cl)	<1	7	<2	46	2	4	3	8	230.000	
Fluoride (F)	<0.10	0.12	<0.05	42	<0.10	<0.10	<0.05	7		4.00
Total Ammonia (NH_3+NH_4 as N)	<0.05	<0.10	<0.05	63	<0.10	<0.10	<0.05	7		Note 5
Total Kjeldahl Nitrogen as N	<0.1	0.7	<0.1	83	<0.1	<0.5	<0.1	11		
Nitrate + Nitrite as N	0.31	3.36	1.71	84	1.05	4.39	1.65	11		10
Phosphorus (P)	0.010	0.160	0.068	58	0.040	0.190	0.100	11		
Cadmium (Cd) - Dissolved	<0.0001	<0.0100	<0.0004	53	<0.0001	0.002	<0.001	11	0.001	0.005
Chromium (Cr) - Dissolved	0.004	<0.050	<0.008	51	0.004	0.005	0.004	11		0.1
Copper (Cu) - Dissolved	<0.0005	<0.02	<0.004	47	<0.001	<0.001	<0.001	8	0.012	1.0
Iron (Fe) - Dissolved	<0.01	<0.03	<0.01	23	<0.03	0.08	<0.02	8	1.000	0.30
Lead (Pb) - Dissolved	<0.002	0.02	<0.004	54	<0.002	<0.003	<0.001	11	0.032	0.015
Manganese (Mn) - Dissolved	<0.005	<0.020	<0.006	25	<0.005	<0.010	<0.005	8		0.05
Nickel (Ni) - Dissolved	<0.005	<0.030	<0.008	42	<0.005	<0.005	<0.003	7	0.160	0.1
Zinc (Zn) - Dissolved	<0.01	0.05	<0.01	46	<0.01	0.04	<0.02	8	0.110	5.0

Notes:

1. All results mg/L unless stated otherwise, metals concentrations are total recoverable.
2. Calculations of means of detection limit values used 0.5 times the detection limit in the calculations.
3. N = number of samples in data set.
4. Chronic aquatic standards assume a hardness of 25 mg/L.
5. Ammonia standards vary by sample event, instantaneous flow, and pH.

Sources: DEQ 1995 (Standards) and Hydrometrics 1997 (data).

Monitoring wells MW–5A, MW–6A, and MW–10 are located east and upgradient of the existing tailings impoundment and west side percolation ponds on the Stillwater River. The water is characterized as a magnesium bicarbonate water, which is soft to moderately hard, with near neutral pH and low dissolved solids, sulfate, nutrients, and metal concentrations. Well MW–6A has shown low concentrations of chromium throughout most of the monitoring period with a historic range of 0.008 to 0.22 mg/L and 1996 levels of 0.01 to 0.02 mg/L. Well MW–5A had nitrate plus nitrite levels of 0.13 to 0.21 mg/L during the 1996 monitoring year while well MW–6A had nitrate plus nitrite levels of 0.52 to 0.84 mg/L. Montana's standard for nitrate plus nitrite is 10 mg/L.

Table 3–5 displays a statistical summary of five wells located below the tailings impoundment. They include data from MW–7A, MW–7B, MW–7C, MW–9A, and MW–11A collected between March 21, 1990 and June 10, 1997. All show parameters at these sites met human health standards.

Monitoring wells MW–7A, MW–7B, and MW–7C are located 500 feet downstream of MW–6A and 400 feet downstream of the west emergency spill basin 200 feet east of the toe of the tailings impoundment. They are completed at depths of 170 feet, 98 feet, and 64 feet, respectively. Concentrations of nitrate plus nitrite have shown a ten-fold increasing trend from baseline in wells MW–7A and MW–7C with 1996 concentrations ranging from 1.93 to 2.34 mg/L and 1.97 to 3.1 mg/L, respectively. Hydrometrics (1996a) identified three potential factors to explain these results: the use of the west side percolation ponds, runoff and infiltration from the tailings dam area, which was constructed using waste rock, and periodic use of the mine water overflow pond.

Well MW–19A is located near the north permit boundary, 100 feet west of the Stillwater River after the river has flowed through the mine site for 0.8 miles. The soft, calcium bicarbonate water has low concentrations of dissolved solids, sulfate and nutrients, with metals at or below analytical detection limits. There is no impact from the mine at this site.

3.1.3.2 Stratton Ranch

The Stratton Ranch is similar to the existing mine site in many ways. A large percentage of the groundwater flowing under the ranch flows to the northeast and then shifts eastward in the unconsolidated surface deposits. The water table ranges in depth from 9 to 18 feet below the ground surface. Surface water encountered nearer to the Stillwater River (small ponds and a slough) appears to be a surface expression of the water table.

Hydrometrics (1996c) inventoried springs and wells in the Stratton Ranch study area on the west side of the Stillwater River between Silver Creek and Redman's Bridge on Stillwater County Road 419. Thirteen sites were identified as springs or potential springs. All of the sites are either upgradient of proposed LAD sites or receive recharge from an upgradient source. Four springs are on the Stratton Ranch itself: SRSSP; SRUSSP; SRNSP; and an unnamed spring near the highway south of the Stratton Ranch area. SRSSP has a reported flow of 100 gpm and SRNSP has a reported flow of 58 gpm. There is no flow information available for the unnamed spring south of Stratton Ranch and SRUSSP has a reported flow of 8 gpm. The remaining springs are located in the landslide deposits associated with Cathedral Mountain or on other upland areas within the study area. Flows range from unreported to 53 gpm, but typically are less than 5 gpm. Water rights have been filed for twelve of the springs and the owners are summarized in the Hydrometrics (1996b) report.

Ten wells were noted in the study area (Hydrometrics 1996c). Three are located directly on the Stratton Ranch site: (1) SREW, (2) SRWW; and (3) the old Stratton Ranch well. The first two are 59 feet deep and yield 100 gpm. The old Stratton Ranch well, which is not in use, is 200 feet deep and reportedly yields 5 gpm. Seven wells are downgradient of the site on the west side of the river and range in depth from 6.5 to 60 feet for those sites for which data have been reported. Reported yields range from 25 to 35 gpm. Water rights have been filed on six of the sites and ownership is summarized in Hydrometrics' (1996c) report.

3.1.3.3 Hertzler Ranch

Groundwater in the Hertzler Valley is primarily found in two distinct geologic units: sedimentary bedrock and unconsolidated surficial deposits. The majority of the Hertzler Valley is underlain by sedimentary shale and sandstone. The bedrock is mantled with almost two hundred feet of unconsolidated glacial and alluvial deposits. Surficial materials in the Hertzler Valley are predominantly alluvial fan deposits, but glacial drift deposits are found on the north and south sides of the Valley (CDM 1981). Poorly-sorted colluvial deposits also are present to the north and west. As a consequence, unconsolidated groundwater resources are variable. Groundwater is available in the sedimentary units, but generally is not used where more reliable near-surface water in alluvial unconsolidated deposits exists.

Groundwater in the sedimentary rocks of the Hertzler Valley generally flows toward the valley bottom, roughly following the relief of the landscape, and then trends eastward towards the Stillwater River. Much of the lower elevations are underlain by bedrock composed of Colorado shale, which is roughly 1,000 times less permeable than the overlying sand and gravel. The shale's low permeability does not facilitate migration of groundwater, severely limiting the amount of vertical leakage from the overlying surficial deposits. A pumping test of alluvial wells dropped water levels slightly in observation wells completed in the shale. This suggests that the upper portion of the shale bedrock is, to a small degree, hydrologically connected with the overlying saturated unconsolidated material and that some exchange of groundwater between the two units is possible.

The depth of unconsolidated material within the Hertzler Valley varies. The thickest accumulation occurs along the central east-west axis of the valley where it is approximately 137 feet thick (CDM 1981). These materials range in depth from 55 feet to 171 feet. The material is composed primarily of a mixture of alluvial fan and glacial outwash deposits. Most of the groundwater in the alluvium moves in an unconfined state.

During most of the year, these unconsolidated deposits are saturated at depths ranging from 76 feet at the western end of the valley to 42 feet at the eastern end where the Hertzler Valley joins the Stillwater River. Water levels vary with the season. The water table is highest during the late spring and summer and lowest during winter and early spring. It rises as much as 20 feet between low to high periods (CDM 1981).

Testing of hydraulic conductivities below the Hertzler tailings impoundment site range from 1×10^{-3} to 8×10^{-7} cm/sec (Wahler 1981). Flexible wall permeability analyses conducted by Knight Piésold (1996) yielded permeabilities ranging from 4.3×10^{-4} cm/sec to 1.4×10^{-8} cm/sec, depending on confining pressures. Other portions of the Hertzler Valley exhibited high transmissivities. Groundwater can be extracted from the unconsolidated deposits of the Hertzler Valley at high rates. Pumping and recovery tests of glacial outwash materials in the Hertzler Valley indicate transmissivities ranging from 150,000 to 800,000 gpd/ft (CDM 1981). Recovery tests in the overlying alluvial materials indicate transmissivities of 656 to 11,165 gpd/ft. Several observation wells were capable of producing more than 200 gpm, sufficient for sprinkler irrigation of hayfields. Recharge is derived from precipitation, losses from stream channels, and contributions from bedrock aquifers. Infiltration of irrigation water also is a major source of recharge for the valley system. Over half of the irrigation water brought in from the West Fork of the Stillwater River is lost to infiltration. An irrigation ditch runs most of the length of the Hertzler Valley and is used to flood irrigate hayfields.

Five wells produce water from alluvial deposits in the Hertzler Valley study area (Hydrometrics 1996c). Two are upgradient of proposed operations (RW–2 and Hart/Evans). The MDFWP's well is located one mile east of all proposed disturbance in the Stillwater alluvium. The two DeGroat wells are upstream of the intersection of the Hertzler Valley and the Stillwater River, 0.9 miles east of the proposed tailings impoundment location. There are also three springs north of the Hertzler Valley in the Stanley and Tandy Coulees. The springs have reported flows ranging from 12.5 to 40 gpm. Water rights have been filed on the springs. The old Hertzler Homestead Spring is located near the southeast toe of Bush Mountain. There are no water rights filing on the spring and no flow information. It is downgradient of an irrigation ditch derived from the West Fork of the Stillwater River, which could serve as a source of recharge.

Two wells, the Nye Firehouse well and the Hart/Evans domestic well, produce water from sedimentary units in the area. Completion reports are not available, but it is surmised that water is derived from sandstones in the Colorado Group. The Madison limestone is the source of several springs, the largest, Madison Spring (MD–5), discharging 45 gpm. The Eagle sandstone is the source of the Tandy Coal Spring (TC–5), which flows less than 10 gpm throughout the year. CDM's (1981) baseline survey noted five springs discharging from sedimentary deposits.

All six observation wells drilled in the Hertzler Valley in the unconsolidated deposits tapped groundwater of quality suitable for use in irrigation or stock watering, the water's current primary use. The calcium bicarbonate water is moderately hard with a slightly basic pH and low to moderate TDS concentrations. Valley groundwater was found to consistently exceed Montana's human health water quality standard for iron. Sampling information on lead is inconsistent. Three of six observation wells also had lead values above the recommended limit for human health (four to 15 times the standard) during the collection of baseline data in 1981. Lead levels were below the human health standard and at the detection limit in quarterly monitoring performed in 1996 (SMC 1997c). Manganese was above the human health water quality standard of 0.05 mg/L for four of six wells in the valley. Nitrate plus nitrite concentrations ranged from 0.24 to 1.47 mg/L in the monitoring of seven wells in 1996 and do not pose a risk to human health. Phosphorus levels ranged from <0.001 to 0.56 mg/L (SMC 1997c). In general, alluvial groundwater under most of the Hertzler Valley would not be desirable for domestic water supplies due to elevated concentrations of iron and manganese. The standards for these metals are based on aesthetics and are federal secondary drinking water standards to prevent staining. The origin of the constituents that make the water undesirable for drinking water is unknown, but probably is the poor quality water seeping upward from the underlying bedrock and from infiltration of surface irrigation water (CDM 1981 and SMC 1997c).

Water quality samples taken from two observation wells completed in the bedrock that underlies most of the valley (Colorado Shale Group) exceeded the drinking water limits for the following constituents: total dissolved solids, arsenic, cadmium, chromium, iron, lead, manganese, selenium, silver, and sulfate. The poor quality of the water in the Colorado Group rocks, coupled with the very small amount that could be pumped from the units, makes the Colorado Shale an undesirable source for beneficial use.

3.1.4 Wetlands

Wetlands occur at Hertzler Ranch and along the proposed route for the pipelines. These wetlands are extensively described in SMC's Section 404 Permit Authorization Request (SMC 1997b). Overall, an estimated 1.5 acres of wetlands fall within the project area and most of this acreage occurs along the pipeline route.

Westech (SMC 1997b) identified five categories of wetlands within the project area. They are herbaceous wetlands, tall shrub/deciduous tree wetlands, riparian channel fringe wetlands, irrigation ditch channel fringe wetlands, and basin wetlands. Westech also provided full descriptions of each category of wetlands, the wetland sites identified, and their locations. The following discussion summarizes this information.

Herbaceous wetlands occupy permanently- to seasonally-flooded sites that are inundated or have saturated soils. They are generally dominated by species of hydrophytic grasses, sedges, rushes and forbs. Woody species are scarce. Herbaceous wetlands are predominantly associated with roadside borrow pits and diversion ditches, small spring-fed streams, and hillside seeps. Most of the wetlands potentially affected by the action alternatives are herbaceous wetlands.

Wetlands in the other four categories are much more restricted in occurrence. Tall shrub/deciduous tree wetlands occur on saturated sites that are usually associated with the margins of perennial streams. These sites typically occur along small spring-fed streams, riverine floodplains, and, occasionally, in the seep collections at the base of road fill. Riparian channel fringe wetlands are associated with the two branches of the West Fork Stillwater River. Irrigation ditch channel fringes are narrow wetlands bordering irrigation water flow on seasonally-saturated soils. Finally, the occurrence of basin wetlands is restricted to the central portion of a reclaimed stock pond in an internally-drained basin on the Hertzler property.

In addition to the delineations, an assessment of the wetlands' functional values was conducted for each category of wetlands. The assessment determined all wetlands, except the West Fork Stillwater River and its associated floodplain, had low functional ratings overall (SMC 1997b). Reasons given for these low ratings included any or all of the following conditions: small size of the wetland, small size of the watershed, artificial nature of the wetland, existing disturbance, low vegetation/water interspersion, no threatened or endangered species present, and proximity to human activity. The West Fork Stillwater River and its floodplain had an overall functional rating of moderate (SMC 1997b). High hydrologic support, high erosion control, high water purification, and high aquatic diversity/abundance values accounted for the West Fork Stillwater River's overall rating of moderate.

3.2 Wildlife

The project area and its wildlife resources have been extensively reviewed and discussed in previous documents, including the 1981 baseline reports (CDM 1981) and 1985 final EIS for the Stillwater Mine (DSL and Forest Service 1985). A reconnaissance conducted during 1996 determined large-scale changes have not occurred in the areal extent of habitats available for wildlife in the area or their distribution since the 1980 studies (Western Technology and Engineering, Inc. 1996c). However, small-scale changes have occurred. They include the development of the Stillwater Mine, an increase in the number of homes and cabins along the Stillwater River and West Fork Stillwater River, and improvements at public recreation sites along the Stillwater River. The increase in the number of homes and cabins (many of which appeared to be recreational or second homes) does not appear to be limited to the project area, but appears to have occurred downstream of the project area and in other drainages (Western Technology and Engineering, Inc. 1996c). These changes were predicted in the final EIS for the Stillwater Mine (DSL and Forest Service 1985).

Because no major changes have occurred in the project area, the wildlife habitats remain relatively unchanged. Consequently, this discussion does not repeat information documented in the 1985, 1992, and 1996 final EISs and the 1989 Environmental Assessment (see **Appendix A** for additional descriptions of these documents) that has not changed. Instead, it focuses on those issues developed through scoping and the species and groups of species affected by the changes that have occurred since the previous documents were prepared.

3.2.1 High-Interest Species

3.2.1.1 Stillwater Mine Site

3.2.1.1.1 Bighorn Sheep

A small, native herd of about 20 to 25 bighorn sheep resides in the Stillwater Valley around the Stillwater Mine. The herd has been monitored since the early 1970s, more than 10 years before the Stillwater Mine was developed. This monitoring suggests the trend for this population of bighorn sheep has been downward since the 1980s. In order for the population to recover, lambs must survive for several years into reproductive age and losses of adult ewes must decrease (recently, annual mortality of adult ewes exceeded 20 percent for two consecutive years and reached 47 percent during the winter of 1996–97). Also, the population needs to expand its current home range or reoccupy historic home range.

The traditional primary winter concentration area for these sheep lies along the west side of the Stillwater River between the Stillwater Mine and Woodbine Campground. However, monitoring of the population conducted since the mid-

1980s (Farmer and Stewart 1986, 1987, 1988; Farmer, Stewart, and Richter 1990, 1991, 1992, 1993, 1996) suggests part of the population spends at least part of the winter on the West Fork Stillwater River about 3 miles west of the 1980 baseline study area. Although some sheep have been using the West Fork Stillwater River as winter range recently, most still appear to winter close to the Stillwater Mine (Western Technology and Engineering, Inc. 1996c).

A review of sightings of bighorn sheep mapped since the mid-1980s indicates very few sightings occurred where the new facilities would be constructed (Western Technology and Engineering, Inc. 1996c). In particular, no sightings have been recorded downstream from near Stratton Ranch or at the Hertzler Ranch area. Consequently, the occurrence of bighorn sheep is unlikely where most of the new facilities are proposed.

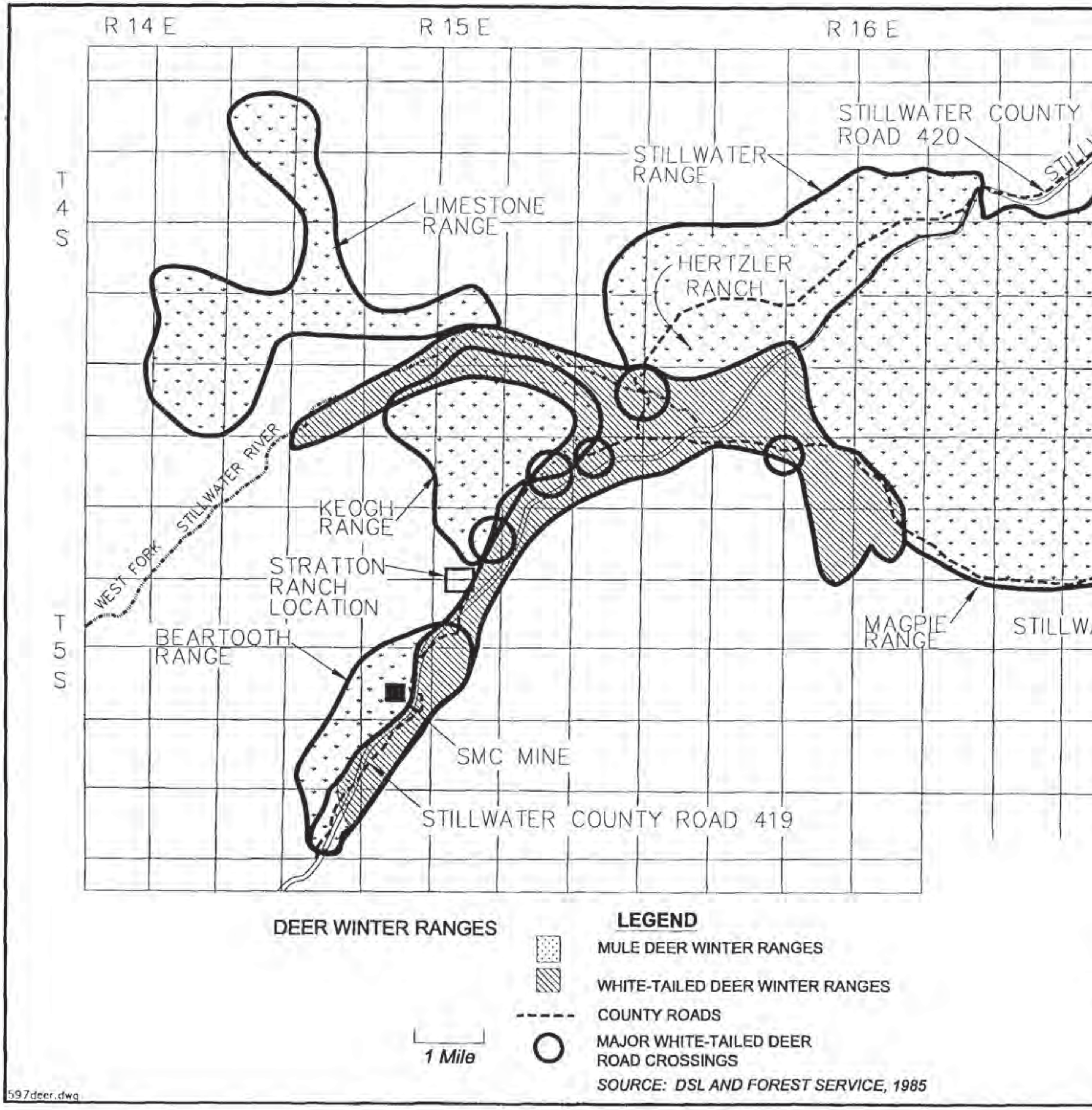
3.2.1.1.2 Mule Deer

Mule deer are the principal big game species found in the project area. Although present year-round, they are most abundant during the winter when they concentrate on winter range. Four distinct mule deer winter ranges exist in a complex that covers about 130 square miles. Generally, this complex extends from Woodbine Campground north to Beehive, Montana, and from Sweetgrass County east across Horseman Flats to Twin Butte. **Figure 3–3** shows the portion of this range present within the project area.

Previous aerial and ground surveys conducted within the project area determined mule deer use a variety of habitats within their local winter ranges. Use of stoney grasslands and hay meadows was highest. However, they also use open Douglas-fir forest, limber pine forest, steep aspects, and south slopes (Western Technology and Engineering, Inc. 1996c).

During peak occupancy of their winter range (January to April), observations of 100 mule deer between the Stratton Ranch and Woodbine Campground are common. In 1989, about 200 deer occupied the range immediately adjoining the mine and between 400 and 600 deer occupied the Horseman Flats portion of winter range (Stewart 1989, pers. comm.). However, mule deer populations are at their lowest in recent history (Stewart 1997, pers. comm.). The reasons for the decline are not clear, but may be related to naturally-occurring fluctuations, mortality that occurred during the winters of 1995–96 and 1996–97, and changes originating from increased human presence and activity in the Stillwater Valley. Additionally, fawn recruitment over the past two years has averaged about 18 per 100 adults (Stewart 1997, pers. comm.).

Mule deer using the winter ranges from the Stillwater Mine to Woodbine Campground do not spend their summers in the upper Stillwater Valley. Instead, they migrate to Yellowstone National Park for the summer.



Stillwater Mine
Revised Waste Management Plan
and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

Deer Winter Range Complex
in the Upper Stillwater Valley
Figure 3-3

3.2.1.1.3 White-tailed Deer

White-tailed deer occupy the project area year-round. These deer primarily occur along the Stillwater River. Vegetation types most frequently used by the deer include riparian woodlands, stony grasslands, and meadows. **Figure 3–3** shows the areal extent of winter range for white-tailed deer identified around the Stillwater Mine.

During 1985, the MDFWP estimated 570 white-tailed deer inhabited the area, a density of 27 animals per linear mile of riparian habitat (Stewart 1990, pers. comm.). Populations of white-tailed deer in the project area were at all-time highs in the early 1990s. However, their numbers declined substantially during the winter of 1996/97 (Stewart 1997, pers. comm.).

3.2.1.1.4 Elk

Historically, the number of elk inhabiting the upper Stillwater Valley has ranged between about 80 and 160 animals. Winter ranges for elk are located along the Stillwater River between the mine and the West Fork of the Stillwater River, Horseman Flats, Picket Pin (north of the West Fork of the Stillwater River), Meyers Creek area, Lodgepole Creek area north of Limestone, and, recently, the Bad Canyon and Trout Creek areas. Calving areas are located along Rabbit Gulch and Horsehead Draw in Horseman Flats and in the Bear Pen Creek-Swamp Creek drainages in the Picket Pin area. Elk travel to summer ranges as distant as the Breakneck Plateau and Placer Basin during May through July. Movement back to winter ranges begins in September.

Although elk do occur within the general vicinity of the project area, they do not occur at the sites where components of the alternatives considered in detail are proposed. Consequently, no potential exists for the alternatives to affect elk and they are not discussed any further in this EIS.

3.2.1.1.5 Other High-Interest Species

Other high-interest species known to occur within the project area include mountain lions and black bears. MDFWP captured and radio collared mountain lions during the 1989 to 1990 and 1990 to 1991 winters as part of the monitoring for the bighorn sheep. The data collected from these collars suggested that the ranges of 3 to 5 mountain lions overlap with the project area. Mountain lions primarily prey on deer.

Black bears or their sign have been observed occasionally within the project area. Because individual black bears have large home ranges, CDM (1981) concluded that the project area probably comprises only portions of one or more home ranges. The current understanding of black bear's habits and preferences for habitats suggests the primary habitats present in the project area (stony grassland and open Douglas-fir/limber pine forest) do not comprise denning or other critical habitats for black bear (Western Technology and Engineering, Inc. 1996c).

Although mountain lions and black bears do occur within the general vicinity of the project area, they do not occur specifically at the sites where components of the alternatives considered in detail are proposed. Consequently, little potential exists for the alternatives to affect mountain lions or black bears and they are not discussed any further in this EIS.

3.2.1.2 Stratton Ranch

Although bighorn sheep and elk do not occur at the Stratton Ranch, the other high-interest species (mule deer and white-tailed deer) occur on the ranch during the winter. Like the situation at the mine, mule deer using the winter ranges around the Stratton Ranch do not spend their summers in the upper Stillwater Valley. They also migrate to Yellowstone National Park for the summer. Furthermore, most of the ranch's winter range has been disturbed by the aggregate mining and previous construction and occupation of employee housing.

Within the upper Stillwater Valley, five sites have been identified as major road crossings for white-tailed deer. These sites are located between Nye, Montana, and the Stratton Ranch along Stillwater County roads 419 and 420 (**Figure 3–3**). All sites are along or near the route SMC proposed for the pipelines and they are within delineated winter range.

3.2.1.3 Hertzler Ranch

Two high-interest species occur at the Hertzler Ranch. They are the mule deer and white-tailed deer.

3.2.1.3.1 Mule Deer

As with the Stillwater Mine site, the mule deer is the most abundant large mammal in the area. Although present in the general area year-round, they are most common during the winter when they concentrate on winter range (**Figure 3–3**). In particular, one group of migratory deer (200 to 300 animals) occupies the Hertzler Ranch site (Stewart 1990, pers. comm.) and migrates to Lodgepole Creek and the divide above the Dry Fork of East Boulder Creek for the summer. However, unlike the mule deer occupying the winter ranges around the mine and Stratton Ranch, none of these deer migrate into Yellowstone National Park. Like most mountain populations of mule deer, recruitment in this herd is generally low (13 young per 100 adults during 1996–97).

3.2.1.3.2 White-tailed Deer

White-tailed deer also occupy the Hertzler Ranch area year-round. The deer primarily occur along the Stillwater River and major tributaries, such as Little Rocky Creek. As discussed previously, vegetation types most frequently used by the deer include riparian woodlands, stony grasslands, and meadows. In 1985, the MDFWP estimated 570 deer inhabited the upper Stillwater Valley (Stewart 1990, pers. comm.), a density of about 27 animals per linear mile of riparian habitat.

3.2.2 Threatened, Endangered, and Sensitive Species

The USFWS identified four species listed as threatened or endangered that may occur in the project area (McMaster 1997, pers. comm.). All four are species of wildlife. They are the bald eagle, peregrine falcon, grizzly bear, and black-footed ferret. For the present analysis, the USFWS did not identify any species of plants for consideration.

3.2.2.1 Bald Eagle (Threatened Designation)

Two general habits of bald eagles are of primary concern with this species: nesting and wintering. Breeding bald eagles typically build stick nests in the tops of coniferous or deciduous trees along streams, rivers or lakes. They also may select cliffs or ledges as nest substrates (Call 1978). Selection of nest trees appears to depend, in part, on the availability of food early in the nesting season (Swenson et al. 1986).

Primary wintering areas are typically associated with concentrations of food sources along major rivers that remain unfrozen where fish and waterfowl are available and near ungulate winter ranges (Montana Bald Eagle Working Group 1990). Wintering bald eagles are known to roost near concentrations of domestic sheep and big game in forests with large, open conifers and snags often protected from winds by ridges (Anderson and Paterson 1988).

Bald eagles occur along the Stillwater River as fall (October to December) and spring (February to March) migrants. However, sporadic winter occurrence has also been recorded (Flath 1989). This pattern of occurrence coincides with general trends observed in other mountain valleys of Montana. Although habitats appropriate for concentration areas occur along the length of the Stillwater River, no concentration areas have been identified (DSL and Forest Service 1989). Finally, although suitable habitats are present in the area, only a single occurrence of bald eagles nesting in the Stillwater River drainage has been documented. This nest is well outside the project area.

3.2.2.2 Peregrine Falcon (Threatened Designation)

Nesting habitats of the peregrine falcon usually involve cliff faces 200 to 300 feet high, but cliffs as high as 2,100 feet have been used. Most known nest sites are below 9,500 feet in elevation, but nests located as high as 10,500 feet have been documented (USFWS 1984). An available prey base of shorebirds, waterfowl or small- to medium-sized terrestrial birds usually occurs within ten miles of a nest site. Wetlands and riparian zones, as well as open meadows, parklands, croplands, lakes and gorges are potential habitats in which prey bird species are found and easily hunted by peregrines. Nesting peregrines may, however, hunt up to 17 miles from their nest to locate prey (USFWS 1984).

Bird populations on the project area appear to be sufficiently abundant and diverse to support peregrines and some of the cliffs located in the central and southern portions of the Stillwater Valley are high enough to provide suitable nesting habitats. In spite of the presence of what appears to be suitable habitats, no recent observations of peregrines in or near the project area have been documented. However, a historic nest site occurs in the valley near Nye, Montana. This site is on a cliff complex overlooking the West Fork of the Stillwater River and provides excellent foraging habitats. The last confirmed occupancy of this nest occurred in 1976.

3.2.2.3 Black-footed Ferret (Endangered Designation)

Prairie dog colonies are essential habitat for the black-footed ferret, which depends on prairie dogs for food and uses the prairie dogs' burrows for shelter and raising their young (Hillman and Clark 1980, Fagerstone 1987). Because ferrets are nocturnal and spend much of their time underground, their presence in an area is difficult to ascertain, but their original distribution in North America closely corresponded to the distribution of the prairie dog (Hall and Kelson 1959, Fagerstone 1987).

Although prairie dog colonies are present in the Stillwater River valley (McMaster 1989), many of the individual towns by themselves may be too small to support black-footed ferrets. Furthermore, no known colonies exist near any of the proposed facilities. Therefore, the black-footed ferret is unlikely to be present within or near the project area and is not considered any further in this analysis.

3.2.2.4 Grizzly Bear (Threatened Designation)

The grizzly bear is present in the Absaroka-Beartooth Mountains and may enter the project area on occasion. Wildlife monitoring activities conducted for the Stillwater Mine have not produced or located any confirmed reports of grizzlies in the project area. However, this was not unexpected. Also, the project area does not contain any denning habitats or other sites that might be considered critical to grizzly bears (Western Technology and Engineering, Inc. 1996c). Thus, any grizzly bears that might occur within the project area would be transitory.

Although grizzly bears occasionally may occur within the general environs of the project area, they do not inhabit the sites where components of the alternatives considered in detail are proposed. Consequently, little potential exists for the alternatives to affect grizzly bears and they are not discussed any further in this EIS.

3.2.2.5 Sensitive Species

The previous MEPA/NEPA documents prepared for the Stillwater Mine included discussions of various species of wildlife identified as sensitive by the Forest Service (e.g., the documents identified in **Appendix A**). These documents and species were reviewed during this analysis. The sensitive species list was compared with the current USFS Northern Region sensitive species list (Risburdt C., June 10, 1994 pers. comm.). The review determined the affected environment involving these species was still valid for the alternatives under consideration here. The high-gradient streams in the area do not provide suitable habitat for *Gentianopsis simplex*, which requires boggy areas (Pierson and Reid 1998, pers. comm.).

3.3 Fisheries

3.3.1 Stillwater Mine Site, Stratton and Hertzler Ranches

The Stillwater River is a torrential-type stream, flowing large amounts of clear, cold, high-quality water. The aquatic habitats, including the riparian zones, at all stations on the Stillwater River and the West Fork of the Stillwater River are in stable condition and provide an excellent wild trout fishery with an abundant food supply. Habitat conditions were considered suitable for aquatic insect production and ideal for game fish spawning and rearing. Characteristics contributing to this situation include a stable gravelly substrate, shallow side channels, and favorable stream gradient, flow regimes and water quality. For a more detailed description of the Stillwater River's physical habitat refer to the Water Quality and Quantity Section.

The MDFWP has instream flow reservations on the Stillwater River and West Fork of the Stillwater River to help maintain minimum flows in the system to protect the fishery.

3.3.1.1 Fish

The MDFWP considers both the Stillwater River and the West Fork of the Stillwater River to have substantial fishery resources (MDFWP 1990). Nongame fish present throughout the river include longnose sucker, mountain sucker, longnose dace, and white sucker. The year-long average species composition in the Stillwater River within the study area during a 1980–81 survey was 35 percent brown trout, 33 percent mountain whitefish, 27 percent rainbow trout, and 5 percent brook trout (CDM 1981). In the lower river, the comparable composition was 50 percent whitefish, 27 percent brown trout, and 13 percent rainbow trout. No bull trout occur in the Stillwater River.

The nature of the gravel substrate, shallow side channels, flow regimes, water quality, and stream gradient make the Stillwater River within the project area ideal for spawning and rearing of game fish that live in the lower Stillwater and Yellowstone rivers. The river environment downstream from Beehive, Montana, is suitable for year-round occupancy, but does not provide the ideal spawning and rearing habitats that are present in this section (especially near the town of Nye).

The composition of game fish in the Stillwater River within the project area varies seasonally, depending largely on the spawning times of each species. Brown trout and whitefish are the most common fish in the Stillwater River during their fall spawning. However, during the spring, rainbow trout increase in number.

Since 1981, annual estimates of the numbers of brown trout present in the Stillwater River within the project area have varied. During 1981 and 1985, numbers of brown trout ranged from 400 to 500 per mile in the spring and from 600 to 700 per mile in the fall. MDFWP (1990) attributes the seasonal differences to influxes of spawners into the area in the fall. In 1986 and 1989, the number of brown trout per mile were lower than the 1981 and 1985 estimates. The decrease was attributed to severe drought conditions present during that period.

By 1994, data collected at another station in the Stillwater River indicated the fishery had recovered from the drought. In March 1994, MDFWP found 2,392 brown trout per mile with 300 per mile exceeding 13 inches in length. Excluding yearling fish, the 1994 population estimate was 40 percent higher than in 1991 and 75 percent higher than a 1987 estimate. MDFWP (1997) attributes this increase to implementation of more restrictive fish limits in 1990 and a decrease in drought conditions that were evident during the 1987 collection.

The reach between Woodbine Campground and the West Fork of the Stillwater River appears to be used by large spring-spawning rainbow migrating from the Stillwater and Yellowstone rivers through the area to prime spawning gravels upstream and by small rainbows (age 1 and 2) that leave prior to maturity. In 1994, MDFWP estimated the number of rainbow trout present in the section of the river near Hertzler Ranch as 355 per mile (MDFWP 1997).

Increased mining in the Absaroka-Beartooth Mountains and increasing popularity of the Stillwater Valley (resulting in subdivision developments) have contributed to a population boom in the Stillwater area. This increase in the people in the valley has resulted in increased fishing pressure on the fishery. As a result, MDFWP imposed more stringent fishing regulations, which included reducing the fish limit from five to two. MDFWP's overall management is apparently working because populations of fish present in the Stillwater River in 1994 exceeded MDFWP's goals.

3.3.1.2 Aquatic Macroinvertebrates

Aquatic invertebrates were sampled within the Stillwater River in 1980, 1981, and 1997. On October 10, 1997, quantitative(triplicate surber) samples were taken at SW–1 and SW–2 (SMC–11) within the section of the Stillwater River near the Stillwater Mine (**Figure 3–1**). Samples also were taken at SW–3 and SW–4 (SMC–13) within the section of the Stillwater River near the Hertzler Ranch (**Figure 3–1**).

The results of the 1997 sampling were very similar to the data collected in 1980 and 1981. Both sets of results suggest aquatic conditions of the Stillwater River are very healthy. The bioassessment metrics calculated on the 1997 data suggest clean-water conditions, good diversity, and good biotic condition (**Table 3–7**).

Abundance during the 1997 collection was lower than the fall 1980–81 data. However, flows that were substantially higher than normal (at least 50 cfs above normal) probably influenced 1997's results. These abnormally-high flows made sampling difficult and efficiency questionable. Therefore, the quantitative data should be considered minimum estimates of macroinvertebrate populations.

Species found in 1997 were generally the same as those found in 1980–81, with the newly found stonefly *Doroneuria theodora* being the notable exception. Species found were generally those considered to be clean-water taxa, indicating the presence of good water quality and a healthy aquatic habitat. Additionally, several species are found only in torrential-type, well oxygenated waters. Metrics not related to abundance were generally healthier than the average values Bahls et al. (1992) identified for other mountain streams in Montana.

Another notable observation in 1997 was a significant shift in species composition and dominance by order at the SW-3 station compared to the other stations (**Table 3–7**). Although Ephemeroptera is the dominant order at the three other stations, the order Diptera is dominant at SW–3. The shift was caused by

Table 3–7 Macroinvertebrate Bioassessment Metrics for Stations in the Stillwater River

	Sample Stations[1]			
Parameter	SW-1	SW-2	SW-3	SW-4
General Metrics				
Total Abundance (# / ft²)	75	148	207	153
Total Abundance (# / m²)	808	1593	2232	1643
Total Number Taxa	25	26	34	30
EPT Taxa	21	23	22	20
Percent Dominant Taxon	20.9	19.6	31.8	17.0
Percent Chironomidae	3.6	1.6	3.2	8.1
EPT/Chironomidae	22.35	61.01	16.65	9.49
Diversity Indices				
Shannon (H)	3.74	3.71	3.88	4.07
Evenness (e)	0.76	0.69	0.62	0.00
Biotic Indices				
HBI	2.9	2.6	1.8	3.0
CTQ	48.6	46.4	36.6	59.3
Percent Composition Per Order				
Ephemeroptera	50.2	57.2	26.4	46.9
Plecoptera	10.2	10.8	5.8	8.3
Trichoptera	20.0	26.8	21.4	21.4
Odonata	0.0	0.0	0.0	0.0
Diptera	14.3	4.7	44.5	15.9
Coleoptera	5.3	0.0	1.4	6.6
Hemiptera	0.0	0.0	0.0	0.0
Miscellaneous Taxa	0.0	0.5	0.5	0.9
Total	100.0	100.0	100.0	100.0

Notes:

1. Station locations are shown on **Figure 3–1**.

Abundance:	Under certain types of stresses, this value may be increased (by tolerant organisms) or reduced (by lowering the number of non-tolerant organisms).
Total # of Taxa:	The total number of taxa (richness) generally increases with increasing biotic condition.
EPT Taxa	The total number of distinct taxa within the orders Ephemeroptera, Plecoptera, and Trichoptera. This value summarizes taxa richness within the insect orders generally considered sensitive to pollution.
Percent Dominant Taxa:	The percent contribution of the most numerous taxon found. Undisturbed environments generally support communities having large numbers of species with no individual species present in overwhelming abundance.
Percent Chironomidae:	The percent contribution of the family chironomidae. Disproportionate dominance of this generally tolerant group usually indicates poor biotic condition.
EPT/Chironomidae:	Skewed population having a disproportionate number of the tolerant chironimids relative to the more sensitive EPT group may indicate environmental stress.
Shannon H:	A diversity index where relative abundances of the different taxa are taken into account. In general, values from 3 to 5 indicate clean water (good), 1 to 3 moderately polluted water (fair), and values below 1 indicate heavily polluted water (poor).
Evenness:	The measure of how evenly the individuals are distributed among species. Values greater than 0.5 are considered to characterize natural stream communities. Even slight levels of degradation can reduce evenness below 0.5, and generally below 0.3.
HBI:	The HBI (modified Hilsenhoff biotic index) summarizes the benthic community's overall tolerance to pollution. 0.00-3.75 (excellent), 3.76-4.25 (very good), 4.25-5.00 (good), 5.01-5.75 (fair), 5.76-6.5 (fairly poor), 6.51-7.25 (poor), and 7.26-10.00 (very poor).
CTQ:	(Community Tolerance Quotient). Similar to the HBI, each individual organism in a sample has a preassigned tolerance value. Mean values range from 40 to 108. The higher numbers indicate more tolerant communities and may show stressed conditions.

Source: Greystone 1997.

the abundant occurrence of the taxa *Bibiocephala* and *Philorus*. These species were not found in the Stillwater River above SW–3 and only in very small numbers at SW–4. The presence of these species in the West Fork of the Stillwater River directly upstream of this station likely explains this shift in species composition within this short segment of the Stillwater River. Despite this shift to dipterans, the two taxa are still characteristic of the Stillwater River because they are both considered clean-water taxa and occur in torrential-type streams.

3.3.1.3 Periphyton

A 1980–81 periphyton study of the Stillwater River within the project area and the West Fork of the Stillwater River indicated a diverse periphyton community (CDM 1981). The data suggest diversity was higher in the Hertzler Ranch section of the Stillwater River and the West Fork of the Stillwater River than upstream in the Stillwater Mine/Stratton Ranch section. Several of the species collected are indicators of good water quality. Furthermore, many of the most-abundant species found are indicators of high concentrations of dissolved oxygen, high velocities, and cool temperatures. The dominance of diatoms at most stations indicates an aquatic ecosystem that is largely undisturbed.

A study of periphyton and limiting nutrients (ENSR 1992) suggests primary production (algal growth) is limited in the Stillwater River within the project area. This was supported by the low concentrations macronutrients and micronutrients found. Data indicate nitrogen is not limiting in the Stillwater River, but phosphorus, possibly in conjunction with micronutrients, may be limiting algal growth.

Additionally, the presence of abundant filamentous green algae at a station 20 miles downstream of the Stillwater mine indicates that point and nonpoint sources not related to the mine are affecting the river's nutrient load. Septic systems leaching into the surface water and agricultural run-off are the likely sources of these nutrients.

Data from SMC's water quality monitoring (collected since the mine's initiation) indicate nitrates are somewhat higher at the downstream surface water site (SMC–11) than at the site upstream of surface water site (SMC–1A). The difference is apparently caused by SMC's operations leaching nitrates into the groundwater and then into the surface water. This increase, up to 0.2 mg/L, is not likely to be substantially altering primary production, especially because nitrogen was found to not be a limiting factor for growth of algae. This is further supported by ENSR's determination that primary productivity in the Stillwater River is low (ENSR 1992).

3.4 Air Quality

Air quality in the project area remains good. Particulates less than 10 microns in diameter (PM_{10}) are well below established federal and Montana ambient air quality standards. Therefore, the area is rated as in attainment status for air quality. Concentrations for sulfate and lead are also low. The entire area surrounding the project area, including the Absaroka-Beartooth Wilderness, is classified as a Prevention of Significant Deterioration (PSD) Class II airshed. The closest Class I PSD airshed is Yellowstone National Park, located about 20 miles southwest of the mine. Class I areas are pristine national parks and wilderness areas where very little degradation in air quality is allowed. Class II areas (all areas other than Class I) are areas where well-managed industrial growth can occur without significant degradation of air quality.

SMC presently operates the underground mine and mill under Air Quality Permit Number 2459–07 issued by DEQ's Air and Waste Management Bureau (AWMB). This air quality permit covers a maximum production of 730,000 tons of ore per year (tpy) at an average production rate of 2,000 tpd and a maximum rate of 3,500 tpd. However, the AWMB is reviewing SMC's application to revise the permit to cover a maximum rate of 5,000 tpd (see **Appendix E** for the preliminary determination on this permit application).

SMC has been monitoring particulates since 1981. SMC also monitored PM_{10} at Hertzler Ranch from February 1996 through March 1997, specifically for this analysis. The latest PM_{10} data (**Table 3–8**), measured at upwind and downwind locations within the permit boundary, show ambient air concentrations of particulates at the Stillwater Mine are well below the federal and State of Montana National Ambient Air Quality Standards (NAAQS) established for PM_{10}. The measured values at the mine indicate present activities result in ambient levels that are 25 percent or less of the established NAAQS.

Particulates (total suspended particulates [TSP], of which PM_{10} generally constitutes less than 50 percent) were sampled at Hertzler Ranch from August 1980 through July 1981 (CDM 1981). During the fall, winter, spring, and summer, average TSP concentrations were 14, 6, 11, and 25 $\mu g/m^3$, respectively. Using the general relationship between TSP and PM_{10}, one can assume concentrations of PM_{10} were less than half of the TSP values.

Lead and sulfates also were monitored at the Hertzler Ranch from August 1980 through July 1981 (CDM 1981). Concentrations of lead and sulfate were found to be quite low. The maximum concentration of lead was 0.008 $\mu g/m^3$ and concentrations of sulfate did not exceed 6 $\mu g/m^3$ during the 12 months of monitoring.

Table 3–8 Stillwater Mine and Hertzler Ranch PM_{10} Data[1]

PM_{10} Monitor Site and Year	Annual Average NAAQS	Annual Data (Percent of NAAQS)	Annual 24–Hour NAAQS	Highest 24–Hour Data (Percent of NAAQS)	Second Highest 24–Hour Data (Percent of NAAQS)
Stillwater Mine	50[2]		150[3]		
Site 1, 1995		7 (14.0)		26 (17.3)	22 (14.7)
Site 2, 1995		9 (18.0)		28 (18.7)	26 (17.3)
Hertzler Ranch					
Feb 1996 to Mar 1997		9 (18.0)		38 (25.3)	32 (21.3)

Notes:
1. Values are in micrograms per cubic meter (μg/m3).
2. 24–Hour average not to be exceeded more than once per year.
3. Annual average is arithmetic average of quarterly averages.

Source: Gelhaus 1997

3.5 Socioeconomics

The Stillwater Mine is located in Stillwater County, Montana. For purposes of this analysis, the area of potential effect has been defined as Stillwater County. The communities of Absarokee, Columbus, Fishtail, Nye, Park City, Rapelje, and Reedpoint are the primary communities in the study area.

3.5.1 Population

Since the completion of the previous NEPA/MEPA documents (e.g., DSL and Forest Service 1985 and DSL, DHES, and Forest Service 1992), Stillwater County's population has continued to grow. In 1996, the Bureau of the Census estimated the population of Stillwater County, Montana at 7,653 persons. Based on these numbers, Stillwater County's population has grown at an average rate of about 2 percent annually since 1990. This rate of growth is higher than projected and is higher than the rate of growth experienced by Montana and the United States.

In terms of demographics, Stillwater County probably has changed little since the 1990 census. Data from this census indicate residents of Stillwater County comprise a fairly homogeneous population, with a very low percentages of minorities. In addition, Stillwater County's population was generally older than the statewide average. In 1990, the median age in Stillwater County was 36.5 years, compared to 33.8 years for the state. The 1990 census listed 16.7 percent of the County's population as 65 or older compared to 13.3 percent statewide.

3.5.2 Labor and Employment

3.5.2.1 Civilian Labor Force

As of 1996, the civilian labor force in Stillwater County consisted of 3,952 people. Of this labor force, 3,774 workers were employed in the county and 178 were unemployed, which equates to an annual unemployment rate of 4.5 percent. This rate is lower than Montana's statewide average of 5.3 percent for 1996 (Montana Department of Labor 1997).

The distribution of employment for Stillwater County by industry for 1996 is shown in **Table 3–9**. The distribution presented is for "covered" employment as defined by the Montana Department of Labor. The term covered employment includes employers who are subject to Montana's unemployment insurance law and excludes railroad employees, employees paid by commission, elected officials, and direct sellers of consumer products. Therefore, the total employment shown in **Table 3–9** is lower than the total employment figure mentioned above. The mining industry accounted for the single largest portion of the County's total employment (almost 26 percent). Trade, government, and manufacturing comprised next largest categories of employment.

Table 3–9 Employment Distribution by Industry, Stillwater County, 1996

Industry	Average Annual Employment (number of employees)	Portion of Total (percent)
Mining	574	25.6
Construction	77	3.4
Manufacturing	364	16.2
T.C.P.U.[1]	29	1.3
Trade	428	19.1
F.I.R.E[2]	29	1.3
Services	302	13.5
Agriculture	41	1.8
Government	398	17.8
Total	2,242	100.0

Notes:
1. T.C.P.U. = Transportation, Communication, Public Utilities.
2. F.I.R.E. = Finance, Insurance, Real Estate.

Source: Montana Department of Labor 1997.

3.5.2.2 Stillwater Mine Employment

The Stillwater Mine provides a significant contribution to employment in Stillwater County and this contribution has increased since the completion of the previous NEPA/MEPA documents (e.g., DSL and Forest Service 1985 and DSL, DHES, and Forest Service 1992). As of December 31,1997, employment at the Stillwater mine was 655 employees (SMC 1998). This level of employment represents about a 42 percent increase over the 460-employee level projected in SMC's Amended Hard Rock Impact Plan (SMC 1988). SMC's recent monitoring reports suggest 56 percent of mineral development employees are immigrating (i.e., employees originating from outside Stillwater County). SMC also estimates secondary employment to amount to 7 percent of the immigrating mineral employment. Approximately 16 percent of Stillwater County's labor force is employed at the mine.

3.5.3 Local Economy

The distribution of labor income among major industries provides some insight into the structure of a local economy. As shown on **Table 3–10**, the mining industry accounted for almost half of total labor income in Stillwater County during 1996. Labor income in manufacturing was slightly higher (14.7 percent) than the statewide figure of 8.7 percent. Compared to the state, agriculture and mining in Stillwater County are relatively more important industries and other industries make up a smaller percentage of total labor income compared to statewide totals. Industries, such as trade, services, finance, insurance, and real estate, suggest residents leave the county to purchase goods and services (Montana Department of Labor 1997). Recent trends indicate retail sales have decreased in Montana's rural counties and increased in more populated counties. In addition, the service sector has been growing rapidly in more populated counties.

Although agricultural activities do not account for a large percentage of labor income in Stillwater County, agriculture represents a substantial use of land. As of 1992 (the latest agricultural census information available), 446 farms existed in Stillwater County. Together, they encompassed a total of 889,294 acres, equating to about 77 percent of land in the county (**Table 3–11**). The average size of the farms was 1,994 acres. The market value of agricultural products sold in the County in 1987 was $26.2 million. More than 75 percent of this value was generated from the sale of livestock and poultry. Additionally, just over 25 percent was generated from the sale of crops (Census of Agriculture 1987 and 1992).

Table 3–10 Labor Income by Major Industry, 1996

	Income ($thousands)		Portion of Total	
Industry	Stillwater County	Montana	Stillwater County	Montana
Agriculture	$887	$66,883	1.6	0.9
Mining	$25,944	$225,239	47.1	3.0
Construction	$1,734	$436,065	3.1	5.9
Manufacturing	$8,083	$641,057	14.7	8.7
T.C.P.U[1]	$619	$511,293	1.1	6.9
Trade	$4,729	$1,470,109	8.6	19.9
F.I.R.E[2]	$563	$412,085	1.0	5.6
Services	$4,349	$1,862,237	7.9	25.2
Government	$8,222	$1,766,022	14.9	23.9
Total	$55,130	$7,390,990	100.0	100.0

Notes:
1. T.C.P.U. = Transportation, Communication, Public Utilities.
2. F.I.R.E. = Finance, Insurance, Real Estate.

Source: Montana Department of Labor 1997.

Table 3–11 Farm Statistics, 1987 and 1992

	Number of Farms		Average Size (acres)		Market Value of Agricultural Products (average per farm)	
	1987	1992	1987	1992	1987	1992
United States	2,087,759	1,925,300	462	491	$65,165	$84,459
Montana	24,568	22,821	2,451	2,613	$62,980	$75,818
Stillwater County	447	446	1,885	1,994	$58,637	na[1]

Note:
1. na = not available

Source: Census of Agriculture, 1987 and 1992 (census conducted every 5 years)

3.5.4 Property Tax Base

The 1997 taxable valuation of property in Stillwater County totaled $25.4 million. As of this year (1997), taxable valuation of the Stillwater Mine and precious metals smelter was $3,412,000. This represents about 19 percent of the total valuation of Stillwater County. SMC is a significant source of property tax revenue to the County. The 1996 property tax liability of SMC, including the smelter in Columbus and gross proceeds tax, was approximately$1.8 million. In addition, SMC pays a metal mines license tax to the state on the gross proceeds from the mine and 25 percent of that is returned to the County. At least 40 percent of the County's share must be put in a reserve for use when the mine closes or a substantial reduction in employment occurs. As of June 1997, this reserve fund contained nearly one million dollars (Beaudry 1997, pers. comm.).

3.5.5 Property Values

One of the issues raised during scoping is the potential for a reduction in property values in subdivisions near the proposed facility sites. Similar issues have been raised for earlier proposals for mine expansion submitted by SMC. Earlier environmental documents determined that this potential impact would be considered significant if the new facilities could be shown to directly cause a decrease in property values of greater than 15 percent. However, no significant effects on property values were identified.

An comparative analysis of this issue was done in 1990 during preparation of the preliminary Draft EIS for SMC's proposed smelter. The measure of potential impacts was a review of what had happened historically in the Stillwater Valley. Data were obtained from Stillwater County (Ferster 1989, pers. comm.) for lot prices at the various subdivisions over time. Because exact prices are confidential under Montana law and lot prices vary by location, average prices were used. The focus was on prices in 1984 and earlier (pre-mine) and prices in 1990–1991 (post-mine) to determine if there was a trend in price changes and the magnitude of any changes that had been realized from development of the mine.

At Cathedral Mountain Ranch, lots of two different sizes were being sold. The smaller lots sold for an average price of $7,000 to $7,500 in 1984 and earlier. From 1987 through 1989, they sold for an average price of $9,000 to $9,500. The larger lots, which sold for an average price of $10,000 to $12,000 in 1984 and earlier, sold for about $20,000 in 1989.

At the Rainbow Ranch and Whited subdivisions, lot prices remained fairly constant over the study period, but the listing period increased somewhat. Lots down-valley from Nye with river frontage also remained stable with very slight increases in price. At Buffalo Jump, the value of lots near the river remained constant, whereas the lots in the more remote areas in the subdivision decreased slightly in value ($10,000 to $12,000 in 1984 and earlier compared with about $10,000 in 1989).

During the same period (1983–1989), land values in Stillwater County as a whole remained relatively stable. Prices of subdivided lots in the County and house prices in Columbus and Absarokee also remained relatively stable. Prices for agricultural land, however, decreased by 30 to 50 percent. The analysis was unable to provide any explanation for the decrease in agricultural land values, but since it occurred country-wide, it did not appear related to the development of the mine.

3.5.6 Housing

In 1980, 2,480 year-round housing units and 200 vacant units were present in Stillwater County. The average rate of occupancy was 2.67 persons per unit. About 77 percent of the residents lived in owner-occupied units and 23 percent lived in rented units. At that time, vacancy rates were approximately 15 percent.

By 1990, the total number of housing units in Stillwater County had increased to 3,291, a 22.8 percent increase. Of these units, 2,523 were occupied and 73.6 percent of these were occupied by owners. On average, there were 2,56 persons per household. The median value of a home was $56,200. Approximately 2.6 percent of owner-occupied units were vacant, and 9.5 percent of rental units were vacant. At that time, the statewide vacancy rate for owner-occupied units was 2.9 percent, whereas the vacancy rate for rental units was 9.6 percent (Bureau of the Census 1990).

Persons relocating to Stillwater County for employment at the Stillwater Mine have often had to accept temporary accommodations, including renting vacation homes or mobile homes, until permanent accommodations become available. As a result, rental rates have increased by 5.9 percent. From 1980 to 1990, the median value of single family homes was categorized as stable, increasing by an average of 2.7 percent.

In response to local conditions, SMC developed a temporary mobile home park at the Stratton Ranch for its employees, but the park has been closed and reclaimed by SMC. In addition, SMC has subdivided the Circle T Ranch northwest of Absarokee and employees used to be able to purchase lots at a cost below what SMC had invested in the development. However, SMC is now selling the last few lots at market value. Electricity and domestic water are available to the lots, but individual septic sewer system must be installed. The subdivision contains 59 lots and there is additional room for expansion, as needed.

In addition, SMC is in the process of developing a single-family unit subdivision in the Town of Columbus. Although this subdivision will be geared primarily toward SMC's employees, it also is intended to ease the demand for housing in the county. Thus, the homes will be available to anyone seeking housing.

3.5.7 Community Services

3.5.7.1 Hard Rock Impact Plan

The Montana Hard Rock Mining Impact Act of 1981 requires each developer of new, large-scale hard rock mineral developments to prepare a local government impact plan in cooperation with affected units of local government. Through the impact plan, the developer identifies and pays the increased costs for local government services and facilities needed as a result of the mineral development. Affected local governments review the proposed plan and the county holds a public hearing on it before it is approved. The governing body may negotiate with the developer to change the proposed plan and may ask the state Hard Rock Mining Impact Board to adjudicate disputed issues. Together, the local government units and the developer implement the approved impact plan. The impact plan may trigger tax base sharing under the Property Tax Base Sharing Act, and may also affect distribution of metal mines license tax revenue (Montana Department of Commerce 1997).

SMC's original Hard Rock Mining Impact Plan and the 1988 amendment define the affected local jurisdictions as Stillwater County; the town of Columbus; the Absarokee Rural Fire District; and school districts in Absarokee, Columbus, Fishtail, and Nye. Among the needs identified by these jurisdictions were additional personnel and increased funding for such functions as municipal court operations, libraries, mental health programs, and assistance to low income individuals. Additionally, the local agencies and districts identified needs for additional facilities and equipment.

The Hard Rock Impact Plan establishes that SMC will provide mitigation in the form of tax prepayments, grants, and guarantees for the payment of principal and interest in educational impact bonds. A substantial amount of financial assistance has been provided by SMC through the Plan and most residents seem to feel that this funding has enabled the local communities to better accommodate growth. Under the 1985 Impact Plan and its 1988 amendment, SMC has paid a total of about $4 million for expanding schools, buying equipment for the Absarokee Fire District, upgrading the Absarokee sewage treatment plant, upgrading the Columbus sewer and water systems, and improving Stillwater County roads 419 and 420 (Richard 1997, pers. comm.).

In spite of the mitigation, concerns still exist about the provision of services to Stillwater County's residents. The sewer system for the Town of Columbus is at capacity and water lines in Columbus need to be upgraded. Additional traffic from population growth has resulted in unmet street maintenance needs and some gravel roads need to be paved to accommodate traffic better (DSL, DHES, and Forest Service 1992). Between 1987 and 1991, in-migrating school-aged students whose parent or guardian moved into the area to work at the mine accounted for all of the increases in enrollment at Absarokee's schools, but were less of a factor in the expansion of the Columbus and Fishtail elementary schools. Absarokee's schools have a limited capability to absorb future increases, especially in the elementary school. Fishtail and Nye's elementary schools could accommodate more students. Columbus' elementary school system is at capacity, both in terms of class size and facilities. However, its junior and senior high schools are below capacity.

Increases in mill levies since the mine was developed appear to be primarily due to changes for some individual expense categories, such as the removal of a freeze on school levies and a new levy of 40 mills authorized by the 1989 state legislature to equalize school funding in all counties. In terms of constant dollars, the taxable value of Stillwater County's property is essentially the same in fiscal year 1991–1992 as it was in fiscal year 1982–1983 before the mine was developed.

3.5.7.2 Water Supply

Absarokee, Columbus and Rapelje have central water systems. The remaining areas of the county are served by individual water systems. These include wells, springs and cisterns.

The Absarokee Water and Sewer District is a cooperative that provides, for each purchasing property owner, potable water and treatment. This district was converted from a Water User's Association in 1995. Absarokee receives its water from a series of wells. The existing system is capable of providing 340,000 gpd in the winter months and up to 840,000 gpd in the summer. Two storage tanks have a maximum storage capacity of 325,000 gallons of treated water, combined. Columbus' municipal water system has surface water supply sources with a combined capacity of more than 2 million gpd. The town also has 1.5 million gallons of storage capacity. The Rapelje Water Users Association's water supply source is a developed spring from which water is pumped into an 8,000 gallon cistern.

3.5.7.3 Sewer Systems

Absarokee, Columbus and Park City have public sewer systems. The remaining areas of the county are served by individual septic systems.

Absarokee's sewer system, maintained by Stillwater County, includes an aerated, three-celled lagoon system encompassing 1.46 acres. An ultra-violet light system and seven aerators provide secondary treatment. The system is designed to serve up to 1,200 people. Columbus' municipal sewer system consists of a collection system and a four-cell facultative lagoon treatment system. Capacity of the system is considered to be 1,600 people. Park City's sewage collection and treatment system is managed by Stillwater County. It consists of a two-celled, 5-acre lagoon, with sufficient land to develop a third cell.

3.5.7.4 Solid Waste

The Town of Columbus provides solid waste collection to the residents and businesses within the corporate limits of the town. Most of the solid waste is hauled to the Billings Landfill for disposal. The remaining waste is taken to the Stillwater County Landfill. Stillwater County's refuse disposal district collects solid waste in the unincorporated areas of the county. The county operates a Class II landfill 3 miles north of Columbus. The Class III landfills at Absarokee, Park City, and Rapelje have been closed out. In the past, the county has also hauled garbage to the Livingston resource agency recovery facility when necessary.

3.5.7.5 Educational System

Stillwater County has five high school districts and eight elementary school districts plus a portion of the Broadview district. Recently completed construction and plans for future development in the district include a new high school in Absarokee, additional rooms at Columbus' high school and elementary school, and a new classroom at Nye Elementary. Enrollment figures for certain school districts in Stillwater County, as well as more recent information on the number of students from families of mine employees (mineral development students) are shown in **Table 3–12**.

3.5.7.6 Hospitals and Clinics

Stillwater Community Hospital has 27 beds, an emergency room, a laboratory, facilities for physical therapy, a nursery, and expanded outpatient services in a nearby clinic. In addition, it has a seven-unit, limited-care retirement home. The Hospital employees 46 people, including three physicians and nine nurses.

Additional medical services in Stillwater County include: three volunteer ambulance services with EMTs in Absarokee, Columbus, and Park City; an 81-bed convalescent center in Columbus; and a satellite office of the South Central Montana Regional Mental Health Center in Columbus. Two dentists, an optometrist, and a chiropractor have offices in Columbus. Absarokee is served by one dentist office, an optometrist and a chiropractor.

Table 3–12 Distribution of Elementary and High School Students, Stillwater County

School	Total Enrollment March 31, 1991	In-Migrating Mineral Development Students 1988 Plan	March 31 1991	December 31 1996
Elementary Schools				
Absarokee	259	110	78	77
Columbus	392	22	29	48
Fishtail	40	33	4	4
Nye	4	18	4	6
Red Lodge	na[1]	-	na	6
Other	na	3	na	29
Total	695	186	115	170
High Schools				
Absarokee	132	27	36	37
Columbus	130	5	18	16
Red Lodge	na	-	na	6
Other	na	1	na	3
Total	262	33	54	62

Notes:

1. na = not available.

Sources: SMC 1988; DSL, DHES, and Forest Service 1992; SMC 1996a; Campbell 1997, pers. comm.

3.5.7.7 Fire Protection

Four fire districts exist in the County. Absarokee, Broadview (encompasses parts of four counties), Park City, and Columbus have active districts. Additionally, five volunteer fire departments are present. They include Molt, Rapelje, Reed Point, Nye, and a county-wide department. The following are the number of volunteers at each fire district or department: Absarokee (26), Broadview (26), Columbus (14), Molt (12), Park City (25), Rapelje (22), Reed Point (7), Nye (26), and Stillwater County (12).

Mutual aid agreements exist among the departments and districts. Stillwater County and the Montana Division of Forestry also have a cooperative equipment agreement. Local resources for fire protection are adequate to handle most fires. In the event of major fires, state and federal assistance is requested.

3.5.7.8 Law Enforcement

Law enforcement services in unincorporated Stillwater County are provided by the Stillwater County Sheriff's Department, which consists of eight full time deputies. The Columbus Police Department has three officers.

3.6 Tailings Impoundment Stability

3.6.1 Area Geology and Seismicity

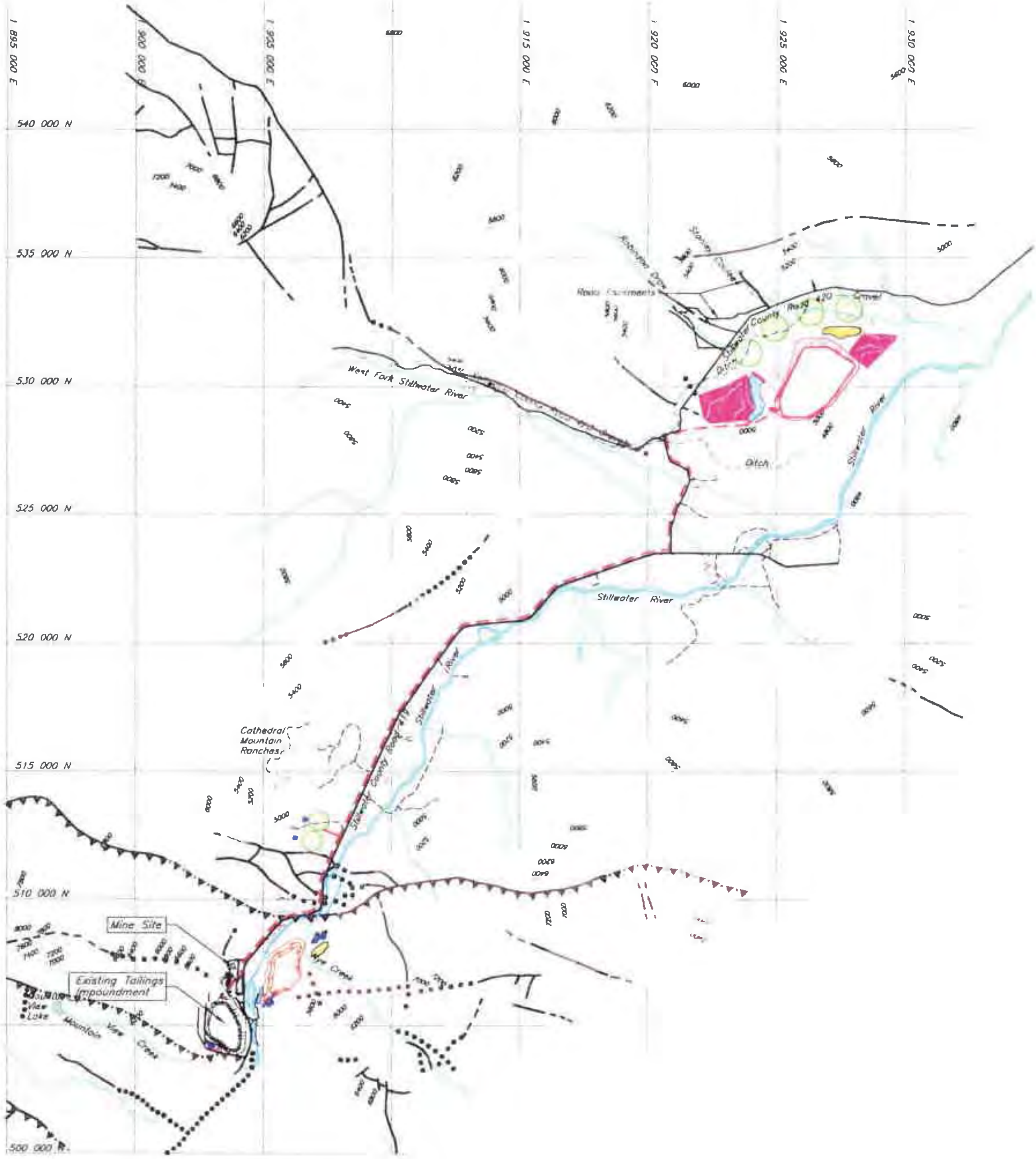
3.6.1.1 Stillwater Mine Site

Northerly-dipping Paleozoic and Mesozoic sedimentary bedrock outcropping in the mine area overlies Precambrian granitic bedrock of the Stillwater Complex (Page, et al. 1973). This complex consists of layers of iron- and magnesium-rich, generally dark-colored, intrusive igneous rocks. Near the mine site, the rocks of the Stillwater Complex are exposed over a 1.5- to 2-mile-wide band.

Two main sets of faults are present in the project area (**Figure 3–4**). One set consists of east-west trending fault systems. A large east-west trending fault, the Bluebird Thrust, borders the area on the south. The Horseman Thrust borders the project area on the north.

Low earthquake activity has been documented for this local area during the past thirty years. Areas within 50 miles of the mine site are, however, earthquake prone, and have been the site of recent earthquakes which have caused moderate ground shaking at the mine site. An updated search of the National Earthquake Information Center's Earthquake Data Base (USGS 1997) was conducted for a 100-km (62-mile) radius of the site. The search checked for seismic events exceeding a magnitude of 3.5 on the Richter scale (the scale is 0.1 to 9.9) during the period 1973 to 1997. Ten seismic events occurred during the period June 30 to July 7, 1975, centered 53 to 61 miles to the southwest in Yellowstone National Park. The largest event registered 6.1 on the Richter scale. Since 1975, only two events with magnitudes greater than 3.5 have occurred within 100 km of the site, most recently in 1985.

The 1959 Hebgen Lake earthquake, with its epicenter 30 miles to the west-southwest of the site, measured 7.1 on the Richter scale. Ground shaking at Nye caused a water main to break, foundations to crack, and initiated several rock falls. Earthquakes that are most likely to create future ground shaking in the Stillwater River valley will have their origin in the Hebgen Lake – Yellowstone Park area (CDM 1981). Based on the review of potential fault zones, the Maximum Credible Earthquake for use in designing structures was determined to be 7.0 along the Emigrant fault, which is about 30 miles from the Hertzler site (Knight Piésold 1996).



LEGEND

- Proposed Pipeline Alignment
- Road
- Land Application Disposal Site
- Borrow Area
- Topsoil Stockpile
- Land Application Disposal Storage Pond
- Waste Rock Storage Area
- Hertzler Tailings Impoundment
- Sediment / Percolation Pond
- Fault (Dashed where inferred; dotted where concealed)
- Thrust Fault (Dashed where inferred; dotted where concealed.) (Sawteeth on upper plate)

Source: Norman J. Page, Frank S. Simons, and John C. Dohrenwend, 1973

Stillwater Mine
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TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

0 2000 4000 10000
SCALE (FT)

N

Geologic Faults

Figure 3-4

S97FAULTS.DWG

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Slope failures in the Stillwater River valley have varied in size from small slumps to large landslides with most activity occurring during the last ice age. Most areas along the Stillwater River valley are relatively stable at the present time, but some areas may be adversely affected by earthquakes and above normal water influx, which tends to lubricate slide planes.

Two landslide deposits were mapped in the vicinity of the SMC mine site, and partially lie above the site on the west side of the valley. The larger deposit extends to the banks of the Stillwater River and probably dammed the river in the past. These deposits appear to be stable and have not moved, despite the Hebgen Lake earthquake of 1959, and the mine and road development.

3.6.1.2 Stratton Ranch Area

The Stratton Ranch area is underlain by sedimentary rocks that dip steeply to the north. Resistant Madison Limestone forms a prominent ridge that extends about a third of the way across the Stillwater Valley along the southern edge of the ranch.

Three general types of unconsolidated deposits exist at Stratton Ranch. They are alluvium (stream-laid deposits), colluvium (gravity-controlled deposits), and ancient mass-movement deposits. The last type of deposit consists of two large landslides that cover much of the slope along the north-northwestern edge of the Stratton Ranch area.

3.6.1.3 Hertzler Ranch Area

Sedimentary rocks, mostly limestones and other carbonates with lesser sandstones, shales and volcanics were deposited in this area from the Cambrian through Tertiary eras. These rocks are variously exposed in the Hertzler Valley and along the Beartooth Mountain front.

The Hertzler Valley is underlain by the Colorado and Montana group sedimentary rocks. The Colorado group rocks, the deepest bedrock units identified in the valley, are composed mostly of shale with smaller horizons of interbedded sandstone. These rocks are between 2,300 and 3,000 feet thick. The Montana group rocks are comprised of a 100-foot-thick sandstone layer, overlain with alternating layers of shale and fine-grained sandstone that is overlain by a fine-grained silty sandstone. There is also a thin coal seam near the base of the Montana group rocks.

These rocks directly underlie the 55- to 170-foot deep surficial deposits in the Hertzler Valley and specifically at the proposed tailings impoundment site. These rocks are characterized as mostly dark grey, black shales interbedded with brown and grey sandstones. The shales are nearly impermeable. The surficial deposits include glacial outwash deposits (**Figures 3–5** and **3–6**). These deposits are in turn overlain by younger alluvial fan deposits. These alluvial fans dominate the surface of the site and consist of bedded clay, silt, sand, pebbles, cobbles, and boulders. The Hertzler Valley is located at the west end of the Nye-Bowler Structural zone. Several folds and faults have been mapped in the area, though extensive surficial deposits preclude complete characterization of the area. Earthquake risks are the same as they are for the SMC mine site. Landslide and avalanche risk are nonexistent due to the site being located in a relatively flat area (CDM 1981).

3.7 Aesthetics

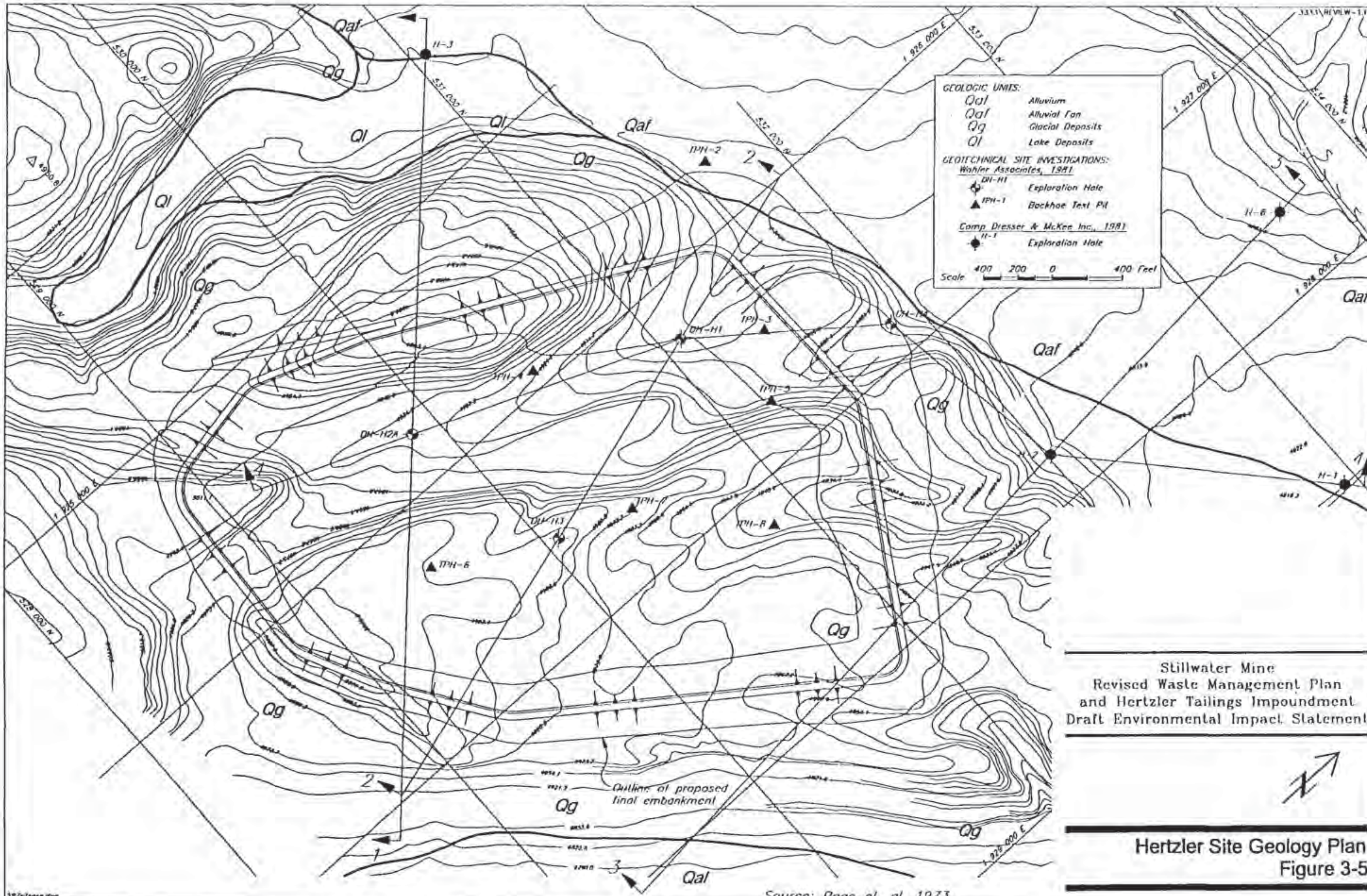
3.7.1 Visual Resources

Previous environmental analyses prepared for the Stillwater Mine used the Forest Service's Visual Management System (VMS) to evaluate visual resources in the project area. This system applies specifically to National Forest System lands. Although neither the State nor the Forest Service have enforcement authority over private lands, the Forest Service's VMS was applied to private lands for comparative purposes. Consequently, Visual Quality Objectives (VQOs), Existing Visual Conditions (EVCs), and the Visual Absorption Capabilities (VACs) have been established for public and private lands in the project area.

The VQO for lands in the CNF's Management Area E include Retention, Partial Retention, and Modification (Forest Service 1986a). The CNF's Forest Plan also states, "Short-term degradation will likely occur during mineral development that will not meet the assigned VQO of the area. Emphasis will be on rehabilitation immediately after the development phase and at the completion of production."

The existing visual condition (EVC) is the present state of visual alteration measured in degrees of deviation of the natural landscape. The EVCs for the Hertzler Ranch and the Stratton Ranch sites are classified as EVC 2 and EVC 3, respectively. EVC 2 is defined as Unnoticed: changes in the landscape are not visually evident to the average person, unless pointed out. This includes low visual roads. EVC 3 is defined as Minor Disturbance: changes in the landscape are noticed by the average person, but they do not attract attention. The natural appearance of the landscape still remains dominant. This includes pastures and roads.

The Visual Absorption Capability (VAC) is the inherent ability of the landscape to absorb alterations. The VAC of the project area in the Stillwater Valley, including the analysis areas, is high due to the vegetative regenerative capacity and relatively gentle slopes.



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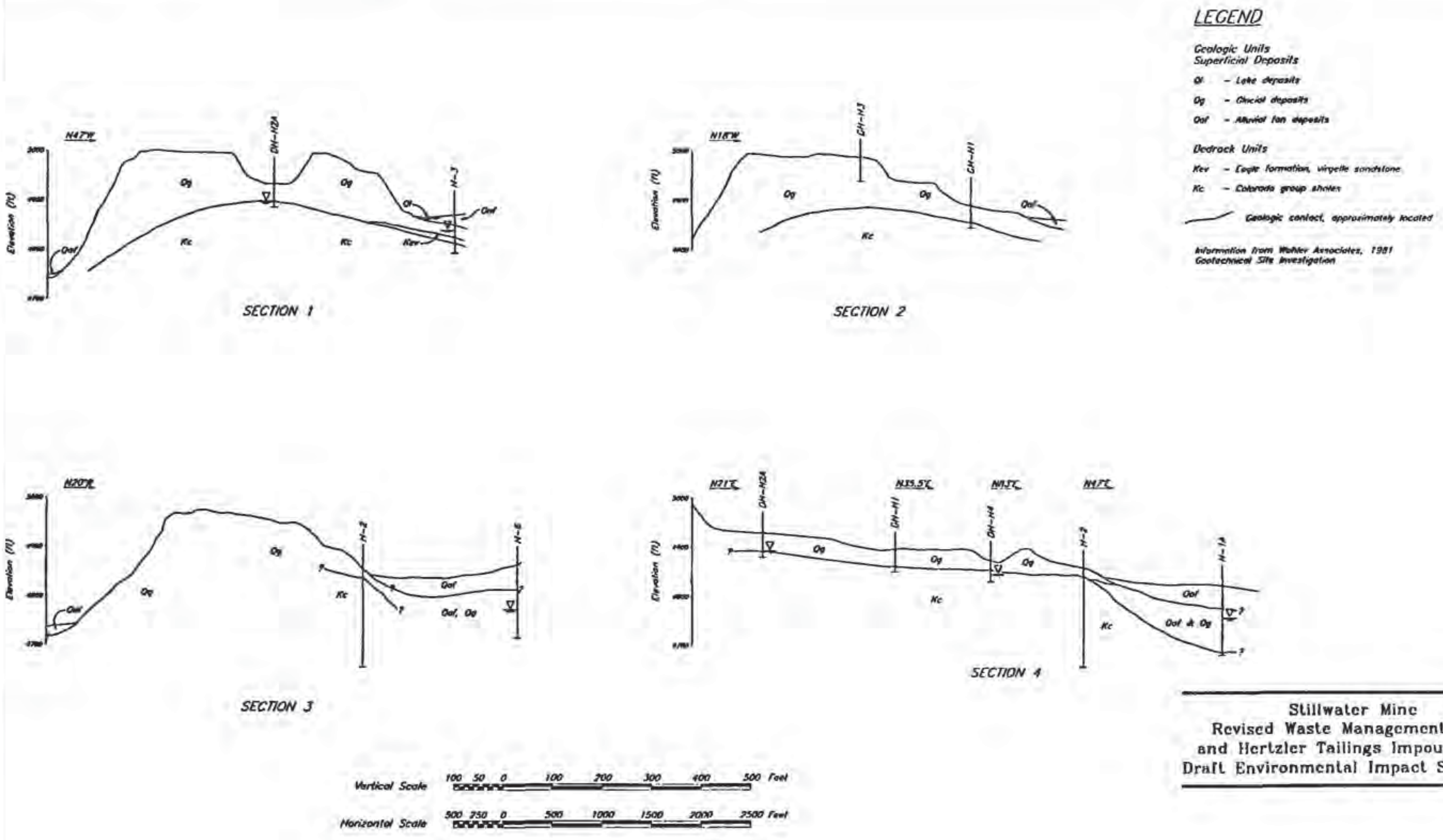
Hertzler Site Geology Plan
Figure 3-5



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Geological Cross-Sections for Hertzler Ranch
Figure 3-6

Source: Page etal. 1973

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3.7.1.1 Stillwater Mine Site

The area surrounding this site falls within the Yellowstone Rockies Character Type. In the project area, this type has been subdivided into the foothill and mountainous subtypes (CDM 1981). The foothill subtype, located in the valleys of the study area, is composed of gently rolling, grass-covered hills with irrigated pastures. As seen from a distance, the valley presents a landscape of uniform brown or green, depending upon the season, and rolling land contrasted against the darker backdrop of rugged mountains. The dominant foreground feature is the Stillwater River and the associated cottonwood, aspen, and willow riparian vegetation.

Within the foothill subcharacter type, most of the man-caused alterations to the landscape are the result of past and present mining activities, ranching and agricultural activities, roads, and subdivisions. These alterations include fence lines, farm support structures, houses, irrigation ditches, haystacks, and farming equipment. Most of the ranching activities do not adversely affect scenic quality. The predominant visual alterations are second home/condominium developments. The ability of the valley bottom lands to absorb visual changes is greater than the upper portions of the valley due to gentler slopes.

The mountainous subcharacter type, located around the Stillwater Mine, consists of steeply-elevated, angular landforms that rise sharply from the Stillwater River Valley floor. Although most of the mountainous subcharacter type is free of visual impact, mine access roads and past and current mine development at the Stillwater Mine and in the Nye Creek, Verdigris Creek, and Mountain View Creek areas affect scenic quality. The visual impact is most evident where roads cut across steep slopes and where mine facilities have been constructed.

The Stillwater Mine has placed numerous yard lights around the buildings at the mine to provide safety and security, but lights are not placed where personnel do not work. In response to neighbor's concerns, SMC shrouded all outdoor lighting so light only goes down, which minimizes lights shining off the property. Additionally, SMC operates very little heavy equipment on the surface during night time hours. All construction and heavy equipment operation on the surface are conducted during daylight hours, or when necessary after dark, by means of the vehicles' own lights only.

3.7.1.2 Stratton Ranch

Stratton Ranch is located on SMC-owned lands in the relatively flat benches of the Stillwater valley on the west side of the river. The site is within the viewshed of several residences in the Cathedral Mountain Estates subdivision that overlook the site. Currently, considerable disturbance exists at the site where vegetation has been removed, resulting in a large area of exposed, lightcolored soils. Surrounding public lands have the VQOs of Retention, Partial Retention, and Modification assigned to them.

3.7.1.3 Hertzler Ranch

Hertzler Ranch (like the Stratton Ranch) is within the foothill character subtype. Evidence of farming and ranching activities occur here and some residences are also nearby. Most residences in the surrounding area are located in the valley near the community of Nye, and along the Stillwater River. Nearby Forest lands have been given the VQO of Partial Retention because there are man-made alterations already existing in these areas, but the natural appearance of the landscape is the dominant factor. Under the Partial Retention objective, management activities may introduce new form, line, color, or texture, but the changes must remain subordinate to the characteristic landscape.

3.7.2 Noise

Discussions of environmental noise do not focus on pure tones. Commonly-heard sounds have complex frequency and pressure characteristics. Accordingly, sound measurement equipment has been designed to account for the sensitivity of human hearing to different frequencies. Correction factors for adjusting actual sound pressure levels to correspond with human hearing have been determined experimentally. For measuring noise in ordinary environments, A-Weighted correction factors are employed. The filter de-emphasizes the very low and very high frequencies of sound in a manner similar to the response of the human ear. Therefore, the A-weighted decibel (dBA) is a good correlation to a human's subjective reaction to noise.

The following discussion sets a basis of familiarity with known and common noise levels. A quiet whisper at five feet is 20 dBA; a residential area at night is 40 dBA; a residential area during the day is 50 dBA; a large and busy department store is 60 dBA; 50 feet from a vehicle traveling 65 mph is 75 dBA; a typical construction site is 80 dBA; a subway train at 20 feet is 90 dBA; and a jet takeoff at 200 feet is 120 dBA.

3.7.2.1 Stillwater Mine Site

Site-specific noise studies have not been conducted in the vicinity of the Stillwater mine. However, the noise levels associated with the site are likely to be typical of those associated with underground mining. Typical sound levels at underground mine sites are presented below:

- entrance portal — 45 decibels (dBA);
- underground blasting — 54 dBA at 1,000 feet; and

➢ warehouse/shops — 45 dBA at 100 feet.

Noise levels from the existing operations are not obvious to travelers on County Road 419 or recreationists on National Forest lands (DSL and Forest Service 1989). Local residents living within 0.5 mile of the mine site stated in responses to the draft EIS that noise from beepers on vehicles, the mill, and other equipment operating at the mine is noticeable at their residences. In response to comments provided in the past, SMC has fitted some surface vehicles with mass-sensitive backup alarms that only sound when objects are present behind the vehicle. Thus, although SMC uses backup alarms at the mine, the frequency of their use is minimized.

Excluding the mine site activity, background noise levels in the Stillwater Valley can be expected to range from approximately 52 to 61 dBA. The major background sound sources are the Stillwater River and persistent winds (DSL and Forest Service 1985).

3.7.2.2 Hertzler Ranch

Specific noise surveys have not been conducted in the vicinity of the Hertzler Ranch. However, because the area is undeveloped and rural in character, existing sound levels are probably low. Rural areas are generally recognized as having day-night average sound levels (Ldn) of less than 50 dBA.

Ambient sound levels measured at a rural farm averaged about 40 dBA (Eldred 1974). Sound levels in the East Boulder Creek Valley were measured at 52 to 61 dBA, with the largest sound source being the East Boulder River (DSL and Forest Service 1985). It is likely that background sound levels can be expected to be similar or somewhat less than those measured in the East Boulder River Valley. The Stillwater River would contribute less to the sound levels due to the Stillwater Valley's more open topography, but a slightly greater effect would be expected from local traffic on County Roads 419 and 420.

3.8 Transportation

Overall, three roads serve the Stillwater Mine and the surrounding area. They include Stillwater County roads 419 and 420 (both secondary) and State Highway 78 (primary). Primary access to the Stillwater Mine is provided by Stillwater County Road 419 between Absarokee and the mine and State Highway 78 between Columbus and Absarokee. Stillwater County Road 420 provides secondary access to the mine from Absarokee. Stillwater County Road 419 is an improved two-lane road built in the 1940s by the Montana Department of Highways and the federal government to provide improved access to the now closed Benbow and Mouat mines. In addition to providing primary access to the

Stillwater Mine from Absarokee, this road provides primary access to Absarokee, Fishtail, Nye, Dean, and new rural developments in the area. The general public also uses this road to access fishing and recreational areas. It was designed to handle an average daily traffic capacity of 2,200.

Average Daily Traffic (ADT) totals for the period between 1994 and 1996 are shown on **Table 3–14**. Of the 1990 ADT total of 600 vehicles on Stillwater County Road 419, the Stillwater Mine-related traffic generated 286 vehicles. A condition of the decision on the 1989 East Side Expansion required that employees living more than two miles from the mine to car pool with at least three other employees. Although this condition was later modified to exclude employees within 10 miles of the mine from the car pooling requirement, the agencies are no longer pursuing monitoring because SMC has achieved the desired level and the agencies cannot enforce the requirement. The action was only expected to increase ADT by 24 trips.

Table 3–14 Average Daily Totals (ADT) of Traffic, 1994–1996

County Road	1994	1995	1996
Secondary 419	595	818	803
(22.5 miles, junction of Hwy 78 south of Absarokee to local road north of Nye)			
Secondary 420	402	427	442
(6.9 miles, junction of Hwy 78 at Absarokee to local road 7 miles west)			
Primary 78 (about 47 miles long)			
Red Lodge – milepost 0.000	1,665	1,890	2,230
Leaving Red Lodge – milepost 0.472	854	875	939
Roscoe – milepost 19.686	430	615	580
Leaving Carbon County – milepost 23.920	460	500	570
Leaving Stillwater County – milepost 24.317	490	560	570
Junction 419 – milepost 29.991	1,660	1,765	1,550
Junction 420 – milepost 32.880	1,554	1,950	2,055
Junction 421 – milepost 45.998	2,605	2,920	2,990
Entering Columbus – milepost 46.446	3,448	3,707	4,314
Leaving Columbus – milepost 47.250	2,260	2,900	3,340

Note: ADTs are for both directions of traffic.
Source: Lythgo 1997, pers. comm.

Currently, Stillwater County Road 419 is being upgraded between Absarokee and Nye. This upgrade includes widening the road, providing shoulders, replacing bridges, and improving the surface and subsurface drainage.

Stillwater County Road 78 is the major north-south highway in the region. Design capacity of the road is estimated at 3,000 ADT. The portion of the road between Absarokee and Columbus also has recently undergone improvements and reconstruction.

3.9 Reclamation

3.9.1 Soils

3.9.1.1 Stillwater Mine Site

Soils at the Stillwater Mine site are described extensively in the 1985 EIS (DSL and Forest Service 1985). Additionally, many of the soils have been disturbed by mining or covered by tailings and cannot be classified. Soils at the east side waste rock storage site have all been disturbed previously by the deposition of chrome tailings. SMC has been reclaiming some of these chrome tailings-covered areas.

3.9.1.2 Stratton Ranch

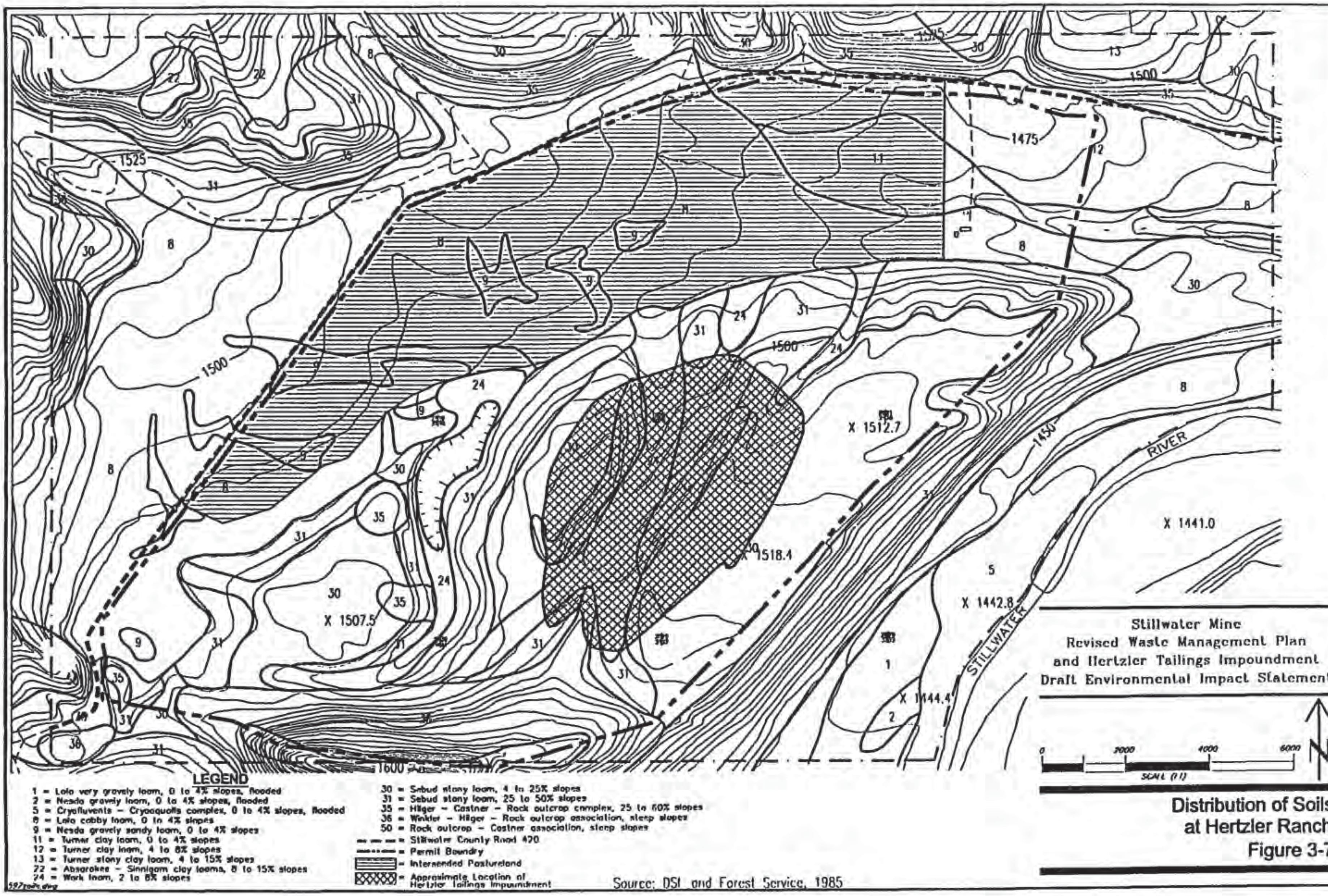
Native soils at the Stratton Ranch are deep, well-drained, and medium textured. They also are either very stony, cobbly, or gravelly. Numerous large boulders are present both on the surface and in the soil.

Although native soils exist on portions of the ranch, the dominant soils have been disturbed over most of the ranch. Under an opencut permit (#00549) from DEQ, SMC has twice conducted opencut mining of portions of the ranch for gravel. Currently, SMC is reclaiming its Stratton Ranch gravel operation.

3.9.1.3 Hertzler Ranch

Soils at the Hertzler Ranch site are similar to those at the Stratton Ranch. The Hertzler ranch site is located at a lower elevation than the Stillwater Mine site and in an open valley dominated by native grassland and improved pasture. About 26 percent of the ranch has been plowed and planted to improved pasture.

Soils in the vicinity of Hertzler Ranch are generally deep, well-drained, medium-textured, and very stony (ibid). In some places, large boulders are present at the surface and in the soil. **Figure 3–7** shows the distribution of soils at Hertzler Ranch.



Distribution of Soils at Hertzler Ranch
Figure 3-7

3.9.2 Vegetation

Vegetation present at the Stillwater Mine area, at Hertzler Ranch, and along the pipeline route, has been extensively described in previous environmental documents. Four basic categories of vegetation have been identified and further refined into 13 vegetation types. These types are listed in **Table 3–15**. For more detailed discussions of the vegetation types, readers may review the 1981 baseline reports (CDM 1981) and the Final EIS for the Stillwater Mine's original development (DSL and Forest Service 1985).

Table 3–15 Vegetation Categories and Types in the Stillwater Mine Project Area

Category	Types
Low Elevation Grass and Shrubland	1 Stoney Grassland 2 Sagebrush shrubland 3 Skunkbush shrubland
Low/Middle Elevation Riparian and Ravine Types with High Soil Moisture	4 Drainage bottomland 5 Riparian woodland 6 Ravine aspen-chokecherry
Forested Types	7 Open forest-meadow understory 8 Open forest-rocky understory 9 Lodgepole pine forest 10 Douglas fir forest
Disturbed Areas	11 Revegetated chrome tailings 12 Cultivated hayland 13 Other disturbed

3.9.2.1 Noxious Weeds

Noxious weeds are species of plants that undermine the quality of wildlife habitats, grazing and agricultural lands, and biodiversity. Efforts to control the spread of noxious weeds are overseen by both state and county agencies (Noxious Weed Act, County Weed Control Act 7–22–2101 (5), MCA). In Stillwater County, these efforts are focused primarily on leafy spurge (*Euphorbia esula*), spotted knapweed (*Centaurea maculosa*), and, to a lesser extent, on Canada thistle (*Cirsium arvense*), field morning glory (*Convulvulus arvensis*), mullein (*Verbascum thaspus*) and houndstongue (*Cynoglossum officinale*). Except for field morning glory, which affects agricultural productivity, these species have been designated as noxious due to their effects to rangeland.

Within the project area, these six species occur as isolated populations and as scattered individuals. Spotted knapweed is present on disturbed areas and an inventory of the Hertzler Ranch area conducted in 1996 noted the presence of leafy spurge, spotted knapweed, field morning glory and Canada thistle (Western Technology and Engineering, Inc. 1996a). Although new individual plants continue to appear in the area, efforts by Stillwater County to manage weeds have prevented the expansion of noxious weeds in the area. SMC's weed management practices are directed and implemented in cooperation with county weed managers and are focused primarily on the eradication of spotted knapweed. This species is especially problematic because it may be transported on site by machinery and become established on disturbed areas. Despite the constant potential for invasion, eradication of noxious weeds at the Stillwater mine is generally viewed as successful (Pearson 1998, pers. comm).

Stillwater County's weed management program is integrated, using biological, chemical and mechanical controls. To eradicate new infestations, herbicides (TORDON, ESCORT, and 2,4-D) are the single most effective tools and, as such, these chemical controls are the primary techniques used at the Stillwater Mine to control weeds. Stillwater County uses all three controls to contain the spread of well-established populations. Considered to be most effective on mature populations, biological controls used in the county focus primarily on leafy spurge and spotted knapweed. Although mechanical controls, such as grazing, are typically not viable due to toxic or unpalatable nature of most noxious weeds, Stillwater County has used sheep and goats to graze on mature populations of leafy spurge (Pearson 1998, pers. comm.).

3.9.2.2 Stillwater Mine Site

Vegetation types within the portion of the Stillwater Mine's current permit boundary east of the Stillwater River are a mixture of open forests with either a meadow or rocky understory, an open forest-rocky understory, ravine aspen-chokecherry, lodgepole pine, rocky grassland and disturbed. Within the 80-acre footprint of the proposed east side waste storage site, about one third (20 acres) is Rocky grassland. The rest (60 acres) is revegetated chrome tailings.

3.9.2.3 Hertzler Ranch

The 1,112 acres of rolling landscape comprising the Hertzler Ranch site are dominated by the Stony grassland vegetation type (65 percent). This vegetation type has been replaced by a band of Cultivated hayland in the northern portion of the ranch, which stretches from east to west. The hayland is flood-irrigated by a historic ditch that travels along the northern permit boundary. Cultivated hayland accounts for 26 percent of the total area encompassed by the Hertzler Ranch site.

Several vegetation types account for the remaining nine percent of the area. Sagebrush shrubland and Skunkbrush shrubland vegetation types account for 5 percent and 2 percent, respectively, and are restricted to northwestern and southeastern aspects defined by slope shoulders, toes of slopes and swales. About six acres (1 percent) of Drainage bottomlands are present and only three acres of open forest-meadow understory (less than 1 percent) are present. Disturbed areas other than the Cultivated haylands account for 1 percent of the Hertzler Ranch site's total acreage.

3.9.2.4 Pipeline Route

Most of the lands crossed by the proposed pipeline route presently support the rocky grassland vegetation type. However, several small segments also cross riparian woodland (at the Stillwater River crossing), cultivated hayland, drainage bottomland, skunkbrush shrubland, ravine aspen-chokecherry, and open forest with meadow understory.

3.10 Cultural Resources

3.10.1 Overview

The study area falls within the Northwestern Plains and Mountains archaeological culture areas as synthesized by Frison (1991) and summarized more specifically for the Custer National Forest by Beckes and Keyser (1983). The overall cultural chronology is a refinement of Mulloy's (1958) classic Northwestern Plains chronology. The latter chronology was based largely on investigations in south-central Montana and northwestern Wyoming. This chronology is conventionally divided into the Paleoindian (ca. 11,500–8000 years ago), the Early Plains Archaic, partially coinciding with the Altithermal climatic episode (ca. 8500–5000 years ago), the Middle Plains Archaic (ca. 5000–3000 years ago), the Late Plains Archaic (ca. 3000–1500 years ago), the Late Prehistoric (ca. 1500–500 years ago), and the Protohistoric (ca. 500–200 years ago). The cultural chronology of this region focuses on the stylistic and technological attributes of distinctive chipped stone hafted bifaces which exhibit widespread "traditions" over time. For a more detailed discussion of this chronology as it relates to this project area see Lahren (1997).

In the Protohistoric period, pottery-using Shoshoni groups are evident in southern Montana, but with the arrival of guns, horses, and other European elements, they are displaced by the Siouan speaking Absaroka, or Crow. Small groups of mountain or Sheepeater Shoshoni remained in some areas, but the valleys and open plains were dominated by the equestrian Absaroka. Absaroka tradition holds that they often hunted bison by the drive or jump strategy, as well as the surround and chase that were made feasible by the adoption of the horse (Lahren 1997:8-12).

From the late 1700s through the mid 1800s, several private and government-sponsored expeditions, including the Lewis and Clark Expedition of 1806, passed through the region and fur trading companies established trade relationships with the Crow, Blackfeet, and Flathead, and brought trappers into the region. As the United States began to encroach on this territory in the early to mid 1800s, the Crow established and maintained amiable relationships with the encroaching whites and served as scouts with United States troops in the Plains Indian Wars.

The Fort Laramie Treaty of 1851 established most of what is now south-central Montana and north-central Wyoming as Crow territory. This territory extended from the Powder River on the east westward to Geyser Park at the head of the Yellowstone River and from the Wind River Range on the south northward to the Musselshell River. The second Fort Laramie Treaty, in 1868, ceded 30 million acres, nearly 80 percent, of Crow territory, and granted absolute and undisturbed use and occupation of the remaining land. The reduced territory in southern Montana started at the 107th degree of longitude on the east and ran westward to the Yellowstone River and from the Wyoming-Montana state line on the south northward to the Yellowstone River. Over the years Crow territory was repeatedly reduced by treaty cessions (1882, 1891, and 1904) to the present Crow Reservation in south-central Montana (see Lahren 1997, page 5–9 through 5–12). The early history of the region was dominated by mining exploration and cattle ranching. The Crow agency moved to several locations, including a location near present-day Absarokee in 1875, before moving to its present location on the Little Bighorn River in 1884.

The early history of the region was dominated by mining exploration and cattle ranching. The Stockgrower's Association remained a strong influence in Montana history, despite the setbacks of the harsh winter of 1886–87. The open range ranchers who dominated Montana prior to 1887 had largely avoided the Stillwater Valley because of the prevalence of indigenous loco weed.

Partially because of Indian conflicts in the region, the Yellowstone Valley did not experience gold rushes similar to California, Nevada, Colorado, and Idaho. Prospecting was sporadic in the Stillwater Valley in the 1860s and 1870s and marked by minor conflicts with the Indians. In 1881, the Northern Pacific Railroad established a depot at Stillwater (now Columbus) spurring a new period of prospecting in the region. In 1883 Jack Nye, Joseph Anderson, and hundreds of other prospectors staked mineral claims on the Stillwater and the Stillwater Mining Company was first established. Nye City was not officially established until 1887 and was briefly abandoned two years later when it was found to be within the Crow Reservation. Much of the early mining in the area was centered on various copper ores. World War II demands for chrome triggered a brief development of the Mouat Mine in 1943 and a reopening of those operations in the early 1950s, but no major mining operations developed in the Stillwater Valley until the 1980s.

Homesteading and ranching began in this region in the 1880s and 1890s with major reductions in the Crow Reservation, but the major period of dryland homesteading was from 1900 to 1920. Encouraged by a series of wet years in the early 1900s, increased availability of steel plows and farm implements, an expansion of credit purchasing, and by the Enlarged Homestead Act of 1909, a major homesteading "boom" occurred in Montana from 1913 to 1919. This expansion was brought to a halt in southern Montana by major droughts accompanied by grasshopper, wireworm, and cutworm infestations in 1918 and 1919. Nearly half of the farm mortgages in Montana were foreclosed, precipitating numerous bank failures in the early 1920s. The survivors of this regional depression had diversified or turned to ranching and were better prepared than many areas for the Dust Bowl and Depression of the 1930s.

3.10.2 Previous Investigations

Lahren (1997) recently completed a cultural resource inventory for SMC's proposed slurry line and tailings impoundment in Stillwater County, Montana. This investigation of the project area included files searches, a review of previous investigations, interviews with local landowners and avocational archaeologists, oral histories, review of aerial photographs and historic maps, pre-survey reconnaissance of project area, intensive pedestrian survey of potential pipeline corridors and tailings impoundment area, and systematic testing at known site areas and areas of potential Holocene deposition. The preferred pipeline corridor and several alternates were investigated to establish the most reasonable route. The east side waste storage site had been covered by previous investigations (WCRM 1981) and no resources had been reported in those locations. The Stratton Ranch LAD area, involving limited surface disturbance for two small storage ponds and two LAD pivots, is located within a reclaimed gravel pit which, also was previously surveyed (WCRM 1981). One new site was recorded for the project area (24ST306), and the effect that the project might have on previously recorded sites was assessed. One "sensitive" area referred to as spring 15 was noted by Lahren as having the potential to contain buried cultural material, but was not recorded as a site.

Prior to the current investigation, there had been 12 cultural resource investigations covering portions of the project area:

- Lahren 1976, Johns-Manville Stillwater Complex, Baseline Study
- Lahren 1980, Johns-Manville Stillwater Complex, Class III Inventory
- WCRM 1981, Anaconda Stillwater Project, Baseline Study
- Lahren 1982, East Boulder Area, Sweetgrass County, Class III Inventory

- Mineral Research Center and BEAK Consultants 1982, Stillwater PGM Resources, Class I Overview
- Historical Research Associates 1984, Survey and Evaluation of Mouat Homestead (24ST67)
- DSL and Forest Service 1985, Stillwater Project, EIS
- GCM Services 1988, Addendum to Anaconda Stillwater Complex Cultural Inventory
- Lahren 1989, Additional Evaluations of East Boulder Area
- Lahren 1990, Additional Evaluations of East Boulder and Placer Basin
- RTI (Rosillon and McCormick) 1991, Stillwater River Road, Class III Inventory
- Forest Service and BLM 1993 Beartooth Mountain oil and gas EIS.

Anthro Research conducted a baseline study and a cultural resource inventory for the Johns-Manville Stillwater Complex (Lahren 1976, 1980), Western Cultural Research Management conducted a baseline study (WCRM 1981) of the Anaconda Stillwater Project (now SMC), GCM Services (1988) supplemented the latter inventory, and Renewable Technologies conducted a cultural resource inventory of the Stillwater River Road (Rossillon and McCormick 1991), roughly covering the proposed pipeline corridor. The remaining six investigations were summaries of existing data or evaluations of recorded sites.

3.10.3 Criteria for Evaluation

The sites within this project area represent a wide array of site types and dates of occupation. A primary goal of inventory and other investigations is to provide evaluations and management recommendations for these properties in terms of the Criteria for Eligibility for the National Register of Historic Places (Register). The evaluation process is best discussed with reference to the various types of sites that have been documented and may be encountered in future inventories. To be eligible for the Register, a resource must retain essential aspects of integrity and meet one or more of the Criteria for Eligibility (36 CFR §60.4). For archaeological resources, eligibility is typically recommended under criterion d, on the basis of the information potential of surface artifacts and features and intact subsurface cultural deposits. Some archaeological sites may also be exceptional manifestations of broad patterns important in prehistory (criterion a) or may be traditional cultural properties eligible under any of the criteria for eligibility (see Parker and King 1990). Historical resources may be evaluated under any of the four criteria on the basis of information potential or significant historic associations.

3.10.4 Known Resources

Twenty-two cultural resources had been recorded within 500 meters of the proposed pipelines and tailings impoundment (**Table 3–16**). Three sites would be crossed by the proposed pipeline (24ST54, 24ST306, and 24ST401) and one site is located within the proposed tailings impoundment (24ST51). The Guthrie site (24ST54) and the Keogh Bison Jump (24ST401) have been formally determined eligible for nomination to the National Register of Historic Places. Site 24ST51, the wagon road, was found not eligible during the investigations in 1981 (WCRM 1981). The Rocky Pass site (24ST306) is considered potentially eligible to the National Register, but no formal determination has been conducted to date.

3.10.5 Ethnography

The Crow were the principal tribal group in the region in the early historic period. There are traces in surrounding areas indicating that Numic groups occupied this region in the Protohistoric period, prior to the westward expansion of the Crow from the Middle Missouri. On the Upper Yellowstone and the Clarks Fork, Mountain Shoshoni or Sheepeater bands were still noted into the late 1800s. Lahren (1997:4-15) also notes Sheepeater lodges are still present in the Lodgepole and Myers creeks areas. By the time of sustained Euroamerican contact, the Crow, who had separated from the Hidatsa village horticulturalists of the Middle Missouri region, were a classic Plains Equestrian culture. The adoption of the horse, and later the consistent availability of guns and ammunition, had profound influences on settlement, social, and subsistence patterns. In northwestern Wyoming, south of the project area, there were frequent territorial conflicts between the Crow and the equestrian Eastern Shoshoni. The horse, and to a lesser degree the gun, made new bison hunting strategies (such as the chase and the surround) practical, increased the range of mobility of villages, and introduced new symbols of wealth and power. But the horse also introduced demands for forage and water that altered the requirements for settlement locations and made villages more vulnerable to sudden attacks. Symbolically and economically early historic Crow culture was centered on the horse and vast bison herds. Large-scale communal bison hunts, as might be represented at the Keogh Bison Jump, were important social and subsistence elements of Crow culture and many aspects of political and social organization were manifested in these hunts.

The Crow Reservation is about 50 miles east of the project area and, as recently as 1891, the study area was within the Crow Reservation, which then extended west to the Boulder River. In the period from 1875 through 1883 the Crow agency was located near Absarokee at the confluence of the Stillwater River and Rosebud Creek, east of the present project. The Crow, despite heavy losses in warfare with the Lakota and Cheyenne and in the smallpox and cholera

Chapter 4.0 — Environmental Consequences

Chapter 4.0 — Environmental Consequences

This chapter describes the potential effects of each of the alternatives described in Chapter 2. Data and analyses from previous environmental analyses (see synopses in **Appendix A**) were also incorporated into this analysis. The intent of this chapter is to provide the scientific and analytical basis for the comparison of alternatives presented in Chapter 2. The discussion in this chapter includes direct, indirect, and cumulative effects from implementation of the proposed action and alternatives. The chapter also discusses mitigation measures that are part of existing operations at the SMC facilities and which would be implemented at the expansion facilities, plus additional mitigation measures that would be considered for the new facilities.

In addition to the analyses of changes to SMC's mine waste management operation discussed below by resource area, the effects of removing the limitation on daily production (currently 2,000 tpd) were evaluated. Removal of this limitation, which is included in all three action alternatives, would result in a permit based on an approved "footprint" of surface disturbance, not a rate of production. The analyses of removing this limitation on daily production identified no effects for almost all resource areas because most effects are associated with physical facilities and these facilities would not change with changes in rates of production. The single resource where potential effects were identified is transportation. These effects are discussed in the discussion of the transportation analysis (**Section 4.8**). The overall lack of effects associated with the other resource areas is not discussed any further.

The numerous comments on the draft EIS have resulted in additional information being incorporated into this chapter of the final EIS. The greatest amount of changes occurred in Water Resources including analyses relative to MPDES permit limitations (loading rates, mixing zones), clarification on the HELP model, additional modeling of surface and ground water quality impacts (LAD, impoundment and waste rock storage site seepage), impacts on flows, impacts on persons with water rights, and impacts from a potential pipeline rupture. Other changes include a discussion on indirect impacts to bighorn sheep, information on the diffuser for discharging water into the Stillwater River, information regarding the proposed zoning petition, and a new section on regulatory restrictions on the use private property (the applicant's private property). Twelve new mitigations were developed as a result of public comments on the draft EIS (see **Section 2.4.5**); six for Water Resources, two for Wildlife, one for Air Quality, one for Tailings Impoundment Stability, one for Transportation, three for Reclamation Potential, and one for Cultural Resources.

4.1 Water Quality and Quantity

4.1.1 Direct and Indirect Effects

4.1.1.1 Alternative A — No Action

Under the No Action Alternative, conditions would be as described in the Existing Environment section. Water quality at the Stillwater Mine site from the upper permit boundary to the lower permit boundary would be virtually the same, although there might be some temporary localized increases in nitrates and metals immediately adjacent to the Stillwater River and in its alluvium.

SMC would continue to operate its water management system for adit water and process water. Adit water is clarified, then disposed of through evaporation, evapotranspiration, and land application via irrigation sprinklers or through percolation ponds. Direct discharge to the Stillwater River also is an option under SMC's present MPDES permit. De-nitrification using anoxic biotreatment cells (ABC) accounts for approximately 500 gpm. Evaporation from the tailings impoundment spray systems on the tailings crest and ponds consumes approximately 385 gpm. Land application utilizes approximately 325 gpm. Some adit water is used for dust suppression and some for make-up water in the mill. Process water contains reagents used by SMC to "float" ore particles to the surface of tanks where they can be captured. This water is discharged to the tailings pond where it either evaporates or is recycled back to the mill.

4.1.1.2 Alternative B — Proposed Action

4.1.1.2.1 Stillwater Mine Site

Construction of the east side waste rock storage site would replace the two LAD sites located on the east side of the river, cover the chrome tails in the area, and result in the relocation of some of the east side percolation ponds and the topsoil stockpiles. The Proposed Action alternative would increase mine-related activity acreage from 38 to 88 acres, almost all of which has been previously disturbed. The east side waste rock storage facility will be located 120 to 600 feet from the Stillwater River Channel and outside of the 100-year, 24-hour floodplain. The base of the waste rock facility will be armored with large rock which will protect the structure in the event of a probable maximum flood event. The east side waste rock storage site could result in increased sediment loading during the construction phase, prior to stabilization with vegetation. This impact would be temporary and localized, as runoff would be mitigated with flow into stormwater detention ponds prior to discharge into the river. At the same time, runoff from the footprint of the east side waste rock storage site would increase due to the increase in slope and change in vegetative cover. Flows from the site during and following a storm would be controlled by the stormwater ponds, sized to handle flows from a 25-year, 24-hour event, resulting in moderate flows over a longer period than anticipated from an equivalent site without a pond.

Replacement of the existing LAD sites with the east side waste storage site would decrease the saturation of the alluvium in that area, increasing the depth to the water table slightly. Removal of the LAD sites would decrease the nitrates in the soils and groundwater immediately below the pivots. Deep percolation below the pivots is estimated at 0.1 pounds of nitrogen per acre/per day (MSE-HKM 1997). However, waste rock also would have nitrates left from blasting. Compaction of the waste rock and the use of water conveyance structures to move water off the pile quickly should limit the amount of water leaching through the waste rock. Water would leach nitrates into the adjacent alluvium over time.

SMC's MPDES permit regulates discharges of water from the Stillwater Mine. Water quality discharge standards were set based on potential impacts. Waters from the mine can have elevated concentrations of suspended solids, nutrients, or metals. Concerns about the aquatic ecosystem and downstream domestic users resulted in effluent standards for all three types of water quality parameters at Outfall 001, the direct discharge into the river. SMC minimizes the release of suspended solids in the percolation ponds through clarifiers or earthen sediment traps to maintain the percolation pond efficiency. Because the low concentrations of metals in discharges through the percolation ponds are adsorbed by fine soil particles in the alluvium, limits have been set only for total nitrogen at Outfalls 002, 003, and 004, which are the percolation ponds.

The nutrients nitrogen and phosphorus can stimulate algal growth. The effluent standards were developed to maintain the integrity of existing aquatic life. At concentrations exceeding 10 mg/L, nitrates also can limit human fertility and pose a risk to infants three months and younger.

Nitrogen loading is restricted to 100 pounds of nitrogen and 1.1 pounds per day of phosphorus from all outfalls. Nitrates and ammonia from blasting materials are found in adit waters. SMC treats elevated nitrogen in waste streams through denitrification in the ABC and LAD. Nitrogen removal from the ABC has ranged from 60 to 99 percent. Rates of removal were higher at regular maximum water throughput and warmer temperatures. Removal efficiencies are increased during cooler conditions with a reduction in flow rate and an increase in residence time. Nitrogen removal through plant uptake and evaporation at the LAD sites averages 80 percent. The nitrogen loading limitation would not increase the background concentration by more than 1 mg/L in the river.

The ABC facility generates discharges of 0.08 to 0.1 mg/L phosphorus when run at 90 percent efficiency, and 0.05 mg/L at 60 percent efficiency. The phosphorus loading limitation would not increase the background concentration by more than 0.001 mg/L during the summer and 0.003 mg/L during the winter.

To estimate the amount of nitrates that might leach from the proposed east side waste rock site into the alluvium, EPA's Hydrologic Evaluation of Landfill

Performance (HELP) model was used to estimate infiltration through the waste rock facility (Techlink and Greystone 1998). The HELP model estimates the rate of infiltration based on surface and subsurface water balances. The HELP model takes into account the following: precipitation, snow melt, surface runoff, land surface slope, size of area, vegetation, surface evaporation, temperature, precipitation, solar radiation, relative humidity, evapotranspiration, hydraulic conductivity and porosity of the soil, and the initial soil moisture conditions. Input assumption reflect site specific area and slope condition, monthly temperature and precipitation averages, quarterly averages on relative humidity, and the modeler's best professional judgement on other climatic and physical characteristics. The output from the HELP model gave an average infiltration rate of 2.7 inches per year through the waste rock pile at the Stillwater Mine site.

The total amount of nitrogen in the waste rock was estimated from laboratory analysis using the "Sequential Saturated Rolling Extractions" method. With this method, the rock is pulverized and mixed with water to determine the leachable nitrogen in the waste rock. Based on three tests, the average total nitrogen concentration was 40.12 mg/kg of waste rock. This value represents the maximum (worst case) amount of leachable nitrogen in the waste rock.

The rate at which this nitrogen is leached was estimated by the "Column Leach Extraction" method. This method consists of sequentially running 1, 2, and 3 pore volumes of water through the waste rock column and measuring the concentration of nitrogen in the outflow water. Based on the results from tests on three samples, the porosity of the waste rock was estimated at 5 percent.

Based on the average infiltration rate of 2.7 inches per year from the HELP model, a 30 percent soil porosity, and an estimated average thickness of 80 feet, it will take approximately 33 years to infiltrate one pore volume of water through the waste rock storage site. These parameters result in an estimated nitrogen loading rate of 13.6 lbs/day from the waste rock storage site or 0.12 lbs/acre/day. This value represents the average nitrogen rate of loading for the first volume of water through the waste rock storage site (i.e., the next 33 years). This nitrate loading on a per acre basis is similar to the LAD loading. However, the LAD application occurred on 26 acres and the waste rock storage extends across 80 acres. This source of nitrates would be monitored through SMC's MPDES permit obligations to sample water in the groundwater mixing zone and in the river.

Additional mine development may result in decreased flows in springs with hydraulic connections to faults or fracture systems intersected by the mine. As noted in Chapter 3, flows to SP–3, above the east adit ceased in the early nineties. Water quality impacts from the mine are not likely.

4.1.1.2.2 Stratton Ranch

SMC would install two 800-foot diameter LAD center pivot irrigation systems at the reclaimed gravel pit along Stillwater County Road 419 on the Stratton Ranch. The site previously was occupied by thirty trailers which had a leach field that handled 150 to 250 gpm. The Stratton Ranch LAD sites would be supported directly by the pipeline. These circles would take less than 1,000 gpm of adit water, which is at or slightly below the human health standard for nitrates, and irrigate two fields of high-nitrogen-uptake species. (Most of the adit water would be handled by the Hertzler Ranch LADs discussed below).

Hydrologically, the runoff characteristics of the site would decrease substantially, as water would run across a deep grass rather than across a surface of alluvial cobbles and gravel. In addition, less water would recharge the Stillwater alluvial aquifer during storm events than previously, as the alluvium would be saturated and there would be some uptake by the grasses. However, this would be offset by the continuous irrigation of the site for 7 months every summer with the LAD system. The water table in the vicinity would rise slightly. Should groundwater mounding in the area develop, which would saturate the toe of the colluvial material to the north and west, instability might occur. Use of the LAD system at Stratton Range would have no impact on the springs in the area, as they are either located upgradient or on the opposite side of the river.

In the unlikely event of a 100-year storm or a probable maximum flood event, the Stratton LAD site would be partially or completely inundated and the pivots may be lost. Secondary treatment though LAD disposal would temporarily cease until floodwaters drop.

Water quality concerns associated with nitrates focus on elevation of natural nitrate levels, human health effects, and the subsequent potential impacts to nutrient loading of the Stillwater River. Nutrient loading of nitrates and phosphates, in tandem, can result in significant algal growth. The ABCs are anticipated to discharge 0.1 mg/L of phosphate. The human health water quality standard for nitrate-nitrogen is 10 mg/L. The baseline levels of nitrate in the SMC complex area are <0.05 to 0.4 mg/L in surface waters and 0.31 to 3.36 mg/L for groundwater.

Nitrate concentrations would increase in the alluvial aquifer immediately downgradient of the LAD systems. Water quality at alluvial wells within 200 feet downgradient of SMC's existing LAD systems had nitrate-nitrogen values ranging from 0.13 to 23.4 mg/L, with an average value at approximately 3 mg/L. These LAD pivots are located within 250 feet of the river. Nitrate-nitrogen levels in the Stillwater River increased from the upstream site to the downstream site (**Table 3–1**) by up to 0.2 mg/L. The downstream site is located approximately 1,400 feet downstream of the northeastern-most point of the LAD pivots. The Stratton Ranch LAD sites would be 900 to 1,000 feet from the river.

Mixing calculations were performed by Hydrometrics in support of the MPDES renewal (SMC 1996b). LAD application rates of 600 gpm of adit water containing nitrate-nitrogen concentrations of 7.5 mg/L were modeled 1,600 feet downgradient from the LAD. These predictions indicated maximum concentrations of nitrate-nitrogen in the Stillwater River of 0.505 mg/L or an increase of 0.005 mg/L. The concentration of nitrate-nitrogen in the groundwater mixing zone would increase from 0.28 mg/L to 0.82 mg/L when water is applied 12 hours per day 5 days per week.

During 1996, the LAD pivot irrigation system irrigated 41.5 acres with 322 acre-feet of the 1,024 acre-feet of water produced between 4/23/96 and 10/29/96. MSE/HKM (1997) evaluated the performance of SMC's LAD system and found the LAD system consumed 2,841 pounds of the 3,299 pounds of nitrogen delivered, or 86 percent, through dispersive evaporation and plant and soil uptake. For permitting purposes, 80 percent uptake from these sources was assumed. SMC is limited to discharging less than 100 pounds of nitrogen per day under its existing MPDES permit.

LAD application of adit water may result in soil uptake of manganese, cadmium and lead and subsequent mobilization of soil bound copper (Grass-Land Maxim Technologies and Western Technologies and Engineering, Inc. 1996). Metals concentrations are not expected to preclude land use choices in the future and copper levels are not anticipated to diminish ground water quality.

The Stratton Ranch LADs would have several indirect impacts. The site is formerly an open pit gravel operation and the grasses would be visually more acceptable. The grasses would stay greener later into the summer than normal range in the area due to the continuous irrigation. The site also may act as a magnet for wildlife due to the high productivity of palatable grasses. The LAD storage ponds may serve as a watering site for wildlife unwilling to cross the Stillwater County Road 419 to the Stillwater River.

4.1.1.2.3 Hertzler Ranch

The Hertzler tailings impoundment would increase disturbance in the area during operations and result in a temporary increase in surface water runoff and sediment loss from the site. Following reclamation, surface water runoff would drop, but would still be greater than observed under current conditions due to the change from a gently-sloping terrain to an embankment with 2:1 (horizontal distance to vertical distance) crest sideslopes. At the Hertzler site, similar stormwater management practices would be in place to divert water from a storm of probable maximum precipitation (PMP) around the site. The tailings impoundment would be designed to have adequate freeboard to handle the PMP to prevent a surface water release during a large storm event.

Sediment loss would increase during operations, but would extend only a limited distance beyond the disturbance area due to the 1.5 percent slope of the valley, stormwater control measures, and plans to revegetate the downstream toe within 2 years of stage 1 construction. Sediment loss would continue to decrease with final reclamation.

The use of an HDPE liner on a clay liner, coupled with an overlying seepage collection system would minimize the potential of groundwater seepage into the unconsolidated materials in the valley and promote drainage of the tailings. The existing tailings impoundment has not had a rupture in the twelve years of operation. In the event a rupture in the liner occurred, lateral migration of waters with elevated total dissolved solids concentrations and nutrients would be limited, due to the low permeability of the underlying clays and slimes in the impoundment. This migration would occur either to the east along the centerline of the Hertzler Valley or south to the Stillwater River. Alluvial waters along the Stillwater River would not be affected, as it is more than one mile to the river. The three adjudicated springs and two of the existing wells in the area are upgradient of the proposed facilities and would not be impacted. The DeGroat wells are located on the Stillwater upstream from the river's intersection of the Hertzler Valley swale and would not be affected. The MDFWP's well is located in the Stillwater alluvium north of the intersection of the Hertzler Ranch swale and one mile downgradient and would not likely be impacted. The unadjudicated old Hertlzer Homestead spring is located downgradient of the Hertlzer LAD holding pond and the tailings impoundment. Baseline reconnaissance suggested that it is derived from irrigation return flows. In the unlikely event of seepage from the holding pond or tailings impoundment and hydrologic connection to the springs, flows could increase and water quality could change.

The two tailings recycle ponds located north of the proposed impoundment would be lined with an HDPE liner and have automated pumps to recycle the water back into the tailings impoundment. The use of an HDPE-lined impoundment results in a closed system that is unlikely to detrimentally impact the hydrologic balance at the site. The integrity of the liners in the tailings recycle ponds and the tailings impoundment is predicated on the QA/QC program during construction, which would regularly evaluate the installation with regard to design specifications of subgrade preparation, liner quality, and the soundness of the welds.

Four 1,000-foot diameter pivots would be installed north of the Hertzler tailings impoundment to support treatment of as much as 2,000 gpm of mine adit discharge water. Some of the 2,000 gpm would be treated by the two LAD circles at Stratton and the balance would be treated by the four LAD sites at Hertlzer. This water would have elevated nitrate and moderate salinity levels. Center pivot irrigation systems would irrigate a range seed mix that would include Garrison creeping meadow foxtail grass. Application would occur for approximately 7 months during the warmer portion of the year and application rates would be gaged to maintain saturation within the soil. This could result in an increase in the runoff characteristics of the area, increasing runoff or ponding following a storm. SMC would manage the irrigation system by turning off the sprinklers during long storm events.

An irrigation ditch that runs through the site would be buried. The water would be piped to ensure that downstream uses received pre-mining disturbance water quality.

The LAD operations would recharge the Hertzler Valley aquifer and slightly increase the water table elevation. MSE-HKM (1997) evaluated the LAD operation within the Stillwater alluvium at the SMC facilities area and found that for every inch of precipitation and irrigation, 0.44 inches recharged the groundwater. Ground water must migrate 1,500 feet south or an average of 6,200 feet east along the Hertzler Valley towards the Stillwater River before reaching the river.

Mixing projections (SMC 1996b) for the Hertzler Ranch site assume LAD application rates of 2,000 gpm with nitrate-nitrogen concentrations of 7.5 mg/L. The modeling assumes a mixing zone length of 4,380 feet between the site and the Stillwater River. The resultant nitrate-nitrogen concentration in the groundwater would be 0.70 mg/L. Nitrate concentrations in the Stillwater River following mixing during a 10-year, 5-day low flow would increase by 0.01 mg/L to 0.51 mg/L nitrate-nitrogen. Actual nitrate concentrations are anticipated to be much lower due to uptake by vegetation, evaporation and higher flow in the Stillwater River.

Adit water utilized by the LAD operations has average concentrations of metals below acute aquatic standards and human health standards. Field testing of Hertlzer LAD sites showed a reduction in manganese, cadmium, and lead levels in infiltrated water suggesting that soil uptake of these metals had occurred (Grasssland Maxim Technologies, Western Technology and Engineering, Inc. 1996). Natural concentrations of these metals are more than a magnitude lower than suitability standards for plant growth medium (EPA 1981). Uptake is not anticipated to preclude future land uses. Copper concentrations in the leachate did increase in the control samples suggesting elevated watering rates mobilized copper. This is not expected to deleteriously impact uses due to groundwater quality.

The four LAD sites would be supported by a 24.5 acre-foot (80 million-gallon) LAD storage pond located west of the Hertzler tailings impoundment. This unlined storage pond would exhibit low rates of infiltration (Knight Piésold 1996) as the permeability of the underlying glacial material is approximately 1×10^{-7} cm/sec. Seepage from the pond at maximum containment is projected to be less than 2 gpm, and would have no significant impact on groundwater quality.

The LAD areas would result in several indirect impacts. The grasses below the center pivot irrigation systems would differ from those there now and would provide substantially more cover. The LAD storage pond also might serve as a watering site for local deer and elk.

Motorists along Stillwater County Road 420 might drive through a mist when the road is downwind of the center pivot lines. The LAD irrigation may act to decrease dust conditions along the road and improve travel conditions.

4.1.1.2.4 Pipeline Corridor

Hydrologic impacts associated with the tailings pipeline can be classified into construction and operational impacts. Construction impacts consist of an increase in localized sediment loading during installation and in the interim period before revegetation efforts are successful on the portions of the pipelines not buried under the roadbed . These should be limited in extent and would be minimized by the presence of vegetated road ditches and vegetated areas between the disturbance and perennial channels. In addition, trenching across the West Fork of the Stillwater River may result in increased sedimentation in the stream. This would be minimized by diverting water into a single channel and performing the installation on the other channel during low flow periods.

Operational concerns associated with the tailings pipeline focus on the potential for a breach during operations. A major breach along the pipeline route is most likely to occur if a pipeline is damaged by construction equipment or if a large earthquake occurs. Two of the four pipelines would carry tailings, a slurry of mine waste material with elevated total dissolved solids (TDS) concentrations. One pipeline would carry adit discharge water, which would have elevated levels of nitrates that would be near the human health standard. The last pipeline would carry recycled tailings water salvaged from the tailings operation to be reused in the milling circuit. This water also would have elevated TDS concentrations.

SMC has proposed several mitigation measures to ensure the potential of a breach would be low and the result of a spill would be limited in extent. The two tailings pipelines would be composed of steel and sleeved with HDPE. The other two pipelines would be unlined steel pipe. The pipelines would be buried below the frost line, where possible. In some instances where the pipeline may not be buried below the frost line, such as within the roadway, SMC would super-insulate the pipelines to prevent their contents from freezing.

The pipeline system would include flow, moisture, and pressure instrumentation along with inspection ports for physical pipe wear measurements. The tailings pipelines would utilize a double lined system along the entire length of the pipeline route in order to minimize the potential for spillage due to a pipeline failure. Emergency containment facilities (vaults) would also be placed on both sides of the stream crossings on the West Fork Stillwater River (SMC 1996b).

The proposed pipeline monitoring instrumentation scheme is designed to automatically shut down the tailings pumps in response to a pressure drop or moisture detection along the pipeline route. A discharge of the entire pipeline(s) would be unlikely; the monitoring system should detect any change in operating conditions before a total system collapse.

The spill treatment plan would involve constant monitoring of the system, immediate shutdown and inspection upon warning, and flushing of the system if conditions warrant. Clean-up efforts would begin as soon as conditions permit and would focus on preventing the migration of spilled materials into surface waters.

In the event of a breach within the buried trench below the West Fork of the Stillwater River channel, flow in the pipeline would increase briefly until the system shuts off. A total evacuation of both 8-inch tailings slurry pipelines would result in the release of about 1,100 cubic yards of tailings slurry. A rupture of the tailings pipeline would result in an increase in sediments in the river, which would be taken up by the river and moved downstream during periods of high flows. Smaller particles, such as clays, would be moved more frequently than larger particles, such as gravels, resulting in higher turbidities and temporary, localized deposition of fine grained materials. This should have no long-term impact on spawning gravels. In addition, a breach in the tailings pipeline would result in a release of waters that have an average TDS concentration of 1,520 mg/L and an average sulfate concentration of 850 mg/L. These concentrations would be diluted rapidly by flows in the West Fork of the Stillwater River during high flows and dissipated correspondingly more slowly during low flows. A breach in the adit discharge line would release waters with a concentration of nitrate-nitrogen near 8 mg/L. These would be diluted downstream by stream volume. A breach in the recycled tailings water line also would release water with elevated concentrations of TDS. The water quality increases of TDS, metals concentrations and nitrate levels would be localized and of brief duration and are not likely to deleteriously impact the health of aquatic organisms, fish, or human populations.

4.1.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

4.1.1.3.1 Stillwater Mine Site

Alternative C calls for the expansion of the permitted tailings impoundment from 3.5 million tons to 8.35 million tons through an increase in height to 5,175 feet, expansion to the north, and an increase in the disturbance area from 60 acres to

68 acres. This would have no significant effect on water flow in the facilities area or on surface or ground water quality. However, in the event of an unplanned release of water from the tailings facility, due to a catastrophic failure, the Stillwater River would be only 200 feet away. Tailings and water could be released into the river.

The impacts of the east side waste storage site of 17.886 million tons of waste rock along the east side of the Stillwater River would be similar to Alternatives B and D. An increase in sediment loading during the construction of the structure, prior to stabilization with vegetation, might occur if a portion of the waste is sand size or finer. This impact would be temporary, lasting the life of the active storage period. Runoff would increase from existing conditions from the increase in slope.

4.1.1.3.2 Stratton Ranch

The impacts of utilization of 24 acres of the Stratton Ranch for LAD are similar among alternatives B, C, and D. Runoff characteristics of the site would decrease due to the change in cover from gravel to grasses. Continuous irrigation during summer months would result in ponding in the alluvium between the site and the Stillwater River, elevating the water table. Surface and ground water quality in the immediate vicinity of the site would show increases in nitrates, but concentrations would decrease rapidly with dilution from the river and would not exceed water quality standards.

4.1.1.3.3 Hertzler Ranch

The tailings impoundment at Hertzler would occupy 129 acres, rise to an elevation of 5,007 feet and hold 10.15 million tons of tailings under Alternative C. The decrease in the disturbance from the Proposed Action from 163 acres to 129 acres would flatten the runoff hydrograph during storm events, result in smaller peak flows, and decrease the sediment migration in the immediate vicinity of the tailings impoundment. The scheduling of the construction of the Hertzler tailings impoundment would shift, delaying the onset of disturbance in that area. In addition, the construction of a smaller impoundment would result in a shorter period between the initiation of construction and final reclamation of the impoundment, thus reducing the period of temporary impacts. In the unlikely event of a spill from the closed water management system at the site, water would have to migrate a minimum of 1,500 feet south or 4,400 feet east before reaching the closest perennial drainage, that of the Stillwater River. The potential for spill attenuation and/or containment prior to discharge to the river or its associated alluvium is high and results in a low risk situation.

Four center pivot irrigation circles would extend across 80 acres at Hertzler for use in the treatment of mine water containing elevated concentrations of nitrates. The impacts for Alternative C would be the same as those enumerated for

Alternative B at Hertzler. The use of these sites would reduce the potential for low-level detrimental impacts to the Stillwater River, due to the substantial distance between the Hertzler LAD sites and the river.

4.1.1.3.4 Pipeline Corridor

A shorter construction and operational period of the Hertzler tailings impoundment would shorten the period in which the tailings pipeline would be used and would reduce the potential of an unplanned spill associated with the pipeline.

4.1.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

4.1.1.4.1 Stillwater Mine Site

Alternative D would result in the long-term construction of two tailings impoundments on opposite sides of the Stillwater River. The existing tailings impoundment would have the same impacts as Alternative C in the expansion of the permitted tailings impoundment from 3.5 million tons to 8.35 million tons (see section **4.1.1.3.1**). This would have no significant effect on water flow in the facilities area or on surface or ground water quality. However, Alternative D includes the construction of a second tailings impoundment, with a footprint of 72 acres holding 4.94 million tons of tailings rising to an elevation of 5,085 feet. This tailings impoundment would cover the chrome tails in the area, eliminate the 41.5 acres of LAD sites in the area, and result in the relocation of some of the east side percolation ponds and the topsoil stockpiles.

Standard stormwater control features would be implemented at the new tailings impoundment. Water from the overlying drainage would be directed around the impoundment and diversion would carry drainage from the waste pile to stormwater collection basins.

SMC's water management plans might be pushed to their limit during the winter or under peak mine discharge events as the plans for the East Stillwater impoundment do not include a storage pond, such as that proposed at Hertzler. In the event that no additional water could be treated by the ABCs or stored in the tailings impoundments and percolation ponds at the mine site, adit discharges would have to occur directly to the river. If this occurred during the winter, during low flows, less water would be available for dilution and concentrations of nitrates would approach 1 mg/L. As discussed in SMC's MPDES permit, SMC's loading of nitrate to the Stillwater River is limited to 100 pounds per day from all sources.

The East Stillwater impoundment would have closed circuit water management design features similar to the proposed Hertzler tailings impoundment, having a 100-mil HDPE liner on a layer of fine-grained materials with an overlying seepage collection system. In the event a rupture in the liner occurred, there might be long-term migration of waters with elevated salinities and nutrients into the Stillwater River alluvium and, subsequently, into the Stillwater River, due its close proximity. As noted earlier, in the event of an unplanned excursion of liquid from the surface of either of the tailings impoundments, the Stillwater River is 200 feet away. Some protection is afforded by percolation ponds on the western side of both tailings impoundments, which may be in a position to contain a spill if they were not full.

The tailings pipelines for the East Tailings embankment would be suspended across the river or attached to the bridge. The potential for a breach of these lines would be greater under this alternative than other alternatives due to vandalism.

More than 9.8 million tons of waste rock would be used in the construction of the East Stillwater impoundment's embankment. The footprint of the structure would extend across 72 acres, in contrast to the 80-acre east side waste storage site proposed under alternatives B and C. This slightly smaller disturbance would result in a decrease in surface runoff compared with the other two action alternatives. Increased sediment loss would be routed into control structures during construction.

Although nitrate concentrations in the alluvial groundwater would increase slightly during operations, the increase would be substantially less than the 11.3 lbs/day estimated for alternatives B or C. Compacted waste rock would only be present in the embankment (leaching of nitrates occurs as water migrates through waste rock that has remnants of nitrate blasting materials), rather than throughout the structure as would be the situation with the east side waste rock facility under alternatives B and C. Thus, the surface area exposed to water would be substantially smaller. Also the impoundment would be about 50 feet higher than the east side waste rock facility, which would slow the rate of infiltration of seepage to groundwater. Nitrate leaching would end following capping of the impoundment and there would be no long-term impacts.

4.1.1.4.2 Stratton Ranch

The LAD sites at Stratton Ranch would have impacts similar to those described for alternatives B and C. However, more water might be disposed of at this site than would occur under alternatives B or C. Twenty-four acres of LAD sites at Stratton Ranch would replace the 41.5 acres of LAD sites currently operating at the mine. This alternative would not have the potential for 80 acres of supplemental sites at Hertzler as identified for alternatives B and C.

A pipeline handling only adit water would be built from the mill to Stratton Ranch, a distance of 8,000 feet. Disturbance associated with installation of the pipeline would impact a smaller area and the impacts of sediment loss in the immediate area of the trench would be commensurately more limited. There would be no disturbance in the vicinity of the West Fork of the Stillwater River. In the event of a spill from the pipeline, the slightly-nitrogenated water would pose little risk to the adjacent agricultural land prior to containment. Also, the site of the break would be reclaimed immediately after repair of the broken pipeline and other cleanup activities.

4.1.1.4.3 Hertzler Ranch

There would be no disturbance at the Hertzler Ranch under Alternative D. No tailings impoundment, borrow areas, LAD sites and support structures, or pipeline construction would be constructed. Conditions at the Hertzler Ranch would continue as described in Chapter 3, reflecting conditions associated with Alternative A — No Action.

4.1.2 Wetlands

4.1.2.1 Direct and Indirect Effects

Additional information regarding wetland and riparian soils and vegetation can be found under Section 4.9, Effects on Reclamation Potential.

4.1.2.1.1 Alternative A — No Action

Implementation of this alternative would have no direct or indirect effects on wetlands. Essentially, wetlands present in the project area would continue to exist in their current condition, as described in **Chapter 3**.

4.1.2.1.2 Alternative B — Proposed Action

Under this alternative, about 1.5 acres of wetlands would be disturbed for installation of the pipelines between the mine site and Hertzler Ranch. Most of this disturbance would be short-term in nature and reclaimed immediately after the pipelines' installation. One wetland (about than 0.75 acre in size) would be inundated by the LAD storage pond at Hertzler and some minor parts of wetlands may be disturbed by the toe of the east side waste storage site.

The U.S. Army Corps of Engineers has reviewed the potential effects of this alternative to wetlands. Based on this review, the Corps determined the disturbances to the 1.5 acres of wetlands discussed above would be authorized under the Corps' Nationwide Permit system (McInerney 1997, pers. comm.). Installation of the pipelines would be authorized under Nationwide Permit

Number 12.. The construction of the LAD storage pond and east side waste storage site would be authorized under Nationwide Permit Number 26.

4.1.2.1.3 Alternative C — Modified Centerline Expansion and Hertzler Ranch Site

The effects of implementing this alternative would be the same as those described for Alternative B. The same wetlands would be disturbed for construction of the same facilities. Also, the Corps' Nationwide Permits 12 and 26 would still apply to the wetlands disturbed by this alternative.

4.1.2.1.4 Alternative D — Modified Centerline Expansion and East Stillwater Site

The direct and indirect effects of implementing this alternative would be less than those described for alternatives B and C. The primary source of the difference is that the pipelines would not be constructed between Stratton Ranch and Hertzler Ranch and the LAD storage pond would not be constructed at Hertzler Ranch. Although the areal extent and number of wetlands that would be disturbed under this alternative would be less, the Corps' Nationwide Permits 12 and 26 would still apply to this alternative.

4.1.3 Cumulative Impacts to Water Resources

Anticipated changes in the Stillwater River watershed include the upgrade of a campground upstream of the mine and the anticipated increase in recreational use and an increase in residential units in the valleys northeast of the mine. Woodbine Campground improvements include the paving of roads and spurs, which should eliminate sediment loss from roads immediately adjacent to the Stillwater River while slightly increasing surface water runoff during storm events. Higher recreational use can result in an increase in disturbance associated with hiking trails and slight increases in runoff and sedimentation. Any campground has the potential to increase nutrient loading if sanitation is not adequately maintained.

Additional housing would change the vegetation type from native vegetation or agricultural crops to residences with lawns or pastures of introduced species for some acres. This would modify the runoff hydrograph in the area, increasing flows. Unimproved access roads would result in increased disturbance and accompanying sediment loading. Sewage treatment in rural portions of Stillwater County is accommodated through residential septic systems. Older, inadequately-sized or poorly-maintained septic systems could increase nutrient loading in the Stillwater River alluvium and in the river immediately adjacent to the discharge site. Increased residential construction may also increase demands for potable water.

The mine waste expansion project is the largest anticipated new disturbance and dwarfs the others in its projected impacts. However, SMC has anticipated the consequences and proposed mitigative measures to minimize those impacts. Increases in surface water runoff would not increase peak flows from storm events measurably and channel stability would not be compromised. Sedimentation might increase in limited localized areas for short periods during construction activities. Nitrate loading also would increase, but would not increase above the 100 pounds nitrate per day limit. The 100 pounds of nitrogen/day was based on not exceeding a total instream concentration of 1 mg/L nitrate-nitrogen during a 7-day low flow during a 10-year period (7Q10) of 31.1 cfs.

4.1.4 Water Quality and Quantity Mitigation

SMC would continue the annual sampling and testing of tailings and waste rock to verify the lack of acid-generating potential of the materials. This sampling and testing would continue for the life of the mine. SMC would also continue to follow its Stormwater Pollution Prevention Plan, which was previously approved by DEQ and CNF. In the event of a stormwater or mine discharge to surface waters, SMC would sample and report the discharge as required by its approved MPDES Permit. Most MPDES discharges occur through percolation ponds and effluent standards are tested weekly at the inlets to the pond. SMC has the option to discharge waste water to the Stillwater River through a diffuser. Use of this outfall would initiate daily flow measurements and weekly water quality measurements.

SMC's Mining Permit #00118 includes annual reporting and triannual monitoring of eight river or creek stations, one spring, fifteen alluvial wells, two adit discharge sites and one mill decant water site. In addition, five wells are monitored three to twelve times per year and two springs twice per year. Water levels are acquired at three piezometers monthly. The approval of an Action Alternative that includes Hertzler would result in tri-annual monitoring of three additional surface water sites and eleven shallow wells. The use of Stratton LAD sites would add triannual monitoring of one surface water site and four shallow wells.

SMC has prepared a Pipeline Monitoring and Spill Contingency Plan for operation of the pipelines. The plan has three elements to ensure the safety of the pipelines: (1) pipeline design that meets or exceeds industry standards, (2) pipeline inspections, and (3) pipeline leak detection and response. Details of this plan are presented in **Chapter 2**.

The agencies would require testing and monitoring of the permeability of the clay liner or compacted base on which the HDPE liner would be placed. If this testing showed that the material does not meet the minimum permeability requirement of $1x10^{-6}$ cm/sec, then additional clay material may need to be brought in to reduce the permeability or SMC could explore other options which would achieve a minimum permeability requirement of $1x10^{-6}$ cm/sec.

SMC would be required to monitor ground water at the Hertzler Ranch to determine effects of seepage from the impoundment to the Stillwater River. If ground water monitoring at the Hertzler Ranch indicated that nitrates or other contaminants were migrating at concentrations that would cause increases above the trigger level, specified in the MPDES permit, with in the Stillwater river, SMC would be required to conduct biological monitoring of periphyton and macroinvertebrates above and below the site twice a year.

SMC would be required to identify and collect baseline data for nearby down-gradient residential wells prior to construction of the pipeline and impoundment. If monitoring at Hertzler Ranch showed that groundwater quality exceeded nondegradation standards outside of the mixing zone then SMC would be required to replace the affected water as required under MMRA. This sampling would ensure that down-gradient water users who could potentially be effected by construction and operation of the Hertzler impoundment would be identified and compensated if their water supplies became contaminated.

SMC would be required to purchase a 250 kW backup generator to ensure pipeline leak detection sensors function during power failures or partial power outages. This measure is intended to insure the integrity of the leak detection system associated with pipeline operations and to provide 24 hour leak detection. SMC will develop a power outage contingency plan for review and approval by the agencies.

In order to insure that pipeline design and operational parameters are achieved, SMC will provide the results of pipeline wear data for agency review. In the event that resultant data suggest excessive wear, SMC will be required to collect and submit this information for agency review every six months for tailings pipelines and annually for water pipelines.

SMC, DEQ, and CNF would re-evaluate paste technology applicability for use at the Stillwater Mine after 5 years of operations in order to insure that the most applicable reasonable tailing disposal is identified and implemented at the Stillwater Mining Company. This re-evaluation will focus on economic and technologic feasibility of paste tailing disposal.

4.2 Effects on Wildlife

4.2.1 Direct and Indirect Effects

4.2.1.1 Alternative A — No Action

Under this alternative, there would be no change in the current trend and condition of wildlife resources within the project area beyond those that were previously disclosed and permitted. Neither mule deer nor bighorn sheep would experience additional disturbance to their respective winter ranges that differ from what has been previously analyzed (DSL and Forest Service 1985, 1989).

A reconnaissance conducted during 1996 determined large-scale changes have not occurred in the areal extent of habitats available for wildlife in the area or their distribution since the 1980 studies (Western Technology and Engineering, Inc. 1996c). However, small-scale changes have occurred. They include the development of the Stillwater Mine, an increase in the number of homes and cabins along the Stillwater River and West Fork Stillwater River, and improvements at public recreation sites along the Stillwater River. The increase in the number of homes and cabins (many of which appeared to be recreational or second homes) does not appear to be limited to the project area, but appears to have occurred downstream of the project area and in other drainages (Western Technology and Engineering, Inc. 1996c). These changes were predicted in the final EIS for the Stillwater Mine (DSL and Forest Service 1985).

4.2.1.2 Alternative B — Proposed Action

4.2.1.2.1 High-Interest Species

The Proposed Action would affect a total of 678 acres. These effects would include the direct disturbance of an estimated 251 acres of previously-undisturbed terrestrial wildlife habitats, until such habitats are reclaimed, in addition to the 255 acres of disturbance already permitted within the existing permit area and 68 acres of existing disturbance at the location of the proposed east side waste storage area. These 251 acres of this additional direct disturbance would be associated with the development of facilities at the Hertzler (250 acres) and Stratton (1 acre) ranches.

All the 574 total acres removed from forage production under this alternative (255 currently permitted, 68 acres currently disturbed at the location of the east side waste storage site, and 251 proposed for new disturbance) would be reclaimed following mine closure. The disturbance of these 574 acres would be considered a long-term habitat loss during the life of the project, until final site reclamation is completed. Revegetation would result in a ground cover primarily consisting of cool season grasses (see the Reclamation section). These grasses, together with planted trees and shrubs, would provide adequate habitat for most species of terrestrial wildlife. The quality of habitat would likely increase over time as plant diversity increases and as woody plants become established.

In addition to the 574 acres of long-term habitat loss, about 104 acres of habitats at the Hertzler (80 acres) and Stratton (24 acres) ranches would be converted from their present uses (grazing and gravel extraction, respectively) to SMC's LAD system. The application of adit water to this acreage would improve both areas for wildlife because both areas are disturbed to some degree. Additionally, SMC has been mining aggregate from the proposed LAD sites at Stratton Ranch, so they also offer little value to wildlife. Experience with SMC's LAD sites on the east side of the Stillwater River strongly suggests the implementation of the LAD system at both ranches would increase the quantity and quality of forage for high-interest wildlife due to fertilization effects of the LAD water, which would increase the attractiveness of the LAD sites to wildlife.

The increase in disturbance associated with this alternative would increase the opportunities for noxious plants to spread in the project area. If not controlled, these plants could affect use of the project area by wildlife. However, the spread of noxious plants is not considered a major problem because SMC is required to implement its program of controlling noxious plants throughout its permit area.

4.2.1.2.2 Stillwater Mine Site and Stratton Ranch

Bighorn Sheep. Implementation of the Proposed Action is unlikely to result in any substantial adverse direct effects to the Stillwater bighorn sheep herd (one of only 13 native herds left in Montana). Two considerations formed the primary foundation for this conclusion. First, most of the areas where the new facilities would be constructed are outside of the identified range for the Stillwater herd of bighorn sheep and facilities located near the sheep's range would be constructed on habitats that have little value to the sheep. The pipelines and facilities proposed for Stratton and Hertzler ranches would be constructed outside winter range for the Stillwater herd. Only the site proposed for the east side waste rock storage site is remotely near identified range (the sheep primarily occur on the mountainsides above the east side waste rock storage site). Additionally, habitats on the east side waste rock storage site were disturbed by previous chrome mining and most of the site is covered by chrome tailings; some portions have already been reclaimed by SMC. These tailings and partially-revegetated tailings offer little value to bighorn sheep.

Second, implementation of this alternative would not disturb the primary winter range used by the Stillwater herd. Available data suggest the remaining sheep in the herd depend on a small fraction of their former primary winter range, encompassing the 5400E portal area, toe dike, reef, river pasture, and 5900W portal area. This habitat complex may be critical for survival of the herd. Implementation of the Proposed Action would not adversely affect any of this habitat complex.

In contrast, construction of the east side waste rock storage site may indirectly affect bighorn sheep using winter range around the mine site. Overall, the habitats that would be covered by the east side waste rock storage site do not appear to be preferred by mule deer for foraging. Some of the area is covered by chromium tailings with a comparatively sparse cover of vegetation and forage values are not sufficient to support many deer. Consequently, the loss of this acreage is unlikely to displace many deer. However, those few deer that may be displaced could move more onto the bighorn sheep herd's winter range. Because mule deer and bighorn sheep avoid each other, additional mule deer foraging on the bighorn sheep's winter range may displace some of the sheep. Considering the condition of the bighorn sheep herd, competition with additional mule deer may further depress the number of bighorn in this population.

Mule Deer. Implementation of this alternative would result in limited direct and indirect effects to mule deer within the environs of the Stillwater Mine and Stratton Ranch. Construction of the east side waste rock storage site would remove about 68 acres of additional habitats for the long term. However, these habitats were heavily disturbed during historic chrome mining and much of the area has deposits of chrome tailings. Although some of these habitats currently are part of SMC's LAD system, overall habitats at the east side waste rock storage site would remove have limited value to mule deer. The direct loss of these additional 68 acres is not expected to adversely affect mule deer substantially. Following reclamation, the east side waste rock storage site, would provide better habitats than are present now.

At the Stratton Ranch, implementation of this alternative would probably result in some beneficial direct effects to mule deer. Currently, the sites proposed for SMC's LAD system at Stratton Ranch are disturbed. But with construction of the LAD system, the value of these habitats to mule deer would improve substantially. Experience with SMC's east side LAD system suggests mule deer preferentially use the habitats enhanced by the LAD over adjoining habitats. Consequently, construction of the LAD system would result in an additional 24 acres of high-value habitats becoming available for mule deer under this alternative.

Indirectly, some mule deer may be displaced during by mining activity or habitat loss at the site of the east side waste rock storage site. However, the adverse effects of this displacement are expected to be minimal. Also, following reclamation, habitats present in the east side waste rock storage site would be more attractive and of higher value to mule deer than what is there presently. Experience at the Stillwater Mine accumulated over the last 10 to 12 years suggests mule deer become accustomed to construction and displacement usually is only for a very short distance. Thus, no long-term substantive adverse effects due to displacement are expected.

Increased workforce requirements as a result of the Proposed Action alternative would increase the potential for vehicle collisions with and illegal shooting and harassment of mule deer. In addition, a temporary increase in the recreational use of the surrounding area during the construction and production phase of the project, including hunting, might occur due to the expanded human population and additional access to the project area. Continued implementation of SMC's policies against the transportation of firearms to, from, and on the mine and a continued encouragement of carpooling would minimize the potential effects of vehicle collisions and illegal shooting.

4.2.1.2.3 Hertzler Ranch & Pipeline Corridor

Development of the Hertzler Ranch area would directly remove approximately 250 acres of wildlife habitat from wildlife uses. These habitats would be lost to use by wildlife until they are reclaimed at the end of the Hertzler impoundment's useful life.

Bighorn Sheep. Proposed development of additional facilities at the Hertzler Ranch Site does not include any habitats within defined bighorn sheep winter range. The nearest winter range for bighorns is located approximately 8 miles to the south. Consequently, no direct or indirect effects due to the development of this area are anticipated.

Mule Deer. The entire Hertzler Ranch area lies within habitat designated as winter range for mule deer. About 250 acres of this habitat would be lost from construction of the external borrow areas, tailings impoundment, topsoil stockpiles, and LAD storage pond, until the site is reclaimed. This entire area consists of grassland habitats (as a result of the 1996 wild fire) that are grazed by domestic livestock. Virtually all of this acreage would be lost to use by mule deer until the area is reclaimed following closure of the Hertzler impoundment. The application of water via the LAD would increase the quantity and quality of forage on these 80 acres making them more attractive to mule deer. The loss of the 250 acres would remove about 4 percent of the winter range from the Stillwater winter range. Following reclamation of all facilities on the Hertzler Ranch, forage overall is expected to be improve over current conditions.

Indirect effects to mule deer at this site would essentially be the same as those described for the Stillwater Mine site. These include displacement from winter range, minimal avoidance of areas proximal to human activity, and the potential for increased vehicle collisions with, illegal shooting, and harassment of mule deer.

4.2.1.2.4 Impacts to Threatened or Endangered Species

A Biological Assessment (BA) and Biological Evaluation (BE) were prepared to evaluate the effects on threatened, endangered, and sensitive species. These documents are included as **Appendices F and G**, respectively. The effects on threatened and endangered species are summarized below.

Bald Eagle. Implementation of Alternative B would not be likely to adversely affect the bald eagle. Bald eagles do not occur in or near the project area. A few bald eagles are present along stretches of open water along the river and are limited primarily by the availability of prey (i.e. waterfowl and fish). Wildlife killed by vehicles along Stillwater County Road 419, particularly big game, could attract bald eagles. Eagles feeding on carrion would therefore be potentially more vulnerable to injury or death from increased vehicular traffic because of the SMC mine expansion. However, dead animals would be removed from along the roads by SMC and cooperating agencies so little risk exists to bald eagles.

Peregrine Falcon. Implementation of this alternative would be unlikely to adversely affect the peregrine falcon. Although peregrines have historically nested in and near the project area, there have been no recent records of nesting activity near the project area. Further, there is no evidence that indicates that the project area is used by the peregrine falcon, except on an occasional migratory basis.

4.2.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

4.2.1.3.1 High-Interest Species

The majority of impacts to terrestrial wildlife resources from the implementation of Alternative C would essentially be somewhat less than those discussed for Alternative B. With the implementation of Alternative C, about 644 acres of habitats would be affected, including the long-term disturbance of 540 acres. Approximately 68 acres of this 540-acres disturbance would be associated with the proposed east side waste rock storage site. Another 216 acres would be associated with the development of facilities at the Hertzler Ranch area for Alternative C. The remaining 255 acres were previously permitted for disturbance.

Bighorn Sheep. Implementation of this alternative would result in very similar effects as those that would occur under Alternative B. Directly, more disturbance of habitats for bighorn sheep would occur in association with the expansion of SMC's existing tailings impoundment. An additional 8 acres of habitats on the western margin of the existing tailings impoundment would be lost to the expansion. Although small, this loss would be a long-term, direct effect on the Stillwater herd of bighorn sheep. Indirectly, the effects of implementing this alternative would be the same as those described for Alternative B.

Mule Deer. The direct and indirect effects of implementing this alternative would be similar to those described for Alternative B. Construction of the east side waste rock storage site would result in the same direct and indirect effects. However, the expansion of the existing tailings impoundment would remove an additional 8 acres of habitats on the impoundment's western margin that would not occur under Alternative B. The long-term loss of this additional acreage is not expected to substantively affect mule deer because of the acreage's proximity to the existing impoundment.

At the Hertzler Ranch site, direct effects to mule deer would be more limited than those described for Alternative B. Only 216 acres of habitats would be removed because the impoundment proposed for construction under this alternative would be smaller than the impoundment associated with Alternative B. Consequently, only about 3 percent of the Stillwater winter range would be lost due to construction and operation of the Hertzler impoundment under Alternative C. Additionally, construction of the impoundment would be delayed 10 to 15 years, so the effects of its construction would not occur immediately.

4.2.1.3.2 Impacts to Threatened or Endangered Species

Impacts on the bald eagle and peregrine falcon would be identical to those described under Alternative B. Implementation of Alternative C would be unlikely to adversely affect either species.

4.2.1.4 Alternative D - Modified Centerline Expansion and East Side Tailings Impoundment

4.2.1.4.1 High-Interest Species

Surface disturbance under Alternative D would be the smallest of all alternatives considered. The implementation of this alternative would result direct affects to 340 acres of habitats, including the direct disturbance of 61 acres of wildlife habitats, 255 acres previously-permitted for disturbance, and 24 acres for LADs at Stratton Ranch. This includes a total of 60 acres associated with the east side impoundment and 1 acre associated with the LAD storage ponds at Stratton Ranch.

Bighorn Sheep. The direct and indirect effects of implementing this alternative would be similar to those described for Alternative C. The same 8 acres of habitats around the existing tailings impoundment would be lost with this alternative. Although about 8 fewer acres of habitats would be disturbed for the east side tailings impoundment (versus the east side waste rock storage site), this acreage is not within the primary winter range for the Stillwater herd of bighorn sheep. Indirect effects would be similar to those identified for both alternatives B and C. Thus, the direct and indirect effects of implementing this alternative would be expected to be similar to those that would occur under Alternative C.

Mule Deer. Overall, the direct and indirect effects of implementing this alternative would be minimal on mule deer. No direct or indirect effects would occur to mule deer inhabiting the Magpie or Stillwater winter ranges because no facilities would be constructed at Hertzler Ranch. The direct and indirect effects at and near the Stillwater Mine site would be similar to those described for alternatives B and C.

4.2.1.4.2 Impacts to Threatened or Endangered Species

Impacts on bald eagle and peregrine falcon would be identical to those described under alternatives B and C. Neither species would likely be adversely affected by implementation of Alternative D.

4.2.2 Cumulative Impacts on Wildlife Species

Cumulative effects to wildlife species may result from the combination of past, present, and foreseeable future human activities. Human use of the Stillwater River Valley has resulted in habitat alterations over the past century. The most drastic alterations, and those affecting the largest area, have resulted from brushland, native grassland, and various forest types cleared on low elevation private lands. The effects of mining, logging, cattle grazing, residential, and recreational activities have also had varying influences on local habitats and the wildlife that use them. Wildfires have also modified area habitats including the Storm Creek fire in 1988 and the fire on Bush Mountain and the Hertzler Ranch in the summer of 1996. Forest Service timber sales, pond development on private lands, and the above land use practices have benefitted some wildlife groups and adversely affected others.

Development of the Stillwater Mine has not caused as widespread adverse effects to wildlife in the Stillwater Valley as has human occupation and use of the valley for nonmining-related uses, such as additional housing developments and use of the valley's bottom lands for domestic livestock grazing. This trend in expanding human occupation and use of the Stillwater Valley is expected to continue. The localized effects of the alternatives considered in this analysis in conjunction with the continued expansion of human occupation and use of the Stillwater Valley would continue to cause adverse cumulative effects to wildlife in general and mule deer and other high-interest species in particular. Of the three alternatives under consideration, Alternative D would result in the smallest contribution to cumulative effects because it eliminates the construction of facilities at Hertzler Ranch.

4.2.3 Mitigation for Wildlife

The major mitigation measure for wildlife would be successful implementation of the reclamation plan. Reclamation, including removal of structures and roads, and reestablishing vegetative communities would be the best way to turn the facility sites back into wildlife habitat, but there is no guarantee that sites would remain as wildlife habitats. Reclamation activities would return disturbed areas to grazing, wildlife habitat, and recreation uses. Grazing use in the post-mining period would be reestablished with rangeland plant species, primarily grasses and legumes. Wildlife habitat requires fairly large contiguous areas of various vegetative communities and sources of water. The final grading of disturbed areas would create landforms that blend with the surrounding undisturbed topography but would supply similar diversity to the natural terrain. Final reclamation would be implemented upon completion of the project.

To offset the indirect effects on bighorn sheep of displacing mule deer from the area around the east side waste storage site, a mitigation measure has been identified. Under this mitigation SMC would cooperate with the Stillwater Valley Bighorn Sheep Management Committee to explore opportunities for habitat enhancements through the use of prescribed fire to help minimize competition for forage between bighorn sheep and mule deer.

An additional mitigation measure that could be implemented to minimize effects to wildlife would be altering the species composition of vegetation under SMC's LAD system. Although deer and other species forage on the LAD's vegetation, an adjustment in species composition may make the forage more palatable and nutritious. If additional native species can be added to the species mix without adversely affecting the uptake of nitrate, wildlife could experience a more beneficial effect than they do with the current species composition.

Although no active nests for bald eagles or peregrine falcons exist within the Stillwater Mine's immediate environs, these species might nest within the area in the future. If active nest sites were detected for bald eagles or peregrine falcons, SMC's activities would be adjusted to follow the guidelines in the respective recovery plans.

4.3 Effects on Fisheries

4.3.1 Direct and Indirect Effects

4.3.1.1 Alternative A — No Action

If the No Action Alternative is selected, no change would occur in the types or magnitude of impacts on aquatic invertebrate populations or fisheries beyond those of previously disclosed and permitted activities. Essentially, the condition of fisheries would continue as described in **Chapter 3**.

Fishing pressure would continue to increase due to the expected continued influx of people responding to the continued development of residential and vacation homes in the Stillwater Valley. However, SMC's operations would end in 2003, reducing the work force by about 655 people, which would result in a loss of at least some of this number of people from the local population. This loss would likely decrease fishing pressure.

4.3.1.2 Alternative B — Proposed Action

Potential effects the Proposed Action could have on the fishery and other aquatic life include stream sedimentation, release of chemicals/metals from a pipeline rupture or mine operations, nutrient enrichment, alteration of water quantity, and increased fishing pressure, and channel modification. These potential effects are described below.

4.3.1.2.1 Sedimentation

The primary fisheries-related sediment concern is the potential for the sediment to reduce available macroinvertebrate and spawning habitat by filling interstitial spaces within the gravel substrates. The potential for sedimentation of the Stillwater River is discussed in **Section 4.1 — Water Quantity and Quality**. The analysis determined that sedimentation loading is unlikely to occur. Furthermore, the hydrologic dynamics of the river system would likely remove any sediments from these habitats during high flows, resulting in no long-term impact to fish, their spawning grounds, or their food source.

4.3.1.2.2 Potential Chemical/Metals Release

There is a very small potential for a pipeline rupture, which could cause an increase in total dissolved solids and nitrates in the Stillwater River or the West Fork of the Stillwater River. However, the Proposed Action includes several measures to ensure that the potential of a breach is very low and that the water quality effect of a spill is limited. Additionally, SMC has prepared a Pipeline Monitoring and Spill Contingency Plan for operation of the pipelines.

If a breach occurred at a crossing of the West Fork of the Stillwater River or where the pipeline is adjacent to the Stillwater River, there would be short-term effects to the stream. These effects could include a short-term increase in flow, sediment, total suspended solids, total dissolved solids, sulfates, and nitrates. Although specific effects to the fishery and other aquatic life cannot be fully identified here, the effects would be temporary and, most likely, minor. Furthermore, fish can tolerate relatively high concentrations of suspended solids for a limited time. The increase in nitrates would be a temporary, one-time, load and would not have any long-term effect on enrichment.

Implementation of the Proposed Action would likely have similar results to the current operation at the existing tailings impoundment (annual monitoring has identified no adverse effects to the Stillwater River). The proposed Hertzler facility is much farther from the Stillwater River than the existing tailings impoundment resulting in a much lower likelihood of impacts to the Stillwater River from this facility.

4.3.1.2.3 Nutrient Enrichment

Water quality monitoring data indicate current mine operations have mildly increased nitrate concentrations in the Stillwater River. This is apparently caused by the leaching of nitrates into the ground water and, thereby, into the surface water. This increase, up to 0.2 mg/l, is not likely to be substantially altering primary production, especially because nitrogen was found not to be a limiting factor for algal growth. Total inorganic nitrogen concentrations greater than 0.5 mg/L are often associated with eutrophic conditions and amounts greater than 1.5 mg/L with hypereutrophic (very high productivity) conditions (Wetzel, 1982).

The analysis in the **Section 4.1 — Water Quality and Quantity** suggests the Proposed Action would not likely increase nitrate loading over what is currently occurring. Moreover, the analysis suggests that the nitrate load may be even less than at present for the following reasons: 1) the ground water must migrate 1,500 feet south or an average of 7,500 feet east along the Hertzler Valley before reaching the river; 2) the addition of 80 more acres of LAD facilities would allow much greater disposal of nitrates; and, 3) the nitrogen-eliminating ABCs may eventually treat up to 500 g.p.m. of the adit water that is currently disposed of through the LAD system.

Nitrate concentrations in the Stillwater River following mixing during a worst-case scenario (10-year, 7-day low flow) would be 0.517 mg/L nitrate-nitrogen. Actual nitrate concentrations are anticipated to be much lower due to uptake by vegetation and evapotranspiration, and higher flow in the Stillwater River. Furthermore, because nitrogen is not the limiting nutrient in the Stillwater River, the potential increase of only nitrate to the system should not influence the growth of algae in the river.

Selection of the Proposed Action could potentially affect phosphate loading into the Stillwater River by extending the Anoxic Biotreatment Cells (ABCs) period of discharge past the current end (2003) for about 30 years. ABCs, when in full operation sometime in 1998, are anticipated to discharge 0.1 mg/L of phosphate. Because phosphorus was determined to be a limiting nutrient in the system, there is a slight potential that this could increase primary production in the system.

However, the dilution factor after entering the Stillwater River is approximately 100x, which translates to an average of a 0.001 mg/L increase of phosphate into the Stillwater River. This amount of increase would not likely increase algal growth.

4.3.1.2.4 Fishing Pressure

Implementation of the Proposed Action would most likely increase fishing pressure on the Stillwater River Fishery. This is because SMC's current employment of 655 people would end in 2003 under the No Action, but would be increased to approximately 700 employees and continue for an estimated 30 more years. Accordingly, this would also maintain the fishing pressure at, or slightly higher than, current levels. Increased fishing pressure can influence fish populations, species composition, and size class distribution. However, MDFWP has imposed more stringent fishing regulations including reducing the fish limit from five to two. As discussed in **Chapter 3**, this management plan appears to be working and, as a result, the continuation of (and slight increase in) employees numbers should not adversely affect the fishery.

4.3.1.2.5 Water Quantity

The Proposed Action would increase the number of LAD sites and percolation ponds, resulting in a further increase in ground water recharge. Estimated effect on surface water flows downstream of the Hertzler facility was determined to be immeasurable. This amount of an increase would likely have negligible effects on fish and other aquatic life in the Stillwater River.

4.3.1.2.6 Channel Modifications

SMC is planning to install a diffuser (a 50-foot long, 6-inch diameter pipe) across the Stillwater River east of the existing tailings impoundment. The river is 80 feet wide at this location. During the 7-day, 10-year (Q7–10) low flow, fish may have to swim around the end of the pipe to pass. DEQ, CNF, and USFWS do not believe the diffuser would effect or be a barrier to migratory fish or aquatic life. Burial of the slurry and recycled water pipelines would change the West Fork Stillwater River's channel substrate over the narrow trench briefly, but natural flows would reestablish the substrate within a year.

4.3.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

The effects of implementing this alternative would be similar to those described for the Proposed Action. Although minor differences in effects to water quality and quantity (as described in **Section 4.1**) would occur, these differences are unlikely to express themselves in the Stillwater River fisheries.

4.3.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

The effects of implementing this alternative would be similar to those described for the Proposed Action and Alternative B. Minor differences in effects to water quality and quantity (as described in **Section 4.1**) would occur because no development would occur at Hertzler Ranch. Also, no pipelines would cross the West Fork of the Stillwater River. However, the same tailings pipelines would cross the Stillwater River at the Stillwater Mine. Thus, the low potential for a spill from the pipelines would still exist under this alternative, just in a different location. Although the locations of many of the facilities would change under this alternative, same relative effects identified for alternatives B and C would occur under this alternative express themselves similarly in the Stillwater River fisheries.

4.3.2 Cumulative Effects on Fisheries

Increasing development in the Stillwater Valley is probably the most potentially adverse cumulative impact to the Stillwater River's fishery. This increased development will cumulatively add to the mine-related population in the area, resulting in additional increases in fishing pressure. Increased fishing pressure could directly affect the fishery by lowering populations or altering size-class composition. Additionally, increased fishing pressure could affect the fishery by increased stream-bank traffic (causing reduced bank stability and erosion) and wading-disturbance of spawning grounds.

Furthermore, the current and expected subdivisions within the Stillwater River's floodplain would increase the number of septic systems and, therefore, cumulatively increase the potential for enrichment of the Stillwater River. Current agricultural application of fertilizers and riparian cattle grazing would also cumulatively increase nutrients to the Stillwater River. Historical mining projects (e.g., old tailing and roads) could cumulatively affect sediment and chemical loading in the Stillwater River. However, as discussed above, the expansion is not expected to have any long-term effects from increased sediment or chemical levels.

4.3.3 Mitigation

SMC has committed to several measures that would mitigate for potential impacts to the fishery and other aquatic life. These measures include: 1) ground water monitoring in several wells upgradient of the Stillwater River, serving as an early warning system of degraded water quality that could affect the fishery; 2) surface water monitoring at several sites within the Stillwater River to enable determination of impacts; 3) voluntary implementation of ABC's in an attempt to further reduce nitrates; 4) using creeping meadow foxtail in the LAD areas to assimilate nitrogen compounds; 5) implementation of a state-approved macroinvertebrate and periphyton biomonitoring program; and, 6) continuation of sediment control measures and their Stormwater Pollution Prevention Plan approved by the DEQ and CNF. Collectively, these mitigation measures would reasonably assure that the proposed mine expansion would not affect the fishery and other aquatic life in the Stillwater River.

4.4 Air Quality Effects

4.4.1 Direct and Indirect Effects

4.4.1.1 Alternative A — No Action

If an action alternative is not implemented, SMC could continue to operate until about 2003. SMC could increase their daily production to a nominal level of 2,000 tpd (maximum peaks of 3,500 tpd) under the conditions of its existing permit. Therefore, PM_{10} emissions could still increase over the present values associated with a maximum production rate of 2,000 tpd. However, the short-term PM_{10} emissions associated with the pipeline and Hertzler Ranch construction activities would not occur. The air quality analysis for the permitted activities (DEQ 1992) showed no air quality exceedances would occur at a production rate of 3,500 tpd.

4.4.1.2 Alternative B — Proposed Action

4.4.1.2.1 Construction Effects

Short-term air quality impacts would occur during the construction of the proposed east side waste rock storage site, the 7.8 mile-long tailings and water pipelines, and the Hertzler Ranch tailings impoundment. Fugitive dust would be generated during the clearing and excavation of the pipeline right-of-way along Stillwater County roads 419 and 420 and at the Hertzler Ranch tailings impoundment. Additional dust would be generated on the exposed pipeline right-of-way until reclamation is complete. Short-term gaseous exhaust emissions (nitrogen oxides, sulfur dioxide, carbon monoxide and particulates) would also be generated from the operation of construction vehicles and equipment. Vehicle and construction equipment emissions, as well as construction-related fugitive dust, would cease when construction is finished.

4.4.1.2.2 Operational Effects

PM_{10} Emissions SMC has submitted an application to the Air and Waste Management Bureau (AWMB) for an alteration to its existing air quality permit number 2549-07. The emissions levels in the following discussion are taken from the SMC application. Under the requested permit modification, SMC could increase production to 1,825,000 tpy with a maximum of 5,000 tpd. This represents a level of production in excess of what SMC expects to reach anytime in the near future, but by permitting for a higher production level SMC can vary its current levels of production in the short-term without violating air quality standards. As part of the application requirement, SMC submitted modeling results for PM_{10} air quality impacts based upon the PM_{10} emissions generated by a maximum annual production of 1,825,000 tons. As SMC presented in its air quality permit application, the PM_{10} emissions that would be generated at the maximum production scenario are summarized in **Table 4–1**. The table lists the control measures and corresponding estimated control efficiency for each activity. SMC has to comply with all emissions limitations, but in some cases, not all control measures are required to achieve compliance. Under the current air quality permit, the PM_{10} emissions expected for a daily maximum production of 3,500 tpd would be 90.56 tpy (DEQ 1992). Therefore, emissions under the Proposed Action (99.51 tpy) could represent an increase of 8.95 tpy (9.9 percent) over the currently-permitted values.

Gaseous Emissions Additional air pollutant emissions would occur from blasting, operation of diesel-fueled equipment and vehicles, propane fuel use, and vehicles using unleaded gasoline. As SMC presented in its air quality permit application, **Table 4–2** summarizes the annual emissions that would occur under SMC's proposed maximum operational scenario.

Air Quality Impacts To evaluate the effects of the proposed production increase on air quality, SMC performed an air quality dispersion modeling analysis. The All Terrain Dispersion Model (ATDM), an EPA-approved dispersion model for multiple sources and elevated terrain, such as the area surrounding the Stillwater Mine, was used to evaluate the ambient air concentrations of PM_{10}. The meteorological data used in the modeling were collected on site by SMC over the period of February 1995 through January 1996. Ambient air concentrations were calculated at locations on SMC's permit boundary to determine the maximum 24-hour and average annual concentrations.

The results of the modeling suggest ambient PM_{10} concentrations would increase over present levels, but would still be well below the NAAQS. The second-highest 24-hour concentration beyond the permit boundary would be 74 $\mu g/m^3$. When these modeled values are added to the average background value of 22 $\mu g/m^3$, the maximum impact beyond the permit boundary would be 96 $\mu g/m^3$, a value less than 67 percent of the 24-hour NAAQS. The maximum

Table 4–1 SMC PM_{10} Annual Emission for Maximum Operating Scenario

Activity	Uncontrolled Emissions (tpy)	Control Measures	Control Efficiency (percent)	Controlled Emissions (tpy)
Topsoil Stockpiles	0.06	Revegetation	75	0.02
Disturbed Areas	4.02	Revegetation (42 percent)	30	2.33
Coarse Ore Stockpile	0.02	None	0	0.02
Ventilation Exhaust	50.40	None	0	50.40
Dumping Coarse Ore to Conveyor System	5.48	Minimize fall distance	0	5.48
Conveyor System Transfer Points	38.32	Covered conveyors	90	3.83
Load and Dump Coarse Ore into Mill Grizzly	5.48	Minimize fall distance	0	5.48
Haul Roads — Ore to Mill Grizzly	0.32	None	0	0.32
Haul Roads — Ore from East Side	3.78	Chemical stabilizer, water as necessary	90	0.38
Load and Dump to Coarse Ore Stockpile	0.55	Minimize fall distance	0	0.55
Haul Roads — Ore to Stockpile from West	0.56	None	0	0.56
Load and Dump Waste Rock	13.09	Minimize fall distance	0	13.09
Haul Roads — Waste Rock to Stockpile	27.39	Chemical stabilizer (east side)	90	8.22
		water as necessary (west side)	50	
Light Duty Vehicle Traffic	21.31	Chemical stabilizer, water as necessary	90	2.03
Diesel Exhaust	4.61	Operation	0	4.61
Concentrate Dryer	2.19	Wet scrubber	*	2.19
Annual Total	177.58			99.51

Note: Uncontrolled emissions for concentrate dryer are actually controlled emissions. Chemical stabilizer is magnesium chloride.
Source: SMC 1996

annual average concentration was 18 $\mu g/m^3$. When added to the annual average background concentration of 7 $\mu g/m^3$, the maximum annual average would be 25 $\mu g/m^3$, a value 50 percent of the NAAQS. Based on the modeling results submitted by SMC in its air quality permit application, no exceedances of federal or State NAAQS should occur, even if SMC reaches a maximum production of 5,000 tpd or 1,825,000 tpy.

4.4.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Under this alternative, impacts would be similar to Alternative B. Because the Hertzler Ranch tailings impoundment would be 34 acres smaller, the fugitive

Table 4–2 SMC Gaseous Annual Emissions for Maximum Operating Scenario

	Pollutant		
Activity	Carbon Monoxide (tons/year)	Sulfur Dioxide (tons/year)	Nitrogen Oxides (tons/year)
Blasting	140.70	4.28	35.70
Diesel Exhaust (equipment and vehicles)	108.60	22.07	260.36
Propane fuel	0.72	0	2.88
Vehicle Exhaust (unleaded gasoline)	102.96	0.14	4.79
Total	352.98	26.49	303.73

Source: SMC 1996a

dust generated from the construction activities would be slightly less. The expansion of the current tailings impoundment from 60 to 68 acres would produce slightly more fugitive dust emissions during construction than Alternative B.

4.4.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Under this alternative, neither the Hertzler Ranch tailings impoundment nor the pipeline would be constructed. Therefore, the construction-related fugitive dust and vehicle emissions would not occur. However, construction-related emissions would occur during the construction of the East Stillwater impoundment. Operational air quality impacts would be similar to Alternative B.

4.4.2 Cumulative Effects on Air Quality

Cumulative effects on air resources would be represented by the project emissions. As was demonstrated above, the Proposed Action would not have substantive emissions and would not violate any air quality standards. Other projects in the cumulative effects study area include the Forest Service Projects of Concern and residential development in the Stillwater Valley. As none of the Forest Service Projects of Concern and none of the proposed residential developments would generate major emissions, the analysis for cumulative effects indicates that project emissions would be representative of the incremental increase in air emissions in the cumulative effects area.

4.4.3 Mitigation Measures

Control measures taken by SMC for each activity are listed in **Table 4–1**. In addition, when operating the two tailings impoundments, SMC shall maintain compliance with applicable emission limitations, as defined in the Preliminary Determination of the Air Quality Permit Application (see **Appendix E**). If necessary, SMC would use mitigative measures to control wind-blown emission (such as keeping the surface of both impoundments wet to minimize dust generation). The agencies also would require that when one tailings impoundment was out of service for any reason, SMC would provide supplemental water to wet the surface of the out-of-service impoundment to minimize dust generation.

4.5 Social and Economic Effects

4.5.1 Direct and Indirect Effects

4.5.1.1 Alternative A — No Action

Selection of the No Action alternative would not meet the purpose and need for the project as described in Chapter 1. SMC's need for additional capacity for storage of waste rock and tailings necessary for production to continue beyond 2003 would not be met. Therefore, the lifespan of the mine would likely be shortened, unless another waste management alternative is developed. The employment and income generated by the extension of mining would be foregone and the additional demands on housing and community services would be avoided. The local economy would probably continue to grow, but at a slower rate. This growth would likely occur as a result of other economic development activities being promoted by Stillwater County.

4.5.1.2 All Action Alternatives — Alternatives B, C, and D

4.5.1.2.1 Population

SMC would hire about 45 additional people (a combination of permanent employees and contractors) under any of the action alternatives. Projections suggest about 60 percent (27 employees if all 45 additional people are permanent employees) would originate from outside Stillwater County and would migrate into the area. SMC's employment monitoring reports indicate an average of 1.86 dependents would accompany each in-migrating employee.

Based on workforce surveys and Impact Plan Monitoring Reports, SMC has estimated the distribution of in-migrating employees and their dependants. These projections are shown on **Table 4–3**. Because SMC plans to develop housing for its employees and other home seekers, it is projected once the expansion of the mine is completed, about 20 percent of the future workforce and their dependents would reside in Columbus. Additionally, the community of Absarokee has grown in response to the population increase resulting from the SMC's mineral development. SMC estimates the amenities of the community are expected to attract 35 percent of in-migrating population. Also, due to the fact that travel from the Stillwater Mine to Red Lodge has improved, it is assumed that about 8 percent of the in-migrating population would reside in Carbon County (Richard 1997). SMC has projected that the 45 in-migrating workers and their families, as well as persons seeking secondary employment, would increase the population of Stillwater County by about 456 persons.

Table 4–3 SMC's Population Effects

Parameter	12/31/97 Level	Projected Addition	Total
Total In-migrating Population	807	456	1,263
In-migrating Elementary Students	169	51	220
In-migrating High School Students	44	37	81

Source: SMC 1998

4.5.1.2.2 Employment

Employment effects of the Proposed Action in Stillwater County can be categorized into direct, indirect, and induced effects. Direct employment effects are classified as the actual number of new employees SMC would require for implementation of the proposed project. Indirect economic effects refer to the effects on support industries that provide services to the mining industry. Induced economic effects occur as a result of employees and businesses spending income within the area.

Full implementation of the Proposed Action would result in an increase in employment at the mine to 700 workers, including 50 contractors for the first four years of the expansion. These contractors would be housed in SMC's facilities near Nye, without families. These employees are not included in calculations of secondary employment of dependants. This projected level of employment represents an increase of 240 employees from the projected workforce of 460 in the 1988 Hard Rock Impact Plan Amendment. The total estimated employment, including secondary employment, is shown on **Table 4–4**. The existing Hard Rock Impact Plan requires an amendment whenever the mine workforce exceeds a threshold of 15 percent above the employment level projected in the 1988 Plan (525 employees). Therefore, an amendment to the Hard Rock Impact Plan is being prepared concurrently with this EIS.

It is probable that indirect or secondary employment would be created as a result of additional direct employment. Most of these secondary employment effects would occur in the motor freight, wholesale trade, and maintenance and repair facilities. Induced impacts would also occur. A minor increase in local employment in the retail trade and service sectors can be expected. Currently, it is estimated that about 24 workers in the secondary employment category have in-migrated to Stillwater County to provide goods and services to SMC's facilities. With the proposed project, an additional 14 in-migrating employees would be expected. In-migrating secondary employment is estimated at approximately 7.5 percent of in-migrating mineral employment (SMC 1998).

Table 4–4 SMC Employment

Parameter	Dec. 1997 Level	Additional Employment	Total
Mineral Development Employment/Contractors	655	45 (combination of permanent employees and contractors)	700 (650 permanent employees plus 50 contractors)
In-migrating Mineral Employment/Contractors	312	128 (combination of permanent employees and contractors)	440 (390 permanent employees plus 50 contractors)
In-migrating Secondary Employment	20	14	34
Total In-migrating Employment	332	142	424 permanent employees plus 50 contractors

Source: SMC 1998

4.5.1.2.3 Local Economy

The expansion of the Stillwater Mine would result in an increase in the importance of the mining sector in the local economy. The demand for commodities, such as platinum and palladium, is typically derived from the consumer demand for final goods containing those metals. An increased dependance on mining in Stillwater County creates a potential for economic down cycles due to fluctuations in the national and international markets for final products containing platinum and palladium. The lack of economic diversity in the county (see **Chapter 3**) has the potential to increase Stillwater County's vulnerability to fluctuations as a result of heavy reliance on one sector. Fluctuations in the markets for those products affect not just the mining sector, but also the businesses that supply goods and services to the mine and the retail trade and service establishments where employees spend their income.

While a positive market for platinum and palladium can have positive impacts on the economy of Stillwater County, cutbacks in production due to changes in the markets for these metals could result in a need to reduce output levels and changes in the estimated lifespan of the mine. Depending on the duration and magnitude of actions and subsequent production cutbacks, economic impacts could be minor to severe. Layoffs of sufficient length and severity could eventually result in out-migration and associated impacts on real estate values, school enrollments, secondary employment, and social services.

4.5.1.2.4 Property Tax Base

The proposed project would result in an increase in taxable value of the Stillwater Mine, including the value of property, equipment, and gross proceeds. It is anticipated that the overall percentage of SMC's taxable valuation compared to Stillwater County's total taxable valuation would increase. Currently, SMC's taxable valuation represents about 19 percent of the total county-wide valuation. SMC's projections indicate that beginning in 1999, this percentage would increase to 24 percent, followed by an increase to 26 percent by year 2000.

Estimates of taxable valuation depend upon a number of assumptions and are, therefore, subject to change. Variables, such as the current market price of platinum and palladium, machinery and equipment costs, and the value of industrial improvements, are all factors that affect taxable valuation.

SMC paid $1.8 million in property taxes in 1995–96 based on a taxable valuation of about $4.9 million (Richard 1997). The construction of the Proposed Action would raise SMC's valuation to a total of $8 million. With implementation of the Proposed Action, the tax payments to Stillwater County would increase proportionately.

4.5.1.2.5 Housing

It is estimated that 424 persons would in-migrate to Stillwater County as a result of this project and would result in the creation of about 162 new households. **Table 4–5** presents the anticipated distribution of population and a probable pattern of settlement of in-migrating workers in Stillwater County, including that which has occurred since the 1988 Hard Rock Plan was approved as well as the estimated population influx predicted under the proposed mine expansion. It is projected that about 20 percent of the in-migrating population would seek housing in the town of Columbus.

Previous reports have noted constraints in Stillwater County's housing market and the escalating rental market. Several factors may provide some relief to in-migrating workers attempting to enter Stillwater County's housing market. First, the projected distribution of in-migrating employees would spread out housing impacts and avoid any substantial concentrations of home seekers, which would tend to make existing deficiencies worse. Secondly, as a result of a relatively "tight" housing and rental market in the County, SMC would make housing available to its employees, as needed, in the Columbus area. This action would lead to a higher percentage of employees successfully finding housing and subsequently residing in Columbus.

Table 4–5 Distribution of Impact Employees and Population

	1988 Plan	Levels: 12-31-95 Report	Levels: 12-31-97 Report	Projected Totals After Mine Expansion	Change from 1988 Plan Through Expansion	Percent of 1988 Plan	Projected Percent After Mine Expansion
Impact Employment	320	327	282	474	154	100	100
Columbus	31	68	80	100	69	10	21
Rural Stillwater County	100	81	80	135	35	31	28
Absarokee	177	101	122	141	-36	55	30
Stillwater County Total	308	250	282	376	68	96	79
Other	12	77		98	121	4	21
Impact Population	830	935	807	1,263	433	100	100
Columbus	80	194	229	286	206	10	23
Rural Stillwater County	260	232	229	294	34	31	23
Absarokee	460	289	349	403	-57	55	32
Stillwater County Total	800	715	807	983	183	96	78
Other	30	220	0	280	250	4	22

Source: SMC 1998

About 34 in-migrating elementary school students are expected to accompany new workers. Distribution of elementary and high school students is assumed to reflect the distribution of mineral employees. Consequently, incoming students are expected to attend schools in the Columbus, Absarokee, Fishtail, Nye, and Red Lodge districts. **Table 4–6** shows the expected distribution of students.

4.5.1.2.6 Property Values

An issue of concern expressed during scoping pertained to the project's potential to result in a reduction in property values near the mine and Hertzler Ranch. This issue has been a concern for all earlier proposals for mine expansion or operational changes submitted by SMC. For this concern to be considered significant, proposed project features would have to be shown to cause a direct reduction in the values of surrounding properties. Previous environmental documents used a 15 percent value reduction as a threshold of significance.

The assumption that construction of additional mine facilities would result in a direct reduction in property values is ambiguous and the cause-and-effect relationship between the mine's facilities and property values is difficult to analyze. Mining activities might lead to an eventual decrease in property values or selling prices if the following environmental factors were present in the long-term: visual impairment, noise, air quality impacts (including dust or smoke), or deteriorated water quality. For the potential for property value reduction to be present, one or more of these environmental impacts would have to be experienced on several nearby properties to a significant level. For this project, mitigation requirements are incorporated into the project's design so significant effects would not occur. The potential for property values to be reduced by 15 percent or more as a result of significant environmental effects is considered low.

In the absence of significant environmental effects associated with the proposed project, historical and recent trends in real estate can be evaluated to determine whether or not previous mining activities have resulted in reduced property values. An analysis of this issue was done in 1990 by Greystone (unpublished) and was presented in **Chapter 3**. That analysis was updated as part of this EIS. It must be noted that the 1990 analysis did not look at individual properties, but rather looked at trends in the Stillwater River valley.

The subdivisions considered were Cathedral Mountain Ranch, Rainbow Ranch, Whited subdivision, Buffalo Jump, and lots located on the Stillwater River near the proposed Hertzler Ranch tailings impoundment. In Cathedral Mountain Ranch, smaller lots, which sold for an average of $7,500 in 1984, increased to $9,500 during between 1987 and 1989. Larger lots, which sold for an average of $10,000 to $12,000 in 1984, increased to $20,000 in 1989. Currently, lot prices are fairly consistent with 1989 prices. However, access to some lots is difficult and many of the homes are used in the summer months only. At the Rainbow

Table 4–6 Distribution of SMC Elementary and High School Students

	1988 Plan	Levels: 12-31-96 Report	Levels: 12-31-97 Report	Projected Totals After Mine Expansion	Change from 1988 Plan Through Expansion	Percent: 1988 Plan	Projected Percent after Mine Expansion
Elementary Students	186	164	169	220	34	100	100
Columbus	22	24	70	77	55	12	35
Absarokee	110	90	86	94	-16	59	43
Fishtail	33	6	5	5	-28	18	2
Nye	18	1	8	8	-10	10	4
Other	2	43	5	37	34	2	17
High School Students	82	82	44	81	-1	100	100
Columbus	12	18	14	23	11	15	28
Absarokee	68	39	30	35	-33	83	43
Other	2	19	0	23	21	2	28

Source: SMC 1998

Ranch and Whited subdivisions, prices remained fairly constant between 1984 and 1989, but listing periods increased somewhat. Current (1997) lot prices at Rainbow Ranch are fairly consistent with earlier prices and some new homes have been built. Home prices at the Whited subdivision have increased from previous years and there is a notable demand for homes in this area by mine workers seeking affordable housing outside of nearby Absarokee.

Lots down-valley from Nye with river frontage experienced slight increases in selling prices between 1984 and 1990, with prices for 1.3-acre to 1.5-acre lots averaging about $20,000. Current selling prices for these same lots have increased to as much as $45,000 to $50,000. At Buffalo Jump, river front lots remained constant in price while lots in more remote areas of the development decreased slightly in value between 1984 and 1989 ($10,000 to $12,000 in 1984 down to $10,000 in 1989). Current prices are estimated at $30,000 to $35,000 per lot.

Finally, areas across the river south of the proposed Hertzler Ranch site had previously been selling for around $30,000 (5-acre lots). These same lots are currently selling for as much as $65,000 to $85,000 (river front property) and these lots have been advertised for sale in wilderness magazines (Ferster 1997).

The supply of residential lots appears plentiful in the area. Other plat maps filed with Stillwater County include the Lone Feather Subdivision, Delger Subdivision, and Spreading Winge Ranch. The Lone Feather Subdivision southwest of the Stillwater bridge and Stillwater County Road 419 has 39 sites, 17 of which are on the river. The Delger Subdivision plat in Section 14 west of Dean contains 22 lots. The Spreading Winge Ranch plat located two miles east of Nye comprises 61 lots with 27 on the river. Finally, nine lots are platted in Section 13 near Dean, Montana.

The analysis done in 1990 and this current analysis suggest that historical mine development activities have not had a significant detrimental effects on property values in the upper Stillwater River Valley. However, DEQ and CNF recognize that individual properties within close proximity to the mine may have realized a downward value trend. On the contrary, due to an increased popularity in rural properties with significant aesthetic values, there has been increased demand for land and homes within the Stillwater Valley. As long as substantial environmental effects associated with the proposed project are mitigated to less that significant levels, it is expected that this trend will continue and that the proposed project would not result in a reduction in local property values.

Because no land value impacts appear to have been realized from initial development of the Stillwater Mine, none are anticipated to occur as a result of developing additional facilities. The proposed expansion represents only an incremental change to an existing use, whereas the original mine development was essentially the reestablishment of a dormant historic land use.

The proposed project is compatible with current zoning of the lands involved in the alternatives. However, under the provisions of Montana Code Ann § 76–2–101 et. seq. (1995), a zoning petition was submitted to the Stillwater County Commissioners on April 1, 1997, revised and resubmitted on May 18, 1997. Subsequently, affidavits were obtained for some signers to verify their signatures and various legal issues were addressed (February 5, 1998). The petition requested that a planning and zoning district be established, which encompasses about 7 miles of the Stillwater River (a downstream path from Nye to Riddle Cliff). This proposed zoning district is called the "Stillwater River Corridor," and contains more than 13,000 acres, including a portion of the former Hertzler Ranch where the proposed tailings impoundment would be located. The petition encourages agriculture, residential, recreational and neighborhood commercial land uses: and it excludes industrial, manufacturing, and waste disposal uses, such as disposal or storage of mining waste and tailings.

The zoning petition was formally accepted with the necessary signatures and, pursuant to Montana State Code, the Stillwater River Corridor Planning and Zoning District was formed recently. Additionally, a zoning commission has also been established. To date, the commission has not approved any formal land use or development density changes for the corridor, which includes a portion of the Hertzler Ranch site. Until the time when such zoning changes are formally approved by the commission, no potential consequences from implementation of the action alternatives can be identified.

4.5.1.2.7 Community Services

As stated earlier, about 34 in-migrating elementary school students are expected to accompany new workers. Distribution of elementary and high school students is assumed to reflect the distribution of mineral employees, and incoming students are expected to attend schools in the Columbus, Absarokee, Fishtail, Nye, and Red Lodge districts. The projected distribution of students is shown on **Table 4–5**.

It is not expected that the population growth resulting from in-migrating workers required for project implementation would adversely affect the capability to provide other services, such as fire protection, law enforcement, emergency services, or medical care. The increase of 45 new permanent employees in Stillwater County, distributed over two to four communities, would not place an unacceptable burden on community services. The discussion of existing levels of service, staff, and workload at various agencies in the county (see **Section 3.5.7** in Chapter 3), indicates that the new employees could be accommodated under existing conditions.

The Columbus sewer system is in need of expansion and upgrading. Additionally, the domestic water distribution lines in the city need upgrading and retrofitting. To some degree, these deficiencies would be made worse by the incoming population who chose to live in the Columbus area.

The impact analysis performed for community services (as well as employment, transportation, and other elements) was used by SMC to amend its Hard Rock Mining Impact Plan. The Hard Rock Mining Impact Plan and the EIS use the same basic information. The Hard Rock Impact Plan was approved during September 1998.

4.5.1.2.8 Land Use Management and Planning

NEPA implementing regulations require discussion of possible conflicts with federal, regional, state, and local land use plans (40 CFR 1502.16(c)). All action alternatives would be consistent with the CNF's Forest Plan, which provides for multiple land uses. All action alternatives would also be consistent with the Stillwater County Master Plan of Land Use. Mineral extraction industries are an accepted use of areas currently unzoned or provisionally zoned as agriculture.

4.5.2 Cumulative Effects on Socioeconomics

The nature, scale, and timing of related development activities on the Beartooth Ranger District suggest that cumulative impacts on employment, population, housing, public facilities and services would not be appreciably different than the effects of project activities alone. Several of the Forest Service Projects of Concern involve improvement in access and camping facilities. To the extent that these activities are designed to improve the recreational experience of forest visitors, a subsequent increase in visitation from outside the County may occur. This increase would likely result in spending in local businesses and services, and subsequent contribution to the local economy. Additional population growth in the area is possible as a result of various in-migration factors and could result in additional demand for land uses other than mining and agriculture, including residential developments and recreational developments.

4.6 Tailings Impoundment Stability

4.6.1 Direct and Indirect Effects

4.6.1.1 Alternative A — No Action

If the No Action alternative was selected, no changes would occur to the facilities comprising SMC's Stillwater Mine. The existing tailings impoundment would continue to be operated as originally designed. This design exceeded the minimum safety factors of 1.5 and 1.0 for the static and pseudostatic cases, respectively. All analyses of minimum safety factors were based on a Maximum Credible Earthquake of magnitude 7.0 along the Emigrant fault.

4.6.1.2 Alternative B — Proposed Action

4.6.1.2.1 Stillwater Mine Site

Under this alternative, no changes would occur to the existing tailings impoundment at the Stillwater Mine. Thus, SMC would continue to operate the impoundment as originally designed. This design exceeded the minimum safety factors of 1.5 and 1.0 for the static and pseudostatic cases, respectively.

Analyses of the proposed east side waste storage site were conducted to examine stability under both static and pseudostatic (during a seismic event) loading conditions. The analyses were conducted using the computer program SLOPE/W. Minimum factors of safety of 2.5 and 1.9 were computed for static and pseudostatic conditions, respectively (Brouwer 1998). These figures, exceeded the standard minimum acceptable factor of safety of 1.5 and 1.0, respectively.

4.6.1.2 Hertzler Ranch

Analyses of the proposed impoundment were carried out to examine stability under both static and pseudostatic (during a seismic event) loading conditions. The analyses were conducted using the computer program SLOPE/W, which obtains the minimum factor of safety from a number of potential slip surfaces (SMC 1996b). Factors of safety of 1.5 for static conditions and 1.0 for pseudostatic conditions are generally considered the minimum acceptable values. A minimum pseudostatic factor of safety of 1.0 is generally considered appropriate because of the low probability of occurrence of the design seismic event.

Embankment stability under seismic (pseudostatic) loading was analyzed using a seismic coefficient recommended by the U.S. Army Corps of Engineers for seismic zone 3, the zone in which the Hertzler site is located. A material strength parameter of zero was conservatively assigned to the tailings (meaning the tailings were assumed to have no strength to resist a seismic event). Average effective friction angles were assigned to the borrow material in the embankment based on laboratory triaxial sheer testing on representative samples collected during the 1996 site investigation program (Knight Piésold 1996).

Minimum factors of safety of 1.7 and 1.3 were computed for static and pseudostatic conditions respectively (SMC 1996b). These figures exceed the standard minimum acceptable factor of safety of 1.5 and 1.0, respectively.

Site-specific variations in geotechnical characteristics between the site of the existing tailings impoundment and the site of the proposed Hertzler tailings impoundment suggest the performance of the two impoundments during an earthquake event would differ somewhat. Earthquake engineering research in the last 20 years has determined that site-specific soil conditions can result in variations in surface ground motions from the same earthquake event, due to the manner in which the subsurface materials propagate seismic waves. The thin soil cover at the existing tailings dam site would result in earthquake ground motions at the base of the dam that are expected to be essentially the same as the bedrock ground motions. In contrast, the deeper, stiff soil profile at the Hertzler site has the potential to dampen the bedrock ground motions somewhat, resulting in potentially-lower forces applied to the base of the dam. Thus, the proposed Hertzler tailings impoundment would be expected to experience less ground motion during an earthquake event.

Although the modeling suggests the Hertzler tailings impoundment exceeds minimum acceptable factors of safety, insufficient data exist regarding the strength and consistency of the Colorado Shale units underlying the Hertzler site to base a meaningful analysis of the potential for a deep bedrock failure of the entire site toward the Stillwater River. Previous stability analyses at the Hertzler Ranch essentially considered the glacial till to be infinitely deep and the critical slip surfaces did not extend into the till units. If one increased the strength properties with depth to reflect the apparent competency of the Colorado Shale unit, this result would not change, that is, the foundation materials do not control stability of the embankment. This is, as expected, because a very soft foundation is needed before a base failure becomes the critical condition in embankment analyses. There is a theoretically-feasible failure mode of the shale if it is assumed the entire site is an existing landslide area. Any increased wetting of the shale or loading of the top of the slide by the tailings dam could feasiblely trigger movement if there was a slip surface. However, there is no indication that the Hertzler impoundment area is underlain by anything other than competent bedrock.

The potential for overtopping of the tailings impoundment would be minor. The Hertzler tailings impoundment would have a constant freeboard depth capable of containing the volume of a Probable Maximum Precipitation event. This freeboard would contain internal runoff from storm events and the negligible external runoff that may enter the impoundment. Thus, little potential exists for overtopping and subsequent adverse effects.

4.6.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

4.6.1.3.1 Stillwater Mine Site

Modeling results suggest the existing tailings impoundment with a modified centerline expansion would continue to be a stable and safe structure (minimum factors of safety of 1.55 and 1.24 for static and pseudostatic conditions, respectively). However, the site's thin soils suggest the potential for ground motions at the base of the embankment to be the same as bedrock ground motions during an earthquake event (as discussed above). This potential combined with the additional height added to the embankment during the expansion suggest an expanded tailings impoundment at the Stillwater Mine site would be expected to have a higher crest acceleration during an earthquake event. Although a higher crest acceleration might reduce the impoundment's potential stability during an earthquake event, the reduction would not be notable.

A small potential for environmental impacts due to overtopping of the tailings impoundment would continue to exist. However, with the freeboard depth included in the impoundment's design, an appropriate surface area would exist to provide the maximum freeboard storage volume (freeboard height times impoundment surface area). This would provide a excess containment volume before an overtopping discharge would occur.

The potential for overtopping of the expanded tailings impoundment would be minor. As is currently the case, the impoundment would have a constant freeboard depth capable of containing the volume of a Probable Maximum Precipitation event. This freeboard would contain internal runoff from storm events and the negligible external runoff that may enter the impoundment. Thus, little potential exists for overtopping and subsequent adverse effects.

4.6.1.3.2 Hertzler Ranch

The proposed impoundment that would be constructed at the Hertzler Ranch under this alternative would perform similarly to that described for the larger impoundment under Alternative B. The impoundment would be safe and stable for the same reasons as presented under Alternative B.

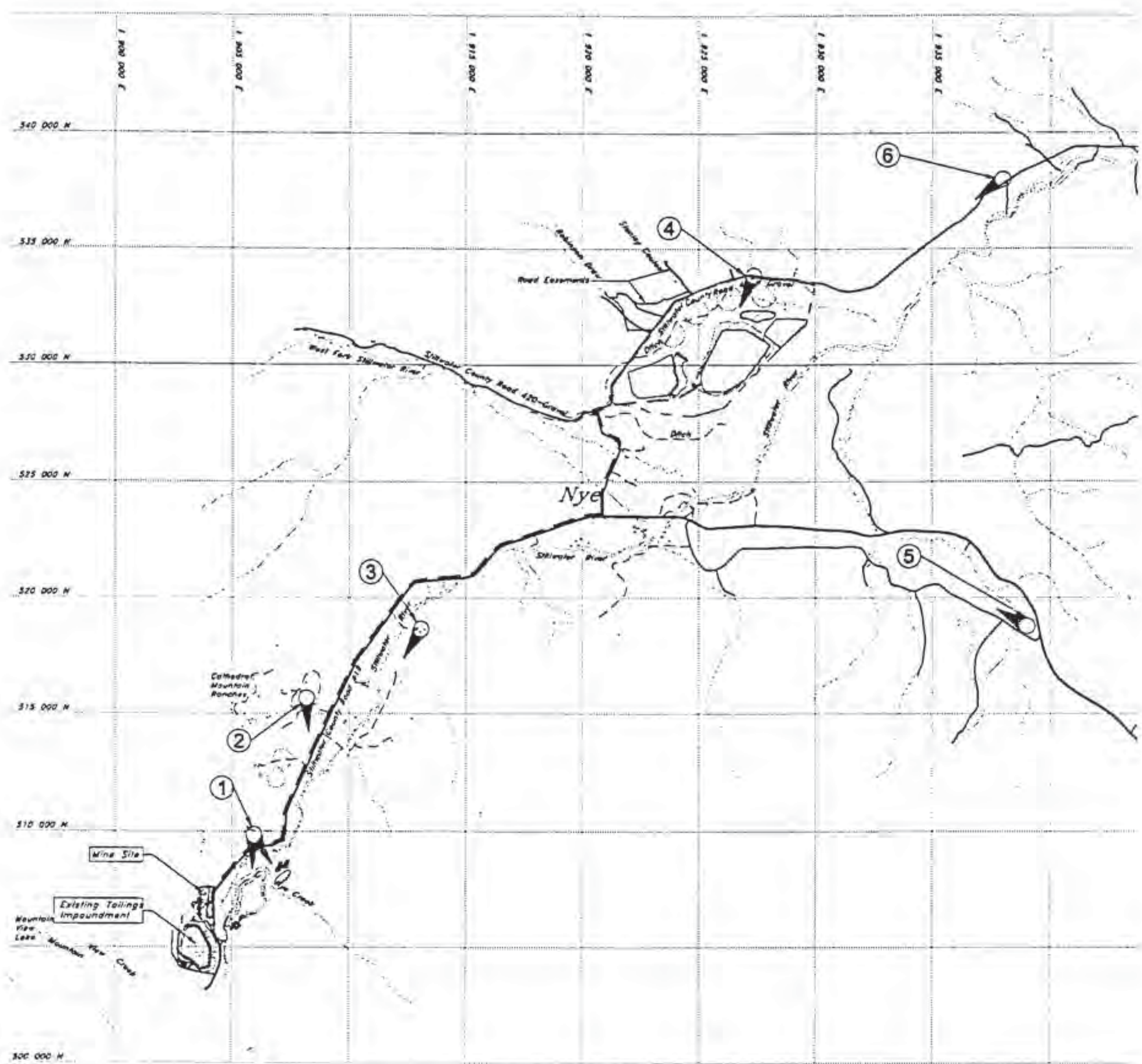
4.6.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

4.6.1.4.1 Stillwater Mine Site

The effects of expanding the existing tailings impoundment through a modified centerline expansion would be the same as described for Alternative C.

4.6.1.4.2 East Side Tailings Impoundment

The analyses of the three impoundment sites (existing, Hertzler Ranch, and east side) suggest the stability and performance of the east side tailings impoundment



LEGEND

- Proposed Pipeline Alignment
- Road
- Land Application Disposal Site
- Borrow Area
- Topsoil Stockpile
- Land Application Disposal Storage Pond
- Waste Storage Area
- Hertzler Tailings Impoundment
- Sediment / Percolation Pond
- 1 Key Observation Points
- Direction of View
  - Camera
  - Target

Stillwater Mine
Revised Waste Management Plan
and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

0 7,500 15,000 37,500
SCALE (FT)

N

Location of Key Observation Points for Visual Analysis

Figure 4-1

597KOP.dwg

site would be intermediate between the existing tailings impoundment site and the Hertzler Ranch site (minimum factors of safety of 1.52 and 1.20 for static and pseudostatic conditions, respectively). The thin soil cover is similar to that present at the site of the existing impoundment, which when considered with the proposed height of the embankment suggests the embankment's crest acceleration during an earthquake event would be higher than for either proposed impoundment at Hertzler Ranch. It also suggests the crest acceleration would be less than that of the existing tailings impoundment with the modified centerline expansion.

The potential for overtopping of the tailings impoundment would be minor. The east side tailings impoundment would have a constant freeboard depth capable of containing the volume of a Probable Maximum Precipitation event. This freeboard would contain internal runoff from storm events and the negligible external runoff that may enter the impoundment. Thus, little potential exists for overtopping and subsequent adverse effects.

4.6.2 Cumulative Effects

No cumulative effects would occur under any of the alternatives. No other tailings impoundments exist in the upper Stillwater River valley. Thus, no potential exists for the effects described above to overlap cumulatively with the effects at any other tailings impoundment.

4.6.3 Mitigation Measures

The agencies would require that a professional engineering geologist or geotechnical engineer would be present to observe and evaluate excavation of the Hertzler Impoundment foundation and borrow areas to determine if any geomorphological features were exposed that would indicate ancient mass failure. If such features were observed, then SMC would be required to develop a plan for a detailed bedrock drilling program and analysis. The plan would be subject to agency review and approval prior to implementation to resolve any problems identified in the drilling and bedrock analysis. This mitigation is intent ed to confirm the that the shale bedrock and glacial till had not been affected by past mass movement and that the glacial till would provide a suitable foundation for the impoundment.

4.7 Effects on Aesthetics

4.7.1 Visual Resources

4.7.1.1 Direct and Indirect Effects

4.7.1.1.1 Alternative A — No Action Alternative
No additional impacts to visual resources would occur under this alternative beyond those previously disclosed and permitted. The existing condition of National Forest System lands in Management Area E and the Stillwater project area would be maintained under the current management direction as defined in the CNF's Forest Plan. Standards within that Plan do not apply to private lands.

4.7.1.1.2 Alternative B — Proposed Action Alternative
The project area for the analysis of impacts of the proposed project facilities on visual resources consists of the east side waste rock site, the facilities at Stratton Ranch, the pipeline route, and the Hertzler Ranch facilities. In general, the quality of the landscape would remain high in the project area and on adjacent lands because facilities would be located at sites of existing disturbance related to historic and current mining activities or would be mostly hidden by surrounding terrain. In addition, the landscape is characterized by the stunning backdrop of the Beartooth Range rather than the common rural landscape in the foreground and middleground views. The overall character of the landscape would not change with the addition of the proposed facilities.

Key observation points (KOP) were identified for the project area in consultation with CNF's resource specialists. These are located as shown in **Figure 4–1**. The KOPs represent viewpoints from which proposed facilities in the project area may be evident to the casual observer.

The Stillwater project facilities under any action alternative on National Forest System lands would be on lands classified with the VQO of Modification. Based on the assessment of each facility, (weak to moderate visual contrasts; historic and current mining activities comprising a part of the existing visual character; high visual absorption capacity; and high viewer sensitivity) all of the alternatives would comply with the VQOs on National Forest System lands.

<u>Stillwater Mine Site</u> The east side waste rock storage site would be visible from Stillwater County Road 419. Some of the storage site would be screened from view by the rugged topography and by stands of trees and other vegetation. In addition, the facility would be developed on a site that has been previously disturbed by chrome tailings. The facility would be evident in the landscape as viewed by travelers on the road and from KOPs 1 and 2 (**Figures 4–2b** and **4–3b**). However, the existing character of the landscape includes historic and current mining operations and would retain that character with the addition of

the waste rock storage site. Views of the east side waste rock storage site from areas farther north than KOPs 1 and 2 would be screened by intervening topography.

The east site waste rock storage site would cover an area of 80 acres, and have a high profile adjacent to Stillwater County Road 419. Prior to recontouring and reclamation, the east side waste rock storage site would be approximately 120 feet above the existing terrain. In general, the east side waste rock storage site would borrow from the horizontal, vertical, and angular lines of the existing landscape, which has sufficient diversity to absorb the modifications. The most-visually prominent features of the facility would result from the contrasts of the colors and textures of the existing vegetation with the waste rock materials that would be introduced into the landscape. The overall texture of the landscape would be influenced by the light and color contrasts as well as shape of the materials and facilities.

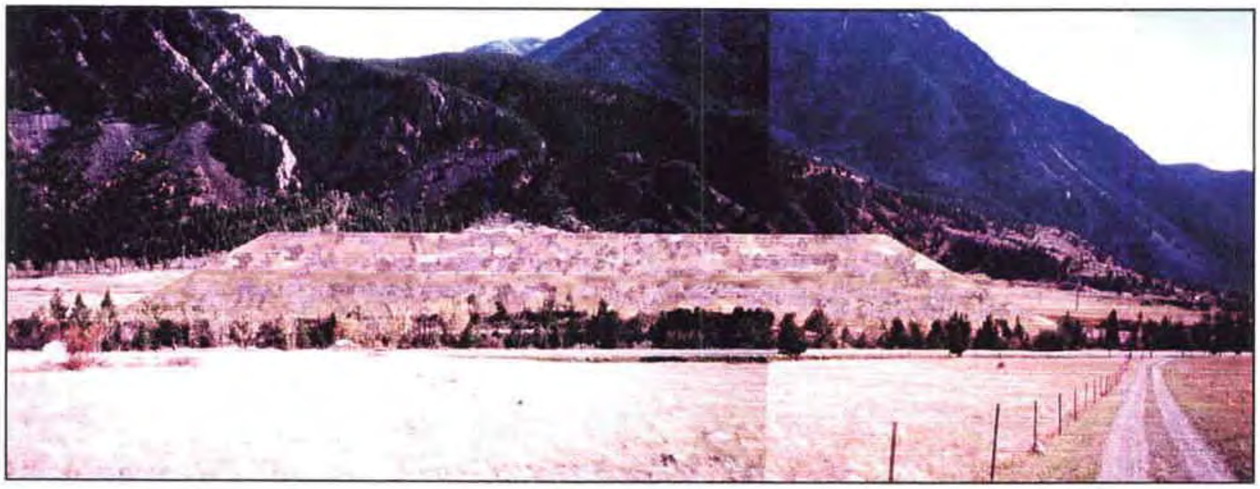
During the last years of construction, the top cap of the east side waste rock storage site would be shaped to an irregular surface that would better blend the embankment into the surrounding natural terrain. The final reclamation and revegetation would establish a mosaic of vegetation that would further blend the embankment with the adjacent terrain. Areas that are successfully revegetated would reduce differences in color and texture among disturbed and undisturbed areas. Some coarse and durable material that would be placed on angle of repose slopes that are not revegetated may be darker than naturally-exposed rock surfaces in the area. Over time, as the rock weathers, these changes may become less visible and could more closely resemble naturally occurring talus slopes and rock surfaces in the surrounding area.

Stratton Ranch Area Existing disturbance at the Stratton Ranch site is the result of a gravel pit associated with prior SMC mining activities. The two LAD sites and the two LAD storage ponds may constitute an improvement of the visual character of the existing landscape. The low profile of the LAD storage ponds and the weak contrasts of the linear sprinkler systems would constitute a lesser visual intrusion than the pre-existing gravel pit. The existing bare soils would have topsoil applied and would be seeded and irrigated with wastewater applied by the LAD system. The resulting vegetation would enhance the visual character of the site.

The LAD storage ponds would be located on the west side of the LAD sites and would not be visible from any KOPs along the road. The ponds would be visible from KOP 2 at the Cathedral Mountain Ranch subdivision, but would not be a major addition to the landscape because of their relatively small size compared to the existing disturbance and because of the low profile of the ponds. The ponds would not be visible from KOP 3 (**Figure 4–4b**) because of intervening vegetation along the Stillwater River.

Existing Condition
Figure 4-2a View to the East from KOP 1 west of County Road 419, Fall 1997.

Photographic Simulation
Figure 4-2b Simulation of East Side Waste Rock Facility (Alternatives B and C) from KOP 1 After Reclamation, 2027.



Photographic Simulation
Figure 4-2c Simulation of East Side Tailings Impoundment (Alternative D) from KOP 1 After Reclamation, 2027.

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Existing Condition
Figure 4-3a View to the south from KOP 2 in Cathedral Mountain Ranch, Fall 1997.

Photographic Simulation
Figure 4-3b Simulation of LAD at Stratton Ranch and East Side Waste Rock Facility (Alternatives B and C) from KOP 2 After Reclamation, 2027.

Photographic Simulation
Figure 4-3c Simulation of LAD at Stratton Ranch and East Side Tailings Impoundment (Alternative D) from KOP 2 After Reclamation, 2027.

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Existing Condition
Figure 4-4a View to the south from KOP 3 Located 1.2 miles South of Nye, Fall 1997.

Photographic Simulation
Figure 4-4b Simulation of East Side Waste Rock Facility (Alternatives B and C) from KOP 3 After Reclamation, 2027.

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Pipeline Corridor The tailings pipelines would be buried in existing county road rights-of-way or under the roadbed in very-confined locations. Impacts to the characteristic landscape along the proposed pipeline route would be construction related and temporary. The pipelines also would be buried below the West Fork Stillwater River crossing. Trees and other vegetation would be removed as necessary to accommodate installation of the pipelines. Once the pipeline construction disturbance is reclaimed and revegetated, the route would return to pre-project conditions. There would be no long-term visual impacts from locating the route in existing rights-of-way or under the river.

Hertzler Ranch Site Facilities proposed for the Hertzler Ranch site include a tailings impoundment, four LAD sites, and an LAD storage water pond. The tailings impoundment would be constructed on a plateau looking down on the Stanley Coulee drainage. Disturbances associated with the impoundment would also include two borrow areas and a topsoil stockpile. The maximum embankment height above the existing terrain during the third stage of the development would be approximately 156 feet at a crest elevation of 5,036 feet. The third stage would be built approximately seven years after initial construction of the facility. The construction and operation of the facilities would introduce new elements of form, line, color, and texture into the landscape.

All of the Hertzler facilities are screened from most viewpoints by the rugged topography. The site would not be visible from KOPs 1, 2, 3, and 6 (**Figures 4–2b, 4–3b, 4–4b, and 4–7b**) along Stillwater County roads 419 and 420 to the east and south of Hertzler Ranch, nor from any residential subdivisions in the upper Stillwater Valley. KOP 4 (**Figure 4–5b**) on Stillwater County Road 420 along the northern boundary of Hertzler Ranch is the only viewing area from which the site would be fully visible. The site would attract the attention of travelers on the road for a brief period of time, until the facilities are screened by the topography. The facilities would be evident to viewers, but would not dominate the landscape as viewed from the road. Portions of the waste rock storage site, the borrow areas and topsoil pile would be visible from KOP 4. The borrow areas and the topsoil piles would be screened from view from any other KOP by topography.

Most of the tailings impoundment at the crest elevation would be screened from most of the roads and residences to the south and east due to the higher elevation of the plateau relative to sensitive viewing areas. Also, the intervening ridge (about 5,000 feet in elevation) between the site and any potential viewpoint would effectively screen the proposed project from most views. The site would be partially visible from KOP 5 in the last years of its construction. Nearly 40 feet of the top of the tailings pile at the final crest elevation would be visible to viewers at some locations in the valley. The crest elevation would be reached during the final years of the third stage development. For most of the 30-year life of the facility, the elevation of the impoundment would be below the

5,000-foot elevation of the ridge and would not be visible from any viewpoint to the south or east.

All of the proposed facilities at Hertzler Ranch, including the tailings impoundment, would be screened by Bush Mountain from KOPs 1, 2, and 3 and all other viewpoints located to the southeast of the site, including Stillwater County Road 419 and residences. The mountain has an elevation of 5,315 feet, and is located on the southwest side of Hertzler Ranch. However, all of the facilities at Hertzler Ranch would be obvious in the viewshed of KOP 4, located on Stillwater County Road 420 to the north of the site.

Some of the crest of the tailings impoundment would be visible to KOP 5 (**Figure 4–6b**), which is located at a higher elevation than the Hertzler Ranch site. However, the site is located more than 3 miles from KOP 5. The impoundment would be an obvious feature in the landscape, but because of the distance, it would be subordinate to the existing character. Views of the site from KOP 6 would be obstructed by a ridge at the curve in the road west of the KOP. To demonstrate the intervening topography, **Figure 4–7b** shows a cross section of the terrain from KOP 6 to Hertzler Ranch.

The tailings impoundment would be most noticeable during embankment construction and before reclamation of the outer slopes. However, the outer slope of the embankment would be reclaimed concurrently with the facility's operation. However, the outer slope would be disturbed and reclaimed a second time after the second stage of the embankment was constructed over that of the first. Because the embankments would be constructed from on-site borrow material, additional growth medium would not be required for reclaiming the first stage embankment. Growth medium would be distributed on the outer surface of the second lift of the embankment and revegetated with an approved seed mix. This would minimize the visual effect of the embankment as seen from KOP's 4 and 5.

Once the operation of the tailings impoundment ceases, the unreclaimed portions of the facility would be regraded. Available topsoil from the stockpile at Hertzler Ranch would be spread on the tops and sides of the piles, and an approved seed mixture would be applied. The resulting landform should harmonize with the characteristic landscape.

Four LAD sites would be visible as sprinkler systems applying wastewater to the ground surface on land adjacent to Stillwater County Road 420. The sprinkler systems would consist of a low-contrast, linear form that is not an intrusive element in the landscape and is consistent with the rural, agricultural character of the project area. The vegetation would be enhanced by application of the wastewater.

Existing Condition

Figure 4-5a View to the south from KOP 4 Located 1.6 miles south of Moraine Fishing Access, Fall 1997.

Photographic Simulation

Figure 4-5b Simulation of Proposed Hertzler Tailings Impoundment (Alternative B) from KOP 4 After Reclamation, 2027. (Under Alternative C, Impoundment Would be Very Similar but 30 Feet Lower).

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Existing Condition
Figure 4-6a View to the northwest from KOP 5 Located 4 miles east of Nye, Fall 1997.

Photographic Simulation
Figure 4-6b Simulation of Hertzler Tailings Impoundment (Alternative B) from KOP 5 After Reclamation, 2027. (Under Alternative C Impoundment Would not be Discernable).

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Figure 4-7a View to the southwest from KOP 6 Located 0.3 miles south of Moraine Fishing Access, Fall 1997.

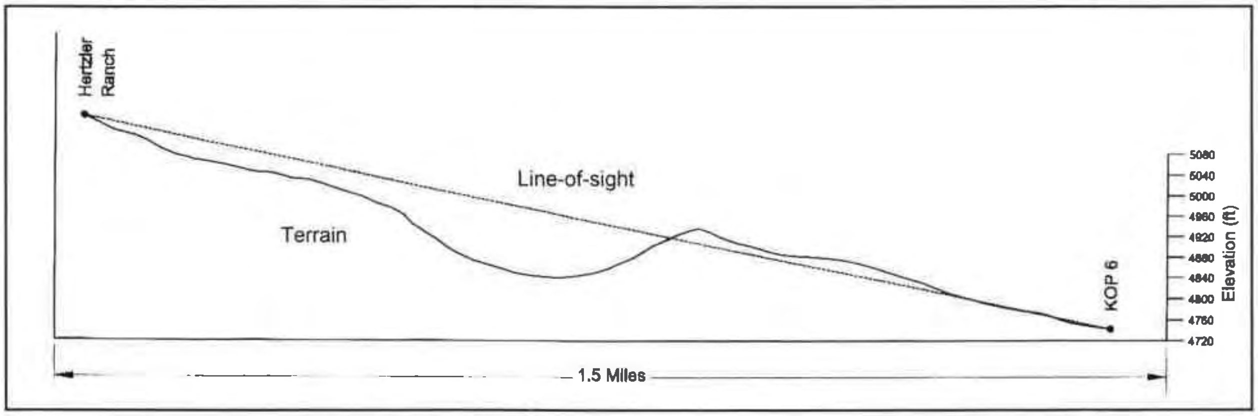

Figure 4-7b Cross Section of Terrain Between KOP 6 and Hertzler Ranch Showing Intervening Topography.

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4.7.1.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Alternative C would consist of the same project components as described for the Proposed Action. The elements unique to the alternative are the modification of the Hertzler tailings impoundment and the expansion of the existing tailings impoundment.

The modified Hertzler impoundment differs from the Proposed Action primarily in the size and operating life of the impoundment, which would facilitate an earlier start to reclamation than would occur under the Proposed Action. The impoundment would be smaller and the crest elevation would reach approximately 5,007 feet, which is slightly less than the intervening ridge elevation of 5,012 feet. The Hertzler tailings impoundment under this alternative would exhibit the same line, form, color, and texture modifications to the existing landscape as described for the Proposed Action. The potential effect on the landscape character would occur for a shorter duration of time than the Proposed Action. KOPs 4 and 5 are the only viewpoints from which the impoundment would be seen at any development stage of the facility.

In addition, the existing tailings impoundment would be expanded by 8 acres. The expanded tailings impoundment would appear very similar to the existing facility as described in the 1985 and 1992 final EISs (DSL and Forest Service 1985 and DEQ and Forest Service 1992).

4.7.1.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Alternative D would consist of most of the same project components as described for the Proposed Action, except no facilities at Hertzler Ranch site are proposed for this alternative. A tailings impoundment would instead be located at the site described for the east side waste rock storage site in the Proposed Action. In addition, the expansion of the existing tailings impoundment would be included as described for Alternative C. **Figures 4-2c** and **4-3c** present simulations of the proposed facilities after reclamation. The impoundment would be higher, have a flatter top, and have more uniform outer slopes than the waste rock storage site in Alternatives B or C.

This alternative would result in a major impact to the visual character of the upper Stillwater Valley. Visual effects would be confined to both sides of the river at the existing mine area. The presence of tailings impoundments on both sides of the river would present a greatly altered view of the river valley at the Stillwater Mine site. All impacts associated with the construction and operation of the facilities at the Hertzler Ranch site and from the construction of the pipeline to the site would be eliminated. The East Stillwater tailings impoundment would result in visual effects similar to those described for the east side waste rock storage site in the Proposed Action. Construction related impacts to the landscape from the installation of the pipeline would occur between the existing mine area and the LAD facilities at Stratton Ranch.

4.7.1.2 Cumulative Effects

Cumulative impacts to visual resources would result from other planned or foreseeable development activities that could occur on lands adjacent or located near the proposed project in addition to existing developments. Economic and population growth in the county has increased steadily in the past two decades, resulting in changes in land uses and the visual character of some areas, as commercial, residential, and industrial uses are developed on lands previously used for agriculture or as open space. This type of growth is expected to continue in Stillwater County in the future, therefore, it is likely that development would occur in the vicinity of the proposed facilities. Subdivisions identified in **Section 4.5.1.2.6** include more than 131 lots in the upper valley, many of which are still for sale.

Cumulative impacts also result from historic, existing, and permitted mining activities in the upper Stillwater Valley. These include the historic chromite mine facilities, Mouat Mine, and Benbow Mine, none of which are operating. The cumulative effects due to disturbances associated with existing and approved exploration activities by SMC in combination with any action alternative would also occur over the life of the mine.

Impacts to visual resources in the project area would be moderate from the east side waste rock storage site, minor from the facilities at Stratton Ranch and the pipeline route under any of the action alternatives, and non-existent from the No Action alternative. The proposed Hertzler Ranch tailings impoundment would produce a minor impact due to its siting within the viewshed of KOP 5 located at residential areas to the east. The tailings impoundment at Hertzler Ranch would create a moderate impact in the viewshed from KOP 4. Reclamation procedures for the tailings impoundment, east side waste rock storage site and the pipelines are defined in Chapter 2.

4.7.1.3 Mitigation Measures

SMC developed a Visual Mitigation Plan as part of the Reclamation Plan, which is designed to stabilize mine-related disturbances and return them to a post-mining landscape that is compatible with pre-mining land uses. Final reclamation and mitigation measures recommended for impacts to other resources, such as vegetation and wildlife, would minimize color and texture contrasts and lessen landform modifications, mitigating any change to the characteristic landscape. Any major landform changes would be a permanent alteration of the characteristic landscape, however, landform modifications would be contoured to blend with the existing landscape and would be compatible with VQOs established by the Forest Service.

Visual mitigation is designed to reduce operational and post-operational impacts. The short-term objectives of reclamation include measures to minimize the visual impact of operational disturbances. This would be achieved by a combination of operational practices and interim revegetation. Long-term objectives include the establishment of a post-operational environment that is compatible with existing land uses. Measures to achieve long-term objectives include the restoration of a land configuration compatible in the watershed, and the reestablishment of an aesthetic environment allowing for visual quality.

Reclamation activities would begin concurrently with mining operations and would be completed approximately two to three years after permanent mine closure. The final grading of disturbed areas would create landforms that blend with the surrounding undisturbed topography. The post-mining topography should supply a visual diversity similar to the natural terrain. Specific reclamation procedures for the tailings impoundment, east side waste rock storage site, and the pipelines are defined in Chapter 2.

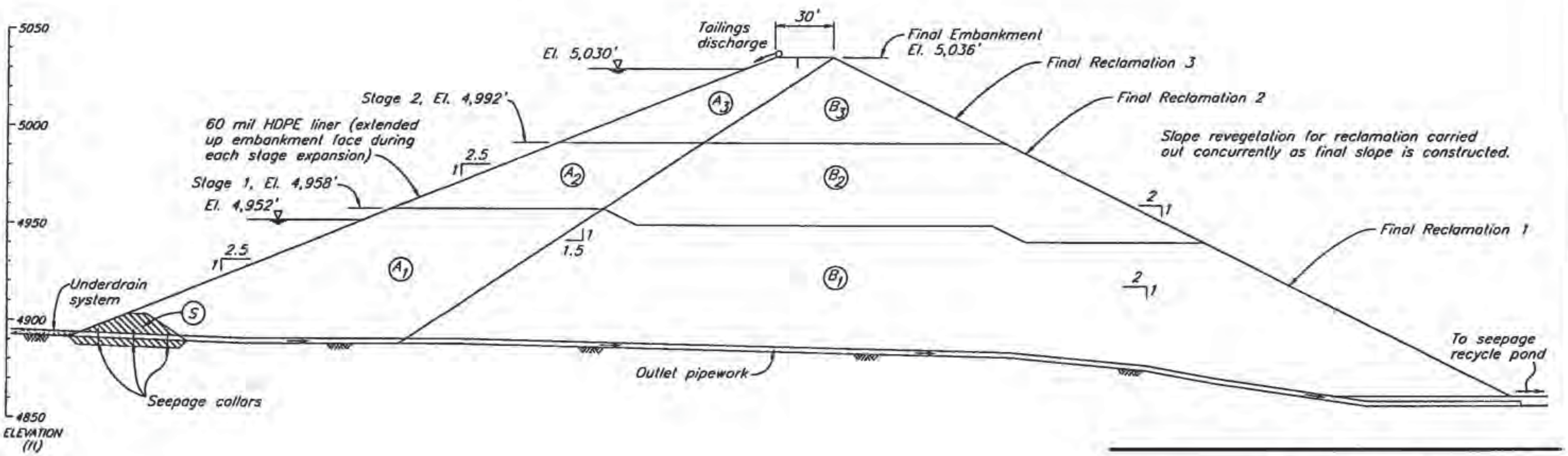
Modifications to the construction of the Hertzler tailings impoundment's embankment (**Figure 4–8**) would allow final reclamation of the outer slopes to occur soon after they were constructed and would limit redisturbance. This would minimize the visual impact during construction of the second lift.

4.7.2 Noise Effects

4.7.2.1 Direct and Indirect Effects

4.7.2.1.1 Alternative A — No Action

If the No Action alternative was selected, SMC could continue to operate as at present, until about 2003. SMC could increase its daily production to a nominal rate of 2,000 tpd under the conditions of its existing permit. Therefore, noise might be slightly higher than present levels because of increased operation of facilities and vehicles. However, the short-term noise increases associated with



ZONE	MATERIAL TYPE
S	Low Permeability Glacial Till
A_1	Glacial Till – Stage 1
B_2	Random Fill – Stage 2

Stillwater Mine
Revised Waste Management Plan
and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

NOT TO SCALE

Hertzler Tailings Impoundment Modified Cross Section of the Embankment

Figure 4-8

construction of the pipelines and Hertzler Ranch tailings impoundment would not occur.

4.7.2.1.2 Alternative B — Proposed Action

Under the Proposed Action, noise levels at the Stillwater Mine site would remain essentially unchanged. There would be increases in construction noise at the east side waste rock storage site and at the Stratton Ranch LAD site. Noise levels would temporarily increase with construction of the pipelines along Stillwater County roads 419 and 420. Noise from construction vehicles and equipment would be apparent to residents along Stillwater County roads 419 and 420 for the two-month duration of the construction. Once construction was completed, noise levels at all locations would return to pre-construction levels.

Noise levels would be higher at Hertzler Ranch for the duration of the project. Noise would be associated with initial construction activities building the new tailings impoundment. Afterwards, slightly elevated noise levels would be associated with operational personnel visiting the site and electrical pumps and equipment. All pumps would be housed inside an insulated structure and service personnel would only visit the site during daylight hours, except in case of emergency. However, these elevated noise levels would be partially abated at the residences south and southwest of the Hertzler Ranch tailings impoundment by the enclosures and topography. The ridge to the south of Hertzler Ranch is about 200 feet higher than the surrounding topography. Thus, the ridge would provide a sound barrier between Hertzler ranch operations and the residences. At the completion of operations noise levels would return to pre-mining levels.

4.7.2.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Noise impacts would be quite similar to Alternative B. Noise at Hertzler Ranch would be slightly less than under Alternative B because the impoundment construction would require less time and would start later in mine life than under Alternative B due to the delay in construction.

4.7.2.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Operational noise impacts would be similar to the No Action Alternative because the pipelines and Hertzler Ranch tailings impoundment would not be constructed. However, construction noise levels would temporarily rise during construction of the East Stillwater impoundment and the Stratton Ranch LAD site. Operational noise would be restricted to the Stillwater Mine site, the east side site, and Stratton Ranch. While an operating tailings impoundment has only minor noise sources associated with it, the presence of a second tailings impoundment at the east side site would result in noise levels slightly higher than the No Action alternative.

4.7.2.2 Cumulative Noise Effects

None of the reasonably foreseeable activities in the Stillwater Valley would generate noise over the long term. Both Forest Service projects of concern and road and residential construction would only have short-term construction noise. Therefore, the noise levels identified for the project would represent the cumulative noise effects.

4.7.2.3 Mitigation Measures

The first step of construction on the east side waste rock storage site would be the construction of a major berm to serve as the facility anchor to the slope. The berm would incidentally act as a noise barrier for residences nearby. At the Hertzler Ranch, long-term noise would be generated by pumps, but the pumps would be enclosed in an insulated structure. The structure and intervening topography would help attenuate noise levels to acceptable levels at residences in the area.

4.7.3 Lights and Lighting Effects

4.7.3.1 Direct and Indirect Effects

4.7.3.1.1 Alternative A — No Action

If the No Action Alternative was selected, there would be no additional lights beyond the existing lights at the mine site.

4.7.3.1.2 Alternative B — Proposed Action

The Proposed Action would only require one or two yard lights to be erected at the driveway and pump facility near the southwest corner of the Hertzler tailings impoundment. These lights would be constructed according to SMC's policy, which is to erect only shielded lights to avoid the transmission of light off-site. The east side waste rock storage site and the LAD areas would not require lights, as normal operations and servicing would be done in the daylight hours. If work during darkness was required, the work would be conducted using vehicle lights or portable temporary flood lights. Bush Mountain and the ridge south of the tailings impoundment would shield residences to the west and south of the lights. The tailings impoundment itself would shield residences to the east. The lights may or may not affect residences to the north of Hertzler Ranch.

4.7.3.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Lights and their potential impacts under this alternative would be the same as for Alternative B. The timing of these effects would be delayed since construction of the Hertzler impoundment would not be implemented for a number of years.

4.7.3.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Without the construction of the Hertzler tailings impoundment, no additional lights would be erected at that location. Some additional lights would be added on the east side of the Stillwater River, but they would be shielded according to SMC's policy and the effects would be minor.

4.7.3.2 Cumulative Effects

Implementation of any of the action alternatives would result in minor cumulative effects from lighting and lights. The one or two new lights added under each action alternative would increase the overall amount of artificial light visible in the upper Stillwater Valley. However, the increase would be very small and minor, especially when the mitigation measures are considered.

4.7.3.3 Mitigation Measures

If any action alternative is selected and implemented, SMC would apply operational procedures currently used to minimize the amount of light visible off SMC's property. These procedures would consist of the application of site-specific shading to the new lights to ensure the light reaches only its intended targets and is not randomly visible from off SMC's property.

4.8 Effects on Transportation

4.8.1 Direct and Indirect Effects

4.8.1.1 Alternative A — No Action

If the No Action alternative was implemented, traffic volumes and patterns would remain unchanged from current conditions. SMC's workforce would not increase, so commuter traffic would stay the same. Without the construction of the pipelines, SMC would likely not enter into an agreement with Stillwater County to upgrade the roads. Commercial vehicles traveling to and from the mine would also remain similar to current levels.

4.8.1.2 Alternative B — Proposed Action

The proposed project would affect existing roadways and traffic levels in the following ways. First, construction of project facilities would temporarily affect local roadways. To a lesser degree, project activities during the operational phase of the project may impact traffic. Finally, increased employment at the mine would result in moderately increased levels of commuter traffic. SMC proposes no modifications of existing and previously approved permit-related roads within the permit boundary.

Construction of the tailings pipelines would temporarily affect traffic flows on Stillwater County roads 419 and 420. SMC plans to negotiate an agreement with Stillwater County for upgrading the roads along the pipelines' route, in the form of an amendment to the Hard Rock Impact Plan. Additionally, minor road extensions would be required from Stillwater County road 420 to the Hertzler impoundment. These extensions would be constructed on property owned by SMC and would not allow public access. These roads would be reclaimed after SMC closes the Hertzler impoundment.

Installation of the pipelines would cause traffic delays and may require some detours. It is anticipated that installation of the pipelines would be completed within two to three months. Prior to initiation of the major construction phases, SMC would coordinate with Stillwater County to develop a traffic management plan to be implemented during construction. This plan would describe items such as construction timing, location of equipment storage and staging areas, phasing plan, road closures and detour routes (if necessary), traffic control, and other details necessary to provide a plan for safe and effective traffic movement during construction. Also, if deemed necessary, alternate plans for employee commuter patterns (during pipeline installation) would be identified. Plans for road improvements would also be negotiated with Stillwater County officials. Once construction is completed, many segments of Stillwater County roads 419 and 420 would be improved and upgraded beyond their original condition, which, in many areas, are in need of repair. This project could present an opportunity for SMC to work in conjunction with Stillwater County to accomplish two goals: installation of the tailings slurry pipelines and much needed road improvements.

Expansion of the east side waste rock storage site would require the use of 25-ton trucks to haul waste rock to the facility. These trucks would use the existing access road and the Stillwater River bridge to access the east side storage site. Traffic on Stillwater County road 419 has the right-of-way and the haul trucks would have to yield right of way to oncoming traffic. Because of the limited amount of traffic passing through the mine area at this location, it is not anticipated that any significant conflicts would occur.

Use of the approved under-the-river haulage way could reduce the amount of truck traffic hauling waste rock. However, until the haulage way is constructed and use patterns are established, the amount of waste rock that can be conveyed via the haulage way and the resulting reduction in truck traffic cannot be determined.

There would be minor increases in traffic on Stillwater County roads 419 and 420 between the mine site and the Hertzler Ranch tailings impoundment. Mine service personnel would visit Stratton Ranch on a daily basis through the irrigation season and Hertzler Ranch on a daily basis year-round to perform inspections and monitoring of the facilities. This traffic would increase and decrease over time as production levels rise and fall.

Finally, expansion of the workforce at the Stillwater Mine would lead to some increase in employee commuting and additional vehicles entering traffic flows on local roadways. Implementation of the proposed project is expected to increase the existing workforce by approximately 11 percent, with new employees and their dependents residing in several communities throughout Stillwater County. It is expected that increases in traffic would be distributed accordingly.

In 1990, Stillwater mine and mine-related traffic accounted for about half (48 percent) of the ADT on Stillwater County road 419. In 1996, the ADT on Stillwater County road 419 increased to 803, partly due to the increase in employment at the mine as well as increased recreation traffic and general population growth in the area.. SMC estimates that mine-related traffic currently accounts for about 245 two-way trips per day, with about 20 percent distributed to Stillwater County road 420, and 80 percent to Stillwater County road 419. This traffic represents approximately 24 percent of the 1996 ADT on Stillwater County road 419, and 11 percent of the ADT on Stillwater County Road 420. The decreased percentage of mine-related traffic as a part of the overall traffic flow on these roads is due to an increase in non-mine traffic flow, attributable to regional growth and recreational traffic.

Utilizing the December 1997 employment level of 655, an average of 2.6 employees travel to and from the mine in each vehicle. If this average holds constant through the expansion, an additional 17 trips per day would be distributed to Stillwater County roads 419 and 420.

Several factors suggest that the increased traffic resulting from project implementation would not have a substantial effect on local roadways, including Stillwater County road 419. First, the design capacity of Stillwater County road 419 is 2,200 vehicles per day. Existing traffic levels are well below design capacity, however, capacity is limited by the degraded physical condition of the roadway in some areas. Therefore, the actual capacity with the project would likely remain lower than design levels, still well within acceptable limits.

Secondly, portions of Stillwater County road 419 are undergoing improvements and more upgrades might be completed by SMC as part of the pipeline installation.

4.8.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Under Alternative C, traffic impacts would be the same as under Alternative B.

4.8.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Under Alternative D, traffic impacts would be the same as described for Alternative B, except that there would not be any mine-related traffic increases between the mine site and Hertzler Ranch. However, the increases in mine-related traffic between the mine and local communities, such as employee traffic, would occur.

4.8.2 Cumulative Effects

The traffic increase identified above represents the cumulative impact on traffic. There are no other major commercial or industrial traffic-generators in the upper Stillwater River valley. All other traffic would result from residents and recreational tourists. If the constituents of the traffic remain proportional, then ADT would be 435 mine-related trips and 471 non-mine-related trips on roads in the upper Stillwater valley.

4.8.3 Mitigation Measures

The proposed modification of SMC's waste management operation would trigger an amendment to SMC's Hardrock Mine Plan. That amendment, the permit needed from the County Road Department, or some other form of agreement between SMC and the County would address possible mitigation measures for transportation impacts to Stillwater County roads.

Although the agencies cannot enforce monitoring of car pooling, they can require SMC to develop incentives to encourage employee car pooling. Such incentives might include premium parking spaces, cash incentives, bonuses, or some other measure that would encourage employees to car pool to work. How many employees would participate in such a program cannot be determined, but it is anticipated that the existing amount of car pooling would not decrease with such a program.

4.9 Effects on Reclamation Potential

4.9.1 Soils

4.9.1.1 Direct and Indirect Effects

Soil surveys of the mine area and proposed slurry pipeline corridor (CDM, 1981) and of the Hertzler Ranch area (Western Technology and Engineering, Inc. 1996d) indicate that a sufficient depth of soil for salvage and reclamation is available in the proposed disturbance areas. These surveys also included field measurements and lab analyses indicating that the physical characteristics and chemical quality of the soils would not be an impediment to their use in reclamation.

4.9.1.1.1 Alternative A — No Action

Implementation of the No Action alternative would not create any additional disturbances to soils beyond those previously disclosed and permitted. SMC would continue mining with its existing facilities according to its current mining plans as approved by DEQ and CNF. Reclamation would be completed with the existing soil stockpiles.

4.9.1.1.2 Alternative B — Proposed Action

Stillwater Mine Site For the east side waste rock storage site, soil replacement would be conducted according to approved reclamation procedures in the 1993 reclamation plan (SMC 1993). Approximately 255 acres have been previously approved for disturbance at the mine site proper, and this proposal would disturb an additional 68 acres on the east side of the Stillwater River. A total of 142,500 cubic yards of soil would be needed to provide at least 12 inches of soil cover for final reclamation of the outer slopes of the east side waste storage site and adjoining facilities that were stripped previously. Soil stockpiles and soil borrow areas would provide sufficient soils for final reclamation of this site. **Table 4–7** shows the soil storage volumes by area. The locations of the soil storage sites are shown in **Figure 2–2**.

Soil loss from the Stillwater Mine site would be considered negligible because of the existing, permitted stormwater control measures. Disturbance of an additional 68 acres might increase soil losses somewhat, but the increase would likely be undetectable in the Stillwater River.

Table 4–7 Quantity of Soils for East Side Waste Rock Storage Site Reclamation

	Area (acres)	Avg. Thickness (inches)	Volume (yd^3)
Soil Stripping During Construction			
Stage 1	33	12	53,000
Stage 2	40	12	64,000
Stage 3	4	12	6,000
Portal Area	6	See note 1	–
Misc.[2]	5	12	8,000
Hertzler Ranch	See Note 3	–	11,500
Total Stripped Area	88		142,500
Reclamation Soil Quantities Required			
Waste Dump Surface	40	12	64,000
Waste Dump Slopes	40	12	64,000
Portal Area[3]	6	8	6,500
Misc.[2]	5	12	8,000
Total Reclaimed Area	91		142,500

Notes:

1 Soil for the Portal Area has been previously stripped and stockpiled at existing soil stockpiles.

2 The miscellaneous area for soil stripping and reclamation is assumed to consist of approximately 10 percent of the remaining disturbance area. This area includes temporary facilities including; soil stockpiles, boulder stockpiles, laydown areas, parking areas, stormwater BMPs, roads, monitoring stations, etc.

3 Additional materials required for reclamation at closure will be obtained from either the Hertzler Ranch soil stockpile, existing soil stockpiles, or from borrow areas under permit within the current project area.

Stratton Ranch/Hertzler Ranch Previous disturbance at the Stratton Ranch involved 14 acres for a permitted gravel pit. New disturbance by the proposed project would affect less than two acres for LAD facilities. A minimum of 12 inches of soil material would be spread over the reclaimed gravel pit at the Stratton Ranch site. Undisturbed soils at the Stratton Ranch are deep, well-drained, medium textured, and have a moderate water-holding capacity. Soils at the Hertzler Ranch are very similar, and are well suited for use as a land application medium. Disturbance at the Hertzler site would involve 250 acres, all of which were previously grazed. For the Hertzler impoundment, a minimum of 12 inches of soil materials would be stripped and stored for final reclamation prior to the excavation of the impoundment. Up to 24 inches of soil materials would be stripped from the external borrow areas to provide sufficient material for reclamation of the tailings surface. As shown in **Table 4–8**, soils to be stripped during construction of the impoundment would equal or exceed the soil materials required for reclamation. The locations of soil stockpiles are shown in **Figure 2–2**.

The Stratton Ranch area is flat and susceptible to run off and soil loss. However, the presence of Stillwater County Road 419 and the wide vegetated area parallel to the river both would serve as control measures to trap erosion before it entered the Stillwater River.

Soil loss from the Hertzler Ranch would be negligible. A large vegetated area would remain surrounding the tailings impoundment. Surface runoff from the site would have to travel 2.0 miles before it could enter the Stillwater River. Both of these facts would serve to mitigate against soils entering the Stillwater River.

Pipeline Corridor Soil salvage along the pipeline route would be restricted to approximately 12 inches depth on average. Soil stripping width along the portion of the pipeline route within the borrow ditch, adjacent to Stillwater County road 419 is estimated at 10 feet. Soil materials from the pipeline route would be stockpiled adjacent to the pipeline right-of-way. Soil salvage volumes would be sufficient for reclamation, as shown in **Table 4-7**.

4.9.1.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment and Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Reclamation procedures would be the same for these alternatives as for Alternative B. Differences would be a result of different acreages of disturbance, which would primarily originate from no tailings impoundment being constructed at the Hertzler Ranch under Alternative D. Alternative C would need to reclaim 80 acres of waste rock storage site and 129 acres of tailings impoundments whereas Alternative D would have to reclaim 72 acres of tailings impoundments. Soil stockpiles and soil borrow areas would provide sufficient soil materials for final reclamation of the sites.

4.9.1.2 Cumulative Impacts

Overall soil impacts resulting from this project in conjunction with other projects would be low. Soil erosion that would impact other resources is not expected to occur because of the existing stormwater control plan at the Stillwater Mine, the

Table 4–8 Soil and Embankment Fill Quantities for the Hertzler Tailings Impoundment

	Area (acres)	Avg. Thickness (inches)	Volume (yd^3)
Soil Stripping During Construction			
Stage I Impoundment	100	12	160,000
Impoundment Expansion	75	12	121,000
LAD Storage Pond	17	12	28,000
External Borrow Areas	70	24	226,000
Miscellaneous (Note 1)	24	12	39,000
Total	286		574,000
Pipeline Corridor to Hertzler Site	8	12	13,000
Soil Required for Reclamation			
Hertzler Ranch			
Tailings Surface (Note 2)	115	24	371,000
Embankment	42	Not required (Note 3)	
LAD Storage Pond	17	12	28,000
External Borrow Area	70	12	113,000
Miscellaneous (Note 1)	24	12	39,000
Total for Hertzler Ranch Site			551,000
Pipeline Corridor to Hertzler Site	8	12	13,000
Fill Borrow Areas			
Borrow from Within Hertzler Impoundment			
Stage I Borrow			1,948,000
On-going Borrow			2,913,000
Total			4,861,000
Total Fill from External Borrow Areas (Note 4)			2,539,000
Total			7,400,000
Impoundment Fill Requirements			
Embankment			
Stage I Embankment	--	--	1,948,000
On-going Expansion to Final Embankment	--	--	4,892,000
Reclamation			
Tailings Surface Fill Capping Layer (Note 2)	115	36	560,000
Total Fill Required			7,400,000

Notes:

1 The miscellaneous area for soil stripping and reclamation is assumed to consist of approximately 10 percent of the remaining disturbance area. This area includes temporary facilities including; soil stockpiles, boulder stockpiles, boneyard, laydown areas, parking areas, sand and gravel borrow areas, stormwater BMPs, roads monitoring stations, etc.

2 Additional soil and fill quantities required for reclamation will be obtained from external borrow areas at the Hertzler site.

3 Reclamation soils are not required as exposed materials will be suitable for direct reclamation.

4 Total fill available in the knoll adjacent to the LAD pond is 3 million yd^3. Potential borrow material of about 2 million yd^3 is available in the hill adjacent to the northeastern end of the tailings impoundment.

absence of additional disturbance at Stratton Ranch, and the large buffer zone between Hertzler Ranch and the Stillwater River. The cumulative impacts of all local projects, would not eliminate any unique soil resources.

4.9.2 Vegetation

4.9.2.1 Direct and Indirect Effects

4.9.2.1.1 Alternative A — No Action

Under the No Action Alternative, no new kinds of impacts would occur and no new areas would be impacted beyond those previously disclosed and permitted. Existing disturbances and disturbance-related activities would continue to occur in vegetation communities within the permit boundary, and would be limited to those approved and permitted activities that were analyzed in the Stillwater Mine Expansion 2,000 TPD EIS (DSL, DHES, and Forest Service 1992) and earlier environmental documents (see **Appendix A**).

SMC currently has mitigation measures in place to minimize these sources (see **Appendix C**). Reclamation to mitigate existing disturbances and restore primarily native vegetation would be accomplished under the existing Reclamation Plan (Section 4, SMC Permit #00018). Land within the permit boundary would remain under bond until regulatory agencies have determined SMC has met the necessary standards of reclamation success. As a consequence of these measures, no long-term impacts to vegetation are anticipated to result from the No Action alternative.

4.9.2.1.2 Alternative B — Proposed Action

Under the Proposed Action, there would be some direct and unavoidable disturbance of the vegetation within the project area. This alternative also has the potential to impact wetland and riparian communities, which would occur exclusively in association with the installation of the pipelines.

<u>Stillwater Mine Site</u> Under the Proposed Action, the east side waste rock site would be expanded to cover 80 acres, 12 of which are already permitted for disturbance. All vegetation currently present within the 80-acre footprint would be affected by soil salvage operations and subsequent waste rock storage. Revegetated chrome tailings account for 70 percent of this acreage and stony grassland contributes the remaining 30 percent. During the life of the site, impacts to vegetation such as those caused by weedy invasion, erosion, and fugitive dust, do have the potential to occur. However, these are anticipated to be temporal in nature and would not result in any long-term impacts. This conclusion is based upon the following reasoning.

Direct impacts to vegetation would occur within the footprint of the new facilities because the vegetation present in these areas would be removed during soil salvage activities. Ground disturbance associated with the facilities could also indirectly impact vegetation by increasing the occurrence of fugitive dust, erosion, and noxious weed invasion. The potential for erosion would be restricted to the facility area, however, noxious weeds could invade into the facility area as well as into adjacent areas. Similarly, fugitive dust could impact revegetation onsite, as well as vegetation in adjacent areas downwind of the facility.

Interim revegetation would be placed where practical to stabilize slopes and prevent erosion, thus, limiting the potential for fugitive dust and weed invasion. The potential for the invasion of noxious weeds and formation of erosional features in unreclaimed areas prior to closure would be controlled by SMC's weed and erosion control management. Indirect impacts to adjacent vegetation communities, such as the nearby riparian community located in Nye Creek, would be similarly reduced and quite possibly eliminated by these management plans.

As the site is developed and waste rock is amassed, elevations would increase, and contouring would create several new aspects. Final reshaping would result in maximum slopes of 2H:1V to allow for resoiling prior to revegetation. Reclamation would follow standards defined in the Reclamation Plan. Slopes would be covered with 12 inches of soil materials and be reseeded with the approved mix. Reclaimed areas would remain bonded by SMC until determined successful by regulating agencies.

Hertzler Ranch Site The construction and operation of the tailings impoundment would result in the direct loss of 163 acres of native vegetation. Stony grassland accounts for 95 percent of the 163 acres, the remaining 5 percent is sagebrush shrubland. An additional 70 acres would also be disturbed by borrow areas/miscellaneous and topsoil stockpiles. These disturbances would result in the loss of approximately 59 acres of stony grassland, 5 acres of sagebrush shrubland, less than one acre of drainage bottom land, and 5 acres of cultivated hayland.

Operationally, the tailings impoundment would have the same impact to vegetation as is anticipated to occur at the east side waste rock storage site. Likewise, SMC's management practices and revised reclamation plan would ensure the potential for these impacts to occur is minimized and that impacts are quickly remediated if they do occur. Consequently, long-term impacts to vegetation are not anticipated to occur at this site.

Pipeline Corridor, LAD Sites, and Ancillary Facilities Pipeline installation would result in direct and unavoidable disturbance to the upland vegetation it crosses. The disturbances to vegetation are anticipated to be small and short term; no permanent or long-term impacts are anticipated to result. Reasoning for this conclusion is twofold. First, disturbances would be limited in areal extent due to the linear nature of the pipeline construction. Second, the following steps would be taken so as to promptly reclaim the disturbances: 12 inches of soil would be salvaged prior to trenching; trenching disturbances would be promptly backfilled and resoiled; disturbed areas would be reseeded; and restored disturbances would be aggressively reseeded and monitored for weed invasion and erosion until fully stabilized.

Pipeline construction would result in some direct and unavoidable disturbance to approximately 1.5 acres defined as "Waters of the U.S.", including wetlands. Wetlands in the pipeline route are located in the borrow ditches alongside the road and are typically supported by water from adjacent seeps or road runoff or both, which then pools in depressions associated with the road ditch. Pipeline placement would involve the temporary excavation of these areas, and thus several concerns have been raised regarding the effect of this construction on the aesthetic quality, vegetation, water quality, and hydrology of these communities. The invasion of noxious weeds into the areas of pipeline disturbance is also of concern due to the current presence of Canada thistle and spotted knapweed on wet or mesic sites (Western Technology and Engineering, Inc. 1997b). While short-term impacts may occur, no long-term impacts to these communities are anticipated. Wetland and stream crossing methods are detailed in SMC's Wetland Mitigation Plan (Western Technology and Engineering, Inc. 1997c), and are designed to minimize impacts and successfully restore disturbed areas to their original state. The Corps of Engineers has determined the disturbances to wetlands would be authorized under the Corps' Nationwide Permit system (McInerney 1997, pers. comm.). Installation of the pipelines would be authorized under Nationwide Permit Number 12.. The construction of the LAD storage pond and east side waste storage site would be authorized under Nationwide Permit Number 26.

Several new LAD sites and one LAD pond would be developed under this alternative, accounting for 121 acres total. Two LADs would be created at Stratton Ranch (24 acres) and four would be developed at the Hertzler Ranch (80 acres). Additionally, a pond for LAD storage would be constructed accounting for 17 acres at the Hertzler site. Stony grassland and cultivated hayland currently cover these proposed sites. While the additional irrigation and interseeding of creeping meadow foxtail at the LAD site is anticipated to modify the composition of the vegetation community, this would not impact the viability of the community.

The LAD water is high in nitrates and to expedite the absorption of nitrogen, creeping meadow foxtail, a hyper-accumulator of nitrogen, would be interseeded into these irrigated areas. SMC's records on its newest east side LAD pivot suggest vegetation under the LAD pivots removes more than 80 percent of the nitrates dissolved in the water (MSE-HKM, Inc. 1997). Sites would be irrigated with the pre-treated mine adit water during the growing season (generally April through October) and mowed seasonally to remove the nitrogen accumulated in the above ground vegetation. During the winter, excess adit water would be routed to percolation ponds and LAD storage ponds and stored until spring, at which time it would be routed to the pivots. The additional irrigation water and addition of creeping meadow foxtail would modify the composition of the vegetation community, however, is not anticipated to impact community viability. Therefore, no impacts to vegetation are anticipated to result from the development of the LAD sites. Closure of the LAD sites may result in an influx of dryland range species over the long-term.

Several ancillary facilities would be created under Alternative B: borrow areas and soil stockpiles. Borrow areas would be located on stony grassland. Stony grassland makes up 10 percent of this area, drainage bottom land contributes 64 percent, and reclaimed land makes up the remaining 26 percent. The miscellaneous facilities would eliminate the vegetation within their footprint during soil salvage and result in some permanent loss of vegetation. During operation, these facilities would receive interim revegetation to prevent erosion and weed invasion, and would be inspected periodically to control/eliminate these impacts should they occur. Once the facility is closed, final reclamation activities (per the Reclamation Plan) would reestablish primarily native vegetation. Therefore, no long-term effects to vegetation are anticipated to occur as a result of these facilities.

4.9.2.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Stillwater Mine Site The east side waste rock storage site proposed under this alternative would be the same as that proposed in Alternative B. Consequently, impacts associated with this site are, very similar to those described above for Alternative B. The current tailings impoundment would be expanded by 8 acres under this alternative. Although eight more than Alternative B, all 8 would be in disturbed areas.

Hertzler Ranch Site The construction and operation of the tailings impoundment would result in the direct loss of 129 acres of native vegetation. Stony grassland accounts for 95 percent of the 129 acres, the remaining 5 percent is sagebrush shrubland. Impacts resulting from the operation of this impoundment would be the same as those described in Alternative B. Reclamation procedures for this facility are also those described in Alternative B.

Pipelines, LAD Sites, and Ancillary Facilities Several new LAD sites would be developed under this alternative, accounting for 104 acres total. Long-term closure of the LAD sites would result in a change in the vegetative community to more dryland species. Potential impacts to these communities resulting from pipeline placement are those common to all alternatives with pipeline construction and detailed under Alternative B. Several ancillary facilities would be created under Alternative C: 40 acres of stony grassland would be impacted by two borrow areas; 10 acres of stony grassland would be impacted by soil stockpiles and 17 acres of drainage bottom land and previously disturbed vegetation would be impacted by the proposed LAD pond. Impacts related to the development and operation of the facilities are discussed under Alternative B.

4.9.2.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Stillwater Mine Site The creation of a tailings impoundment on the east side of the Stillwater River would result in the disturbance of 72 acres of previously-disturbed vegetation. Stony grassland makes up 30 percent of this total and revegetated chrome tailings contribute the remaining 60 percent. Impacts associated with these sites are the same as those addressed in Alternative B for the east side waste rock storage site. The expansion of the current tailings impoundment would result in the long-term disturbance of an additional 8 acres of disturbed areas.

LAD Sites and Ancillary Facilities Several new LAD sites would be developed under this alternative, accounting for approximately 40 acres total. Two LADs would be created at Stratton Ranch (24 acres) and a smaller site would be developed at the east side site (15 acres). Stony grassland and cultivated hayland currently cover these proposed sites. Impacts associated with the implementation of these sites are detailed in Alternative B. Ancillary facilities created under Alternative D would be limited to a 1-acre LAD pond. Impacts related to the development and operation of this facility are discussed under Alternative B.

4.9.2.2 Cumulative Effects on Vegetation

The four alternatives were evaluated to determine their contribution to the cumulative impacts affecting vegetation resources within the Stillwater Valley. Currently, cumulative impacts to vegetation in the valley are considered to be twofold. First, the native vegetation communities are being reduced in areal extent and/or fragmented by development and industrial growth; and second, the diversity of native species within these native vegetation communities is being reduced by weedy invasion facilitated by disturbance and traffic corridors. The potential for the alternatives to add to either of these cumulative impact stems solely from activities related to the development, operation, and closure of the tailings impoundments and waste rock storage areas. The evaluation was therefore focused on these activities.

All of the action alternatives would result in the disturbance of vegetation due to facility development and this loss would exist through the life of operation. However, vegetation losses would occur in areas where the vegetation is already disturbed. Approximately two thirds of the east side waste rock storage site would be located on reclaimed chrome tailings and the Hertzler Ranch Site would be located on cultivated hayland and stony grassland, which are grazed by cattle. Also, during operations, these sites would be managed by SMC to control disturbance-related impacts, which could result in the establishment of weedy species on and adjacent to the facilities. The potential for a weedy species invasion during operations is thus very low. Finally, these facilities would be reclaimed promptly after closure so as to re-establish a vegetation community that would be ecologically comparable to that removed by construction. As a consequence of these reasons, facilities at the east side waste rock storage site, the existing tailings impoundment, and the Hertzler Ranch Site are not anticipated to contribute to a major reduction in either the extent of native communities. The diversity of native species would decrease on newly-disturbed acres as a result of the expansion of the facilities. This is an unavoidable impact of disturbance. Subsequently, the three action alternatives are not anticipated to contribute to any major cumulative impacts to the vegetation communities within the Stillwater Valley.

4.9.3 Reclamation Mitigation

SMC proposes to manage the facilities during development and operation so as to actively prevent and eliminate the three primary sources of impact (fugitive dust, erosion, and weedy invasion). This would serve to shorten the duration of impacts that do occur and minimize their frequency of occurrence. Furthermore, reclamation of these facilities has been revised to address concerns regarding the adequacy of reclamation methods. In this manner, SMC would substantially diminish short-term impacts to vegetation and minimize the potential for long-term impacts to occur. This would be accomplished by three key management items emphasized by SMC.

First, interim revegetation of the waste rock storage site and tailings impoundment facilities would be concurrent with operation. A minimum of 12 inches of growth media (soil, soil substitute, or both) would be placed on the outer surface of the embankment and revegetated with a final seed mix. This would minimize the amount of surface area at the facility susceptible to erosion and weed invasion and would minimize the potential for fugitive dust.

Growth media for use in reclaiming the tailings impoundment would originate from one of two sources. The top 12 inches of soil materials within the facility development footprint would be salvaged. This soil would be used immediately in concurrent reclamation of the embankment or stored in soil stockpiles for use in final reclamation of the impoundment. The second source of growth media would be borrow material obtained within the permit areas. This borrow material would consist of alluvial and glacial till subsoils.

Although this borrow material lacks some characteristics of topsoil, several characteristics make it a suitable growth medium. The gravel content of this material makes it less erosive than topsoil alone, which has made similar borrow material with the permit area suitable for use on the existing impoundment and waste rock storage embankment slopes. Volumes of the borrow material present in the area are sufficient to compensate for the relatively shallow soils that exist at Hertzler Ranch. The extra volumes of material have made it possible to reclaim areas where existing soils are very shallow. Also, because this material would be used to construct the embankment, the primary requirement for soil would be the amount needed to reclaim the surface of the impoundment upon closure.

A reclamation measure proposed by the agencies involves construction of the first stage of the proposed Hertzler tailings impoundment out to the final toe location rather than an intermediate toe location. This would provide the final outslope at completion of the first stage rather than several years later. The final outslope could then be revegetated several years earlier than under the Proposed Action. **Figure 4–8** graphically shows this mitigation measure.

Second, SMC would conduct periodic inspections of the interim revegetation areas and the non-vegetated areas to detect evidence of slope failure and weed invasions. In this manner, erosional features that do form would be promptly repaired before they could impact surrounding areas and weed invasions would be eradicated before they could become established.

Finally, the entire facility would be reclaimed to native vegetation upon closure. Final reclamation would entail a 12 inch soil coverage at the east side waste rock storage site and 24 inches over the Hertzler tailings impoundment. All other reclamation methodology (soil handling, embankment stabilization, including creation of a vegetative/rock mosaic with maximum vegetated slopes lengths of 150 feet) would follow SMC's existing Reclamation Plan. Seed mixes have been developed so as to re-establish vegetative cover that is ecologically comparable to pre-mining communities, and to restore watershed, wildlife habitats, and recreational and aesthetic values to meet post-operational land use objectives. Seed selection is based on pre-mining occurrence, establishment potential, growth characteristics, soil stabilization qualities, experience gained from on-site reclamation activities and revegetation monitoring results. Reclaimed impoundments and waste storage areas would be bonded by SMC until regulatory agencies are in agreement that the reclamation has been successful and is permanent.

Disturbances in wetlands resulting from pipeline construction would be temporary and several steps would be taken to ensure their restoration:

- Soil (hydric soils) would be salvaged to a depth of 12 inches to preserve hydrophytic plant parts which can propagate.
- Construction would occur when the site is dry if at all possible, and specialized construction equipment (wide-track or balloon tired equipment, or normal construction equipment on timber mats or prefabricated equipment mats) would be used.
- Disturbance would be limited in areal extent and sediment barriers would be installed to avoid adjacent wetlands.
- Spoil would be placed on the side of the trench or on the working side to avoid adjacent undisturbed wetlands.
- Prior to backfilling, trench plugs would be installed as necessary to prevent flow along the trench.
- After backfilling, the area would graded to pre-construction topography, soil would be replaced. Colonization by hydrophytic species in reclaimed wetlands is common and is expected to occur in these areas, but, if necessary, seeding would be conducted to provide erosion control and create a dominance of hydrophytic species.

Disturbances at stream crossings resulting from pipeline construction would also be temporary and would include several steps to ensure the restoration of these temporary disturbances. "Dry crossing" methods would be implemented to isolate trench excavation and pipe placement activities from surface flow. This would be accomplished by one of three techniques: the diversion technique (where stream flow is physically diverted prior to and during construction); the flume method (which would convey flow from the upstream side of the right-of-way to the downstream side by isolating flow from the area to be disturbed); or the dam and pump methods (which operate in a manner similar to the flume method) (Western Technology and Engineering, Inc. 1997c). Once the pipeline is in place, the watercourse would be restored to approximate preconstruction profile and substrate, stream banks would be restored to their original condition, and salvaged soils would be replaced and seeded. Furthermore, tree clearing in the riparian community bordering the streams would occur only immediately adjacent to the existing path of road clearance and be limited in extent.

As a result of the above-described program, factors which often degrade the hydrology and water quality of a wetland, such as sediment deposition, soil compaction, and erosion, are not anticipated to occur. Also, measures would be taken to prevent noxious weed invasion so as to protect the restored vegetative community and return it to its proper functioning condition. Herbicides would be applied at concentrations that would not impact water quality. This, in addition to the limited tree clearing at riparian crossings, would ensure that the aesthetic quality of these communities is not diminished.

Once in operation, the tailings material transported by the pipeline would not come into contact with the communities. The tailings water has been determined to not be toxic to fish or wildlife, and it is not acid generating. An operation monitoring, inspection, leak detection and spill contingency plan has been developed to minimize environmental impacts should a pipeline rupture (Western Technology and Engineering, Inc. 1997c). Should a pipeline rupture, the line would be completely flushed to remove tailings material prior to excavation. Excavation of the pipeline to repair the rupture and remove any tailings material would be conducted using the aforementioned methods to protect wetland function. While short-term impacts would occur during the repair of the rupture, it is not anticipated that any long-term impact would occur due to the aforementioned restoration methods.

4.10 Effects on Cultural Resources

4.10.1 Direct and Indirect Effects

4.10.1.1 Alternative A — No Action

The No Action Alternative would not involve any new earth-disturbing activities in the project area beyond those previously disclosed and permitted. Any improvements to existing transportation corridors would not impact any identified cultural resources. The No Action Alternative would have no direct or indirect effects on known significant cultural resources.

4.10.1.2 Alternative B — Proposed Action

The Proposed Action includes construction of a tailings impoundment and pipelines that pass through two eligible sites and on potentially-eligible site (**Table 4–9**). No cultural resources exist at the east side waste storage site or are known in the Stratton Ranch LAD area.

Table 4–9 Significant Cultural Resources Within the Project Area

Site #	Name	Site Type	Relation to Project	Evaluation	Effects
24ST54	Guthrie	stone rings	pipeline corridor	Eligible	Pipeline to be located in previously-disturbed borrow ditch in road rights-of-way. No effect.
24ST306	Rocky Pass	stone rings and alignments	near tailings	Potentially eligible	No effect
24ST401	Keogh	bison jump	pipeline corridor	Eligible	No effect

The Guthrie Ring site (24ST54) is an extensive area of stone rings, stone alignments, butchered bone, chipped stone artifacts, and a cairn recorded by WCRM (1981). It is on a small knoll and the first terrace above the river, and is crossed by the pipeline corridor. Lahren (1997:8–16) suggests no in situ materials or features exist within the existing road disturbance.

The Rocky Pass site (24ST306) is a stone feature site recorded by Lahren (1997). The site is described as consisting of "ten stone rings, six rock cairns, two rock lines, seven rock half-circles, seven rock features around glacial boulders, and wagon roads and trails" (Lahren 1997:9–3). The site is considered potentially eligible to the National Register, but formal consultation with the SHPO has not been completed. The site area is outside the proposed areas of disturbance (Lahren 1997). The site can be avoided by placing the pipeline in the previously-disturbed roadbed.

The Keogh Bison Kill site (24ST401) was originally investigated by the Billings Archaeological Society (Malouf and Connor 1962), was listed in the Montana Preservation Plan, and was evaluated by WCRM (1991) in the baseline study. The extensive prehistoric site includes a stone line complex, a bison kill, a processing area, and a camp area. Some of the stone lines are on Forest Service land, but most of the site is on private surface. Lahren (1997) conducted limited testing of the Keogh site to define the nature and extent of the deposits. The results indicated that cultural materials were concentrated at the base of the jump-off slope, were essentially absent in the fan area and on the terrace above the Stillwater River, and that camping and processing activities are on the east side of the present river system.

The Proposed Action would not adversely impact contributing portions of these three resources. The primary basis for this conclusion is that the pipelines would be constructed within the previously disturbed borrow ditch adjacent to Stillwater County roads 419 and 420. These sites could, however, be adversely affected by unauthorized relic collecting.

How increased commuter traffic would affect vandalism or relic collecting at sites in the Stillwater Valley is difficult to determine. Most of the archaeological sites along this corridor are hard to see (e.g., scattered stone artifacts) and lie on private lands outside the jurisdiction of CNF or SMC. It is likely that mine workers driving Stillwater County roads 419 or 420 would have no greater adverse effect on cultural sites in the valley than the thousands of recreationists who travel the same road each summer.

The Spring 15 area will also be avoided by pipeline placement in the previously disturbed borrow ditch.

4.10.1.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Implementation of this alternative also would result in no adverse effects to cultural resources. The area of disturbance of Alternative C would be smaller than that of Alternative B and would involve no new areas that were not addressed in Alternative B. The significant cultural resources within the area of disturbance are the same as for Alternative B. Thus, the effects of this alternative would be similar to those of Alternative B.

4.10.1.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

Alternative D would involve an expansion of the existing tailings impoundment similar to that for Alternative C, a tailings impoundment in the location of the east side waste rock storage site in Alternatives B and C, and no pipeline construction beyond the Stratton Ranch LAD facilities. None of the four significant cultural resources (**Table 4–9**) occur at or near the sites of any of these facilities. Therefore, no adverse effects to cultural resources would occur with implementation of this alternative.

4.10.2 Cumulative Effects

None of the alternatives considered in detail would directly or indirectly affect contributing portions of the three eligible cultural resources present near any of the proposed facilities. Thus, none of the alternatives would contribute to direct cumulative effects on the condition or integrity of cultural resources in or near the project area.

How increased commuter traffic would affect vandalism or relic collecting at sites in the Stillwater Valley is difficult to determine. Most of the archaeological sites along this corridor are hard to see (e.g., scattered stone artifacts) and lie on private lands outside the jurisdiction of CNF or SMC. It is likely that mine workers driving Stillwater County roads 419 or 420 would have no greater adverse effect on cultural sites in the valley than the thousands of recreationists who travel the same road each summer.

4.10.3 Mitigation Measures

No significant direct, indirect, or cumulative effects are anticipated with the implementation of any of the alternatives. However, the agencies would require monitoring of construction by a qualified archaeologist during pipeline placement in areas of known or suspected cultural sites. In the event unidentified cultural material is exposed, operations would cease. This is especially important in the area of Spring 15. If SMC exposes previously-unidentified sites on National Forest System lands during excavation and construction, the company is required to (1) cease activities that could further damage the site and (2) notify the CNF. If SMC exposes previously-unidentified sites off National Forest System lands, it shall halt operations that could damage the site and contact DEQ and the SHPO.

4.11 Unavoidable Adverse Effects

The Proposed Action would disturb approximately 251 new acres for mine-related structures in areas previously used for mining and agriculture. A listing of the unavoidable adverse effects includes:

Groundwater Quality — A localized increase in nitrates.

Surface Water Quality — Minor degradation of certain parameters, but no standards would be violated. Nitrate levels in the Stillwater River would increase, but would not violate any standard. There would be an increase in sedimentation into the Stillwater River. There would be a slight increase in runoff from waste rock.

Waters of the U.S. — Approximately 1.5 acres of wetlands would be affected, but the effects would be mitigated through in-kind reclamation.

Vegetation — Approximately 251 acres would be changed from the current vegetation community of native and introduced (agricultural) species to a different community after reclamation. Species diversity would be reduced in native communities disturbed as a result of implementing the proposal.

Wildlife Habitat — Approximately 251 acres would be affected in the long-term, but would be available for wildlife after mining ceases. Approximately 318 acres of mule deer winter range would be affected in the short-term.

Social and Economics — Approximately 456 new residents would be expected to enter the local communities, including 51 elementary and 34 high school students.

Noise — Construction noise would be created in all locations. Operational noise would increase slightly at the mine site and at the east side site.

Transportation — Average Daily Trips on Stillwater County roads 419 and 420 would increase to 906 from 803.

4.12 Relationship Between Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

In general, short-term refers to the life-of-mine five years or less and long-term effects are defined as those that would extend beyond five years.

Geology and Minerals — Approximately 1,095,000 tons of platinum/palladium ore would be removed from the Stillwater Complex each year of the 30-year mine plan, or over 32 million tons.

Water Resources — Localized short-term increases in nitrates would occur in groundwater and the Stillwater River, but these levels would not violate any standards and would return to near pre-mining conditions after mining ceases.

Wildlife — There would be short-term reductions in vegetation productivity and in wildlife habitat, but because of reclamation and mitigation measures, these conditions would return to near pre-mining conditions.

Socioeconomics — There would be short-term impacts to the local infrastructure. There would be increased productivity during the life of the project including production of platinum group metals, creation of 142 new jobs (mining and secondary), and additional revenues to Stillwater County and the State of Montana.

Visuals — Low level visual intrusions would occur during the life of the project from most of the KOPs. However, KOPs 1 and 4 would have high level intrusions because facilities would be constructed in the foreground or middle ground. Impacts would be reduced through recontouring, reclamation, and mitigation measures.

Noise — Short-term noise impacts during construction would occur at the mine site, east side site, Stratton Ranch, and Hertzler Ranch. During operations, noise would be increased at the east side site and slightly at the Hertzler Ranch. Impacts would cease after reclamation is complete.

Transportation — Short-term impacts would occur during construction of the pipeline corridor. Traffic levels would increase for the life of the mine by approximately 13 percent. Impacts would cease at the close of operations.

4.13 Irreversible and Irretrievable Losses

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, or physical) that could not be stopped. As a result, the resource or its productivity 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, or its utility for the life of the project.

Geology and Topography — Approximately 32,850,000 tons of ore would be removed from underground workings by implementation of any of the action alternatives. However, the platinum and palladium metals could be recycled or reused indefinitely. The removal of the ore would be irreversible and irretrievable. Although some waste rock and tailings would be placed underground, placement of some waste rock and tailings in facilities on the surface would modify the area's topography irreversibly.

Wildlife — Alternative D would place a tailings impoundment on the east side site which would remain as a larger structure after reclamation than the waste rock storage site in the other alternatives. This would represent an irretrievable change in habitat for mule deer and possibly for bighorn sheep.

Socioeconomics — Tax revenues would irretrievably increase during the life of the mine from property taxes, employment taxes, sales taxes, and others. Increased revenues would enable Stillwater County, local communities and the school districts to meet increased demands for services resulting from any mine-related influx of workers as well as general population growth in the area. Mine expansion could irretrievably stimulate the private sector economy, however, the permanence of private sector expansions would depend on the continued needs and demands of the general population after mine closure. Tax revenues would probably return to near existing levels after mine closure.

Transportation — Traffic on Stillwater County roads 419 and 420 would be irretrievably increased during the life of the project. The increase is estimated at 13 percent. Any permanent improvements of these roads as a result of agreements between SMC and Stillwater County would irreversibly mitigate, to some degree, the impacts of the increased traffic.

4.14 Effects of Environmental Justice in Minority Populations and Low-Income Populations

The action alternatives were evaluated for issues relating to the social, cultural, and economic well-being and the health of minorities and low income groups. Such issues are termed environmental justice issues and none were identified for the Stillwater Mine project. Social and economic effects of any action alternative would not affect minority or low-income groups disproportionately.

4.15 Evaluation of Restrictions on Private Property

Section 75-1-201(1)(b)(iv)(D) of MEPA requires Montana state agencies to evaluate in their EISs any regulatory restriction proposed to be imposed on the use of private property. The EIS must state whether there are any alternatives that would reduce, minimize, or eliminate the restriction or the regulation, and must analyze the alternatives. Guidelines for agency implementation of this provision require state agencies to discuss the benefits to be derived from imposing the restriction. This section satisfies this requirement.

The Proposed Action evaluated in this EIS would allow SMC to continue mining for approximately 30 more years. Two action alternatives and 15 mitigations were developed as part of this EIS (see **Section 2.4** for the descriptions). The alternatives and mitigation measures would alter the way SMC conducts mining at the mine site in order to protect environmental and cultural resources. The alternatives and mitigation measures would therefore restrict the use of SMC's mineral rights which are private property. The following sections provide either a qualitative or quantitative comparison of the costs associated with each alternative to the Proposed Action and the costs of mitigation measures that would be required. The costs cited are those in addition to the costs of implementing the Proposed Action unless otherwise stated.

Federal and state laws that regulate SMC's activities at the mine site include:

National Environmental Policy Act (NEPA);
Clean Air Act (CAC);
Clean Water Act (CWA);
Resource Conservation and Recovery Act (RCRA);
National Forest Management Act;
Endangered Species Act;
Migratory Bird Treaty Act;
Antiquities Act;

National Historic Preservation Act;
American Indian Religious Freedom Act;
Native American Graves Protection and Repatriation Act;
Archeological Resources Protection Act;
Montana Environmental Policy Act (MEPA)
Montana Air Quality Act;
Montana Water Quality Act;
Montana Hazardous Waste Act; and
Montana Underground Storage Tank 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 agency has no discretion to alter or waive them The agencies developed the cost figures in cooperation with SMC (Gilbert 1998e).

Analyzed in this section are two types of regulatory restriction, alternatives and mitigations. Alternatives would either prohibit expansion altogether (Alternative A) or amount to a different plan for tailings disposal and waste rock storage (alternatives B, C, and D). Mitigations on the other hand are modifications to Alternative B, SMC's proposed action, but would be applied to any of the action alternatives. For each alternative and mitigation, the benefits and costs, as they relate to the use of private property, are compared. The alternatives and mitigation measures evaluated do not necessarily prohibit further development of the mine site, but could require SMC to spend additional funds beyond the minimum required for compliance with environmental regulations. The higher the costs associated with regulatory compliance, the less economic benefit can be gained from the use of the property and the more restrictive the regulatory action is to the use of private property.

4.15.1 Alternative A — No Action

The no action alternative would prohibit expansion. The benefits of this alternative would be the elimination of predicted impacts caused by continued mining and construction of the waste rock storage site and an additional impoundment, and more rapid reclamation of existing disturbances. SMC lands at Stratton and Hertzler ranches would be available for residential development or other uses SMC might decide to pursue. The costs include a substantial decrease in SMC's mineral property value, a drop in the value of the company's stock, and an almost total loss of economic benefits. This alternative is extremely restrictive of SMC's private property. Several alternatives exist, with measures to reduce the impact of this restriction, including the proposed action.

4.15.2 Alternative B — Proposed Action

SMC would be able to develop its mineral properties over the next 30 years and generate an additional 15,000,000 tons of tailings and 17,886,000 tons of waste rock to be stored on SMC properties. The company would continue to make profits from the sale of the ore mined and processed at the site and retain such value on their stocks as the market would support.

4.15.3 Alternative C — Modified Centerline Expansion and Hertzler Tailings Impoundment

Alternative C would still allow SMC to develop their mineral properties over the next 30 years. However, SMC would have to expand the existing tailings impoundment before constructing the pipeline and a slightly smaller Hertzler impoundment. The benefits of this alternative to SMC are those described for proposed action above. The cost of expanding the existing tailings impoundment and constructing the impoundment at the Hertzler Ranch would be slightly more than the proposed action, $3.29 per ton of tailings compared to $3.27 per ton of tailings for Alternative B (see **Appendix H**). However, SMC would have less operational flexibility for storing tailings until after the delayed construction of the Hertzler impoundment was implemented. This alternative may be slightly more restrictive than the proposed action.

4.15.4 Alternative D — Modified Centerline Expansion and East Side Tailings Impoundment

This alternative eliminates the need to develop the impoundment at the Hertzler Ranch for the short term. SMC would be able to subdivide or otherwise develop the Hertzler Ranch. SMC would still be able to develop their mineral properties but only for approximately 23 years instead of the 30 years under alternatives B and C because there is less storage available in these two tailings storage facilities. Costs for developing the east side impoundment and expanding the existing impoundment would cost $3.38 per ton of tailings compared to $3.27 per ton of tailings estimated for developing the east side waste rock storage site and the Hertzler tailings impoundment (see **Appendix H**).

Although this alternative would allow for interim uses of the Hertzler Ranch, in approximately 15 to 20 years SMC would have to resubmit its application for the Hertzler site (or another site if the Hertzler Ranch had been converted to other permanent uses) to achieve the 30 years of tailings and waste rock storage as planned under alternatives B and C. SMC would be restricted from mining additional mineral reserves until additional storage space had been located, environmental impacts analyzed, and the changes to the operating permit approved by the agencies. This would involve additional costs for SMC's development of the revision application and the environmental impact analysis by the state. If that revision was similar in extent to this proposed revision, application and analysis costs could reach $2 million and $1 million respectively[1]. This alternative would be more restrictive of the use of private property than the proposed action.

4.15.5 Mitigation Measures

There are 14 additional mitigation measures that were developed by the agencies beyond those proposed by SMC to further reduce, minimize, or eliminate impacts, provide compliance with regulations, and respond to public comments. Even though those mitigation measures that would be needed to comply with regulations or address public comments are not subject to restriction analysis, the costs of implementing these measures is provided whenever possiblle. None of the mitigations would prevent SMC from developing their mineral properties. These measures and their effects on the use of SMC's property are described below.

1) The agencies would require testing and monitoring of the permeability of the clay liner or compacted base on which the HDPE liner would be placed. If this testing showed that the material does not meet the minimum permeability requirement of 1x10-6 cm/sec, then additional clay material would need to be brought in to reduce the permeability. The actual cost of obtaining this material would vary depending upon how much material was needed and how far it had to be hauled to get to the site, because this affects the cost of purchasing the material and the amount of work involved in transporting the material to and placing the material at the site. SMC could also investigate other options of achieving the desired permeability. There are too many variables to determine what this cost might entail. If the monitoring showed that required permeabilities were obtained, SMC would noot incur costs for obtaining the additional clay material. No less restrictive method of protecting ground water has been identified.

2) SMC would be required to monitor ground water at the Hertzler Ranch to determine effects of seepage from the impoundment. The agencies would require an additional mitigation measure based on the results of the ground water monitoring. If ground water monitoring at the Hertzler Ranch

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[1]This would be approximately $700,000 in 1998 dollars with a 5% inflation factor over 23 years for the collection of baseline, engineering studies, and preparation of a revision application (Gilbert 1998). The preparation of the EIS by third-party contractor would be approximately $350,000 in 1998 dollars with a 5 percent inflation factor over 23 years.

indicated that nitrates or other contaminants were migrating at concentrations that would cause increases above the trigger level in the Stillwater River, SMC would be required to conduct biological monitoring of periphyton and macroinvertebrates above and below the site twice a year. This mitigation measure, if implemented, would require SMC pay for additional monitoring and testing. This type of monitoring and testing costs approximately $30,000 per year. The number of years of testing required would depend upon when ground water monitoring indicated biological monitoring was necessary. The additional monitoring would be required to comply with both MMRA and the Montana Clean Water Act.

3) If monitoring at Hertzler Ranch showed that groundwater quality exceeded nondegradation standards outside of the mixing zone then SMC would be required to identify, collect baseline data prior to construction of the pipeline and Hertzler impoundment from, and monitor nearby down-gradient residential wells that could potentially be affected by seepage from the Hertzler impoundment. SMC would be required to pay for the collection and testing of water samples. Typical collection and laboratory costs for a single sample range between $35.00 and $330.00 for nitrates and a full range of the constituents specified in SMC's ground water monitoring plan respectively. The total cost would depend upon the number of wells being sampled. This sampling would ensure that down-gradient water users would be identified and help determine if their water supplies became contaminated as a result of the Hertzler impoundment. If that occurred, then SMC would provide replacement water sources as required under MMRA. No less restrictive means of ensuring long term compliance is available.

4) SMC would be required to purchase a 250 kW backup generator to ensure pipeline leak detection sensor function and operation during power failures or partial power outages. This would cost SMC approximately $50,000 to purchase and $32.00 per hour to operate; it would take about 4 hours of pumping to vacate the tailings pipeline. However, if a power outage resulted in undetected leaks or ruptures of the pipeline, the cost of fines, penalties, and repairs could potentially exceed that amount. SMC proposes to construct an underground water storage reservoir at the 6400 foot level, however, it may not be constructed immediately and it would take time for it to fill up with enough water to provide sufficient volume to flush the pipelines by gravity feed alone. There may also be times during mine life when there was insufficient volume of water in the storage reservoir. Therefore, there is no less restrictive means of ensuring that the pipelines could be flushed in the event of a rupture during a power failure although a smaller generator would be sufficient to supply enough power to keep the leak detection system function.

5) If, after 2 years, agency review of pipeline monitoring data resulted in a decision to continue the monitoring of the tailings pipelines every six months and the water pipelines annually, there would be a continuing cost of monitoring the pipelines more frequently than SMC might want to specify. If the agency determined that pipeline monitoring frequency could be reduced, costs to SMC would be reduced slightly. No less restrictive means of ensuring pipeline failure does not occur has been identified.

6) SMC, DEQ, and CNF would re-evaluate paste technology applicability for use at the Stillwater Mine after 5 years of operations. There would be some costs for engineering studies. If the evaluation resulted in implementation of paste technology, there might be increases in construction and operational costs over more traditional mining and waste storage methods proposed under Alternative B. Those costs cannot be estimated at this time. No less restrictive means of providing a denser, and thus potentially smaller impoundment, which also retains less water and can be reclaimed in a shorter period of time has been identified. However, DEQ will make this evaluation again when paste technology is re-evaluated.

7) SMC would be required to work with the Stillwater Valley Bighorn Management Committee to explore options for mitigating indirect impacts to bighorn sheep. The company's main involvement would be attending meetings, developing mitigations, and implementing those mitigations. SMC currently works with the committee as required in their operating permit so no additional costs would be incurred for attending the meetings. No costs of mitigation implementation can be determined at this time because the plans have not be developed; the costs are not expected to be substantial. Furthermore, whether less restrictive means are available will be evaluated before a mitigation is imposed.

8) The agencies would require SMC to replace creeping meadow foxtail with a more palatable native species in the reclamation seed mix for the LADs. There would be virtually no difference in costs to SMC for implementing this mitigation measure.

9) SMC currently has a dust abatement program for the existing impoundment. As mitigation, the agencies would require that program be extended to the Hertzler or east side impoundments, depending upon the alternative implemented. The dust abatement program would be implemented whenever one of the impoundments was not in use as well as when both were inactive. This mitigation would result in a slight increase in operating costs to keep both surfaces wet. This mitigation would be required under the air quality permit to comply with the Montana Air Quality Act.

10) During final design development of the Hertzler tailings impoundment, SMC would be required to conduct stability modeling and analyses on

the Colorado Shale Unit for deep foundation failures. The agencies would also require that a professional engineering geologist or geotechnical engineer would observe the excavation of the Hertzler Ranch impoundment foundation and borrow areas to determine if any geomorphological features were exposed that would indicate ancient mass failure. If such features were observed or if the modeling indicated a potential for mass failure, then SMC would be required to develop a plan for a detailed bedrock drilling program and analysis. The plan would be subject to agency review and approval prior to implementation. Necessary changes to the design of the impoundment would be developed, reviewed and approved by the agencies, and implemented to resolve any problems identified by the drilling and bedrock analysis. There would be a slight increased cost for running the additional stability modeling during final design ($2,000 to $5,000). Since SMC typically has a professional engineer on hand during construction for quality control purposes, there would be no additional cost for the engineer to look for signs of mass failure. The costs associated with drilling and bedrock analysis and any resulting engineering designs and construction changes cannot be determined at this time. This mitigation would confirm that the shale bedrock and glacial till had not been affected by past mass movement and that the glacial till would provide a suitable foundation for the impoundment. This requirement would be required under MMRA and no less restrictive means of ensuring that the impoundment would not be subject to mass failure has been identified.

11) The agencies would require SMC to develop incentives for employee carpooling. This requirement is based on the need for minimizing the potential for accidents on road segments in need of resurfacing. Incentives could have varying costs to SMC depending upon what SMC included in their plan and how many employees take advantage of the incentives. These costs cannot be estimated at this time. This analysis of restriction would be reevaluated when a plan is submitted to the agencies. The need for this stipulation may be eliminated through the Hard Rock Impact Plan.

12) The agencies would require SMC to extend the first lift of the proposed Hertzler tailings impoundment to the full footprint so that the outer slopes can be reclaimed once and not redisturbed during construction of the second lift. This could increase construction costs of the embankment of the first lift by approximately $1.2 million, but it would eliminate the need to reclaim that portion of the embankment a second time under alternatives B and C (there would be no impoundment at Hertzler Ranch under Alternative D). The cost for stage two would be reduced by $1.2 and so there would be no net increase in cost of constructing the impoundment Interim revegetation of the first left as planned under Alternative B would mitigate visual impacts and provide

for slope stabilization, but the slope would be redisturbed when the second lift was constructed and require revegetation for a second time. There are no other ways to provide for final revegetation of the outer slope of the first lift and eliminate redisturbance of the slope. SMC could investigate modifying the final design so that there is no net increase in volume of borrow needed to build the first lift out to the final footprint, it is anticipated that this would reduce the height of the first lift which would be made upp in the second lift; this could reduce the up front capital needed to construct the first lift. This mitigation is more restrictive than that proposed under Alternative B.

13) SMC specified in its revision application that the outer slopes of the Hertzler impoundment and east side waste rock storage site would be reclaimed with a mosaic of vegetation and rock. SMC did not specify how long the soiled and vegetated slopes would be. The agencies would require a mitigation measure to specify that revegetated slopes would not exceed 150 feet in length before being intercepted by a rocky zone. This rocky zone or armor would be placed asymmetrically across the slope. This would not result in any additional costs to SMC and is an extension of a mitigation for the existing required under the 1992 ROD on the 2,000 tpd EIS. This mitigation would be necessary to ensure successful reclamation of these slopes, to reduce erosion, and comply with MMRA.

14) SMC would be required to have a professional archeologist present during construction of the pipeline and the embankments for the first lift of the Hertzler impoundment when construction of these facilities approaches identified and potential cultural sites. The archeologist would be responsible for identifying any cultural material that might be exposed during construction. This would result in additional costs of paying for those services. Current rates for a professional archeologist range between $25.00 and $50.00 an hour; SMC would also need to cover lodging and meals for the person hired for this purpose. The total cost would depend upon on how long construction took and on any needed mitigations. This restriction would be required to comply with the various federal laws pertaining to cultural, historic, and archeological resources. No less restrictive means of protecting archeological resources has been identified.

Chapter 5.0 — Consultation with Others

Chapter 5.0 — Consultation with Others

Agencies, companies, and organizations consulted include the following:

- Jim E. Richard Consulting Services
- Knight Piesold Ltd. Consulting Engineers
- Montana Department of Fish, Wildlife, and Parks
- Montana Department of Commerce
- Montana Department of Labor
- Montana Department of Transportation
- Montana State Historic Preservation Office
- Stillwater Conservation District
- Stillwater County
- Stillwater Mining Company
- U.S. Fish and Wildlife Service
- Western Technology and Engineering, Inc.

Chapter 6.0 — Preparers and Contributors

Chapter 6.0 — Preparers and Contributors

This final EIS was prepared by Greystone, a third-party contractor, under the direction of the DEQ and CNF. Representatives from the cooperating agencies contributed to and participated in the NEPA process. Technical input regarding the proposed project was provided by SMC and its consultants. The following sections present the names of individuals and their area or areas of responsibility from the DEQ, CNF, and Greystone who were involved in the preparation of the final EIS. Brief biographical information also is provided.

Montana Department of Environmental Quality

Name	Project Responsibility	Education
Sandi Olsen	Reviewer	B.A. Biology 21 years of experience
Kathleen Johnson	Project Coordinator	B.S. Landscape Architecture M.S. Land Rehabilitation 10 years of experience
Joe Gurrieri	Hydrology	B.A. Geography M.S. Geology 14 years of experience
Patrick Plantenberg	Reclamation	B.S. Plant and Soil Science/ Recreation Area Management M.S. Range Science/Land Rehabilitation 25 years of experience
Peter Werner, P.E.	Engineering	B.S. Civil Engineering B.S. Geology M.S. Mining Engineering 11 years of experience
Denise Kirkpatrick	Air Quality	B.S. Environmental Engineering 2 years of experience

USDA Forest Service

Name	Project Responsibility	Education
Pat Pierson	Project Coordinator	B.S. Forest Resource Management B.A. Geology 14 years of experience
Carol McCoy Brown	CNF Geologist	B.S. Geology M.S. Geology 20 years of experience
Tom Highberger	Recreation/Aesthetics	B.A. Fine Arts 25 years of experience
Halcyon LaPoint	Cultural Resources	B.A. Philosophy M.S. Archeology 20 years of experience
Clint McCarthy	Wildlife/Threatened or Endangered Species	B.S. Wildlife Management 19 years of experience
Douglas McClelland	Engineering	B.S. Mechanical Engineering M.S. Geotechnical Engineering M.S. Mechanical Engineering 24 years of experience
Richard Marshall	Economics	B.S. Business Administration M.A. Economics Ph.D. Minerals Economics 16 years of experience
Mark Slacks	CNF NEPA Coordinator	B.S. Forest Resource Management 18 years of experience
Don Sasse	Wildlife/Threatened or Endangered Species	M.S. Biology and Wildlife Management 20 years of experience

Greystone — Third-party Contractor

Name	Project Responsibility	Education
Randy Schroeder	Principal-in-Charge	B.S. Natural Resource Management M.S. Environmental Science 22 years of experience
David Cameron	Project Manager	B.A. Biology M.S. Terrestrial Ecology 19 years of experience
Dehn Solomon	Assistant Project Manager	B.A. Biology M.S. Biology 27 years of experience
Cathy Begej	Water Resources	B.S. Environmental Geology 16 years of experience
Mike Bonar	Wildlife/Threatened or Endangered Species	B.S. Environmental Biology 8 years of experience
Jack Sosebee	Water Resources	B.S. Chemistry B.A. Geology M.S. Environmental Studies 23 years of experience
Ed Fleming	Fisheries/Aquatics	B.S. Aquatic Biology 10 years of experience
Susan Hoffmeister	Vegetation/Reclamation	B.S. Environmental, Population, and Organismic Biology M.S. Environmental Science and Applied Ecology 7 years of experience
Will Mahoney, P.G.	Soils	B.S. Geology M.A. Geography 17 years of experience
John Forsythe, AICP	Socioeconomics	B.A. Environmental Studies and Planning MCRP, Planning/Transportation 9 years of experience
Don Douglas	Air Quality/Noise	B.S. Meteorology M.S. Meteorology 27 years of experience
Larry Keith	Aesthetics	BLA, Landscape Architecture 23 years of experience
Lisa Welch	Land Use, Recreation	B.S. Earth Sciences 7 years of experience
Carl Spath, Ph.D.	Cultural Resources	B.A. Anthropology M.A. Anthropology Ph.D. Anthropology 27 years of experience

Pincock, Allen, and Holt — Subcontractor

Name	Project Responsibility	Education
Darrel Buffington, P.E.	Engineering, Impoundment Stability	B.S. Geological Engineering M.S. Civil Engineering 19 years of experience

Techlink Environmental, Inc. — Subcontractor

Name	Project Responsibility	Education
Carlos Tamayo	Seepage Analysis and Modeling	B.S. Civil Engineering M.S. Civil Engineering Ph.D. Civil Engineering
James Warner	Seepage Analysis and Modeling	B.S. Civil Engineering M.B.A. Systems Engineering M.S. Systems Engineering Ph.D. Civil Engineering

Chapter 7.0 — Distribution and Review of the Draft EIS

Chapter 7.0 — Distribution and Review of the Final EIS

The following list identifies the agencies, organizations, and persons to whom the final EIS was sent.

Federal and State Officials

U.S. Senator Max Baucus
U.S. Senator Conrad Burns
U.S. Representative Rick Hill
Montana Senator James H. Burnett
Montana Representative Robert Story, Jr.

Federal Agencies

U.S. Army Corps of Engineers
U.S. Bureau of Land Management, Montana State Office
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

State Agencies

Montana Board of Environmental Review
Montana Department of Commerce
Montana Department of Fish, Wildlife and Parks
Montana Department of Natural Resources and Conservation
Montana Department of Transportation
Montana Environmental Quality Council
Montana Governor's Officer
Montana Natural Heritage Program
Montana State Historical Preservation Officer

Local Agencies

Carbon County Commissioners
City of Columbus
City of Red Lodge
Stillwater County Commissioners
Stillwater County Planner
Stillwater Conservation District
Yellowstone Conservation District
Yellowstone County Commissioners

Tribal Organizations

Crow Tribal Council
Crow Cultural Committee

Organizations

Alliance for the Wild Rockies
Environmental Quality Council
Fishtail Community Center
Greater Yellowstone Coalition
Mineral Policy Center
Montana Council Trout Unlimited
Montana Wildlife Federation
Montana Wildlife Federation
National Wildlife Federation
Northern Plains Resource Council
Northern Rockies Geological Data Center
Sierra Club
Stillwater Protective Association
The Ecology Center
Wildlife Management Institute
Yellowstone Audubon Society
Yellowstone Valley Audubon Society

Companies

ASARSO Incorporated
Laser Incorporated
Maxim Techologies
MEIC
Stillwater Mining Company
Stillwater Printing

Educational Institutions

Absarokee High School Library
Billings Parmly Library
Montana State Library
Montana Technical Library
Stillwater County Library

Media Outlets

Billings Gazette
Carbon County News
KEMC – FM (National Public Radio Corporation, Billings)
KSVI TV (Billings)
KTVQ TV (Billings)
KULR TV (Billings)
Stillwater County News

Individuals

Alexander, C.
Andrews, J.
Arnold, K.
Baken, A.
Bardelmeier, C.
Bare, C.
Bass, C.
Baukol, F. A.
Bedard, D.
Bender, J.
Blattie, H. L
Bliss, B.
Boyd, A.
Brady, D.
Buchowiski, J. L.
Buckalew, R. and Robinson, D.
Buell, A.
Chambers, D.
Christensen, S. M.
Cluett, L.
Connor, H.
Cossitt, A.
Coulter, J. E.
Croston, T.
Degele, J.
DeGroat, P. and M.
Doely, E.
Donohoe, M.
Dowd, B. R.
Duke, P. and M. E.
Egan, C.
Ekwortzel, B.
Ezell, D. T.
Fain, B.
Fauerbacher, F.
Fisher, D. B.
Flanigan, M. L.
Floyd, J. W.
Gauthier, M.
Geddie, J.
Geraghty, E.
Givens, K.
Glenn Family and H. Bender
Graham, B.
Hall, B.
Halstead, M. L.
Harmon, R.
Harris, K. and T.
Harris, K.
Hasberry, C.
Hayes, J.
Heigis, J. E.
Heyneman, J.
Hjelvik, D.
Hjelvik, M.
Hodges, G.
Hoffmann, D. E. and K. M
Holmes, W.
Honorable A. E., Jr.
Howard, R. A.
Hunnes, J. A.
Inter-Fluve, B. A.
Irving, C. and A.
Jahner, G. and R.
Jensen, C. and R.
Jensen, L. and D.
Jensen, P.
Johnson, C.

Johnson, R. and B.
Johnson, S. and D.
Kamos, D.
Kamos, C. E. and P. R.
Keller, V. and A.
Keogh, N.
Kircher, T.
Klee, L.
Knopp, J.
Koch, F. and J.
Langston, K.
Lean, T.
Lee, R. and J.
Lindsay, B.
Lunder, D.
Luoma, D. L.
Madison, H.
Martin, G. and K.
Martin, K. E.
McGough, D. J. and K. Whybrow
McLean, T.
McNeill, T. J.
McPhail, A. R.
Mikelson, R. A.
Milligan, J.
Moseley, C. A.
Moses, L. and G.
Moses, J.
Mybie, R.
Nauman, R. A. and J. C.
Nighbert, E.
Pearson, W.
Pfennig, A. and M.
Powell, D.
Ratliff, P.
Redman, B.
Redman, B.
Redmand, R.
Rich, A.
Richter, J.
Riedesel, J. R. and M. C.
Rollwitz, P. and J.
Rossetter, M. and G.
Sargent, J.
Schramm, W. F. and S.
Shemer, J. and P.
Shenk, R. M.
Sherer, J.
Sherman, D.
Shubin, J.
Smith, C.
Southworth, J. O.
Stafford, B. and S.
Sternod, J. and J.
Stout, C. and C.
Thomas, R.
Thompson, S. and L.
Thompson, B. and J. E.
Torgerson, T.
Trees, J.
Verduin, R.
Vincent, G.
Weppler, J. and N.
Wheeler, R.
Whiting, B. and M.
Willett, F.
Wilson, G.
Winge, P. and I.
Wolfe, D. A.
Wood, E.
Yantis, J.
Yanzick, B. and T.
Yoder, S.

Chapter 8.0 — Glossary

Chapter 8.0 — Glossary

2h:1v – slope angle measurement; slope is twice as long horizontally as vertically.

ABC – Anoxic Biotreatment Cell

acid rock drainage – drainage with a pH of 2.0 to 4.5 from mines and mine wastes that is the result of oxidation of sulfides exposed during mining.

acre-feet – the volume of liquid or solid required to cover one acre to a depth of one foot, or 43,560 cubic feet; measure for volumes of water, reservoir rock, etc.

adjudicated springs – spring for which water rights have been filed with the State Engineer and which have certain rights in a judicial court of law.

adit – entrance to a mine shaft.

affected environment – the natural, physical, and human-related environment that is sensitive to changes due to proposed actions; the environment under the administration of one line officer, such as District Ranger or Forest supervisor.

alkalinity – a measurement of the relative concentration of strong bases (e.g. sodium or potassium) in a substance in relation to strong acids.

ambient concentration – the mass of a pollutant in a given volume of air. It is typically measured as micrograms of pollutant per cubic meter of air.

angle of repose – the maximum angle of slope at which loose, cohesionless material remains stable. It commonly ranges between 33° and 37° on natural slopes.

aquifer – a body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

background – the viewing area of a distance zone that lies beyond the foreground-middleground. Usually from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

best management practices (BMP) – a practice or combination of practices determined by the state to be the most effective and practicable (including technological, economic and institutional considerations) means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

biodiversity – the diversity of species, ecosystems, and natural processes in an area.

browse – shrubby forage utilized especially by big game.

bulk tailings – refers to tailings that contain both the coarse fraction (landfill) and the fine fraction (slimes), which are directed to the cyclones for separation into the coarse and fine fractions.

CFR – Code of Federal Regulations, the compilation of federal regulations adopted by federal agencies through a rule-making process.

clarification – process of removing suspended particles from water by precipitating them and drawing the sludge off.

class I airshed – areas of specific national or regional value from a natural, scenic, recreational, or historic perspective. Class I airsheds are protected under the Clean Air Act of 1977 and only a small degree of air quality deterioration is allowed in locations near Class I areas.

class II airshed – a geographical region which can accommodate normal well-managed industrial growth before significant air quality deterioration would be deemed to occur.

CNF – Custer National Forest.

contrast – the effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

cultural resources – the archaeological and historical remains of human occupation or use. Includes any manufactured objects, such as tools or buildings. May also include objects, sites, or geological/geographical locations significant to native americans.

cumulative effects – as defined by 40 CFR 1508.7, cumulative effects are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

decibel (dB) – a unit used in expressing ratios of electric or acoustic power. The relative loudness of sound.

decibels (dBA) – units for describing amplitude of sound frequencies to which the human ear is sensitive.

DEQ – Montana Department of Environmental Quality.

direct effects – as defined by 40 CFR 1508.9, these are effects which are caused by the action and occur at the same time and place as the action. Synonymous with direct impacts.

discharge – the volume of water flowing past a point per unit time, commonly expressed as cubic feet per second (cfs), gallons per minute (gpm), or million gallons per day (mgd).

dispersed recreation – a general term referring to recreation use outside the developed recreation site; this includes activities such as scenic driving, hunting, backpacking, and recreation in primitive environments.

distance zones – areas of landscapes denoted by specified distances from the observer. Used as a frame of reference in which to discuss landscape characteristics or activities of man.

background (bg) – area located from 3–5 miles to infinity from viewer.

middleground (mg) – area located from 0.25–0.50 to 3–5 miles from the viewer.

foreground (fg) – the detailed landscape found within 0 to 0.25–0.50 mile from the viewer.

DSL – Montana Department of State Lands.

earthquake – sudden movement of the earth's crust resulting from faulting, volcanism, or other mechanisms.

effects – environmental consequences as a result of a proposed or alternative action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time or further removed in distance but which are still reasonably foreseeable. Also referred to as impacts.

endangered species – any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the secretary of the interior as endangered in accordance with the 1973 Endangered Species Act.

environmental impact statement (EIS) – a detailed statement prepared by the responsible official in which a major Federal action which significantly affects the quality of the human environment is described, alternatives to the proposed action provided, and effects analyzed. Required by the federal National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA).

erosion – detachment or movement of soil or rock fragments by water, wind, ice, or gravity. Accelerated erosion is much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of activities of man, animals, or natural catastrophes.

ESA – Federal Endangered Species Act.

floodplain – that portion of a river valley, adjacent to the channel, which is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages.

forb – any herbaceous plant other than true grasses, sedges, or rushes.

foreground-middleground – the area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape, and vegetation is apparent only in pattern or outline.

fugitive dust – airborne particles generated from open sources and not discharged in a confined flow stream such as an exhaust.

game species – animals commonly hunted for food or sport.

gpd – gallons per day.

gpm – gallons per minute.

ground water – all subsurface water, especially that as distinct from surface water portion in the zone of saturation.

ground water table – the surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

habitat fragmentation – the process by which habitats are increasingly subdivided into smaller units, resulting in their increased isolation as well as loss of total habitat area.

HDPE – high density polyethylene – a high density, man-made material used for liners. This material deforms with a low probability of puncturing or splitting. Seams are heat welded instead of glued, thus preventing rupture.

heavy metals – a group of elements that may be acquired by organisms in trace amounts that are toxic in higher concentrations. Includes copper (Cu), lead (Pb), mercury (Hg), molybdenum (Mo), nickel (Ni), cobalt (Co), chromium (Cr), iron (Fe), silver (Ag), etc.

HELP – acronym for the EPA's Hydrologic Evaluation of Landfill Performance model. HELP is a computer model used to evaluate the infiltration of water through landfill-types of structures.

hydraulic conductivity – the capacity of a rock to transmit water.

hydrology – a science that deals with the properties, distribution, and circulation of surface and subsurface water.

hydrophytic vegetation – plants that grow in and are adapted to an aquatic or very wet environment.

indirect effects – as defined by 40 CFR 1508.8, these are effects which are caused by the action but occur later in time or are removed in distance from the action, but are still reasonably foreseeable. Synonymous with indirect impacts.

indurated – rock or soil which has been hardened by heat, pressure, or cementation.

infrastructure – the basic framework or underlying foundation of a community including road networks, electric and gas distribution, water and sanitation services, and facilities.

irretrievable – applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

irreversible – applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity and aspen regeneration. Irreversible also includes loss of future options.

jurisdictional wetland – a wetland area identified and delineated by specific technical criteria, field indicators, and other information for purposes of public agency jurisdiction. The public agencies which administer jurisdictional wetlands are the US Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and USDA-Soil Conservation Service.

LAD – land application disposal.

landscape character – the arrangement of a particular landscape as formed by the variety and intensity of the landscape features as defined as the four basic elements (form, line, color, and texture). These factors give the area a distinctive quality that distinguishes it from its immediate surroundings.

landslide – a perceptible downhill sliding or falling of a mass of soil and rock lubricated by moisture or snow

level of service (LOS) – a qualitative measure of traffic operating conditions whereby a letter grade corresponding to progressively worsening traffic conditions is assigned to an intersection, freeway ramp junction, or roadway segment.

lifts – construction of waste rock dumps in a series of layers.

long-term effects – long-term effects are effects that would remain following completion of the project. As an example, the loss of vegetation from the development of an open pit would be a long-term effect if the pit were not reclaimed and vegetation not re-established at the end of the project.

maximum modification – a visual quality objective that allows activities that alter the vegetation and landform to dominate the original characteristic landscape with some limitations.

MDFWP – Montana Department of Fish, Wildlife, and Parks

milling – the general process of separating the economic constituents (metals) from the undesired or un-economic constituents of ore material (tailings).

mineralization – process of introducing valuable minerals into bedrock. structural changes in response to heat or pressure at depth in the earth's crust

minerals, locatable – those minerals on public domain lands that are disposed of under the general mining laws. Included are minerals such as gold, silver, lead, zinc, and copper, which are not classified as leasable or salable.

modification – a visual quality objective in which man's activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

modified mercalli intensity scale – a qualitative measurement scale describing the intensity (degree of shaking) felt by people, structures, and the ground. Intensities range from I (felt by few, if any, people) to XII (damage total).

monitor – to systematically and repeatedly watch, observe or measure environmental conditions in order to track changes.

NAAQS – National Ambient Air Quality Standards

National Register of Historic Places – A list, maintained by the National Park Service, of areas which have been designated as being of historical significance.

native species – plants that originated in the area in which they are found, i.e., they naturally occur in that area.

NEPA – The National Environmental Policy Act of 1969. It is the national charter for protection of the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations at 40 CFR 1500-1508 implement the act.

Organic Administration Act of 1897 – Act that provides the authority for the Forest Service to administer reserved and outstanding mineral operations in conjunction with the Secretary of Agriculture. The law specifically authorizes the Forest Service to manage the surface resources on National Forest System lands.

partial retention – a visual quality objective in man's activities may be evident, but must remain subordinate to the characteristic landscape.

peak flow – the greatest flow attained during melting of winter snowpack or during a large precipitation event.

pH – The negative log10 of the hydrogen ion activity in solution; a measure of acidity or basicity of a solution.

plan of operations – as required by 36 CFR 228.4, the operator submits a Plan of Operations (POO) to the USFS that includes: the name and address of the operator, location of the proposed area of operations, information sufficient to describe the type of operations proposed, and measures to be taken to meet the requirements for environmental protection.

PM_{10} – airborne suspended particles with an aerodynamic diameter of 10 microns or less

ppm – parts per million.

precious metal – a general term for gold, silver or any of the minerals of the platinum group.

preservation – a visual quality objective that provides for ecological change only.

priority pollutant – one of 126 chemical substances (including metals, volatile organic compounds, and semi-volatile organic compounds) listed by the U.S. Environmental Protection Agency as water pollutants. These substances may be subject to regulation under the Federal Clean Water Act.

recreation opportunity spectrum (ROS) settings – a system of measuring the land's ability to meet the expectations of recreation users. Six recreation categories, from primitive (natural) to urban (highly modified) describe the activities, settings and experiences an area offers. The following categories may be found in or near the analysis area:

roaded natural (RN) – a road corridor with a landscape that is characterized as natural or natural appearing. The road has moderate to high use.

roaded modified (RM) – a moderate to large landscape area that has been modified by man. In a forest setting, the modifications are roads and obvious management activities, such as timber harvest and mining.

recreation visitor day (RVD) – equivalent to 1 person recreating for 12 hours or several people for a total of 12 hours.

retention – a visual quality objective which, generally means man's activities should not be evident to the casual forest visitor.

riparian – situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.

runoff – that part of precipitation that appears in surface streams; precipitation that is not retained on the site where it falls and is not absorbed by the soil.

scatter (archeological) – random evidence of prior disturbance that is distributed about an area rather than concentrated in a single location.

sediment – material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion, rock weathering, agricultural practices, or construction activities.

sensitive species – those species of plants or animals that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species under the Endangered Species Act. This also includes species that are on an official state list or are recognized by the Regional Forester as needing special management to prevent their being placed on federal or state lists.

sensitivity level – a particular degree or measure of viewer interest in the scenic qualities of the landscape.

sensitivity level 1 – the highest sensitivity level, referring to areas seen from travel routes and use areas with moderate to high use.

sensitivity level 2 – an average sensitivity level, referring to areas seen from travel routes and use areas with low to moderate use.

sensitivity level 3 – the lowest sensitivity level, referring to areas seen from travel routes and use with low use.

short-term effects – short-term effects are defined as those effects that would not last longer than the life of the project. As an example, the loss of vegetation from the construction of a drill road would be a short-term effect because the road would be reclaimed and vegetation re-established following completion of the project.

SMC – Stillwater Mining Company.

threatened species – any species of animal or plant which is likely to become endangered within the foreseeable future throughout all or significant portions of its range. It has been designated in the Federal Register by the Secretary of the Interior as a threatened species. Disturbance of the habitat of threatened species is prohibited by the Endangered Species Act of 1973, as amended.

tiering – refers to the coverage of general matters in broader EIS's (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared.

tpd – tons per day.

turbidity – a measurement of the total suspended solids in water.

ultrabasic – igneous rocks with a high concentration of ferromagnesian minerals, to the virtual exclusion of quartz, feldspar and feldspathoids.

variety class – a particular level of visual variety or diversity of landscape character. There are three variety classes; A,B, and C.

variety class A – distinctive

variety class B – common

variety class C – minimal

visual quality objectives (VQOs) – categories of acceptable landscape alteration measured in degrees of deviation from a natural appearing landscape.

maximum modified – man's activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in background.

modified – man's activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

partial retention – man's activities may be evident but must remain subordinate to the characteristic landscape.

retention – man's activities should not be evident to the casual forest visitor.

Waters of the United States – a jurisdictional term from Section 404 of the Clean Water Act referring to waterbodies such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce.

watershed – the geographic region from which water drains into a particular stream, river or body of water. A watershed includes hills, lowlands, and the body of water into which the land drains. Watershed boundaries are defined by the ridges or divides separating watersheds.

wetlands – areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Chapter 9.0 — References Cited

Chapter 9.0 — References Cited

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Appendix A — Synopses of Related Environmental Documents

Final Environmental Impact Statement, Stillwater Project, Stillwater County, Montana. Prepared by Montana Department of State Lands and USDA Forest Service, Custer National Forest. December 1985.

Proposed Action

Stillwater Mining Company proposed to open a platinum-palladium mine within the Stillwater mineral complex. The project would have a 30-year mine life at a daily production rate of 1,000 tons of ore. Underground mining by means of cut-and-fill stoping primarily would be used. Tailings from the milling process would be separated into the sand fraction and the fines fraction. The sand fraction would be backfilled into mining stopes. The fine tailings would be placed in a tailings pond next to the mill. Concentrate from the mill would be trucked to Columbus and shipped by rail to various markets. The project permit area would cover 550 acres.

Alternatives Analyzed

In addition to the No Action alternative, several action alternatives were evaluated in detail in the analysis. Production System Alternatives consisted of three alternative tailing disposal locations (including the Hertzler Ranch Site). Mine Portal Arrangement Alternatives were chosen from three arrangements. Electrical Power Supply Alternatives were selected from three options. A public access route to the West Fork Stillwater River, was chosen from two possibilities.

Environmental Impacts of the Proposed Action

The main areas where issues of concern were identified included: water quality and quantity, reclamation, wildlife, aesthetic values, transportation, surface subsidence, socioeconomic effects, and scenic quality. Water quantity and quality would be affected similar to the effects from exploration. The mine would probably discharge about the same amount and quality of water as during exploration. Detectable increases in nitrate and total nitrogen concentrations in alluvial groundwater would continue downstream of the mine. Water quality of the Stillwater River would be unaffected. Very high flood flows (greater than the 1000-year flood) would encroach on the tailings impoundment, contributing sediment to the Stillwater River. During such a flood, however, the sediment load would be so high from natural sources that the added mine-related sediment would be undetectable.

Reclamation would be affected by soil disturbance and storage. Soils would lose organic matter and this loss would yield a low post-mining water- and nutrient-holding capacity. The decreased capacity would probably result in lower vegetative densities during the initial reclamation years and perhaps some initial revegetation failures. A loss of, or reduction in, soil microorganism populations caused by prolonged storage could result in lower plant species diversity and vigor for several years following initial revegetation. Forage production would increase, primarily from revegetation of 59 acres of previously disturbed lands. Plant diversity would decline from pre-mining levels.

Critical wildlife habitat would not be disturbed. Mule deer and bighorn sheep would lose a small amount of wintering range. These two species may also react to mining activities and noise by withdrawing from nearby areas. The MDFWP believed a herd reduction was imminent and that herd elimination was possible if mining is permitted. Road kills of deer would increase. Population increases in Stillwater County, of which only a portion would be mine-related, would increase housing construction, hunting and other recreation, and poaching by an unknown amount. No threatened or endangered species would be adversely affected by the proposed project.

Aesthetic impacts would be visual (scenic quality) and auditory. The mine and mill would alter the landscape, significantly affecting the visual resources at the mine site. The visual quality objectives would not be met, if at all, until sometime after the completion of reclamation. Noise levels near the mine site would increase considerably. However, because noise decreases rapidly with distance, travelers on County Road 419 would be exposed to only a small increase in noise levels. Residents with 0.5 miles could hear noises associated with the facility.

Transportation effects would include increased traffic volumes on CR 419, CR 420, and CR 78 because of increases in mine-related and household trips. CR 419 and 420 would be most affected by work traffic, and CR 78 by household trips. Increased traffic would result in increased traffic accidents and road maintenance costs. Ranchers, recreationists, and wildlife could be adversely affected by the increased traffic.

Surface subsidence from possible collapse of portions of the mine workings would present minimal long-term risk to the public.

Socioeconomic effects: Area employment and income would both increase. The first year of project construction would add 100 to 150 new jobs to total county employment. If the company proceeds with project development, mill construction would add an additional 150 jobs. During operations the project would employ 200 to 220 people. About 89 jobs are expected to be filled by local residents. The project could increase the population of Stillwater County by 8.1 percent, Absarokee by 24.7 percent, and Columbus by 10.3 percent above the 1995 level without the mine.

Decision

The Commissioner of the Department of State Lands and the Supervisor of the Custer National Forest identified a preferred alternative, approved the project, and issued a Record of Decision in 1985.

Preliminary Environmental Review/Environmental Assessment (PER/EA), Stillwater Project East Side Adit Development. Montana Department of State Lands and Custer National Forest. February 1989.

Proposed Action

Stillwater Mining Company proposed to develop the ore reserves on the east side of the Stillwater River in order to reach 1000 TPD of ore production. SMC proposed the development of six adits and one shaft. Ore from the east side development would be trucked to the west side for processing in the existing mill/ concentrator. Waste rock not used for construction or other uses would also be trucked to the west side for use in constructing the tailings impoundment dam. Tailings impoundment capacity and design would not change from that approved in 1986.

Alternatives Analyzed

Three alternatives were considered in detail. They included the Proposed Action (Alternative 1), the Proposed Action with several agency-identified mitigation measures (Alternative 2), and the No Action Alternative (Alternative 3).

Environmental Impacts of Proposed Action

Various impacts were considered capable of being fully mitigated with the implementation of the following measures: (1) two measures to provide traffic reduction; (2) two measures to reduce visual impact; (3) six specific actions to compensate for losses to bighorn sheep habitat; (4) two measures to protect raptors; (5) four measures to monitor groundwater quantity and water rights; (6) Three measures to protect water quality; and (7) a measure to protect cultural resources.

Decision

The decision was made by the Commissioner of the Department of State Lands and the Supervisor of the Custer National Forest to select Alternative 2 and approve the project (Amendment No. 5) with a Finding of No Significant Impacts on March 2, 1989.

Final Environmental Impact Statement, Stillwater Mine Expansion 2000 Tons Per Day, Application to Amend Plan of Operations and Permit No. 00118. Prepared by DSL, DHES, and Forest Service. 1992.

Proposed Action

SMC proposed to increase the mine production rate up to 730,000 tons per year (2,000 TPD). Included in the proposal was enlargement of the tailings impoundment, expanding waste rock storage, new buildings and berms, etc, on 35 acres, expanding processing facilities capabilities, relocating certain buildings, an incremental addition of 161 additional employees, and an application to change ambient water quality for total dissolved solids, ammonia, nitrates, and metals in both surface and groundwater.

Alternatives Analyzed

Five alternatives were considered in detail. They were No Action, Proposed Action, Proposed Action with Modified Tailings Impoundment (Partial Approval), Proposed Action with Advanced Water Treatment, and Proposed Action with Modifications to Tailings Impoundment, Waste Rock Storage, and Water Resources.

Environmental Impacts of Proposed Action

About 35 acres of new disturbance would occur. Marginal reclamation would occur because of limited replacement soils. Facilities would eliminate vegetative production on 42 acres. Irrigation with nitrate-rich water would increase plant growth. The bighorn sheep herd would continue to be threatened; facilities would eliminate forage on the toe dike. Atmospheric emissions would increase, but permit levels would not be exceeded. Recreational use in area would increase some. Visually, the embankment would be raised 14 feet, the rock armor would be visually uniform, a longer period of time would be necessary to achieve retention of visual quality, and visual screening would be provided by berm on east side. A total employment impact of 232 jobs would occur. Stillwater County's population would increase by 150 people more than projected. Demands would increase for housing, community services, and community facilities. Traffic would double to about 262 vehicles per day.

Decision

The agency decision makers approved and permitted (Amendment No. 8) on September 23, 1992.

Final Environmental Impact Statement, Stillwater Mining Company Underground Valley Crossing and Mine Plan. Application to Amend Plan of Operations, Permit No. 00118. Prepared by DEQ. February 1996.

Proposed Action

In April, 1995, SMC proposed to amend its Operating Permit by proposing to connect the East and West mining areas by means of a haulage drift located at the 4400-foot level of the mine. The haulage drift would be developed beneath the Stillwater River and its floodplain. As part of the proposed amendment, SMC sought approval to mine the ore body at and below the 4400-foot level if and when mineralization was defined.

The project would be conducted in two phases. Phase 1 would include completion of the 4400-foot level haulage drift and the diamond drilling necessary to define the mineralization. Phase 2 would involve implementation of mining below the surface crown pillar. Approval of the proposed amendment would allow SMC to reduce ore and waste handling costs by reducing haul distances to the mill and to crush ore prior to reaching the mill, to access and further delineate additional ore reserves, and to reduce conflict with recreational traffic using County Road 419.

Alternatives Analyzed

Three alternatives were considered by DEQ. They were the Proposed Action, No Action alternative, and Proposed Plan with Modifications.

Environmental Impacts of Proposed Action

Impacts were analyzed to address the issues of geotechnical stability, increased inflow of groundwater to the workings, and water quality of both surface and groundwater. Stability analyses indicated the proposed crown pillar thickness (200 ft) was adequate. The long-term stability of the pillar was not considered to be an issue, particularly because SMC proposed to backfill the 4400-ft level haulage way at closure where it is adjacent to the base of the crown pillar. In addition, all stopes would be backfilled upon completion of mining.

Inflows of groundwater were expected to be similar to flows previously observed in the East Side Mine. The predicted rate of inflow to the haulage level (200 gpm) was not expected to have any impact on flow in the Stillwater River or groundwater levels in the valley.

Groundwater and surface water quality were not expected to change following implementation of the proposed action. Mine production rates and associated nutrient loading from the mining activities would not be increased by the proposed action and would not exceed the levels analyzed in the SMC 200 TPD EIS.

Decision

The Director of DEQ approved the permit amendment (Amendment No. 9) and the project permitted in 1996.

Appendix B —Responses to Comments on the Draft Environmental Impact Statement

Appendix B — Responses to Comments on the Draft Environmental Impact Statement

The draft EIS was available for public review and comment from March 20, 1998 through May 19, 1998. During this period, 45 agencies, elected officials, businesses, conservation or environmental groups, and individuals submitted letters containing comments on the draft EIS. Additionally, a number of people attended a public open house and hearing on the draft EIS held at Absarokee Elementary School, Absarokee, Montana on April 28, 1998. Eleven individuals provided verbal comments on the draft EIS during the hearing.

Comments were provided by a variety of respondents and sources. Individuals submitted about 54 percent of the responses. State agencies and businesses submitted 13 and 11 percent of the responses, respectively. Conservation or environmental groups and federal agencies each submitted about 9 percent of the responses.

Most of the responses (52 percent) were submitted by individuals, businesses, and conservation or environmental groups located in Red Lodge, Carbon, or Stillwater counties (local sources). Another 33 percent of the responses were from individuals, businesses, conservation or environmental groups, or agencies present in other parts of Montana (regional sources). The rest of the responses (15 percent) were from sources outside Montana (national sources).

These responses were reviewed and specific comments were identified. Overall, the comments focused on the nine issues identified in the draft EIS (**Section 2.2.1**) and the MEPA/NEPA process. The following sections present the comments by issue and identify DEQ and CNF's response to each comment.

The following tables identify the individuals, businesses, conservation/ environmental groups, elected officials, and agencies that responded to the draft EIS. The first table lists the respondents alphabetically. The second table lists the respondents by letter/speaker number. Letter/speaker numbers are attached to each comment included in this appendix.

Respondents Sorted Alphabetically [1]

Letter/Speaker Number	Respondent
53s	Aamodt, Tina
09	Applied Ecosystem Services, Inc.
49s	Bardelmeier, Carment
46s	Blattie, Harold
31	Bliss, Bruce and Barbara
43	Boyd, Arleen
51s	Boyd, Arleen
28	Connor, Henry
47s	Connor, Henry
16	Daviau, Kathie
19	Donohoe, Mary
54s	Gould, Kate
52s	Gould, Rick
22	Greater Yellowstone Coalition
17	Hardy, Connie L.
25	Heyneman, Jack
04	Hodnik, John
10	Howard, Robert A.
13	Karnos, Patrick R.
23	Keogh, Noel
24	Keogh, Penny
07	Knight Piesold, Ltd. Consulting Engineers
48s	Koegh, Noel
39	Midnight Canyon Ranch
15	Mikelson Land Company
36	Milligan, James G.
12	Montana Department of Transportation (Billings)
08	Montana Department of Fish, Wildlife, and Parks
26	Montana Department of Transportation (Helena)
38	Montana Department of Commerce, Local Government Assistance Division
42	Montana Department of Commerce, Local Government Assistance Division
01	Montana State Historic Preservation Office
18	Moss, Lucile and George
56s	Myhre, Jane
21	Nauman, Richard A Sr. and Joanne C.

Letter/Speaker Number	Respondent
50s	Nighbert, Dave
40	Northern Plains Resource Council
30	Northern Rockies Geologic Data Center
35	Rex, Polly R.
06	Richter, Jim
05	Robinson, Dale
29	Rollwitz, Lee
41	Rollwitz, Mike
20	Rollwitz, Patrick and Jean
14	Schramm, Sigrid
37	Shemer, Jack and Paula
11	Shemer, Jack E. and Paula M.
45	Stillwater County Commissioners
34	Stillwater Mining Company
27	Stillwater Protective Association
02	U.S. Department of Commerce
33	U.S. Department of the Interior, Office of Environmental Policy and Compliance
32	U.S. Environmental Protection Agency
03	U.S. Fish and Wildlife Service
55s	VanLuchene, Dick
44	Willett, Frank G.

Note:

1. The letter "s" after a number indicates the person presented testimony at the hearing on on the draft EIS, April 28, 1998.

Respondents Sorted by Letter/Speaker Number[1]

Letter/Speaker Number	Respondent
01	Montana State Historic Preservation Office
02	U.S. Department of Commerce
03	U.S. Fish and Wildlife Service
04	Hodnik, John
05	Robinson, Dale
06	Richter, Jim
07	Knight Piesold, Ltd. Consulting Engineers
08	Montana Department of Fish, Wildlife, and Parks
09	Applied Ecosystem Services, Inc.
10	Howard, Robert A.
11	Shemer, Jack E. and Paula M.
12	Montana Department of Transportation (Billings)
13	Karnos, Patrick R.
14	Schramm, Sigrid
15	Mikelson Land Company
16	Daviau, Kathie
17	Hardy, Connie L.
18	Moss, Lucile and George
19	Donohoe, Mary
20	Rollwitz, Patrick and Jean
21	Nauman, Richard A Sr. and Joanne C.
22	Greater Yellowstone Coalition
23	Keogh, Noel
24	Keogh, Penny
25	Heyneman, Jack
26	Montana Department of Transportation (Helena)
27	Stillwater Protective Association
28	Connor, Henry
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33	U.S. Department of the Interior, Office of Environmental Policy and Compliance
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35	Rex, Polly R.
36	Milligan, James G.

Letter/Speaker Number	Respondent
37	Shemer, Jack and Paula
38	Montana Department of Commerce, Local Government Assistance Division
39	Midnight Canyon Ranch
40	Northern Plains Resource Council
41	Rollwitz, Mike
42	Montana Department of Commerce, Local Government Assistance Division
43	Boyd, Arleen
44	Willett, Frank G.
45	Stillwater County Commissioners
46s	Blattie, Harold
47s	Connor, Henry
48s	Koegh, Noel
49s	Bardelmeier, Carment
50s	Nighbert, Dave
51s	Boyd, Arleen
52s	Gould, Rick
53s	Aamodt, Tina
54s	Gould, Kate
55s	VanLuchene, Dick
56s	Myhre, Jane

Note:

1. The letter "s" after a number indicates the person presented testimony at the hearin on on the draft EIS, April 28, 1998.

B.1 Water Quality and Quantity

Seventeen letters (seven local, six regional, and four national) contained comments on water issues. Many comments focused on the MPDES permit, both the permitting process and the sampling, and requirements for monitoring. Three respondents included concerns about nitrate loading from the waste rock storage site and increased runoff. Another three letters requested documentation of nitrate reduction rates associated with the LAD and ABC water management practices. Other water-related comments centered on the legal status of wetlands created by LADs, pipeline integrity and spills, the quality and treatment of surface water at Hertzler, and the stability of the slopes adjacent to Stratton Ranch

B.1.1 Water Quality

1. ... some of the wording in the EIS regarding ground water in the Hertzler Ranch area, a reader could draw the conclusion that the area ground water in general is of poor quality. As you know, my residence in Stanley Coulee is served by a ground water well. That well has been monitored, on a voluntary basis, by SMC for the past two years, and the water quality is quite good, as evidenced by the attached analytical reports. (6)

Response: The text in **Section 3.1.3.3** has been modified to reflect concern about the staining characteristics of wells in the Hertzler area, rather than water quality concerns associated with human health toxicities. The nitrate and phosphate concentrations do not pose a risk to human health.

2. How much of the data in the HELP model are synthesized or are default? How much are local? If much of the data are synthesized or default, how reliable is the output average infiltration of 2.7 in/yr? How much confidence does one put in that output? This would affect one's confidence in the "... approximately 33 years to infiltrate one pore volume... through the waste rock storage site" and in the 11.3 lbs/day N loading from the same site. The program allows one to enter up to 100 years of daily data. Are the input data daily, monthly averages, seasonal averages, annual averages? If averages, one has 50–50 chance of being right. If the bulk of the data are not local but synthesized or default, one's chance of being right declines even further. Most people reading this document tend to believe such numbers are accurate; they truly reflect reality. I firmly believe the author(s) need to be up front about the uncertainty surrounding seemingly absolutely certain, real model results. (9)

Response: Input assumptions reflect site specific area and slope conditions, monthly temperature and precipitation averages, quarterly averages on relative humidity and the modeler's best professional judgement on other climatic and physical characteristics. Additional information about assumptions now supplements the text in Chapter 4. Modeling is used to improve projections of complex situations. Changes in numbers regarding nitrogen loading in

Section 4.1.1.2.1 reflect the final run of the HELP model (Techlink Environmental Inc. and Greystone 1998).

confident about the results generated by the HELP model. The model runs were based on the results of lab analyses, local data, and best professional judgement. Additionally, the model was run by a third-party contractor and reviewed by DEQ and CNF. The report on the HELP analysis is part of the public record and available for review at the agencies' offices.

3. 2.4.2.8. (p 2-32). East Side Waste Rock Storage Site: Reclamation occurs in stages and following the third stage, the storage site is regraded, etc., and covered with topsoil. What concerns have arisen regarding the infiltration and percolation of precipitation and snowmelt through the topsoil and through the waste rock and the effect on water quality, both surface and ground water? (9)

Response: Discussion of the nutrient loading effects of the east side waste rock storage site to ground water may be found in **Section 4.1.1.2.1**. Underground blasting generates residual nitrates, some of which end up on the waste rock that is placed in the waste rock storage facilities. The nitrate loading from waste rock storage sites has been incorporated into SMC's MPDES permit.

4. 4.1.1.2.4 Pipeline Corridor. (p 4-7, 4-8). A spill into any of the channels of the WF will be diluted rapidly during snowmelt flows but unlikely during base flow when irrigation at the LAD sites will be most active. A spill during base flow could have serious consequences downstream. (9)

Response: At low flows in the West Fork Stillwater River, a breach of the pipeline supplying water the LADs still would not have serious consequences downstream. The unplanned discharge of tailings slurry or recycle water would result in a temporary, short-lived increase in TSS, TDS, sulfates, nitrates, and metals. However, such a discharge is unlikely to cause mortalities to aquatic life. Concentrations of nitrate-nitrogen in the water being pumped to the LADs are not high enough to cause serious consequences to aquatic life. This conclusion is based on the MPDES permit, which allows direct discharge of adit water into the river (up to 2,000 gpm), even though SMC does not discharge water from their adits directly into the Stillwater River. A short-term discharge of water from a breach in the pipeline at the West Fork Stillwater River would not introduce as much nitrate-nitrogen into the river as the permitted direct discharge.

5. Both pivots encroach upon the 100-yr flood level and are almost completely within the PMF level. What will be the effect if a 100-yr runoff event floods the LAD sites? A PMF flood? (9)

Response: The LAD sites would be partially inundated during a 100-year flood and totally flooded during a PMF. The sites would not be operative until floodwaters drop for both a 100-year event and PMF flood. The quantity of water inundating the site would have the effect of diluting any water quality characteristics directly attributable to the LAD operation.

6. 4.1.2 (p 4-12). Old septic systems could be old enough that they do not meet State/ County standards and could be poorly maintained, even not maintained. Many may be cesspools. These are the problem systems. New residential septic systems will have to meet standards which could provide reasonable assurance that effluent will not reach the Stillwater R. or its tributaries. (9)

Response: Thank-you for your comment.

7. 3.1.1.1. (p 3-22). "The quality of ground water... is poor to excellent depending on what the water is used for." I may be playing with semantics, but a water's quality is determined by its biogeochemical characteristics which determine its suitability for certain uses. If the quality is a natural condition, that is as good as it will ever get. If its quality is modified by irrigation recharge, whether flood or sprinkler, then it is a man-made problem. I would recommend rewording the sentence: "The ground water in the Hertzler valley may be unsuitable for a number of uses, such as..., because..." (9)

Response: A rephrasing of the sentence was requested, but the sentence of concern was dropped in conjunction with other changes in the section made in response to other comments.

8. No map identified Hertzler Valley; I presume it lies in the vicinity of the LAD pivots, tailings impoundment, etc. along county road 420. This valley is also fed by several streams (coulees, draws) and an irrigation ditch which I presume diverts water from the WF Stillwater R. Water from these sources flows to the main river above Moraine. I also notice several buildings at the Hertzler Ranch and along road 420. If these are residences, where do they derive their domestic water, from surface or ground water sources? If from ground water, presumable alluvium/glacial till/drift, how suitable is it for human consumption; and if consumed, what are the health consequences to its consumption, it may not be unsuitable as far as these residents are concerned. They have adapted to it as have many farm and ranch families who have no other source. (9)

Response: **Figure 3–1** now shows the Hertzler Ranch as Hertzler Valley, which is the area referred to by the water resources narrative. Water rights listings from the Montana Department of Natural Resources and Conservation for the Hertzler Ranch area suggest all domestic surface water adjudications are derived from the West Fork or main stem of the Stillwater River. Atlantic Richfield has a well permit for one 98-foot deep domestic well in the area. Ground water quality is described in **Section 3.1.3.3**, where it now clarifies that the major limitations to domestic use are derived from federal secondary drinking water standards related to staining.

9. 4.1.1.2.1 Stillwater Mine Site (pp 4-2 and 4-3). For what design storm were the storm water detention ponds built? (9)

Response: As proposed, the storm detention ponds are sized for the 25-year, 24-hour storm event.

10. Assuming Figure 2-2 is wrong and 2.4.2.3 is correct, each of the two 800-ft diam. LAD center pivot irrigation systems, operating continuously (24 hrs per day) for 7 months every summer (about 210 days/yr), will produce 300 gpm/pivot. This area receives 15-20 in. precipitation each year. How much additional water does this contribute to the 92+ acres under the pivots and how will this effect those acres? If my computations are correct, each acre under each pivot will receive nearly 290 in. of moisture over and above the annual precipitation, not accounting for evaporation between the spray head and the ground or wind. Given this much added water to these two sites, it seems very certain ground water will mound under the area and that instability of the toe of the colluvial material will occur. It is not a "should ground water mounding" occur issue. What are the consequences of the resulting instability and how might SMC control it? (9)

Response: Figure 2–2 has been corrected to show the proposed LAD pivots.

In 1996, MSE-HKM (1997) estimated that the two half-pivots at the mine site each sprayed 500 gpm or 322 acre-feet of water resulting in the equivalent of 93.2 inches of rainfall. This is equivalent to five times the annual precipitation of 18.3 inches. The Stratton Ranch is located on the edge of the Stillwater River floodplain. Water within the alluvium recharges the river during all but the highest surface water flow periods, with net flow to the east. The materials underlying the Stratton Ranch site are suited to handle a large throughput of water with nominal effect to the adjacent slopes as evidenced when a trailer park occupied the site and had a leach field that handled 150 to 250 gpm. **Section 4.1.1.2.2** has been revised to reflect this information.

11. Table 3-1. Under "Flow" I presume the unit of measure is "cfs." Also under "flow," What does one gain by extending flow data to hundredths of a cfs? In my experience, nothing. Keep the flow data as whole numbers. What prevented Hydrometrics from taking flow measurements each time they collected a water quality sample? "<" usually indicated the detection limit of lab procedure in analyzing a sample. Under TDS for SMC-11, the maximum concentration is <8 and the minimum, <1. This suggests two different analytical methods and/or different degrees of precision. Why? There are several instances where the "detection limit" of the maximum is an order of magnitude higher than that for the minimum even though the concentrations are very low. Why? (9)

Response: **Table 3–1** has been modified to show the unit of flow as cfs and to eliminate the less than symbol (<) from the maximum value of TSS. Surface water flow measurements were not obtained when flows presented dangerous conditions. Detection limits vary depending on the analytical method used and some of the historic data were collected at a higher detection limit than is required or available today.

12. 4.1.1.2.3 Hertzler Ranch (pp 4-5, 4-6). I asked many of the same questions about the amount of water produced by the four LAD pivots as at the Stratton Ranch even though the circumstances are quite different. Here there are four 1000-ft. dia. pivots which spray as much as 2000 gpm, or 500 gpm per pivot. By following the same logic, each pivot could produce nearly 310 in. of moisture during the 7-month period, but even half is 10 times greater than the annual precipitation. How much additional water did flood irrigation historically produce? (9)

Response: In 1996, MSE-HKM (1997) estimated that the two half-pivots at the mine site each sprayed 500 gpm or 322 acre-feet of water resulting in the equivalent of 93.2 inches of rainfall. This is equivalent to five times the annual precipitation of 18.3 inches. Flood irrigation in the Hertzler area has ranged between 2,240 to 4,480 gpm. This is equivalent to 1.25 to 2.5 inches within a three-month period.

13. 3.1.2.3 Hertzler Ranch. (p 3-12). Why are fecal coliform and sulfates occasionally elevated in the waters of Robinson Draw, Stanley Coulee, and Tandy Coulee? Do any of these serve as a domestic water supply? Regarding Cd and Fe, in these same drainages, what does "occasionally...above" mean in a historical context? How often: a few days each year, a few days every few years? How many data sets are needed to define "occasionally... above?" How many data sets represent each of the drainages? If these metals naturally occur, should not their concentrations become the MT standard for those drainages? If these become components of the MT standards, then these are not above the standards because they are the standard. (9)

Response: Baseline data on Robinson Draw, Stanley Coulee and Tandy Coulee were collected monthly from June 1980 through June 1981 (CDM 1981). Instantaneous grab samples were acquired when the water was flowing. Robinson Draw was dry for six of the months. Eleven samples were acquired from both Stanley and Tandy Coulees. Fecal coliform levels ranged from 200 to 270 mpn/100 ml at the standard of 200 mpn/100 ml monthly from September through November 1980 in Tandy Coulee. Fecal coliform levels can be elevated from leakage of a leach field or entrainment of human feces or animal scat, and were attributed to cattle. There were single incidences of cadmium concentrations of 0.02 mg/L in February of 1981 in Stanley and Tandy Coulees. Iron concentrations were elevated above the human health standard every month in Tandy Coulee. The iron standard is a secondary drinking water standard and reflects undesirable color and staining qualities. Naturally-occurring elevated concentrations of water quality parameters do become the standard for a drainage, against which proposed discharges are compared. Within the text of the EIS, the comparison is used to suggest beneficial use limitations. The Montana Water Quality Act, (MCA 75-5-306) states that "It is not necessary that wastes be treated to a purer condition than the natural condition of the receiving stream as long as the minimum treatment requirements established under this chapter are met." Water rights listings from the Montana Department of Natural Resources and Conservation for the

Hertzler Ranch area suggest that all domestic surface water adjudications are derived from the West Fork or main stem of the Stillwater River.

14. 3.1.3.1. Stillwater Mine Site. (p 3-13). I doubt that the bedrock aquifers are recharged by rain. Once snowmelt concludes, the soils dry out and the few rains recharge soil moisture, not the aquifers. Why does water output from the mine vary as new zones are encountered? Why do the "old zones" decline? Underground storage or backfill of tailings? How has the yield of seeps and springs changed as mine development intercepts water-bearing zones? (9)

Response: Recharge to high-elevation bedrock aquifers in this area is predominantly supported by infiltration from snowmelt.

Section 3.1.3.1 suggests that mine development into fractured rock can result in elevated inflows. Once the fracture system is drained, inflows decrease. Vertical mine development typically yields smaller inflows than lateral development once a fractured area is dewatered. SMC also seals abandoned workings to reduce mine discharges from unused portions of the mine. SMC monitors the water quality and flows of springs through their Hard Rock Mining Permit. Flows from the East Side Spring, SP–3 ceased in the early nineties. Other springs in the area have not been affected.

15. 3.1.2.1. Other Surface Water Features. (p 3-10). Table 3.1 shows data on "nitrate + nitrite as N" and as a nutrient in this section. Nitrite quickly oxidizes to nitrate in surface waters unless those waters are polluted or have sluggish flow approaching laminar flow with little mixing. But these waters are rather turbulent. It can be an important constituent in ground water, but this discussion is about surface water. The inference is that nitrite is common, even in concentrations similar to nitrate. I doubt that. Did the lab analyses show nitrite in these waters? If they did, why not report it separately from nitrate? (9)

Response: As suggested, nitrite is unstable in surface waters and atmospheric conditions and converts to nitrate. The standard laboratory analysis acknowledges this state change and the result is reported as nitrate + nitrite as N. 40 CFR 136.3, Table 1B references EPA (1979) methods 353.1, 353.2, and 353.3, the 18th Edition of Standard Methods for the Examination of Water and Wastewater's methods 4500-NO3- E, F, and H, ASTM D3867-90(B) and 3867-90(A) and USGS 1989 method I-4545-85.

16. There is no discussion of how the water quality parameter concentrations, both chemical and physical, dissolved and suspended, vary with flow period. Normally the highest concentrations of dissolved anions and cations and metals occur during base flow, but suspended materials are at their lowest. The reverse usually holds true during snowmelt. One could expect substantial departures following thunderstorms, the base flow period. (9)

Response: The narrative description of water quality has been modified to reflect this truism. Please refer to **Section 3.1.2** to review these changes.

17. "Concentrations of Cd, Cu, Fe, Pb, and Zn at sites upstream and downstream of the mine site have been above water quality standards set by DEQ". The upstream site data could reflect baseline, even background, water quality and become the standard, overriding the basin-wide, or even statewide standard set by DEQ. It appears for this that these dissolved metals occur naturally in these waters. What does this say about the DEQ standards? They do not reflect reality. (9)

Response: Discussions in the text compare water characteristics with DEQ's Water Quality standards to suggest the suitability of the water for identified beneficial uses. In developing MPDES effluent discharge standards for the Stillwater Mine, DEQ set standards higher than aquatic standards for cadmium, chromium, copper, lead, and mercury, to reflect elevated background conditions.

18. 3.1.1.1. (p 3.1). Stream order varies by map scale. I assume stream order for SMC relies upon the 1:24000 USGS maps for this area. Right? (9)

Response: The proper technique for identifying stream order is the use of 7.5-minute USGS quadrangles.

19. 3.1.1.3. (p 3-7). H ow much of the annual precipitation is rain? (9)

Response: Twelve of the 18 inches of annual precipitation are rain.

20. 3.1.1 (p 3-1). A serious deficiency in the section concerns the area of hydroclimatology: What role does climate play in the water resources which influence the Stillwater Valley and SMC? I do not have their reference; DSL and FS 1985, SMC 1997d, Hydrometrics 1996c, Shields, Knapton, White, Brosten and Chambers 1992, and a personal communication with the DEQ hydrologist. CMD 1981, a 12-month baseline study, which noted annual precipitation at 20 to 30 inches, undoubtedly need substantial review to upgrade data and analysis, However, none other suggest a study and analysis of the water resource. In the Upper Yellowstone River Basin, there are 57 stations (SNOTEL sites, snow courses, stream gauges, NW co-op weather stations, etc.) some active, others inactive. Most of the USGS stations have daily as well as peak flow data. In the Stillwater River drainage there are eight USGS stream gauges, though none appear active at present. SNOTEL stations provide important data on snow water content, the start and end of the snowpack season, melt rates, air temperature, and precipitation. Though none are in the Stillwater drainage, some are in adjacent drainages. Many of these station data are available on the Internet which eases data manipulation and analysis and through the West National Technical Center, US DA-NRCS. (9)

Response: The discussion of rainfall and snowfall is found in the initial discussion on water resources. It has been expanded slightly, but a detailed discussion of this topic is beyond the scope of this EIS.

21. Questions: Flow patterns in the Stillwater and WF Stillwater Rivers; estimates of maximum, minimum, and normal stream flows by season; instantaneous peak discharges; recession rates; base flow; 7-day low flows; and how these effect SMC operations; estimates of snow distribution and melt rates, meltout dates; the air temperature and precipitation regime (SNOTEL provides these data as do NWS co-op stat ions); return periods for stream discharge, snowpack yields, and summer storms. Why no discussion of seeps and springs? Why no discussion about stream channel condition, channel stability, and aquatic habitat (not fish habitat)? How have the streams and river channels migrated within the floodplain? In the vicinity of the existing SMC facilities, how has the Stillwater R. responded (lateral migration, meander patterns, and meander migration, etc.)? (9)

Response: The requested seasonal detail on flow patterns on the Stillwater and West Stillwater Rivers is beyond the scope of this EIS document and unnecessary for the formulation of a decision on this action. Supplementary information is provided on the 10-year 7-day low flow (7Q10) for the mine site and Hertzler because many of the calculations on the MPDES permit were derived from an analysis of this parameter. Please refer to **Section 3.1.1.1** to review this supplemental information.

Additional information on springs has been added to the ground water discussions in Chapter 3. Please refer to **Section 3.1.3** to review this information.

Channel morphology information is not available. SMC has met TSS effluent limitations throughout its operations and, thus, has not modified the quantity of gravels deposited in the Stillwater Valley below the Beartooth Range. The existing tailings impoundment does restrict migration of the river to the west in the reach that runs through the mine.

Sections 3.3.1.2 and 3.3.1.3 present information on aquatic habitats. Although the **Section 3.3** is titled *Fisheries*, it presents data on all primary aquatic resources, including macroinvertebrates and periphyton. Aspects of water quality are discussed in **Section 3.1.1**.

22. The poor water quality of Nye and Verdigris Creeks is "probably" due to their source in the basal zone of the Stillwater Complex. Why not validate this assumption; eliminate or greatly reduce the uncertainty surrounding "probably?" Referring to the "composite quality" in Table 3-3, which show "merged," what statistical tests showed that compositing was ok, that the waters of the two sites were not significantly different? If they were different, those differences have been lost. The three wells in alluvium now covered by an SMC tailings impoundment appear to violate human health water quality because of seepage from the impoundment. True? If so, where do these waters surface and how do they affect the quality of stream flows? (9)

Response: A reevaluation of the baseline data for Nye Creek and current information acquired at lower detection limits on two sites at Nye Creek suggest that no limitations exist on water use. The statement in **Section 3.1.3.1** has been deleted. The higher concentrations of some metals in Nye and Verdigris Creeks are due to underlying rock units enriched in metals. Nye Creek also is affected by chrome concentrates left from historic mining.

Tables 3–3, 3–4, 3–5 and **3–6** were developed to provide some representative values for use in the discussion of water quality associated with different operation features. There was no statistical analysis done to evaluate the propriety of compositing. SMC annually reports the water quality data acquired during the year and provides historic sampling results to provide perspective on changes in water quality over time. These documents are available for public review in Helena at DEQ.

The statement on exceedances in the three wells in the alluvium now covered by SMC's existing tailings impoundment has been removed. The three wells were affected by pre-1981 drainage from the Minneapolis Adit and abandoned mine adits discharging water from the basal zone of the Stillwater Complex (CDM 1981). They were not influenced by the current tailings impoundment. Up and downstream water quality comparisons can be found in **Table 3–1**, and the discussion of the differences between the two can be found in **Section 3.1.2.1**, where the text notes that average concentrations of specific conductance, total dissolved solids, hardness, bicarbonate, sulfate, nitrate, and phosphorus are mildly elevated at the downstream surface water site.

23. 2.4.2.3. (p 2-26). Adit water: how corrosive is the adit water? What effect will this water have on the durability of the "unlined steel pipeline?" In the next paragraph, one would presume that the LAD storage pond foundation materials would be machine compacted to minimize permeability but it reads as though the "low-permeability, fine-grained, glacial till deposits" simply by their structure would suffice to control permeability. (9)

Response: No concerns about the corrosivity of the adit water have been identified. This water is not acidic and has not historically resulted in corrosion problems.

The Hertzler LAD storage pond would be located in a gently sloping swale that has experienced deposition of fine grained particles over the years as well as being derived from glacial tills. Sampling of the Hertzler site suggested hydraulic conductivities of the subsoils ranged from 3×10^{-5} to 3×10^{-8} cm/sec, averaging 10^{-7} cm/sec (Wahler 1981). This low-permeability material is well suited as a storage facility with no additional compaction.

24. How has this "violation" of DEQ standards affected aquatic organisms (populations and their health and vigor, diversity of species (macro and micro), plants and animals, vertebrates as well as invertebrate s? What organisms are absent that one would expect to populate this water because these metals "exceed the chronic aquatic standard?" If there are no "absentees," does not this suggest that these organisms have *adapted to their environment and the "chromic aquatic standard" does not apply to them? (9)*

Response: The SMC facilities area and four sites upstream to the confluence with Flood Creek show a slight impairment of biological integrity due to lower concentrations than expected of stone flies and mayflies (Gurrieri 1997). This may be attributed to elevated concentrations of copper in the sediments from historic mining operations upstream or to the high energy flow regime in the mountainous area. There was no difference in biological integrity between samples collected immediately upstream and downstream of the mine. Water quality standards are set with an order of magnitude margin of safety to protect the most vulnerable species or age group of a species. Thus, a domestic health standard may be ten times lower than the concentration at which young children fail to thrive. Many chronic exceedances of metals aquatic standards occurred as maximums, and do not reflect long-term representative conditions in the river.

25. 3.1.1 (p 3-1). A serious deficiency in the section concerns the area of water rights: There are many references to SMC applying for water rights on springs and wells. How do these affect downstream, more senior rights holders? How many ditches divert water from the WF and the main Stillwater R.? If all rights holders exercise their rights at the same time, what does this do to streamflow in the Stillwater R.? How does this influence dilution due to discharges from SMC, including the LAD sites? (9)

Response: SMC is not currently engaged in the development of additional water rights. SMC has surface water adjudications for 3.26 cfs of water on the West Fork of the Stillwater River in five filings and 3.596 cfs of water on the main fork above Hertzler in six filings. SMC has six well permit filings in the facilities area and immediately upstream with well rates totaling 745 gpm and annual use of 817.18 acre feet.

Typical calculations of pollutant loading are based on historic flow data that have been statistically manipulated. There are 59 surface water adjudications along the West Fork of the Stillwater River, which account for flows of 51.3 cfs. Twenty-eight sites have registered methods of diversion, such as headgates or ditches. There are 54 identified water rights above Hertzler Ranch on the Stillwater River for which 321.8 cfs have been adjudicated. Twelve of these water rights are for headgates, ditches or pipelines. Flow data were acquired when existing water users were beneficially using the water, and, as such, the existing dilution afforded by the low flows, 7Q10, was adequate to provide mixing to sustain the existing and future use of water in the rivers.

26. 3.1.2.1 Stillwater River. (p 3-8). "Metals periodically exceed water quality standards for domestic use." Under what stream flow conditions? For how long (duration)? How many residences, ranches, and SMC itself treat drinking water to meet drinking water standards? "The maximum concentration of Fe exceeds the human *health standards." How many water supplies are declared not suitable for human consumption because they are not treated or because one or more of their chemical or physical parameters does not meet drinking water standards? How many residents whose water supply is the Stillwater River have been sickened by consuming its water? Drinking water standards are for treated water both as it leaves the treatment plant, as a minimum filtration and chlorination, and as it flows from the consumer's tap, whether from surface or ground water sources; they do not apply to "natural" and "wild" waters against these standards and it is misleading, and reference to them continues throughout 3.1.2. (9)*

Response: Iron and lead have periodically exceeded the water quality standards for domestic use. Iron concentrations were more likely to be elevated during periods of high flow in May and June. The lead exceedance was a one-time exceedance in 1991. There are seven filings for domestic use along the Stillwater River from the headwaters to the reach below Hertzler Ranch. Individual treatment strategies are not known, but the Stillwater is classified as a B–1 water, which reflects that DEQ finds the water suitable for domestic use after conventional treatment. DEQ does not have public health data showing problems with water quality in the valley. DEQ's Water Quality Standards afford protection to end users of water, whether they are aquatic organisms or humans. These standards are applied irrespective of location and geological setting. Admittedly, mineralized deposits will leach elevated concentrations of metals in their natural settings.

27. *One reported deficiency of Alternative D was that tailings pipelines would be suspended across the Stillwater River or attached to the bridge. Even this exposure was only slightly higher risk than Alternative B. With Alternative D, wouldn't the total evacuation of the both 8" tailings slurry pipelines be similar to that experienced with Alternative B in the event there is a breach of the crossing of the Stillwater's West Fork (pp 4-7, 8). With Alternative D, couldn't pipelines be buried under the river like as in Alternative B? What are the constraints? Could the pipelines be accommodated by the haulage-way under the Stillwater River (reference DEQ 009, approved February 28, 1996)? (11)*

Response: NEPA does not require final designs. It only requires sufficient detail for analysis (40 CFR 1502.4(a). Additionally, MMRA 82-4-335(4)(l) MCA requires sufficient detail to ensure structures are safe and stable.

The tailings pipelines for Alternative B would be 7.5 miles long. The tailings pipeline for Alternative D would be 0.78 miles long. Consequently, the maximum volume of tailings in the pipeline under Alternative D would be one-tenth of the volume in the pipeline under Alternative B.

It is operationally impossible to bury the pipe at this location due to a substantial depth of the riverbed and large boulders at this location. In contrast to the West Fork of the Stillwater, there is also no preexisting channel that can be used to divert the water through during construction. The disturbance acreage would also increase to build a diversion and trench the main channel. Additionally, the 4400 level connection may have insufficient space in which to install the pipelines. Finally, the 440 level connection has not been constructed and may not be constructed before the east side impoundment would need to be constructed and available for placement of tailings.

28. Does the mine have adequate water rights to transport the slurry? (12)

Response: Yes, makeup water for the tailings circuit is primarily derived from adit water, for which SMC has water rights of more than 1,500 gpm through the filing of well permits. In addition, SMC holds surface water rights on the Stillwater River of 1,614 gpm.

29. Page 2-13 "concentrations present in the tailings water pose no human health or environmental hazard? At what concentration do human and environmental hazards exist? What happens when water evaporates and concentrations of reagents increase? (12)

Page 2-13 states "concentrations present in the tailings water pose no human health or environmental hazard." At what concentrations do human and environmental hazards exist? Will the concentration of the reagents increase to hazardous levels as the water evaporates? Measures should be taken to ensure that any accidental spillage/depositing of non-hazardous reagent levels within rights-of-way will remain at non-hazardous levels through time. (26)

Response: The statement has been modified to indicate that the waters pose no direct threat to human health. **Table 3–3** compares tailings or process water quality with aquatic and human health standards. Total dissolved solids and sulfate concentrations exceed potability criteria, and cadmium, chromium, copper, lead, mercury, and zinc exceed one or both of the aquatic standards. Evaporation is a physical process that increases salt concentrations. The respondents are correctly suggesting that the water quality may diminish with evaporation. However, the water at the end of the pipe for SMC–4 has been recycled, concentrations reflect the impact of the milling process and evaporation in the tailings impoundment. The tailings impoundment is engineered to permanently contain the tailings through the use of an HDPE liner underlain with a low-permeability subgrade and reinforced with layers of a fine particle slimes. Accidental spillage along the right-of-way would be contained and cleaned up to minimize environmental impacts in the short- and long-term.

30. 4.6.1 Tailings Impoundment Stability 4.6.1.2 states that insufficient data exist regarding the strength and consistence of the Colorado Shale Units underlying the Hertzler site to base a meaningful analysis of the potential for a deep bedrock failure of the entire site toward the Stillwater River. The SMC does not know how stable the site is... they are assuming that it is sufficiently stable because that is what they want to *believe, not as a result of detailed exploration. Gentlemen, this is not my area of expertise, but I think a second, independent opinion based upon exploration is in order. Does the SMC realize how much water flows from under the hills of the proposed site into the river? Are they sure the underlying aquifer will not be contaminated by their operations? Do they really know how stable the ground is? I would hate to lose the quality of the water in my well because the SMC did not conduct sufficient studies prior to action. (13)*

Response: Although a detailed analysis of the potential for a deep bedrock failure of the entire site was not conducted, the conclusions reached in **Section 4.6.1.2** were not based on SMC's wishes for stability. As discussed in this section of Chapter 4, previous analyses suggest the Colorado Shale Unit is sufficiently competent as a foundation material that it would not be the limiting factor in controlling the stability of the embankment. The only theoretically-feasible mode of failure associated with the Colorado Shale Unit would exist if the entire Hertzler Ranch is an existing landslide area. Any increased wetting of the shale or loading of the top of the slide by the tailings dam could feasiblely trigger movement if there was a slip surface. However, there is no indication that the Hertzler impoundment area is underlain by anything other than competent bedrock.

As an added precaution, DEQ and CNF have identified a mitigation measure that would require SMC to obtain additional drilling data to confirm the competency of the Colorado Shale Unit only if signs of mass failure were observed during excavation of the impoundment foundation or borrow areas. Please refer to **Section 2.4.5** to review this mitigation measure.

Analyses also were conducted to predict seepage flows throughout the life of the impoundment. Their results suggest a maximum of approximately 35 gpm of tailings water would be collected by the underdrain system. However, the total seepage collected by the underdrain system would reduce to approximately 20 gpm during the later stages of filling as tailings consolidation seepage dominates the majority of the basin. Seepage rates though the HDPE liner (with an effective permeability of at least 1×10^{-10} cm/sec) and into the ground water regime would be less than 0.1 gpm throughout the life of the impoundment, which is a fraction of the discharge rates from springs and wells in the aquifers under Hertzler Ranch (range: 10 to 200 gpm). In other words, current saturation rates are much higher than the quantity of water proposed to be supplied by the tailings impoundment. Mining companies are required to replace the quantity or quality of affected water supplies (MCA § 82-4-355).

The agencies have also developed a mitigation requiring SMC to identify, collect baseline data for nearby residential wells down gradient from the Hertzler tailings impoundment that might be affected by seepage from the impoundment. This would be done prior to beginning construction of the pipeline and Hertzler tailings impoundment. If monitoring of ground water wells showed that ground water outside of the mixing zone exceeded nondegradation standards then monitoring of those residential wells would be required to determine whether or not the impoundment was affecting the water supplies and if replacement was required.

31. I would like to express my concerns regarding the proposed LAD pivot irrigation system as it affects the following: The potential instability from saturation of the toe of the colluvial materials to the north and west as described in 4.1.1.2.2 Stratton Ranch paragraph 2 page 4-3. (15)

The impact from the LAD Sprinkler system would be significant if not addressed. I have the same concerns regarding the proposed LAD Pivot Irrigation system as it may contribute to the same impacts to Tracts 12, 11 and possibly Tract 10 of COS #228502 comprising 60 acres owned by myself, which is directly adjacent north of Stratton Ranch and down gradient from the proposed LAD Sprinkler System. (15)

Response: The ground water table in this area slopes eastward toward the river (**Figure 3–2**). Review of historic data from the LAD systems at the SMC facilities area suggests that mounding doesn't occur, and the area to the north is unlikely to be impacted. The statement has been eliminated. The materials underlying the Stratton Ranch site are suited to handle a large throughput of water with nominal effect to the adjacent slopes. The primary evidence supporting this conclusion occurred when the site was occupied by a trailer park. The leach field associated with the park handled 150 to 250 gpm.

32. Even though most of the attention seems to be on the Hertzler development, we are troubled by the east side waste rock impoundment. We are upset about the close proximity of the Stillwater River to the waste rock impoundment on the east side in the alternatives in the DEIS. We understand it would be 100-150 feet from the Stillwater River. We feel this should be restricted to at least 300 feet from the river. According to the DEIS (page 5-19) surface water quality would experience minor degradation under certain parameters and nitrate levels in the Stillwater River would increase under all alternatives. Also, there would be a slight increase in runoff from waste rock in all alternatives. This certainly is a worry and should be prevented. We need to protect our pristine water. (20)

Response: Nitrate loading from SMC's main facilities is limited to 100 pounds per day from all sources: direct discharge, discharge through percolation ponds and waste rock loading. This is verified through point source monitoring and sampling downgradient wells and the Stillwater River. This loading rate will increase nitrate concentrations 0.6 mg/L during low flow periods, and less during higher flow periods. If nitrate loading is greater than permitted under the MPDES permit, SMC would be subject to water quality violations and reexamination of the terms of operation.

Increases in runoff from increased disturbance will be routed through storm detention ponds and will only slightly increase river flows following a storm event.

33. As one reads the DEIS (March 1998) one cannot be concerned by the following: (Chapter 4.0--4/11 Unavoidable Adverse effects) 1- "Ground water Quality--Increase in nitrates." 2 - "Surface Water Quality - minor degradation" 3- "Increase in sedimentation into the Stillwater" (The past 3 years, during September and into fall, the river has had a strong mossy smell and the fish taste badly.) 4- "Increase in runoff from waste rock." (On an least 3 occasions during the past four years during a heavy rain, the river has turned a chalky white. We asked a DEQ official at the meeting about this and was told it was most likely from the spring runoff and the type of rock formations in this valley. This does not happen during a normal spring run off when at first the river is a bit muddy and, as it is right now, higher than usual but very clear. This seems to happen only during a heavy rainfall and high water combined. Couldn't this be caused by the run off from the tailings pond at the mine site?) ?(21)

Response: The objective of an EIS is to identify and disclose impacts of a proposed action to allow a decision maker to balance the advantages and disadvantages of the action. Changes in water quality would occur, but are regulated by the MPDES permit. Loading of nitrates is limited to 100 pounds of nitrogen per day, which would increase nitrates 0.6 mg/L under low flow conditions. The stormwater management plan and use of stormwater detention ponds have substantially reduced offsite sedimentation from storm runoff in the last five years. We are not familiar with the chalky white runoff to which you refer, but are certain that it could not be attributable to runoff from the tailings pond. The tailings pond is part of a closed system and has substantial freeboard protection for storm events. The mine has operated for 13 years without impacting the fishery below the site.

34. The DEQ official we spoke with at the hearing said the DEQ monitors the water quality 3 to 4 times a year. The DEIS states the SMC monitors the waste rock for acid generating substances once a year. It doesn't seem to be enough times during a year. (21)

Response: DEQ may monitor SMC three or four times per year, but SMC monitors the site's water far more frequently. Monitoring occurs in conjunction with the mining permit and the MPDES permit. SMC monitors water quantity and quality under its permit at eight stream or river stations, one spring, and fifteen alluvial wells three times per year. In addition, they monitor the two adit discharge sites and the decant water at the mill three times per year, five wells three to twelve times per year and two springs twice per year. Water levels are acquired at three sites monthly. The approval of an Action Alternative that includes Hertzler would result in the additional tri-annual monitoring of three surface water sites and eleven shallow wells. The initiation of activities at Stratton would result in tri-annual monitoring of one additional surface water site and four shallow wells. Monitoring for the

MPDES Permit occurs at the four outfalls, five monitoring wells and two surface water sites. Direct discharge to the river at outfall 001 is monitored daily for flow and weekly for water quality parameters and initiates tri-annual monitoring at the wells and monthly monitoring of the surface water sites. Discharges into the three sets of percolation ponds, outfalls 002, 003, and 004 are monitored weekly for pH and nutrients. Point source discharges are not anticipated at Stratton or Hertzler and, thus, approval of an Action Alternative would not modify the MPDES monitoring requirements. Additionally, annual monitoring of the waste rock for acid-generating substances is adequate as SMC's waste rock has historically not been acid-producing. Furthermore, dramatic changes is waste rock geochemistry will generate alterations in water quality that would be noted quickly in the previously mentioned water quality monitoring.

35. The DEIS lacks any specifics on cathodic protection from the pipelines. Electrical currents in the vicinity of the mine and potentially generated by the flow of slurry through the pipeline may accelerate corrosion of the steel pipes. The DEIS should address this possibility and develop mitigation to prevent any corrosion (pp 4-6--4 -8,4-12). (27)

Response: Although the preliminary engineering on the pipelines suggests an epoxy coating on the pipelines would provide adequate protection, the pipeline's design specifications have not been finalized. Thus, the determination of the need for cathodic protection has not been finalized. SMC will have to submit the final design for the pipelines to DEQ and CNF for approval before construction can begin. Unless SMC can convince DEQ and CNF beyond any doubt that an epoxy coating is adequate and cathodic protection is not really needed, the agencies would require cathodic protection. A mitigation measure that addresses this situation has been added to **Section 2.4.5**.

36. The DEIS does not provide sufficient information from current water quality permits, which should be included in the EIS. Therefore it is difficult to understand measures that are proposed to protect water quality. (27)

Response: **Section 4.1.1.2.1** now includes detailed information about the MPDES permit. The response to question 34 also contains information about water monitoring requirements associated with the Hard Rock Mining Permit. A new appendix, which identifies all mitigations required by DEQ and CNF in decisions on previous MEPA/NEPA analyses, was added to the final EIS. Please refer to Appendix C to review the measures the agencies required to protect the quality of water at and around the Stillwater Mine.

37. While SPA would not support eliminating a liner beneath paste tails, it seems likely that much more water will seep and require containment from slurried tailings than from paste, at least in the first years after placement. (27)

Response: The total amount of water liberated from the paste tailings would be less than from slurry tailings. However, the paste tailings would still require a containment liner system and the resulting seepage would be expected to be similar to the slurry tailings alternative.

38. Measures should be established in the final EIS to require control of pollution from the waste rock pile and ensure that there is no seepage into ground water. The analysis of infiltration in the DEIS (pp. 4-2-4-3) calculates 33 years for one pore volume of water to infiltrate the waste rock pile. However, this calculation appears to be based on the assumption that the pile would instantaneously be 150 feet thick. Obviously the pile will be building slowly over 30 years, so that infiltration will occur concurrently with construction of the pile. Nitrogen loading to ground water could therefore occur sooner than calculated in the DEIS. The EIS needs to factor this into its analysis and needs to include an explanation of pollution, monitoring and control measures in effect from the current waste rock storage areas. The EIS should permit no seepage from waste rock storage into ground water. (354-27)

Response: The MPDES permit limits total nitrogen release to100 pounds per day from all discharges. The EIS' text describes the maximum nitrogen loading rate for the first 33 years. It does not indicate that it would be 33 years before nitrogen loading occurs from the waste rock storage site. Monitoring requirements have been established in the MPDES permit for wells below mixing zones that also are below the east side waste rock storage site to ensure that the 100-pound limit is not exceeded. As stages of the east side waste rock storage site are constructed, additional wells would be installed as needed.

39. Before permitting, the EIS should share with the public all water quality measures that will be required at all sites. More information is needed in the final EIS on the impacts of the LAD storage ponds proposed for the Hertzler site and the Stratton ranch, and monitoring and mitigation to protect ground water quality should be included. Water quality measures taken at all sites should include frequent sampling and published results for all sites. Sampling results should be easily and locally available for public review. All monitoring and prevention in effect under the current permit should be carried forward to new sites with additional requirements as appropriate, including monitoring of domestic wells close to the mine, tailings, and waste rock facilities. SMC should use their water treatment system at all times. However, no phosphorus should be added to the Stillwater River. (27)

Response: The LAD storage ponds at Hertzler and Stratton Ranch would act as storage and surge ponds to maintain an even flow of water in the pivot irrigation structures. Low-permeability glacial materials line the pond at Hertzler. SMC would line the pond at Stratton to minimize infiltration. SMC would perform additional monitoring of ground water at these sites under the mining permit as described in **Section 4.1.3**. Existing monitoring under this permit would be maintained. Annual Hydrology Reports are available for review with the DEQ in Helena, the CNF at Red Lodge, and at the Stillwater Mine.

The recently-renewed MPDES permit continues to allow SMC to directly discharge adit waters to the Stillwater River. These waters are subject to effluent limitations and narrative water quality standards at the discharge point and site-wide loading limitations for nitrogen and phosphorus.

The MPDES permit has set nondegradation phosphate standards that will result in concentrations less than the trigger concentration during the growing season. Please refer to **Section 4.1.1.2.1** for a discussion of phosphorus.

40. SPA believes that the mine should line the water return pipe from an impoundment at the Hertzler ranch with on HDPE sleeve to reduce the risk of leaks from this pipe (pp. 4-6-4-8, mitigations at .4-12). (27)

Response: SMC proposed to construct the pipelines of steel so the system would not need booster pumps (non-steel pipelines would not handle the pressures required to operate the system without booster pumps between the mine and Hertzler Ranch). However, the steel pipelines would not handle the abrasive characteristics of the tailings slurry as well as non-steel pipelines. Thus, SMC proposed the HDPE liner to minimize abrasion and aid in pipe sleeve replacement

41. It would also provide a good perspective to evaluate the long term impacts of the project by defining land use scenarios after mining has ceased and reclamation has occurred. It is reasonable to assume that SMC would not retain possession of the land in perpetuity and thus would probably sell the property at some point in time. What would be the potential for development in this area? Would there be any restrictions on its use? For example, the LAD system would be employed to dispose of nitrogen from the mine waste water, but also it would distribute other components, including heavy metals. Would these substances accumulate in the area and present a potential risk or are these substances somehow leached into the ground water and dissipated? Is the Hertzler site then usable for residential, recreational or other uses? (28)

Response: It is likely that the property would be owned by SMC or another mining company for the foreseeable future. As long as environmental standards are met, there are many options for post-mining land use. It would probably be managed for the proposed post-mining land uses of cattle grazing and wildlife habitat. SMC's decision to sell or not sell the property is beyond the scope of this analysis.

The mean concentrations of metals in adit and process water are below acute aquatic standards and human health standards. Water quality standards are based on the end user, with the most restrictive standards set for tiny aquatic organisms and the least restrictive standards set for cattle. Infrequently, metals' concentrations in SMC's effluent stream have exceeded aquatic standards associated with chronic exposure. A further complicating issue is a laboratory's capability to discern concentrations as low as the chronic aquatic standards. This is not apparent from the simplifying statistics shown in

Table 3–3. The text reported that the maximum concentrations of dissolved cadmium, copper, manganese, and zinc, and total recoverable cadmium, copper, and lead exceed either aquatic or human health water quality standards. The small amount of metals that would accumulate in the site would not limit future uses of the land.

A metals attenuation study (Grass-Land Maxim Technologies and Western Technology and Engineering, Inc. 1996) at Hertzler and Stratton ranches found the soil column adsorbed manganese, cadmium, and lead. Adsorption is not reversible under normal environmental conditions. Natural concentrations of these metals are more than an order of magnitude lower than suitability standards for plant growth medium (EPA 1981). The control plots released copper, when watered with Stillwater River water, suggesting natural copper in the soils was mobilized.

Monitoring wells are located below the existing land application areas and monitored quarterly under the Hard Rock Mining Permit 00118.

42. Page 3-20: The first full paragraph states that the data in Table 3-5 show dissolved chromium exceeds the human health water quality standard. However, the data in Table 3-5 indicate that even maximum chromium concentrations are less than the standard. Either the data or the statement is in error. (33)

Response: A review of the original data confirms the table values. The sentence has been stricken from the text. Please refer to **Section 3.1.3.1** to review the change.

43. Section 4.1.1.2: The discussion of nitrate loading could be clarified by indicating the anticipated amount of nitrate loading, in pounds per day, from all the potential nitrate sources. Adding this discussion would facilitate comparison of anticipated loading with the permitted maximum loading rate of 100 pounds per day. An estimated loading rate is provided for the waste-rock pile (page 4-3) but not for the new LAD areas or for the unlined water storage pond. Some nitrate loading also is likely through surface runoff from the LAD sites because soil moisture will be maintained at saturation. (33)

Response: Nitrate loading is one of SMC's obligations under its MPDES permit. Consequently, nitrate loading is regulated through the MPDES permitting process, which is independent of this MEPA/NEPA process. For detailed information on nitrate loading, please refer to the recently-approved revision to SMC's MPDES permit on file at DEQ offices in Helena and at CNF offices in Red Lodge.

44. Page 4-6: The estimated nitrate concentration (0.789 mg/L) in ground water downgradient from the land application area might not be reasonable. Concentrations in ground water downgradient from the current LAD have been higher, with an average of about 3mg/L (page 4-4, second paragraph). Second, water with 7.5 mg/L NO_3-N is to *be applied to four 1,000-foot diameter pivots (total area of 72 acres) at 2,000 gallons/ minute for 7 months. The calculated annual rate of nitrate application is about 525 pounds/acre. The rate is higher than typical fertilizer application rates in the corn belt of the midwestern US, where increases in nitrate concentration in ground water have been observed to be much higher. (33)*

Response: Please recognize the mixing zone is substantially greater at Hertzler than at the Stillwater Mine site, and this distance affords a substantial benefit to ground water nitrate concentrations next to the Stillwater River and in the river itself. Also, the high nitrate values in ground water at the present LAD are due to the use of percolation ponds, which would not be used at either the Hertzler Ranch or Stratton Ranch LADs. The application rate is approximately 262.5 lbs/acre, a value on the upper end of agricultural nitrate application rates. (7.5mg/L * 3.785 L/gal * 2,000 gpm* 12 hr/day * 60 min/hr * 7 mos * 30 days/mo * 1g/1,000 mg * 1 # / 454 g / 72 acres.) Additional supporting documentation for the Hertzler LAD mixing calculations may be reviewed in SMC 1996.

45. Table 3-4: The human health standard for chromium is listed as 0.0 mg/L rather than 0.10 mg/L. (33)

Response: The correction of the chromium standard has been made. Please refer to **Table 3–4** to review the change.

46. Page 4-6: The predicted increase in nitrate concentration of 0.017 mg/L in the Stillwater River appears to be unreasonably low. The current operations have resulted in an increase in nitrate concentration of 0.2 mg/L in the Stillwater River (page 4-4). The planned application of two to three times as much minewater and leaching of the additional waste rock could result in concentration increases in the river that are larger than those observed for the existing operation. (33)

Response: The calculations on page 4-6 of the DEIS (**Section 4.1.1.2.3**) refer to concentrations in the Stillwater River below Hertzler. The LAD pivots at Hertzler would be almost one mile (4,380 feet) from the river. SMC would stockpile the waste rock at the Stillwater Mine site.

47. Table 3-3: No data for total-recoverable zinc are listed. Is this an omission or are no data available? Also, are data available for metals other than those listed? (33)

Response: There were three samples of total recoverable zinc from SMC–3, two samples from SMC–4, and four samples from SMC–9. As these tables were composited to provide a broad, representative perspective of water quality, a decision was made early in the development of the tables to only include data for which there were two or more samples for single sites, and eight or more for multiple sites. Thus, the total recoverable zinc data were not included. The data were all lower than the human health standard, but one sample each from SMC-3 and SMC-4 exceeded the chronic standard 0.033 mg/L for zinc.

SMC voluntarily analyzed additional metals for a short time at various Stillwater sites. Other metals included aluminum, antimony, arsenic, barium, beryllium, molybdenum, selenium silver, and thallium. Most analyses met water quality standards. Total recoverable aluminum concentrations exceeded the chronic aquatic standard at SMC–6, SMC–7, and SMC–7D. Detection limits were not low enough to assess compliance with the human health standard of 0.006 mg/L for antimony and 0.0017 mg/L for thallium at MW–T2A, MW–T3A, SMC–7, SMC–7D, and SMC–10. Detection limits were also not low enough to assess compliance with the human health standard for mercury of 0.00014 mg/L at MW–T2A, MW–T3A, SMC–3, SMC–4, SMC–7, SMC–7D, and SMC–9.

48. Page 3-13: The last paragraph discusses the quality of water discharged from adits. The discussion fails to note that the mean total-recoverable copper concentration for adit water exceeds the acute and chronic aquatic standards. (33)

Response: A statement about the mean total recoverable copper concentrations has been added to the adit discussion. Please refer to **Section 3.1.3.1** to review the additional text.

49. Page S-30: The Summary Table for Alternative B shows no increase in overall mine discharge. However, page 2-10 states a possible increase from 1,000 gallons/minute to 1,900 gallons/minute. (33)

Response: The summary table has been changed. The Proposed Action has no cap on ore production or water discharge. Calculations in **Appendix D** show average annual discharges of 2,020 gpm under a 5,000 tpd production scenario, and the MPDES permit allows a maximum direct discharge of 2,000 gpm to the river at site 001 and unlimited discharge through the percolation ponds. Recent historic data suggest the percolation ponds can handle approximately 600 gpm.

50. The discussions of hydrology of springs do not include estimates of the potential effect of the proposed expansion on flow or quality of springs in the area. (33)

Response: Discussions of impacts to spring flows have been added under the proposed action alternative. Continued development of the mine may result in decreased flows in springs with hydraulic connection to faults intersected by the mine. There will be no impact on flows of springs near Stratton Ranch and the springs in Hertzler Valley. Water quality impacts are not likely at Stillwater, Stratton Ranch, or the Hertzler Valley. The Hertzler Homestead spring east of the tailings impoundment may have flow and water quality changes in the unlikely event that the tailing impoundment and holding pond leak. Please refer to **Section 4.1.1.2** to review the additions.

51. Page 4-4: The statement that evapotranspiration will result in lower nitrate concentrations in soil and ground water is incorrect. Any loss of moisture in the root zone would cause concentrations of all dissolved constituents to increase. This comment also applies to similar statements on page 4-6. (33)

Response: The wording on pages 4-4 (**Section 4.1.1.2.2**) and 4-6 (**Section 4.1.1.2.3**) has been changed. The aerial irrigation system results in airborne dispersion and evaporation, evaporation from surface deposition, infiltration, and plant and soil uptake. Due to rapid chemical reactions and low volatilization constants for nitrogen species, aerial evaporation does not concentrate nitrates.

52. Page 4-6, Section 4. 1.1.2.3: "Mixing projections for the Hertzler Ranch site assume LAD application rates of 2,000 gpm with nitrate-nitrogen concentrations of 7.5 mg/L." These assumptions do not correspond to the figures provided in Section 2.4.1.3 regarding the ABC system (see comments 2 and 3 above). It is recommended that the discrepancies in flow volumes and concentrations as provided in the DEIS be clarified in the Final EIS. (32)

Response: **Section 2.4.1.3** for Alternative A indicates that the ABC system currently handles 500 gpm. SMC may double the capacity of that system to 1,000 gpm under the action alternatives. However, all water which is discharged does not need to be run through the ABC system. Thus, the numbers in the final EIS are consistent.

53. Page 2-13, Tailings and Process Water: Are the reported sulfates in process water a product of oxidation of sulfides in the basal unit of the Stillwater Complex or from reagent additions, or both? (32)

Response: Sulfate concentrations in the process water are from the reagent addition of sulfates. The Stillwater Mine is not located in the basal unit of the Stillwater Complex.

54. Page 2-13, 2.4.1.3 Water Management and Disposal and Page 3-12, 3.1.2.3 Hertzler Ranch: The DEIS described the use of ABC cells for nitrate removal and land application. However, it is not clear how waste streams with both nitrogen and heavy metal pollution will be treated such as mine water or storm water. For example, Table 3-3 (adit water quality) and the narrative in section 3.1.2.3 indicate metal pollutants at levels of concern. How will these waste streams be treated? (32)

Response: SMC has several options for adit water discharge from the mine. The company can treat the water with clarifiers, then discharge it to LAD sites, percolation ponds, or the river. Alternatively, SMC can take the clarified water and run it through anoxic biotreatment cells and then discharge it to LAD sites, percolation ponds, or the river. Lastly, SMC has the option to directly discharge unaltered ground water from the mine to percolation ponds or the river. Metals concentrations are low enough that discharge into percolation ponds or through LAD will permanently bind the metals with fine-grained soil particles and yield ground water and surface water with acceptable concentrations of metals. In the event that SMC directly discharges water to the river, metals' effluent limitations are monitored at the outfall and in the river and biomonitoring is initiated. Site stormwater typically falls in an impoundment, or is routed to stormwater detention ponds prior to release into the Stillwater River.

55. Page 2-23, Hertzler Tailing Impoundment: What is the design permeability and total seepage rate (gpm) through the 60-mil thick HDPE liner? Will the selected specifications achieve continuous compliance with the State ground water standards and permit? What is the design thickness of the clay soil material to be bedded under this liner and the design permeability? What quality of this 10^{-6} cm/sec permeability fine glacial till material is required? Is there a sufficient quantity of this material on the Hertzler Ranch to meet clay liner design requirements? Is the clay source on the ranch then to be reclaimed? (32)

Response: SMC is planning to use the existing glacial/alluvial till as the base below the HDPE liner, after smoothing and compacting it. It is 50 to 100 feet in thickness. Construction would occur under the supervision of a professional engineer. In the event that the engineer is concerned about coarse-grrained materials, a 12-inch layer of clay-rich soil material would be spread and compacted. The clay soil to be bedded under the liner is to be comprised of the natural glacial till soils which have an average permeability of approximately 1×10^{-5} cm/sec, with a range of a 1×10^{-3} to less than 1×10^{-7} cm/sec. Higher permeability materials would be removed where exposed in the tailings basin and replace with low permeability material, as required. There is no specific minimum thickness for the low permeability material, however the minimum thickness that can be removed and replaced by construction equipment would typically be more than 1 foot. The quantity of material will be defined by actual field conditions as observed during construction. Suitable material can be developed from the embankment borrow areas and would be expected to be a small fraction of the total material required. The borrow areas would be reclaimed.

Seepage rates through the HDPE liner and into the ground water regime would be less than 0.1 gpm (Knight Piesold, 1996). If there is either insufficient clay materials in the Hertzler Valley or the desired permeability of 1×10^{-6} cannot be achieved with compaction or local clays, then SMC would need to import clay from an outside source or implement other agency approved options that would achieve the desired permeability (see **Section 2.4.5**).

56. Page 2-26, 2.4.2.3 Water Management and Disposal: What is the design percolation rate to ground water in gpm of the unlined 80 million gallon LAD storage *pond designed to "minimize percolation?" Also, in conjunction with LAD and percolation pond design, describe how the pond design will achieve the State ground water standard and permit requirements, including non-degradation. (32)*

Response: Draws in the Hertzler Valley have hydraulic conductivity coefficients ranging from 3 x 10^{-6} to 3 x 10^{-8} cm/sec or approximately 2 gpm. This value is low and thus seepage from the LAD storage pond will not impact ground water in a quantifiable amount. Mixing calculations for the LAD system are based on average nitrate and nitrite concentrations of the tailings of 7.5 mg/L, and the criteria for non-significance in non-degradation is 7.5 mg/L at the end of the mixing zone. The mixing calculations suggest that the evaporation and plant uptake will reduce the nitrogen to less than 1 mg/L at the end of the mixing zone, based on data collected over the last four years. The average concentration of other constituents of the tailings water are lower than human health standards. SMC has filed mixing zone calculations with the State Water Quality Division of DEQ that document that all State water quality standards would be met. Additional information may be found in the Statement of Basis and Purpose of the MPDES Permit and the mine permit itself.

57. It is the suggestion of EPA's technical experts that a detailed mine East and West adits water quality discharge investigation be both initiated and designed to characterize the water quality of all sources of water that constitute each adit discharge, paying specific attention to any waters that comes in contact with the sulfidic basal members of the Stillwater Complex. A detailed examination is recommended of the mine operations records. For example, if a mine sump is blasted into a sulfidic member of the Stillwater Complex, this mine pool may be a pollution source when the pool is occasionally pumped to join the adit discharge. The pumping of a mine pool would normally be reported by the shift foreman in his/her shift report. The reported variations in mine adit discharge water quality suggest that the problem(s) could be traced to operational procedures. (32)

Response: Mining at the Stillwater Mine is confined to the narrow J-M reef within the Banded Series of the Stillwater Complex. No mining takes place in or near the sulfide-rich Basal Series. SMC currently monitors two sites: SMC–3, the west side adit discharge, and SMC–9, the east-side adit discharge. These discharge points do reflect a composite view of adit water quality that is adequate to characterize discharges and future water quality within the flooded workings. The annual hydrology reports can be reviewed in DEQ's offices in Helena.

58. Page 4-7, Section 4.1.1.2.4: "In the event of a breach at the crossing of the West Fork of the Stillwater River, flow in the channel would increase briefly until the system shuts off." In Section 2.4.2.2 it is stated that "the pipelines would be buried about 5 feet deep, including under all streambed, drainage crossings, and West Fork of the Stillwater River." The statement in Section 4.1.1.2.4 needs to be clarified based on the planned buried nature of the pipelines. It is recommended that this clarification be addressed in the Final EIS. (32)

Response: **Section 4.1.1.2.4** has been modified to reflect the buried nature of the pipelines below the West Fork of the Stillwater River crossing. Please refer to this section to review the changes.

59. Page 3-11, 3.1.2.1 Stillwater Mine Site, Geochemical Characterization: Was copper analyzed? (32)

Response: SMC did not analyze copper in the geochemical characterization in 1997. Geochemical testing is performed using the TCLP testing procedure under RCRA and copper is not identified as a hazardous waste.

60. We recommend that a long term water resources and aquatic monitoring program be developed to evaluate migration of contaminants to the Stillwater River. Such monitoring should include routine macroninvertebrate and periphyton sampling in the river above and below mine features. At the very least station SW-1 (above SMC Complex) and SW-4 (below Hertzler impoundment) should be monitored to evaluate mine impacts upon Stillwater River aquatic biota. It would be worthwhile to collect data at stations SW-2 (Stratton Ranch) and SW-3 (above Hertzler impoundment) to focus in on sources of potential contamination and to provide additional river biota information. (32)

Response: SMC has been doing water monitoring since baseline data were collected in 1980. SMC discontinued Hertzler monitoring for 17 years when they did not use the site, but sites were resampled in 1996. SMC performs tri-annual monitoring of more than 30 sites under Montana Hard Rock Mining Permit 00118. Current Stillwater River sites include upstream of the mine at SMC–1A, sites SMC–2 and SMC–10 midstream, and SMC–11, downstream of the facilities area. For additional information, the Annual Hydrology Reports in DEQ's offices in Helena may be reviewed. SMC has begun annual, late summer sampling of periphyton and benthic organisms upstream and downstream of the Stillwater Mine site as part of the renewed MPDES permit.

If ground water monitoring at Hertzler Ranch indicates nitrates or other contaminants are migrating at concentrations that would cause increases above the trigger level in the Stillwater River, biological monitoring of periphyton and macroinvertebrates would be required above and below the site. This mitigation has been added to **Section 2.4.5**.

61. Page 4-4 to 4-8: The discussion of water quality and quantity for the preferred alternative indicates significant quantities of nutrients (primarily nitrogen, although some phosphorus is also present) are likely to discharge to ground water. Sources of potential ground water contaminant discharge appear to be: 1. Seepage/runoff from the east side waste rock pile (estimated nitrogen load of 11.3 lbs per day, page 4-3), and old LAD systems and LAD storage ponds and percolation ponds (undisclosed loading). 2. Seepage from the Hertzler tailings impoundment and waste storage area (undisclosed nitrogen load). 3. Seepage from west side SMC Complex existing tailings impoundment *and percolation ponds (undisclosed nitrogen load). 4. Seepage from unlined LAD storage ponds and percolation ponds at the Stratton Ranch and from irrigation water applied via two 800 ft diameter LAD center pivot irrigation system at the reclaimed gravel pit at the Stratton Ranch. 5. Seepage from unlined LAD storage ponds and percolation ponds at the Hertzler Ranch and from irrigation water applied via four 1,000 ft diameter LAD center pivot irrigation systems. We note that LAD system are stated (page 4-4) for permitting purposes to provide 80% nutrient uptake, but could only be used 7 months per year. The maximum nitrogen loading of 1900 gpm of adit water at 7.5 mg/l total nitrogen would appear to be 172 lb nitrogen per day (w/o factoring in vegetative uptake of nitrogen for that (undisclosed) portion of the adit water what would be used for irrigation, or for the portion (500 gpm?) that would be treated via the ABC system). The allocation of adit wastewater (and thus nitrogen loading) to the Hertzler vs Stratton Ranches LAD system is not clearly disclosed. (32)*

Response: Nitrate loading from SMC's entire facility is limited to 100 pounds per day from all sources: direct discharge and discharge through percolation ponds. This is verified through point source monitoring and sampling downgradient wells and the Stillwater River, which also monitor discharges from waste rock. If nitrate loading is greater than permitted under the MPDES permit, SMC would be subject to water quality violations and reexamination of the terms of operation. The Hertzler Ranch and Stratton Ranch LAD systems are not designated outfalls in the MPDES permit because there is no predicted increase above the trigger value to the Stillwater River from these sources. Detailing of the nitrate balance is outside of the scope of the DEIS and within the scope of SMC's maintenance of their MPDES permit. For detailed information documenting loading calculations, contact DEQ in Helena.

62. Are there other sources of ground water pollutant loading? The estimated amount and quality of seepage and ground water loading of contaminants, including nutrients, from all wastewater disposal and mine runoff sources should be estimated and disclosed. Presentation of an overall water balance for the preferred alternative would be very helpful in describing water sources, water volumes, water management and wastewater disposal. (32)

Response: Other sources of ground water pollutants include the native bedrock and residential septic systems. DEQ signed MPDES Permit MT-0024716 on July 6, 1998. Loading calculations for parameters of concern were performed in the development of that permit. The permit is available for review at DEQ offices in Helena. Average annual water balances have been added to the final EIS and are available for review in **Appendix D**.

63. Page 4-5, 4.1.1.2.3 Hertzler Ranch: What is the meaning of the first sentence in the 3rd paragraph that states "The use of an HDPE liner on a clay liner, coupled with an overlying seepage collection system would minimize the potential for ground water...?" What does the seepage system overlay? (32)

Response: The overlying seepage collection system consists of underdrain pipes covered with a filter media (6-inch perforated corrugated polyethylene (CPT) pipe spaced a maximum of 300 feet apart in a 1-foot thick layer of sand) to allow drainage of water collecting on top of the HDPE liner. This reduces the hydraulic pressure acting to force water through the HDPE and clay liner, which reduces the potential for sufficient seepage through the liner and into ground water. Please see **Section 2.4.2.2** to review this information.

64. Existing monitoring data appears to show that nutrient loads from the SMC mining operations and wastewater disposal have not caused significant impacts upon Stillwater River biota at this time, however, we believe a long term water resources and aquatic monitoring plan should be in place to measure nitrogen and phosphorus levels in the river and to determine aquatic species abundance and diversity (i.e., macroninvertebrates and periphyton) so that actual impacts upon water quality and biota can be determined as the mine expansion occurs and wastewater loads increase. We believe that the water monitoring and biological monitoring programs should be presented as an appendix in the FEIS (e.g., sampling locations, frequency, parameters, analytical methods, data reporting, QA/QC, etc.,). (32)

Response: The various water monitoring programs required through MPDES Permit MT–0024716 and through the Montana Hard Rock Mining Permit 00118 are now described in **Section 2.4.1.7** of Chapter 2. SMC has begun annual, late summer sampling of periphyton and benthic organisms upstream and downstream of the Stillwater Mine site as part of the MPDES permit. The monitoring plans are available for public review at DEQ's offices in Helena.

65. The use of the term "water treatment facilities" for percolation ponds and diversion ditches is considered misleading by EPA. The latter are more properly referred to as "management practices." Typically, high flow percolation ponds function mainly as water discharge sites. It is unclear how much "treatment" is provided by percolation ponds. The LAD and percolation ponds may be found acceptable for some degree of nitrogen removal, but may not be successful in the removal of the heavy metals as known to occur in Stillwater adit discharges. (32)

Response: The term "water treatment facilities" has been modified to "water management practices." No treatment is anticipated for nitrates in the percolation ponds, but heavy metals are considered to be attenuated in soils in both the LAD systems and percolation ponds, when they exist in the discharge as described in **Section 4.1.1.2.1**.

66. Page 1-3 and S-53, Chapter 1, History of Project: EPA requests additional detail (does not need to be in the EIS) on the Stillwater Mine tailings backfill/dewatering technology related to the very fine mill grind. The DEIS states that approx 58% of the coarser fraction of mill tailings are used as backfill in mined-outstopes. The mill grind, however, is indicated to be more than 70% passing 20 microns. This is a very find grind which may be difficult to backfill. What chemical(s), if any, are used to stabilize the underground tailing stope backfill? What volume percentage of a given stope is filled? What unit operation steps are included in the tailings dewatering process? What *dewatering equipment is used? What are the underground minestope filling procedures? How is the stope-to-be-filled supernatant water handled? What percentage of the adits discharge water is supernatant water? (32)*

Response: A discussion of SMC's backfill and dewatering technology was not included in this EIS because decisions on this technology were part of earlier MEPA/NEPA analyses. Additionally, decisions on this technology are not part of this analysis. The information requested in this comment is in the mine plan and permit documents that are available for review at DEQ's offices in Helena, Montana, and at CNF offices in Red Lodge, Montana..

67. It is stated (page 3-12) that the presence of sensitive aquatic invertebrates in the West Fork of the Stillwater River suggest that the quality of the West Fork of the river is good. The discussion of aquatic macroinvertebrates beginning on page 3-34 appears to indicate that the Stillwater River biota above and below the SMC Complex also shows dominance of clean water taxa. However, we note that biological data for the Stillwater River appears to be limited, with sampling data limited to 1980, 1981, and 1997. The recent 1997 sampling showed a drop in abundance of macroninvertebrates from the 1980-81 data. This drop in abundance is attributed to much higher flows that were experienced during 1997 sampling. We believe that additional biological sampling and data collection would be worthwhile to better evaluate this drop in abundance and verify that environmental stress related to migration of mine contaminants is not involved in the drop in abundance observed between 1980-81 and 1997. (32)

Response: SMC has begun annual, late summer sampling of periphyton and benthic organisms upstream and downstream of the Stillwater Mine site as part of the recently-renewed MPDES permit. As they are submitted to the agencies, the reports will be available for public review at DEQ's offices in Helena and CNF's offices in Red Lodge.

68. Page 3-9, Table 3-1: Why does not Table 3-1 show the total nitrogen levels in the Stillwater River downstream of the SMC complex? The maximum measured phosphorus levels in the river are shown to increase from 0.11 mg/L upstream of the SMC Complex to 0.14 mg/L downstream. The amount of increase for total nitrogen in the Stillwater River below the SMC complex would be of great interest. (32)

Response: The total nitrogen as nitrogen analyses were acquired nine times at SMC–1A between June 25, 1990 and November 18, 1992. Similar analyses were not made at SMC–11, the Stillwater Mine downstream site. One can add all of the forms of nitrogen together if they have been converted to nitrogen when examining individual sampling events. It is not scientifically valid to do so with statistically composited results. Nevertheless, comparison of individual sampling results from same-day sampling at SMC–1A and SMC–11 showed increases between upstream and downstream ranging from 0.01 to 0.35 mg/L and averaging 0.11 mg/L for 14 samples acquired between October 3, 1993 and December 15, 1995.

69. Page 3-11: It is stated that the concentration of nitrate + nitrite ranged from 0.08 to 0.25 mg/L at monitoring station SMC-11. This appears to be inconsistent with Table 3-1 which shows nitrate + nitrate to range from 0.06 to 0.55 mg/L. (32)

Response: Nitrate + Nitrite data were reported from two different sources between Table 3–1 and the description of Stratton Ranch water quality. The text was revised to reflect the wider range of concentrations in **Table 3–1. Table 3–1** was derived from a long-term water quality database and information originally on page 3–11 of the draft EIS came from the 1996 water quality study at Stratton Ranch (Hydrometrics 1997b).

70. Page 3-20, Section 3 .1.3.1: "Concentrations of nitrate plus nitrite have shown a ten-fold increasing trend from baseline..." The DEIS then goes on to provide three potential factors for this ground-water quality degradation – all based on current mining operations. The statements provided here in the DEIS indicate that current operations are adversely impacting ground-water resources. What practices will be employed in the proposed plans to account for gréater protection of ground-water quality? The Final EIS should further address this issue for all potential sources of contamination to ground-water and surface-water resources. (32)

Response: The objective of this EIS is to modify SMC's mine waste management system, both the tailings and the LAD water management, and move them a greater distance away from the Stillwater River, as well as increasing the capacity for treatment of mine waters. Discharges of nitrates will drop as the Proposed Action increases the capacity of the LAD and the ABC systems. Also, SMC is actively engaged in recycling more of the waters within their waste stream to minimize discharges.

Point-of-compliance wells are subject to human health water quality standards. The human health standard for nitrate nitrogen is 10 mg/L. Although an increase in nitrate concentrations has occurred, they are still 300 percent lower than the human health water quality standard. Additionally, increases in nitrates in the ground water are allowed through SMC's designated ground water mixing zone and MPDES permit.

71. Page 4-3, Section 4.1.1.2.1: An estimated nitrogen loading rate of 11.3 lbs/day from the waste rock storage sites is provided. Based on the ground- water flow modeling performed for the facility and chemical mass balance calculations, what would be the project impacts to ground-water quality from this input? It is recommended that an estimation of the water quality effects of this discharge to ground water and evaluation of compliance with water quality standards be provided in the Final EIS. (32)

Response: The final modeling results showed nitrogen loading of 13.6 lbs/ day from the waste rock storage site. The MPDES permit restricts SMC to a daily loading of 100 pounds of nitrogen from all currently permitted sources. This loading is verified through the outfall monitoring and sampling within the ground water mixing zone and in the river. Loading contributions from the waste rock storage site will be picked up through sampling of the mixing zone and river sites for which standards lower than human health standards have been set. Total nitrogen concentrations within the verification monitoring wells cannot exceed 8 mg/L. In addition, total nitrogen concentrations at SMC–11 cannot exceed 1 mg/L unless upstream (SMC–1) concentrations are that level or higher. Loading calculations prepared for MPDES Permit MT–0024716 are available for review at the DEQ offices in Helena, Montana, and in the associated Statement of Basis and Purpose.

72. Page 3-9, 3.1.2.1 Stillwater Mine Site, Table 3-1: What is the flow parameter, cfs or gpm? (32)

Response: **Table 3-1** has been modified to show the unit of flow as cfs.

73. Page 2-10, 2.4.1.3 Water Management and Disposal: The DEIS does not contain a water balance. A schematic water balance should be developed for each alternative; and include climate-related precipitation and evaporation, adit flows, ephemeral flows, process water flows, storm water flows, ground water seep flow, discharge(s) to ground water, treatment capacity, etc. The water balance should address different weather cycles such, wet, dry and average precipitation years. (32)

Page 2-10: In 2.4.1.3 Water Management and Disposal, it is stated that current discharges of mine adit water total 1,000 gpm. The approved expansion of the mine to 2,000 tpd rate of production resulted in the lead agencies estimate for the average total discharge for adit water to be as much as 1,900 gpm. What are the mine water discharge rates for a possible range of ore production rates in the range 3,000 tpd-5,000 tpd? (32)

Response: The average total mine water discharge rates for 2,000, 3,000, 4,000 and 5,000 tpd under Alternatives B and C are 1,130, 1,350, 1,650, and 2,020 gpm, respectively. The average mine water discharge rates for 2,000, 3,000, and 3,300 tpd under Alternative D are 1,065, 1,277, and 1,430 gpm. This information is presented in **Appendix D**.

74. On page 3-7: Heavy metal-bearing flows out of three coulees/draw (Robinson, Stanley and Tandy) are advised to be (primarily) ephemeral with a maximum flow rate of 15.62 cfs or 7348 gpm (June 1980-June 1981 sampling period). These flows "appear to flow into the irrigation (Hertzler Irrigation) ditch." Are these continuous and ephemeral flows to be sampled and evaluated? How will these large flows effect the use of the LAD site? For example, will the center pivots be applying water into the coulees or draw? Will LAD be allowed if the streams are flowing? (32)

Response: SMC will regulate the LAD system to prevent overland flow due to application or in conjunction with natural runoff from a storm event. As discussed in the responses to the next comment, the ditch would be buried and piped through the site. No LAD would take place within the three ephemeral draws and there are no plans to monitor them. Surface sites that will be monitored include the West Fork of the Stillwater River upstream at SMC–14, the main fork upstream at SMC–12 and the main fork downstream of Hertzler at SMC–13.

75. In Figure 3-1, the Hertzler (irrigation) Ditch is shown to intersect the three western land application areas. The Robinson Draw ephemeral flow joins the ditch in the 1st (left to right) LAD pivot area. The Stanley Coulee (indicated to flow year-round)joins the Hertzler Ditch in the 3rd LAD pivot area. Both the Stanley Coulee and the Tandy Coal Mine Draw spring (said to flow year-round) flow into the 4th LAD pivot area. In regards to the heavy metals discharges at the site (adit discharges, spring runoff and ephemeral flows in Robinson Draw, Stanley Coulee and Tandy Coulee), EPA requests that consideration be given to design which would collect, contain and treat deleterious heavy metal discharges and flows. For example, one possible flowsheet for water treatment is to obtain heavy metal precipitation through lime precipitation in a redesigned (geomembrane-lined) Hertzler storage pond followed by pH adjustment prior to the point-of-compliance release to the LAD pivot system. (32)

Response: SMC plans to pipe irrigation water through the LAD areas to ensure that the downstream water user has the opportunity to use native water, undisturbed by mining activities. Heavy metals from the LAD are anticipated to be tied up by fine grained soil particles. Ground water in the mixing zone will meet human health standards. The revised Chapter 3 better characterizes the limited incidence of elevated metals concentrations in Robinson Draw, Stanley and Tandy Coulees, and SMC has no plans nor obligation to treat this water.

76. There appears to be some discrepancies in LAD capacity. On page 2-6, sect 2.4.2.3 --- "The capacity of the Hertzler LAD system could be designed to handle flows in excess of 2,000 gpm. "However, on page 2 -13 it is stated that the ABC system could "handle flows up to 500 gpm," Later in the DEIS, the impacts to ground-water quality from the LAD systems is evaluated based on the nitrate levels which are believed to be after ABC system treatment. How can these projections be accurate if flow volumes up to 2,000 gpm are encountered and the ABC system can only handle flow volumes of 500 gpm? It is recommended that the discrepancy between these flow volumes be addressed in the Final EIS. (32)

Response: The Hertzler LAD system is designed to handle 2,000 gpm. Waters used by the LAD may go through the ABC system, but may be directly applied as well. SMC currently has the capacity to treat water at a rate of 500 gpm with the ABC; they anticipate doubling the capacity of the system to 1,000 gpm if necessary. Adit discharge nitrate levels through 1995 averaged 7.5 mg/L, prior to installation of the ABC. In 1996, average nitrate nitrogen concentrations in LAD water dropped to 5.5 mg/L due to the use of the ABC. Discharges from SMC–3 averaged 286 gpm in the early nineties, and the average nitrate-nitrogen concentration over the last seven years has been 12.07 mg/L. Discharges from SMC–9 averaged 649 gpm in the same period of the early nineties, and nitrate-nitrogen averaged 3.04 mg/L. The use of a 7.5 mg/L average is conservative.

77. Page 2-55 (bottom), 2-56 (top): A thicker tailings impoundment liner (100 mil) or a second liner is dismissed due to the contention that the single 60 mil liner, with proper bedding and underdrain, will adequately control seepage to protect ground water. It is stated that the additional costs of a thicker liner, or a second liner, are too great to justify incremental reduction in seepage, however, estimated costs for construction of a thicker liner o r a second liner are not presented, nor are corresponding estimates of reduced impoundment seepage with a thicker liner or a second liner. We believe that such information should be presented to better substantiate the reasoning for dismissal of a thicker impoundment liner or a second liner. (32)

Response: Dismissal of the use of a thicker liner was based on a failure to provide a substantial difference in protection to the ground water, rather than on economics. SMC installed a 100–mil liner at the mine site due to the harsher site conditions. A 100–mil liner has a permeability of $1x10^{-11}$ cm/sec while a 60–mil liner has a permeability of $1x10^{-10}$ cm/sec. The difference in leakage through the liner fabric is insignificant. The Hertzler site does not justify the use of such a thick liner. In addition, slimes from the tailings at the base of the tailings impoundment yield another, relatively impermeable layer.

78. Page 2-26: The discussion of proposed water management and disposal for the preferred alternative does not clearly specify quantities of wastewater disposal using the various wastewater disposal options at the different locations (i.e. percolation ponds, the ABC system, and LAD systems at Hertzler and Stratton Ranches). The anticipated allocation of the 1,900 gpm (over 3,000 acre-ft annually) of adit wastewater discharges to these many proposed wastewater disposal systems should be more clearly presented. How much of the anticipated 1,900 gpm maximum anticipated excess adit water (page 2-10) would be disposed of via seepage in percolation ponds and unlined LAD storage ponds at the Stratton Ranch; via irrigation at the Stratton Ranch; via seepage through percolation ponds and LAD storage ponds at the Hertzler Ranch; via irrigation at the Hertzler Ranch; and via discharge of treated ABC system effluent and where would treated ABC effluent be discharged? Such information is necessary to understand loading of contaminants to ground water at each disposal location. (32)

Response: This EIS does not limit mine production or water discharge at the site. However, the Proposed Action at 5,000 tpd would dispose of 2,020 gpm of water on an average annual basis. Percolation ponds at the SMC facility would handle 288 gpm; there are no percolation ponds at other sites. LAD treatment, as irrigation, would handle 1,044 gpm. SMC has not settled on the placement of these pivots between Stratton and Hertzler. Evaporation would account for 379 gpm annually. Entrainment in the tailings would consume 239 gpm. A maximum of 1,005 gpm of treated ABC effluent would discharge directly to the river. There are no flow limitations on the discharge of ABC effluent to the percolation ponds and LAD sites. Average annual water balances are available for review in **Appendix D**. The assumptions conservatively include rainfall from a wet year. SMC will utilize varying water management strategies as needed, and seasonally.

79. Page 2-13, Sect 2.4. 1.3: A major issue regarding the protection of local ground-water resources is the proposed use of an Anoxic Biotreatment Cell (A BC) system to remove Nitrates from adit water. Based on a review of the data provided in the DEIS, the concern for ground-water quality degradation and inputs through discharge to surface waters is primarily associated with nitrates. However, the DEIS provides very limited information on the proposed ABC system. It is recommended that additional data be included in the Final EIS on the efficiency of this system to meet nitrate standards. (32)

Response: Additional discussion on the ABC units has been added. Please refer to **Section 4.1.1.2.1** to review the changes.

80. Page S-9: The two statements under "fisheries" that the proposed tailings impoundment would be approx 0.25 mile linear distance from the Stillwater River, and that the down-gradient distance from the tailings impoundment to the Stillwater River would be approx 0.5 miles, are confusing. If the impoundment is located 0.25 mile linear distance from the Stillwater River how can the river be 0.5 mile down-gradient? (32)

Response: The Hertzler Ranch surface topography is a swale with a gradient to the east and south. While the impoundment is only about 0.25 miles from the river, the local drainage patterns resulting from the local topography and geology would require any releases to travel 0.5 miles before they would reach the Stillwater River.

81. The impacts of aspects of the mine's water handling should be more fully examined, especially potential impacts from LAD storage ponds and areas of the proposed pipeline where it is very close to surface water. In addition, a more complete analysis of the impact of the waste rock storage site on ground water quality should be included in the final EIS. (40)

Response: A mine water balance is now included in **Appendix D**. The discussion of the Hertzler LAD storage site is found in **Section 4.1.1.2.3**. The LAD storage site is underlain by glacial till with a permeability of 1×10^{-7} cm/sec. There would be virtually no leakage from the site and, thus, no modifications to ground water quantity or quality. The discussion of the hydrologic impacts from the waste rock storage site is found in **Section 4.1.1.2.1**.

82. ... That river gets a lot of pressure just from the fisherman that now fish in it. And we're down to two fish over 16 inches. But I have talked to a lot of floaters, and I float the river, too. And some of the outfitters have told me that they're concerned that the water, the moss in the river seems to be getting larger between the mine and Nye. And if you, if you start to change the quality of the water, that directly affects the fish because of the bugs and things that they eat. And they think that there is a slow, slow *change that's come about in the last four or five years, and there is either nitrates or something that's causing this stuff to grow, the moss and things to grow a little bit more in the river. And I think that's the first stages of degradation of the river. (47s)*

Response: SMC has performed a substantial amount of water quality monitoring under MPDES Permit MT–0024716 and through the state Hard Rock Mining Permit 00118. State water quality chronic aquatic standards are implemented to protect the aquatic community, plants and bugs, from long-term exposure to contaminants. Review of the data in **Table 3–1** suggests that the mean, or average concentrations of metals upstream and downstream from the site exceed the chronic standards. SMC's recently-renewed MPDES permit limits nutrient loading of nitrates and phosphates to prevent eutrophication of the river and will be confirmed by quarterly biomonitoring of waters directly discharging to the Stillwater River and annual periphyton and benthic sampling of the river.

83. I understand that there is going to be some increase in nitrates. How is our drinking water going to be affected? ... I am concerned about my grandchildren drinking the water, the ground water. We have a well, and everybody downstream from the Hertzler Ranch has wells. And are we going to drink water that's safe about 30 years from now? Is it still going to be safe, or is that nitrate and whatever else going to build up to the point of being dangerous for us? (47s)

Response: Modeling of nitrates in the alluvial aquifer below the Hertzler LAD sites predicts nitrate concentrations increasing from 0.34 mg/L to concentrations ranging from 0.7 to 0.789 mg/L (**Section 4.1.1.2.3**). The Montana human health standard for nitrates is 10 mg/L. The consumption of this water would not impact human health. SMC has proposed ground water verification monitoring at Hertzler of eleven shallow wells. There should also be no long-term problems from soil retention and subsequent release of nitrates because they are consumed by plants. Nevertheless, mining companies are required to replace the quantity or quality of affected water supplies (MCA § 82-4-355).

The agencies have also developed a mitigation requiring SMC to identify, collect baseline data for nearby residential wells down gradient from the Hertzler tailings impoundment that might be affected by seepage from the impoundment. This would be done prior to beginning construction of the pipeline and Hertzler tailings impoundment. If monitoring of ground water wells showed that ground water outside of the mixing zone exceeded nondegradation standards then monitoring of those residential wells would be required to determine whether or not the impoundment was affecting the water supplies and if replacement was required.

84. Some place in here, I saw it addressed how close the pipeline would be to the road. But for a considerable distance through that areas, it's within 40 feet of the river, even if you put it on the other side of the road. So that, I think it has not been really *addressed as far as pipeline break and pollution. Now, we did hit, in the EIS, somewhat on, you know, the shutoff stuff on the pipeline. But I don't think that's been addressed in the EIS nearly as much as it should, in my opinion. (47s)*

Response: A discussion on the pipeline spill contingency plan is found in **Section 2.4.2.7**, and an impact analysis is found in **Sections 4.1.1.2.4, 4.1.1.3.4** and **4.1.3**.

B.1.2 Waters of the USA (Wetlands)

1. An application rate which maintains soil saturation will almost guarantee the creation of wetlands. The soil will become mottled quite quickly and an aerobic condition will develop. The soil type will change. According to the "National List of Plant Species that Occur in Wetlands," there are two Meadow Foxtail species, Alepecurus genicultatus and A. pratensis, which are FACW/OBL or FAC/FACW+, respectively, and one Creeping Foxtail, A. arundinaceus, which is FACW? Most Alopercurus spp. also have adapted to moist to wet to swampy areas and to waste areas, old fields, and roadsides where moist. If one of the range seed mix is a wetland plant, how many of the other species in the mix will tolerate, even flourish under wetland conditions? This suggests to me that SMC expects these LAD sites, not only at the Hertzler Ranch but also at the Stratton Ranch, to convert to wetlands due to the volume of water delivered. If this is the case, so state it. Several Alopecurus spp. are non-native. Is it the intention of SMC to introduce non -native species? A question then arises: what will be the environmental consequences to these created wetlands once the mine closes? Will they be maintained as wetlands? Will they revert to dryland? And if they revert, with the change in the soils how will dryland range plants respond to the "wetland" soils that are no longer wet or saturated? If wetlands are created, what are the regulatory consequences of allowing them to revert to dryland? (9)

Response: The purpose of the LADs would be to remove nitrogen from water. For this removal to occur at optimal rates, SMC would seed the LADs with species of vegetation that take up nitrogen at high rates and apply water at a rate that does not overwhelm the vegetation and soils' ability to take up nitrogen. As other species of vegetation invade the LADs over time, SMC would rework and reseed the LADs as needed to keep them operating at optimal conditions. Because these sites would be monitored by SMC and reworked as necessary to keep them functioning at optimal conditions for removing nitrogen from water, conditions conducive to the development of wetlands would not exist and wetlands would not become established on the LADs. High permeability of soils and depths to the water table preclude formation of wetlands under LADs.

Garrison creeping foxtail is not native and was proposed by SMC and has been used at the Stillwater Mine on the existing LADs because of its nitrate and water use characteristics. SMC is not proposing any species of plants that are not already in use in other parts of the Stillwater valley. As discussed in **Section 2.4.5**, DEQ and CNF identified a mitigation measure that modifies the seed mix for the LADs to one that has more palatable native species and eliminates creeping meadow foxtail from the mix. However, this will not prevent the non-native species from becoming introduced over the life of the proposed LAD operations. This will be an unavoidable effect for the use of irrigation and fertilization on the site.

Created wetlands would have to be maintained as long as the impacted wetlands for which the mitigation was required are still affected. If existing wetlands would be destroyed, then the created wetlands would have to remain in place in perpetuity and long-term maintenance may be required by the agencies if success of the created wetlands was doubtful. Any changes in proposed wetland mitigations by SMC would have to be approved by the agencies including the Corps of Engineers.

2. Page 4-6: The discussion of the pipeline corridor in the water resources section does not indicate if wetlands would be impacted by proposed pipeline construction. We note that it is states on page 4-73 that pipeline construction will result in some direct and unavoidable disturbance to approx 1.5 acres of waters of the US. including wetlands. It is also stated that wetland and stream crossing methods are detailed in SMC's Wetland Mitigation Plan (Western Technology and Engineering Inc., 1997c). We would like to request a copy of SMC's Wetland Mitigation Plan. Please send on copy to Mr. Dick Blodnick in our EPA Montana Office in Helena. (32)

Response: The information has been sent as requested.

3. 3.1.4. (p 3-23). Westech identified the wetlands within the project area. However, it did not use the nationally recognized standard reference for identifying wetlands, "Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, 1979. Classification of wetlands and deepwater habitats of the US. USDI-Fish and Wildlife Serv, FWS/OBS79/31." Maybe SMC 1997b makes reference to Cowardin but it seems an appropriate reference here as well. I also assume that wetland determinations on the project area meet the conditions of at least "Department of the Army. 1987. Corps of Engineers wetlands delineation manual. USDOA-COE, Environmental Lab, Tech Rep Y-87-1," better known as the '87 Manual. This should also be referenced since this is the guide for 404 permits, if needed. Westech also performed a functional rating (SMC 1997b). Is this considered a standard method, and is it reproducible? It might be appropriate to directly reference it also. (9)

Response: The information on wetlands in the EIS is based on evaluations made using the 1987 Manual's methods. Because Cowardin et al. is not used in 404 permitting, it was not used in this analysis. Additionally, no further 404 permitting is necessary because on October 29, 1997 the U.S. Army Corps of Engineers determined installation of the pipelines across drainages and wetlands is authorized by Nationwide Permit Number 12. Additionally, the Corps determined the construction associated with the water storage pond and waste rock storage area qualifies for authorization under Nationwide Permit Number 26.

Western Technology and Engineering, Inc. evaluated the functional values of wetlands using a modification of the Wetland Evaluation Technique (WET 2.0) developed by Adamus et al. (1987). The Modified WET 2.0 evaluation was developed for ARCO's Anaconda Smelter Superfund site by EA Engineering and Technology (1992). The method is reproducible.

B.1.3 MPDES

1. 2.4.2.7. (p 2-30). Water Quality: This section entitled Monitoring emphasizes sampling. Monitoring is more than that. It includes an action plan which explains what action SMC will take in the event of a spill or a violation of the MPDES permit? What sequence of events will trigger taking corrective actions, for surface water, for ground water? A permit violation requires a violation of a standard. How is the standard established? What suite of constituents does it include; what concentrations or measurement units? How much natural variability exists in the data? How long (hours, days...) must a spill or storm water violation persist before a violation occurs? A stream's classification does not constitute a standard; it only defines for what purposes a particular water body might be suitable. A standard must be measurable and it must have reasonable level of certainty to support it. (9)

Response: A monitoring plan consists of the identification of sites, a frequency of sampling, and a list of parameters for monitoring. In a traditional sense, it does not include a discussion of the spill control plan, corrective action triggers, or the conditions for establishing a violation. Inspection and monitoring reports, violation paperwork, and procedures are available for review at DEQ's offices in Helena.

The discussion on page 2–30 of the DEIS (**Section 2.4.2.7**) refers to the water sampling plan associated with Hard Rock Mining Permit 00118. Violations of this permit consist of operation-based performance standard violations of the mining law. Water quality violations are typically issued by the MPDES arm of DEQ, and MPDES Permit MT–0024716 specifically spells out noncompliance situations, associated penalties, and obligations to mitigate. The MPDES permit identifies effluent limitations. A violation occurs when an exceedance of an effluent limitation occurs.

Effluent limitations are established based on an evaluation of background conditions, compliance with non-degradation standards, anti-backsliding conditions, and narrative and numeric water quality standards found in WQB–7 (DEQ 1995). In the event that background conditions exceed the standard, background conditions become the standard. When comparing the other criteria, the lowest value is used. The DEIS reader is directed to **Tables 3–1** through **3–5** for aquatic and human health water quality standards.

2. Still worrying about water quality, we do not feel the mine should be allowed to discharge phosphorus or nitrates directly into the Stillwater River under any circumstance. (20)

Response: The recently-renewed MPDES permit does allow SMC to directly discharge waters containing nitrates and phosphates into the Stillwater River in a controlled manner. Denial of SMC's proposed mine waste management plan would not modify the MPDES permit. However, an objective of this proposal is to increase the mine's capability to treat water from the mine at new LAD sites at Hertzler Ranch and Stratton Ranch in preference to direct discharge to the Stillwater River. In addition, the use of water management strategies at Stratton and Hertzler would increase the distance between these structures and the Stillwater River and diminish the potential for water quality impacts.

3. Water quality protection is an important aspect of the environmental analysis of the mine. A key permit to water quality protection is the MPDES permit issued by DEQ. A draft of this permit is currently available. However, an analysis of the MPDES permit is not included in the EIS. It is typical in the environmental analysis of mine proposals to include an analysis of the MPDES permit issued in the EIS. EPA, for instance, does this when EPA is the issuing authority for an NPDES permit. (22)

The DEQ is a co-preparer of this EIS, yet there is no discussion of the MPDES permit, which is also prepared by DEQ. Major issues associated with the MPDES permit that should be included in the discussion of the EIS include: Land application disposal and the assumed rate for removal of nitrates. - The rationale contained in Section B. Wastewater - Effluent Limitations changes from parameter using either degradation or Water Quality Standards, without apparent basis. - The location and potential effects for the placement of diffuser for the disposal of mine water in the Stillwater River - The probable and possible effects on water quality of increasing the production of the mine from 2,000 tons per day to 5,000 tons per day - The potential effects of the discharge of phosphorus into the Stillwater River. (22)

Response: The MPDES permit is discussed in the final EIS. Please refer to **Section 2.4.1.7** to review the discussion. Nitrate removal rates are discussed in **Sections 2.4.1.3, 2.4.2.3, 4.1.1.2.2, 4.1.1.2.3** and **4.1.3**.

DEQ's Statement of Basis for Proposed Permit Limits of Permit No. MT–0024716 (DEQ 1998) discusses the rationale for the effluent limitations. This document is available from DEQ and also is available for review at DEQ's offices in Helena, Montana.

The diffuser will be located east of the tailings impoundment and additional discussion of this MPDES outfall is now found in Sections 2.4.1.7 and 4.1.3. The MPDES permit was written to accommodate maximum flows of 2,000 gpm from the diffuser, Outfall 001, and unlimited flows through the percolation ponds insofar as water quality standards are met. Average ore production of 3,000 tpd would yield 1,342 gpm while projections of inflows associated with the mining of 5,000 tpd would yield 2,020 gpm. SMC has developed a track record for innovatively and successfully treating its effluent streams, and descriptions of the impacts associated with increasing production are discussed in the EIS.

Phosphorus can contribute to an increase of aquatic plant growth in nutrient-rich waters. The MPDES permit has set nondegradation phosphate standards that will result in concentrations less than the trigger concentration during the growing season. The discussion of phosphorus can be found in Section 4.1.1.2.1.

4. The DEIS (p 2-10), in describing water management, is inconsistent with the MPDES permit. The DEIS does not mention that adit water or tailing/process water can be discharged directly to the Stillwater River. This could be considered a deliberate omission of significantly relevant information, particularly as direct discharge of both treated and untreated wastewater into the Stillwater River is a major issue from the public standpoint. In addition, the DEIS does not provide information on advanced wastewater treatment for nitrates consistent with the MPDES. The MPDES estimates 60% removal for nitrates at 1,000 gpm, whereas the DEIS provides an estimate of 70% removal at 500 gpm. According to the MPDES, the concentration of phosphorous is approximately 0.05 mg/l in the effluent, while according to the DEIS (p 2-13), the concentration of phosphorous is approx 0.01 mg/l in the effluent. The DEIS describes tailings and process water as being in a closed-circuit, and does not indicate such water will be discharged as effluent, whereas the MPDES describes such water as being potentially discharged. Information in the MPDES and DEIS is expected to be consistent. (27)

Response: The final EIS has been modified to reflect SMC's option to discharge mine adit water directly to the river under the MPDES Permit. The Statement of Basis and Purpose for MPDES MT-0024716 states on page 11 that SMC has never used its option to directly discharge water into the Stillwater River. It should be noted that the proposed action maximizes SMC's options in employing percolation ponds and LADs as the preferred discharge options. SMC does not have the option of discharging tailings water.

Removal rates and final concentrations are based on the efficiency of the ABC systems, which are affected by temperature, initial concentrations, etc. The text in the draft EIS has been modified to reflect this and to be consistent with the MPDES permit, which conservatively used a 60 percent removal rate.

5. According to the DEIS, the Stillwater Mine Expansion 2,000 TDP EIS estimated these discharges may increase to as much as 1,900 gpm as SMC develops the mine further. Under the 2,000 TDP EIS the mine was to be developed for the production of ore through 2003, at which time the existing tailings impoundment capacity would run out. The DEIS does not provide an estimate for how much discharges will additionally increase as a result of further mine development, but it can be reasonably expected that such increases might be both substantial and significant. Similarly, the MPDES is based on production, in the near future of approx 2,000 tdp (MPDES Statement of Basis, p 11).

Information and evaluation should be provided in the DEIS with response to the highest estimate for future wastewater production from future mining operations. (27)

Response: Current waste water discharges average 1,000 gpm. The MPDES permit indicates allowed discharges could increase an additional 2,000 gpm to 3,000 gpm (page 11, Statement of Basis). The water balances developed under this EIS (**Appendix D**) indicate that average annual water production could reach 2,020 gpm at 5,000 tons per day. SMC is trying to reduce discharges through an underground grouting plan that seals abandoned workings and recycling of water in the processing and tailings circuit.

6. According to the DEIS (p 1-7), if any action taken by a state agency may "significantly affect the quality of the human environment," the MT Environmental Policy Act (MEPA) requires the preparation of the EIS. The regulation of wastewater discharges from the mine might significantly affect the water quality of the Stillwater Valley aquifer, and subsequently the environment of the humans who reside in the area. It is clear from review of the MT Pollution Discharge Elimination System (MPDES) permit, the public comments received by the agencies on the same, that the MPDES permit would have been appropriate as part of the DEIS analysis, This would ensure that MPDES permit benefits from the purpose of the EIS process as provided in the DEIS (p 17), including ensuring the development of conditions, stipulations, or modifications to be made part of the MPDES, and the fullest appropriate opportunity for public review and comment on proposed actions. Inclusion of the MPDES permit and disclosure and discussion of associated water management and water quality information would be consistent with recent environmental analysis recently conducted by the state and federal agencies on the Rock Creek and G olden Sunlight Mines. (27)

It is recommended that the Final EIS incorporate the MPDES permit, as well as all relevant information and analysis related to water quality issues and impacts. The public comments submitted to the DEQ and the MDPES permit should also be included along with DEQ's response to those comments, and modifications to the MPDES permit, in the Final EIS. (27)

The DEIS needs to incorporate the mine's draft water discharge permit (MPDES permit) in order to allow the public to review all of the changes proposed at the mine. Although the permit would have needed to be updated if there was no expansion proposed, the expansion does affect the water permit in a number of ways. Increasing production at the mine will likely increase the volume of water requiring disposal, and the expansion would include several significant changes to wastewater handling at the mine, such as moving land application disposal (LAD) sites, creating new LAD sites, and creating LAD storage ponds. (40)

It would be useful to combine the data in this draft EIS with the MPDES permitting process. This provides a more comprehensive way to analyze and evaluate the effects of different proposals. (28)

Response: SMC's MPDES permit was a renewal, not a new permit connected with the EIS. Consequently, the public comments for the MPDES Permit and EIS were not run concurrently. The public did have multiple opportunities to comment on the renewal of the MPDES permit. Most recently, the public hearing on the DEQ's Decision document was held April 9, 1998 and written comments were taken until April 15, 1998. Notices announcing the meeting and comment period were printed weekly on March 18, 1998, March 25, 1998, April 1, 1998, and April 8, 1998 in the Stillwater County Newspaper. Readers can review the supporting documents in the public record individually. Discussion of the MPDES permit and its monitoring requirements may be found in **Section 4.1.1.2.1**. The MPDES Permit may be reviewed in DEQ's offices in Helena.

7. Ore processing restriction as contained in the DEIS ties back into the MPDES permit. Why haven't changes been made in the MPDES permit in order to process 5,000 tpd? Does this mean the company will seek to amend the MPDES permit in the near future? Wouldn't it be better to allow the public, through the EIS process, to evaluate and participate in the increases necessary in the MPDES permit relative to 5,000 tpd capacity? (27)

Response: The draft MPDES permit contained an incorrect mining production rate. DEQ issued a final permit to accommodate 5,000 tpd. There will be no need to modify the permit to handle any action alternative approved through this EIS.

The public did have an opportunity to comment in the renewal of the MPDES permit. DEQ held a public hearing on its Decision document on April 9, 1998 and DEQ accepted written comments until April 15, 1998. Publications announcing the meeting and comment period were printed weekly on March 18, 1998, March 25, 1998, April 1, 1998, and April 8, 1998 in the Stillwater County Newspaper.

8. Potential water quality impacts from the Stillwater Mine are one of the leading concerns of the public, and have been identified as a highly significant issue in the DEIS. According to the DEIS(p 2-2), water quantity and quality charges could result from increases in the development of the ore body, and increased LAD for wastewater nitrates. This would require later modifications to the MPDES permit. The proposed waste management facilities will contribute to the discharge of pollutants to ground water, and potentially surface water. The draft MPDES permit does not conform with DEQ and FS authority to minimize adverse impacts to surface resources and fisheries. Additional modifications in terms of prioritizing discharges and introducing discharges directly into surface water are reasonable and feasible. Additional comments in this regard are contained in comments previously submitted to DEQ, which are attached. (27)

Response: SMC's Mine Waste Management Proposal does reduce adverse impacts to surface water resources and fisheries by proactively establishing adequate facilities to manage and treat future, increased, mine water discharges and moving LAD sites and the new tailings impoundment to locations farther from the Stillwater River than existing sites.

The MPDES permit will not require modification due to the approval of an action alternative in this EIS. Changes in operating conditions may result in changes to the MPDES permit. The permit also could be modified at future 5-year renewals based on conditions at the time and public comments.

9. The proposed alternative and changes that occur in conjunction with the recent MPDES permit for the mine could conceivably alter the food sources available to the eagles. For example, the discharge diffuser is expected to cover the entire width of the river. This may significantly affect the ability of fish to migrate, ultimately changing the population and food sources available to the eagles. (28)

Fish populations — What has been presented in the MPDES for the mine indicates that the presence of a river wide diffuser could disturb fish migrations, ultimately disturbing the species distribution and populations. This argues for inclusion of the MPDES into the EIS where its ramifications could be examined in conjunction with other aspects of the proposal. Inclusion of the MPDES permit and disclosure and discussion of associated water management and water quality information would be consistent with recent environmental analysis recently conducted by the state and federal agencies on the Rock Creek and Golden Sunlight Mines. (28)

One of the things that has come up is in conjunction with the MPDES water discharge permit. There's some concern that a diffuser would extend across the river and that this may affect the migration of fish populations and those kinds of things. Since eagles' diets consist of a variety of items, including fish and carrion and those kinds of things, I'm concerned that some of these things might cause some changes in the fish population and, thus, cause some perturbation in the eagle population. (47s)

Response: The diffuser is approximately 50 feet long and will be anchored across the river by twelve, one-foot cement blocks, at a location where the river is approximately 80 feet wide at low flow. Only 38 feet of the pipe will contain spigots at 0.5-foot intervals. The DEQ, CNF, and U.S. Fish and Wildlife Service do not believe the diffuser will impact or be a barrier to migratory fish or aquatic life and will not affect the spawning grounds, which are one mile below the mine site.

The MEPA/NEPA and MPDES permitting processes are run concurrently on new operations. In this case, SMC's operation had an MPDES permit that required renewal and public comments on the two permitting processes were not completely parallel. DEQ has renewed the MPDES permit and the permit can accommodate the outcome of the EIS.

10. Page 3-13, 3.1.3.1 Stillwater Mine Site, Table 3-3: Assuming that the deleterious heavy metal mine adit discharges are more design- and operation-related and that adit discharges are not continuously sampled, is it appropriate to state that the west side and east side adit discharges "rarely exceed" Montana's aquatic or human health water quality standard? (32)

Response: Actual heavy metal exceedances have occurred infrequently and may be laboratory artifacts. Through September 1995, SMC's laboratory had a cadmium detection limit of 0.001 mg/L, exceeding the acute and chronic standards of 0.0008 and 0.0004 mg/L, respectively. There was one sampling event at SMC–4 in which 0.002 mg/L dissolved cadmium was recorded and three sampling events at SMC–9 in which 0.001 mg/L were noted. Copper had similar analytical problems through August of 1993 with a detection limit of 0.01 mg/L. One sampling event at SMC–3 had a copper concentration of 0.006 mg/L, exceeding the acute and chronic aquatic standards of 0.0048 and 0.0036 mg/L, respectively. Three of ten sampling events of dissolved manganese at SMC–3 exceeded the secondary human health standard of 0.05 mg/L. Two of 15 samples of the mill decant stream (SMC–4) exhibited concentrations exceeding the acute and chronic aquatic standards of 0.036 and 0.033 mg/L zinc, respectively. The commenter is correct in inferring that sampling is instantaneous rather than continuous.

11. Page 3-15, Section 3 .1.3.1: "Elevated nitrogen values are found in the monitoring wells down gradient of the west side percolation ponds and increases have been detected between the upstream and downstream sites in the Stillwater River." How do these detections compare with compliance levels as set by the ground-water discharge permit that the State of Montana developed for this facility? In regard to the ground-water discharge permit, has there been any times where the facility has been out of compliance? It is recommended that this information be provided in the Final EIS. (32)

Response: SMC's compliance history with various agencies is part of the public record and is available through individual agencies. SMC has never received a violation from DEQ on MPDES permit MT–0024716. There have been no violations since the mine opened on water quality from DEQ on the Montana Hard Rock Mining Permit 00118.

12. Pg 2-26, 2.4.2.3 Water Management and Disposal: It is stated in alternative B, "SMC would continue to handle adit water using existing percolation ponds, the ABC and LAD systems." On Page 3-8, 3.1.2 Surface Water Quality, 4th paragraph, it is stated "concentration of cadmium, copper, iron, lead, and zinc at sites upstream and downstream of the mine site have been above (exceeds) water quality standards set by DEQ (Hydrometrics 1997)... These elevated levels (metal concentrations) are a result of weathering of ultra basic rocks of the Stillwater Complex and as a result of LAD application of adit water enriched in these constituents." The EIS should expand these water quality issues. In particular, what is the history of degradation of the Stillwater River? It would be very helpful to include graphs of water quality over time for nitrogen compounds and heavy metal (i.e., zinc). The EIS states that "exceedances occur only rarely" is insufficient information in that the monitoring that detected these exceedances is not continuous. Do the lead agencies have a strategy for SMC's identification, engineering and correction of the mine-related problems which have led to the violation of water quality standards? (32)

Response: The text has been revised to indicate that increases in the concentrations of metals are from natural weathering of local ultrabasic rocks, and historic mining upstream, not from the LADs. LADs cause increases in nitrates in the river. The SMC annual water monitoring reports under Hard Rock Mining Permit 00118 do provide historic trends in parameters of interest. This analysis of degradation is outside the scope of this analysis, unless it directly relates to the Stillwater Mine. Degradation of the Stillwater River is most likely derived from natural sources, such as flows from other creeks draining into the river. If these were mine-related exceedances, SMC must report the water quality monitoring results and DEQ would inspect and enforce permit requirements. Violations of water quality would occur when exceedances of permit limits for discharges are observed.

13. Page 3-8: It is stated that the concentrations of cadmium, copper, iron, lead and zinc in the Stillwater River have exceeded water quality standards. It is further stated that these elevated levels are a result of the weathering of ultra basic rocks of the Stillwater Complex, and as a result of LAD application of adit water enriched in these constituents. Although review of table 3-1 does not show that the level of water quality standards criteria exceedances for these metals is very large (except zinc maximum), we are concerned about any contribution of SMC's LAD application of adit water that causes or aggravates water quality standards criteria exceedances in the Stillwater River. The DEQ should reevaluate metals loading to the Stillwater River, and if necessary, develop wastewater discharge permit requirements to address water quality standards criteria exceedances resulting from or exacerbated by SMC discharges. (32)

Response: Increases in the concentrations of metals are from natural weathering of local ultrabasic rocks, not from the LADs. LADs cause increases in nitrates in the river. The final MPDES permit for SMC includes effluent standards for the total recoverable metals cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc at Outfall 001 to ensure that there would be no impact to existing and potential uses of a B-1 reach. These uses include drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and fur bearers; and agricultural and industrial water supply.

14. Section 3.1: The DEIS should address application of the non-degradation water quality standard for the mine expansion, especially at the new tailing impoundments, LAD sites and percolation ponds. For example, the DEIS should explain how much additional nitrogen, zinc, etc. can be discharged without exceeding the State's non-degradation standard. (32)

Section 3.1 Affected Environment-Water Resources: Water quality standard exceedances are noted several times in the DEIS. These water quality problems should be linked to a discussion and summary of the surface water and ground water discharge permits in this section. the EIS should disclose how the State's permits will prevent water quality standard exceedances. How will the mine expansion affect pollutant loadings, discharge limits and water quality standard exceedances? (32)

Response: Nondegradation standards are not required at the outfalls designated in the MPDES permit because they existed before enactment of the nondegradation rules in April of 1993. The discharges via land application at the Stratton and Hertzler ranches would be applied at concentrations for nitrogen at or less than the ground water nondegradation limit of 7.5 mg/L. It is expected that 80 percent of this concentration would be used by plants uptake. Discharges to surface water from the LAD systems are predicted to be less than the trigger value of 0.01 mg/L nitrogen, which is the nondegradation criterion. These predictions would be verified by monitoring through the Hard Rock Operating Permit.

All of the exceedances discussed in the EIS are natural background conditions. SMC has not caused any increases in metals concentrations in surface or ground waters and has not violated its discharge permit requirement for nutrients. Additional discussion on water quality standards and the MPDES permit have been added to the final EIS. Please refer to sections **2.4.1.7** and **3.1.2.1** to review this discussion.

15. Page 2-26, 2.4.2.3 Water Management and Disposal: What is the design percolation rate to ground water in gpm of the unlined 80 million gallon LAD storage pond designed to "minimize percolation?" Also, in conjunction with LAD and percolation pond design, describe how the pond design will achieve the State ground water standard and permit requirements, including non-degradation. (32)

Response: The LAD storage site has a hydraulic conductivity coefficient of 3×10^{-3} cm/sec. Its predicted seepage rate is 357 gpm for irrigation 5 days per week and 500 gpm for irrigation 7 days per week. Nutrient discharge from the pond is addressed in the renewed MPDES permit. This value is low and infiltration will be minimized. SMC has filed mixing zone calculations with the State that document that all State water quality standards would be met. Additional information may be found in the Statement of Basis and Purpose of the MPDES Permit and the mine permit itself.

B.2 Wildlife

Nine respondents (4 local, 3 regional, and 2 national) commented on the analysis of effects to wildlife. These comments involved wildlife in general and big game and threatened, endangered, and sensitive species in particular.

B.2.1 General

1. We would suggest that SMC pursue conservation easements on portions of the Hertzler and Stratton Ranch areas to protect these winter ranges from further human encroachment by either subdivision or occasional sales of small homes sites.

Maintaining these properties in agriculture and native range will ensure their use by mule deer in perpetuity. (8)

Response: SMC, as owner of the Stratton and Hertzler ranches, could enter into conservation easements if it so elected. However, DEQ and CNF would not require such easements as mitigation because the impacts do not require such mitigation nor would they participate in any such voluntary negotiations. Any decision by SMC on conservation easements for these properties would be based on its long-term plans for the post-mining management of these properties.

2. If used by wildlife, how will the elevated levels of nitrogen affect them, and will they be considered created wetlands? (9)

Response: The concentrations at which nitrogen would be applied to the LADs (at or less than the ground water nondegradation limit of 7.5 mg/L) is too low to adversely affect aquatic species and the less-sensitive terrestrial wildlife. Wildlife commonly use areas fertilized by farmers and ranchers throughout the agricultural community without adverse effects. Additionally, SMC has operated LADs for several years and mule deer and other species have been commonly observed foraging on the LADs without apparent adverse effects.

As discussed under **Section B.1.2** above, wetlands would not be created on the LADs. The LADs would be designed so the water applied by the irrigators drains comparatively quickly and does not pond. Additionally, the high permeability of soils and depths to the water table preclude the formation of wetlands under LADs.

3. 4.2.3 (p 4-20). Once the LAD systems shut down with mine closure, the drawing card of a more palatable and nutritious forage will disappear. What effect will this have on foraging wildlife species? How long will the return of native plant species to dominance take? (9)

Response: Years of research at several Agricultural and Range Experiment Stations in the western United States and Canada have documented changes in species composition from irrigation and fertilization of native rangeland. Operation of the LAD system at Hertzler and Stratton will change species composition from both the increase in water as well as nitrates in the water. The agencies expect the plant communities would become dominated by water-tolerant species over the years in spite of SMC's attempts to seed to a diverse mix of more native species for wildlife at the request of the agencies. Species such as Garrison creeping foxtail, smooth bromegrass, timothy, and other improved introduced forage grasses would dominate over time, even though they would not be planted.

After closure of the LAD system, native species would not reinvade these sites dominated by these aggressive introduced species. Some native species may reinvade in small quantities, but they would never become dominant. This is an unavoidable effect of the operation of the water management system to control water pollution to the Stillwater River. These abandoned LAD sites would still have some forage value for wildlife as is documented by various unirrigated improved pastureland in the area today. The post-mine land user may continue irrigation of the sites. The loss of native forage in exchange for introduced forage on the LAD areas should not have a substantial effect on the winter mule deer herd that uses the area. The agencies do not feel that a mitigation is required to destroy the introduced community at closure and replant the site to natives.

4. 4.2.2 (p 4-19). "Wildfire have also modified area habitats." This infers that modifications are undesirable. How have they modified area habitats? Most of the vegetative patterns are the result of fire, both recent and historical, a natural component of the ecosystem to which wildlife, big and small, have adapted. The exclusion of fire from the ecosystem by quick response and suppression since the early 1900's has had a more modifying effect than have the fire is 1988 and 1996. This exclusion shifts ecosystems away from a fire climax to an end-point climax, a climatic climax, which in this area is "unnatural." FS timber sales have had minimal effect on habitat modifications, if for no other reason than timber management and harvest is not a major component of the Custer NF resources management and below cost timber sales are unpopular. The stand replacement Yellowstone fires of 1988 cleansed the ecosystem; they began the process of redesigning ecosystems and expanding structural and seral diversity. (9)

Response: The intent of the discussion in **Section 4.2.2** was not to characterize the results of fires as undesirable or unnatural. As discussed, the fires, mining, logging, livestock grazing, and other activities have affected wildlife. However, the effects have been beneficial to some species and adverse to others. For example, the loss of trees due to fire or logging would adversely affect cavity-nesting birds, but could benefit grazers, such as deer and elk. Furthermore, we recognize the effects of fires and logging are limited because the extent of these activities in the Stillwater River Valley is limited.

5. 4.2.2 Cumulative Impacts on Wildlife Species pp 4-19. I built my cabin in 1983, and have seen the area below the Moraine access get filled in with cabins and the area to the East (across river) at Spreading Wing ranch get developed. This means that the corridor for wildlife to move eastward or westward is now along the Hertzler Ranch and up Magpie Creek just north of the Moraine Fishing Access. I can only see further development of the area by SMC to be less area for the wildlife, Per 4.2.1.2.3, 250 acres of wildlife habitat will be lost. (13)

Response: We agree with your assessment. As discussed in the draft EIS, development of the facilities proposed by SMC at Hertzler Ranch would directly remove about 250 acres of habitats while the impoundment is constructed. As a result, deer migrating through the Hertzler Ranch property would probably use areas northeast and south of the impoundment for migration through the area.

6. The fact that wildlife habitats have not changed should not be grounds for excluding a discussion and documentation of those habitats by referencing earlier documents. Many readers do not have access to those documents. (22)

Response: Tiering, which is the process of incorporating information published in earlier documents by reference, is a procedure used to keep NEPA documents to a manageable length. By repeating much of the earlier information, the present DEIS would have been considerably longer and more difficult to review because the discussion would not have focused on the primary issues identified through scoping. MEPA and NEPA direct the agencies to focus on significant issues (ARM 17.4.615 (2) (e) and 40 CFR 1500.1 (b), 1500.4) and use the scoping process to determine the scope of the analysis (40 CFR 1501.7). We recognize that many readers do not have ready access to all the previous documents. However, copies of many of the documents are present in libraries and copies of all documents are available for public review at DEQ, and CNF's offices and can be obtained from DEQ for the cost of copying.

7. Much of the discussion about wildlife, such as mule deer, and fish populations focuses on monitoring. At what point will the agencies decide that action is necessary? What are their criteria and what action is anticipated? (22)

Response: Much of the monitoring of wildlife is already a requirement under the existing permit (see **Appendix C**). Monitoring of additionally-permitted areas would be included into these existing plans and additional monitoring sites specified where appropriate. Mitigation is done to offset potential adverse effects. If monitoring indicates no adverse effects, then no mitigations would be needed. The DEQ and CNF decision makers will determine any needs for monitoring when they make their decisions. The requirements for monitoring associated with the decisions will be included in the Records of Decision.

8. What about non-game and small game mammals species as well as birds (waterfowl, neotropical, resident) and reptiles, etc.? (9)

3.2.1.1.5 Other High-Interest Species (p 3-28) All these are large mammals whether discussed in this sub-section or in 3.2.1.2 (p 3-28) or in 3.2.1.3 (p 3-29). Section 3.2.2 (pp 3-29 to 32) on TES species also discusses raptors. There is no discussion of small mammals, including bats, or small birds (neo-tropical, cavity nesters, songbirds, etc.), of waterfowl or their flyways, of amphibians, These are important components of the ecosystem. (4)

The only issue expressed here is on big game animals. What about small game and non-game mammals, birds, including neo-tropical birds, songbirds, raptors, cavity-nesters, etc.? What about amphibians? (4)

Response: Through project scoping, DEQ and CNF did not identify these other animal groups as high-interest species with a need for specific discussion in the EIS. They were not identified as a point of concern by respondents to the scoping document. Additionally, DEQ and CNF determined the situation involving these groups of animals had not changed since publication of the previous NEPA documents (the species comprising groups of species, such as waterfowl, neotropical birds, songbirds, small game, nongame mammals, bats, reptiles, and amphibians are specifically discussed in CDM 1981 and DSL and Forest Service 1985). Thus, tiering was identified as the most appropriate way to handle these animals.

Tiering, which is the process of incorporating information published in earlier documents by reference, is a procedure used to keep NEPA documents to a manageable length. By repeating much of the earlier information, the present DEIS would have been considerably longer and more difficult to review. We recognize that many readers do not have ready access, but many of the documents are present in libraries and at DEQ, CNF, and SMC's offices.

Because the groups of animals identified above are not specifically discussed does not unequivocally imply no effects would occur to these animals. However, the effects are expected to be very minor and limited in scope. For example, some individual small mammals would likely be destroyed or displaced into adjacent habitats. Birds would be displaced during construction periods, but at least some species would use the area afterwards. Some small burrowing mammals, reptiles and amphibians would likely be lost during the construction periods. This would be an unavoidable effect of implementation of the action alternatives. No important bat habitats have been identified on the proposed disturbance areas.

B.2.2 Big Game

1. Waste rock treatment on the East Side will result in a decline in habitat available as mule deer winter range. Reduction of winter range in these areas could well result in more deer using areas preferred by bighorns, thus increasing competition between these species. Given that the present bighorn population is at a critically low level, where extirpation is a very real possibility, it is essential that any and all steps be taken to maintain all available bighorn habitat in its most productive state. Past bighorn habitat mitigation measures have apparently produced minimal results. We suspect the such poor response has been the result of inadequate sized treatment areas. (8)

3.2.1.1.1. Bighorn Sheep. (p 3-25). My recollection is that the original Stillwater Mine operated during WWII. What explains the downward trend in native herd population?

How much competition is there for range between the Bighorn sheep and mule deer, especially for winter range? (9)

Response: Overall, the habitats that would be covered by the east side waste rock storage site do not appear to be preferred by mule deer for foraging. Some of the area is covered by chromium tailings with a comparatively sparse cover of vegetation forage values are not sufficient to support many deer. Consequently, the loss of this acreage is unlikely to displace many deer. However, those few deer that may be displaced could move more onto the bighorn sheep herd's winter range. Indirectly, this could increase competition for forage between the two species because mule deer and bighorn sheep avoid each other. Additional discussion about this indirect effect has been included in the subsections of **Section 4.2.1** that discuss effects to bighorn sheep.

Conclusions about the decline of the bighorn sheep's Stillwater population recently drawn by biologists monitoring the sheep are (1) despite management efforts, use of the traditional grazing area of native grasslands on the primary winter range was low or nonexistent by mountain sheep; (2) the portion of the mountain sheep herd that has "habituated" to mine-related activities retained this tolerance. Annual mortality of adult ewes exceeded 20 percent for two consecutive years before declining in Phase 10; (3) the potential for predation of mountain sheep by coyotes and mountain lions remained high, but no observations of predation were noted; (4) the minimum known population of mountain sheep at the end of Phase Nine (1993–94) was 21–23 sheep, and at the end of Phase Ten (1994–95) was 25–26 sheep. The Stillwater sheep population has remained stagnant, in terms of growth, for the last six years. Survival of lambs for several years into reproductive age, combined with small losses of existing adult ewes, are necessary to initiate recovery of the population.

Although the alternatives considered in this analysis would have limited direct and indirect effects on bighorn sheep, the cumulative effects resulting from the competitive interaction between mule deer displaced from the east side waste rock storage site or east side tailings impoundment areas are of concern to Montana Fish, Wildlife, and Parks. In acknowledge this concern, DEQ and CNF have developed an additional mitigation that requires SMC to cooperate with the Stillwater Valley Bighorn Sheep Management committee to explore opportunities for the enhancement of habitats for the sheep using prescribed fire. Please refer to **Section 2.4.5** to review this new mitigation, which would apply to all action alternatives.

2. Obviously, SMC's activities to date have had little direct impact on the overall trend of mule deer in this area. The indirect impacts are difficult to quantify but certainly need to be considered. The most significant habitat loss for mule deer has been through the development of small home sites on winter range. While some of *this activity would be occurring with or without SMC's presence, the rate of development in the upper Stillwater has certainly been accelerated because of the mine. However, mule deer populations have now reached a point where additional losses of habitat cannot be tolerated without mitigation. (8)*

2.2.1.2. (p 2-3). What seem to be the reasons for the decline in mule deer populations in the Stillwater Valley? What do the State and FS wildlife biologists say on this? A decline in fawning areas, predation, loss of habitat, competition? There is no mention of elk. Why? (9)

Response: DEQ and CNF agree the development of small home sites on winter range in the Stillwater Valley has affected mule deer and additional development of these home sites will continue to affect mule deer in the valley. However, public input on the draft EIS suggests the Stillwater Mine has not accelerated this development. Public comments on property values suggest people think the mine is having a detrimental affect on property values and the ability to sell property. Most of these comments are from people not associated with SMC or the Stillwater Mine who purchased their properties as vacation or retirement properties.

DEQ and CNF do not think mitigation measures applied solely to SMC for the indirect effects of the continued development of small home sites on winter range are warranted. Public input suggests the presence of the Stillwater Mine and the proposed Hertzler Ranch impoundment may be limiting the development of small home sites in the valley, not enhancing it.

Populations of mule deer are declining in the Stillwater Valley, in Montana in general, and throughout the western United States. Cyclic nature of mule deer populations coupled with modifications of their habitats and the bad winters of 1995–96 and 1996–97 are the most likely cause of the decline in mule deer populations.

Elk were discussed in the draft EIS. Please refer to **Section 3.2.1.1.4**. As noted here, elk do not occur at the sites where components of the alternatives considered in detail are proposed. Consequently, no potential for the alternatives to affect elk was identified and elk were not discussed in Chapter 4.

3. In the DEIS reference is made to possible impact on wildlife, specifically mule deer populations should additional activity take place and tailings be deposited on the east side of the river. No mention has been made of the Bighorn sheep herd that is established near the mine. (14)

Response: The existing condition of the bighorn sheep herd is described in **Section 3.2.1.1.1**. Likely effects of all four alternatives on bighorn sheep were disclosed in the draft EIS in **Section 4.2**. The discussion notes the area on the east site of the Stillwater River is not primary winter range for the

Stillwater herd of bighorn sheep. Additionally, the habitats present at the site of the east side tailings impoundment and east side waste rock storage site have little value to the sheep. Please refer to the individual discussions on bighorn sheep under **Section 4.2** to review the results of the impact analysis on bighorn sheep for the various alternatives.

B.2.3 Threatened, Endangered, and Sensitive Species

1. There is a biological assessment and a biological evaluation in Appendices C and D but these are not referenced in the text. (9)

Response: References have been added. Please refer to **Section 4.2** to review these references.

2. We concur with your determination that the proposed project will not affect the peregrine falcon, black-footed ferret and grizzly bear. If a winter program of removing road-killed wildlife within the project area is instituted, we also concur that the proposed project will not affect the bald eagle. (334-3)

Response: Thank you for your comments. There is an on-going mitigation to remove road-killed wildlife as a result of the 1989 EA and FONSI (see **Appendix C**).

3. The wildlife issues were not fully covered... there will be wolves near... does this affect the DEIS? (25)

Wolves — Wolves were examined in previous EIS documents, prior to their reintroduction into Yellowstone Park. Their presence in this area has been documented, however, they are conspicuously absent in the current draft EIS. What should be undertaken is an evaluation of how the proposed alternatives are going to affect their distribution through the area. It is a major concern to many livestock producers that depradation be prevented, if possible, and some study of how the proposed preferred alternative may affect wolf patterns is warranted. (28)

... there is no mention of the wolves, which we do have as an endangered species in the valley now ... (46s)

... I noticed that the subject of wolves wasn't addressed in the current document. My understanding is that it was addressed in the 1992 study, but since that time, wolves have been reintroduced and have made their way into the — into this part of the country. (46s)

Response: Since the previous NEPA documents were published, the gray wolf's status in the project area changed. As noted in the comments, the wolf was reintroduced into the greater Yellowstone environment. These individuals comprising the reintroduction were outfitted with radio collars to facilitate their tracking. Based on the information accumulated from the tracking data and other sources, USFWS decided it had no substantive concerns about the wolf and the proposed project. Also, the wolves reintroduced into Yellowstone do not have the same protected status as native wolves because they are considered to be a *non-essential experimental population*. Therefore, it did not include the wolf on its list of species DEQ and CNF needed to consider during the analysis, which, under the Endangered Species Act, is the primary list of species to which DEQ and CNF must respond. Additionally, no other responses to the scoping document identified the wolf as an issue of concern.

4. Bald eagles — No census information was presented in the sections discussing the bald eagle p 3-30, Appendix C p 5. Additionally, the most recent data is approx nine years old. Much can change in that time frame. Although the region may be not particularly suited to supporting nesting pairs, it has been documented that the eagles use the region periodically in the spring and fall. Their diets consist mainly of fish, carrion, etc., and they can form communal groups during these periods. The range of terrain covered in foraging activities can vary greatly depending on the number of factors, such as age, population density, and density of prey base. (28)

Eagles are considered to be relatively tolerant to human activity. It would be best if there were substantive studies of the population and ongoing monitoring of eagles to assess impacts of development. These studies could enlist local community members to monitor eagle populations and activities and would be useful in the assessment of development effects. Additionally, fish population studies should be implemented to monitor changes that may affect eagle activities in the area. (28)

... and no change in the bald eagle population numbers in the last ten years. I don't think that that's really realistic. Some of these things were covered, specifically with the bald eagle, on page 3-30 and Appendix C. page 5. There's — I'm concerned about a lack of data presented as far as numbers and census and population data. Some of the references cited for the study are nine years old, and I'm just curious if there is more contemporary data. (46s)

One of the things that has come up is in conjunction with the MPDES water discharge permit. There's some concern that a diffuser would extend across the river and that this may affect the migration of fish populations and those kinds of things. Since eagles' diets consist of a variety of items, including fish and carrion and those kinds of things, I'm concerned that some of these things might cause some changes in the fish population and, thus, cause some perturbation in the eagle population. (46s)

Response: No mitigation or monitoring is warranted because no adverse effects have occurred or are expected to occur. The U.S. Fish and Wildlife Service concurs with the conclusion that the proposed project would not affect the bald eagle (see letter at the end of this appendix) as long as road-killed wildlife are removed (this mitigation was required in the 1989 EA and FONSI — see **Appendix C**).

As discussed in **Section 3.2.2.1** of the EIS, bald eagles occur along the Stillwater River as migrants during fall and spring and as sporadic migrants during the winter. When present, they primarily occur downstream of the mine and Hertzler Ranch.

The diffuser would not extend across the entire channel and is not expected to affect fish movement up or down the river. The diffuser is not anticipated to have any effect on the fish population, or indirectly, on the eagle population.

The BA in **Appendix F** and discussion in **Section 4.2** provide additional discussion of the impacts.

B.3 Fisheries

Five respondents (4 local, 1 regional, and 1 national) commented on the analysis of effects to fisheries. The respondents included three individuals, one business, and one conservation/environmental group. The comments focused on concerns about effects of potential breaches of the pipelines and effects of the project on fish populations and migration.

1. 4.1.1.2.4 Pipeline Corridor. (p 4-7, 4-8). A spill into any of the channels of the WF will be diluted rapidly during snowmelt flows but unlikely during base flow when irrigation at the LAD sites will be most active. A spill during base flow could have serious consequences downstream. (9)

Response: At low flows in the West Fork Stillwater River, a breach of the pipeline supplying water the LADs still would not have serious consequences downstream. The unplanned discharge of tailings slurry or recycle water would result in a temporary, short-lived increase in TSS, TDS, sulfates, nitrates, and metals. However, such a discharge is unlikely to cause mortalities to aquatic life. Concentrations of nitrate-nitrogen in the water being pumped to the LADs are not high enough to cause serious consequences to aquatic life. This conclusion is based on the MPDES permit, which allows direct discharge of adit water into the river (up to 2,000 gpm), even though SMC does not discharge water from their adits directly into the Stillwater River. A short-term discharge of water from a breach in the pipeline at the West Fork Stillwater River would not introduce as much nitrate-nitrogen into the river as the permitted direct discharge.

2. 2.2.1.3. (p 2-4) High quality habitat for trout. What species? Bull Trout? What other game species? What non-game species? Native vs. non-native? (9)

3.3.1.1 (p 3-33). Brown and brook trout are introduced salmonids. The brown trout is aggressive. How has it affected the populations of native salmonids and nongame fish in the Stillwater R and the WF? (9)

Response: The statement under **Section 2.2.1.3** is simply the statement of the fishery issue on which the rest of the document focused. **Section 3.3** describes the species present in the project area.

Because the Stillwater Mine has not caused any identifiable effects to water quality, it has not caused any identifiable to introduced salmonids or nongame fish in the Stillwater River or West Fork. No native salmonids inhabit the Stillwater River or West Fork. The only native trout to the watershed is the Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) was eliminated from the drainage previously, probably by the introduction of non-native trout. The non-native trout competed with the native cutthroat. Additionally, the non-native rainbow trout readily hybridize with cutthroat trout.

3. Much of the discussion about wildlife, such as mule deer, and fish populations focuses on monitoring. At what point will the agencies decide that action is necessary? What are their criteria and what action is anticipated? (22)

Response: If monitoring of fish and wildlife resources indicates adverse effects or the possibility of adverse effects, then "action" (mitigations) would be prescribed. Action has been prescribed in past MEPA/NEPA documents for bighorn sheep and has been modified based on the results of monitoring. The requirements for monitoring associated with the decisions will be included in the Records of Decision.

4. Fish populations — What has been presented in the MPDES for the mine indicates that the presence of a river wide diffuser could disturb fish migrations, ultimately disturbing the species distribution and populations. This argues for inclusion of the MPDES into the EIS where its ramifications could be examined in conjunction with other aspects of the proposal. Inclusion of the MPDES permit and disclosure and discussion of associated water management and water quality information would be consistent with recent environmental analysis recently conducted by the state and federal agencies on the Rock Creek and Golden Sunlight Mines. (28)

The proposed alternative and changes that occur in conjunction with the recent MPDES permit for the mine could conceivably alter the food sources available to the eagles. For example, the discharge diffuser is expected to cover the entire width of the river. This may significantly affect the ability of fish to migrate, ultimately changing the population and food sources available to the eagles. (28)

One of the things that has come up is in conjunction with the MPDES water discharge permit. There's some concern that a diffuser would extend across the river and that this may affect the migration of fish populations and those kinds of things. Since eagles' diets consist of a variety of items, including fish and carrion and those kinds of things, I'm concerned that some of these things might cause some changes in the fish population and, thus, cause some perturbation in the eagle population. (46s)

Response: The diffuser would extend about 50 feet across the Stillwater River and would be anchored by twelve 1-foot cement blocks. At the location proposed for placement of the diffuser, the river is 80 feet wide at low flow. Additionally, 38 feet of the 50-foot long diffuser would contain spigots at 0.5-foot intervals. In evaluating the renewal of SMC's MPDES permit, DEQ considered the physical size of the diffuser, the river's physical characteristics at the location proposed for placement of the diffuser, and the location of spawning grounds (1 mile downstream of the diffuser). Through the evaluation, DEQ determined the diffuser would not affect aquatic life in general and fish and spawning grounds in particular. This conclusion also was reached by the USFWS during its review of the diffuser.

Because the diffuser is unlikely to adversely affect fish and other aquatic life, it is unlikely to affect other species, such as the bald eagle, that may prey on fish in the Stillwater River.

5. SMC should not discharge water with phosphorus or nitrates directly to the Stillwater River. (This river is a spawning river for rainbow and browns and has already declined in recent years with regard to fish populations). Algae is already present and additional additives to the Stillwater could further damage the spawning process and hurt the fish population. (14)

... That river gets a lot of pressure just from the fisherman that now fish in it. And we're down to two fish over 16 inches. But I have talked to a lot of floaters, and I float the river, too. And some of the outfitters have told me that they're concerned that the water, the moss in the river seems to be getting larger between the mine and Nye. And if you, if you start to change the, the quality of the water, that directly affects the fish because of the bugs and thing that they eat. And they think that there is a slow, slow change that's come about in the last four or five years, and there is either nitrates or something that's causing this stuff to grow, the moss and things to grow a little bit more in the river. And I think that's the first stages of degradation of the river. (47s)

Response: Information presented in the EIS suggests the quality of water in the Stillwater River continues to remain good overall. Monitoring conducted for SMC's MPDES permit and sampling conducted for this MEPA/NEPA analysis suggest the Stillwater River generally has good water quality. Results of monitoring summarized in **Table 3–1** show the Stillwater Mine is not causing detectable changes in the quality of water in the Stillwater River. Additionally, aquatic macroinvertebrates present in the Stillwater River during the 1997 survey were members of species whose presence characterizes good water quality (see **Section 3.3.1.2**). Finally, the populations of fish present in the Stillwater River recently exceeded MDFWP's goals for these populations (see **Section 3.3.1.1**).

As discussed in **Section 3.1.1.3**, a recent algae (moss) study (ENSR 1992) suggested that nitrogen is not the limiting factor controlling the growth of algae in the Stillwater River. Also described in **Sections 3.1.1.3** and **4.3.1.2.3**, likely sources of nutrients that may be causing increased growth of algae are the increasing number of septic systems within the floodplain and drainage from agricultural operations. Discharges to surface water from SMC's LAD systems are predicted to be less than the trigger value of 0.01 mg/L nitrogen, which is the nondegradation criterion.

B.4 Air Quality

Six respondents (2 local, 2 regional, and 2 national) commented on air quality impacts. All the comments dealt with emissions of fugitive dust or PM_{10}. Five of the respondents identified concerns about potential fugitive dust emissions from the proposed tailings facility at Hertzler Ranch. The other respondent suggested adding controls to the mine ventilation shafts to reduce PM_{10} emissions from that source.

1. What will be used to prevent wind erosion and wind transport of materials off site when the site is used up? (9)

4.4.1.2.1 Construction Effects (Alternative B & C) states the "fugitive dust" would be generated during the clearing and excavation at the Hertzler Ranch tailings impoundment. From many years of living at the site of my cabin below Moraine Fishing Access, I can state that "fugitive dust" is an understatement of mammoth proportions. In the fall, the wind blows through that corridor at a steady sixty or more mile gale for weeks at a time. I nearly lost my barn to the wind and have had to additionally brace the barn and my house to withstand its onslaught. I have had two satellite dishes destroyed and have replaced glass damaged due to the wind. A large area of "disturbance" such as that proposed will create more than fugitive dust, and will certainly cause problems for anyone in the Fishing access below the site, and possibly landowners further downstream. The Stillwater School of Flyfishing run by the Mouat family used to have a building downriver from the old mine tailings that is the current SMC mine site. They showed me their opaque upriver window that was sandblasted by the wind-carried tailings. I suspect that I will have a similar problem if Alternative B or C is accepted. (13)

The EIS should require dust suppression efforts at all disturbed areas to minimize air quality impacts (pp 4-24-4-28). These efforts should include concurrent revegetation as much as possible and keeping other disturbed areas wet. (27)

Appendix B: The air-monitoring measures shown in this appendix for air quality are quite progressive. Monitoring of dust in the air should be conducted with the goal of reducing the PM10 emissions. The name of the chemical stabilizer used on the roads should be mentioned on page 4-26 (33)

...I'm a little concerned about the, the blowing dust and dirt out of that proposed thing at Hertzler. If the thing isn't moist, and the wind blows 80 miles an hour, like it does, we could have blowing stuff all down the valley. So that really concerns me. (47s)

Response: Fugitive dust in the form of PM_{10} is a pollutant regulated by the Air and Waste Management Bureau of DEQ. SMC applied for an air quality permit for the proposed tailings facility at Hertzler and the change in production limit to 5,000 tpd. DEQ's Preliminary Determination of the Air Quality Permit Application is contained in **Appendix E** of the final EIS (this was **Appendix B** in the draft EIS). Appendix E outlines the controls required by the permit and air pollution controls required for all emission sources at the mine are summarized in **Table 4–1** of the EIS. For potential dust from the tailings surface, DEQ identified a mitigation measure that requires a water system to reduce fugitive dust from the tailings impoundment if the tailings are found to be not wet enough themselves to keep dust down without supplemental moisture. For the tailings pond embankment, the CNF and DEQ added a mitigation measure that alters the construction process to allow for concurrent reclamation of the embankment as it is being built (see **Figure 4–8** of the EIS). The tailings facility (pond and embankments) would be reclaimed after closure as described in **Section 4.9.3** to control long-term fugitive dust emissions. Air quality monitoring would be continued as described in **Appendix E**. The chemical stabilizer used on the road is magnesium chloride.

2. According to the Emission Inventory, the largest single source of PM-10 emissions is the mine ventilation exhaust. The mine ventilation constitutes approximately 25% of the total PM-10 emissions. There are no control measures planned for this source of emissions. (Appendix B, p 8) The mine ventilation can be treated like a point source. It is possible to trap most of the exhaust from the mine and to implement control measures. The EIS does not explain why no effort is being made to control PM-10 emissions from the mine ventilation exhaust when this is the largest single source of PM-10 emissions. (22)

Response: The mine ventilation exhaust was permitted previously by DEQ as an emission source and is not part of nor involved in the proposed amendment. DEQ issued the permit for the mine facility without controls on the mine ventilation exhaust because it was not needed to ensure that the emissions would not exceed the National Ambient Air Quality Standards (NAAQS). **Section 4.4.1.2** of the EIS describes the analysis that was done to ensure that the addition of the proposed production increase and new tailings facility also would not exceed the NAAQS.

B.5 Social/Economics

Overall, 16 respondents (8 local, 6 regional, and 2 national) commented on the analysis of effects to social/economics. Primary areas of focus for the comments were concerns about potential effects on transportation (e.g., repaving County Road 419), employment, property values, status and interaction with the Hard Rock Impact Plan's revisions, and removal of the 2,000 tpd cap on production.

B.5.1 General

1. 3.5.7.6 (p 3-47). Does SMC provide ambulance and EMT service for its employees and local residents? Is emergency air evacuation available and from where? (9)

Response: SMC does provide ambulance and EMT services for its employees at the Stillwater Mine. Emergency air evacuation is available from Billings via the helipad located along County Road 419 near the mine's entrance.

2. There is no discussion of socioeconomics, just workforce requirements. How will this alternative affect schools, the county tax base, the use of social services? How will it affect the area's population and demographics? (9)

Response: Section **4.5.1.2** provides discussion about how the alternatives would affect population (including the number of students), employment, property tax base, housing, property values, and community services. Please refer to this section of the EIS to review the discussions.

3. 4.5.1.2 Population (p 4-29). How will the additional 30 employees affect the demographics of the area? This includes population age structure, income, occupations (including teachers). The demographics will change with or without the expansion of SMC. How has it changed over that past couple of decades? How do the "newcomers" differ from the "old timers?" (9)

Response: The additional 45 workers (a combination of permanent employees and contractors) would not measurably affect Stillwater County's demographics, which has more than 7,000 residents as discussed in **Section 3.5.1**. Furthermore, as **Section 3.5.1** discusses, although Stillwater County's population has been growing at a annual rate of 2 percent, it has continued to be fairly homogeneous. Considering the information presented in **Section 3.5.1**, the addition of as many as 45 new permanent employees (SMC would hire some combination of 45 permanent employees and contractors) is not expected to alter Stillwater County's demographics measurably, particularly if most of these 45 workers are hired as temporary contractors from outside the county. The demographic composition of Stillwater County has changed very little over the last 10 to 20 years. The relative percentages of minorities have been, and continue to be very low.

Similarly, the County's population has historically been older than the statewide average, and this trend has continued in recent years. Statistically, there has been very little measurable change in the demographic characteristics of the in-migrating population. Finally, the respondent questions the differences between "newcomers" and "old timers" in terms of the population of Stillwater County. Statistical data examining this phenomenon are limited. Conversations with local real estate agents revealed the impression that a greater majority of persons seeking residence in the area were doing so for the abundance of recreational opportunities in the region, in contrast to a higher percentage of retirees in previous years.

4. Page S-7 Summary and Page 3-42, Social/Economics Paragraph 4 on S-7 discusses "significance" for issues. It distinguishes significance for issues from significance for environmental consequences. Various pages (e.g., Page 3-42, Paragraph 1, last sentence) in the analysis of environmental consequences mention significance. What process did the analysis use to determine the significance of various environmental consequences? Where is the documentation for this process? (4)

Response: The term "significant" was used in the analysis to provide a relative measure of a particular impact, in contrast to the description of significance of issues that related to the issues' "worthiness" of analysis in the EIS. As noted in this comment, the term "significant" was used in the various sections of the environmental consequences descriptions to provide a threshold from which to compare the effects of the proposed project. The determination of significance was based on a comparison of an alternative's consequences to a defined threshold, and if the effect surpassed the threshold it was defined as being a significant effect.

5. SMC proposed to remove any limit on daily production for the next 30 years (pg. S-14 and Chapters 3,4). If approved, this means the "door is open" to unlimited production and concomitant potential environmental and socio-economic disaster. Production controls should be not abandoned. The volume limits could be changed to increase (or decrease) incrementally, but, if and only if, SMC proves its operational results have not, (or have) had adverse consequences over some reasonably tractable operation interval. (11)

I would question one underlying assumption of the DEIS, which I "walked around" but did not focus on specifically in my letter of May 18, 1998. The DEIS appears to address the impacts from the construction and operation of the Hertzler tailings impoundment and to disregard, for the most part, the social and economic effects over time of changing from a TPD limit to a "footprint" limit as the basis for further permit amendments. This implies that the DEQ and the USFS do not consider that the anticipated fluctuations in production would have potentially significant social and economic consequences. That is, I think, a highly questionable assumption, which appears based solely on SMC's expectations that greater mechanization would allow them to maintain a relatively stable employment level. (42)

A higher level of production would almost certainly mean more employees and contractors, if for nothing else than to transport the ore to the smelter. One would think that increased production would mean greater effort of some sort, which might translate into additional production employees, additional transportation employees, and additional smelter employees. It might also translate into additional trips to the mine by service and maintenance contractors and transporting of additional materials and equipment to the mine. Doubling production would presumable double the number of ore trucks on the road between the mine and the smelter, whether in actual trucks or number of trips per truck per day. Either way, it would mean additional wear and tear on secondary roads 419 and 421 and highway 78. (42)

This amendment was based on SMC employment of 700 people. We do not find any detailed analysis of the impacts of increasing production limits. The social and economic effects presented in Section 4.5 indicate effects from 12/31/96 population estimates to population projections associated with SMC employment of 700. If production increases to 3,000 to 5,000 tons per day, will the social and economic effects presented in this DEIS be valid? A detailed analysis of social and economic effects of increasing production limits, independent of SMC's consultant work, should be included in the final EIS. (46s)

Response: The removal of the production limit considered in this analysis would not result in unlimited production by SMC. Disturbances under SMC's operations would still be limited to the total acreage approved in previous decisions in combination with DEQ and CNF's decisions on this analysis. Even if the agencies decide to eliminate the current 2,000 tpd production limit, SMC's production effectively would be limited to about 5,000 tpd because SMC probably cannot install enough equipment to handle long-term production above 5,000 tpd within the approved disturbance footprint. To increase long-term production above 5,000 tpd, SMC would have to get the approval of DEQ and CNF to increase the amount of land disturbed for the Stillwater Mine. This approval would require another MEPA/NEPA analysis of effects.

Increases in production above the 3,000 tpd average, are not expected to cause socioeconomic effects different than those described in this EIS. SMC maintains that increases in production above 3,000 tpd probably would be possible only with increases in mechanized mining, not increases in personnel. Consequently, higher production levels are unlikely to result in additional employees above 700.

If SMC's mineral employment does increase or is projected to increase for any reason and the increase exceeds thresholds defined in the 1998 amendment to SMC's Hard Rock Impact Plan, then the Plan would have to be modified to address potential socioeconomic effects. Based on employment, the 1998 Plan Amendment establishes two thresholds for modification. The 1998 Plan Amendment may be modified is in-migrating mineral employment in any affected unit of local government differs by more than 15 percent from the level projected in the amendment. Also, an affected unit of local government may petition for an amendment to the Hard Rock Impact Plan if in-migrating employment at the SMC mineral development is forecast to increase or decrease from the levels projected in the 1998 amendment by at least 75 employees.

6. 4.5.1.2 All Action Alternatives B, C, D: I am somewhat confused in this section as to how many in-migrating employees and their dependants are anticipated: 4.5.1.2.1 states 18 employees will in-migrate, 4.5.1.2.2 talks about an increase of 240 workers from the projected workforce of 460 in the Hard Rock Impact Plan, and 4.5.1.2.5

Housing also states 250 would in-migrate with a resultant estimated 70 new households. Why the differing figures? (13)

Response: During the preparation of the draft EIS, SMC was in the process modifying its Hard Rock Impact Plan, resulting in numerous revisions to employment and population projections. The 1998 modification to SMC's Hard Rock Impact Plan was formally adopted on August 10, 1998 and therefore the following discussion presents SMC's final employment numbers. **Section 4.5.1.2.1** of the draft EIS identifies the level of permanent employment projected beyond existing employment. This figure has been used to evaluate the effects of increased employment beyond current levels. Because there are currently 655 workers/contractors employed at the mine (December 31, 1997) and a projected employment level of 700 (650 employees and 50 contractors) , a net increase of 45 workers (some combination of permanent employees and contractors) would result. The December 31, 1997 Hard Rock Impact Plan Monitoring Report identified 312 in-migrating employees and contractors employed at the mine and projects this number will increase to 440 after the expansion is complete, equating to an increase of 78 employees and 50 contractors (see **Table 4–4**).

The employment figures provided in **Section 4.5.1.2.2** identify the increase in employment that has occurred since the last revision to the Hard Rock Impact Plan. This figure is included to show employment growth since the last Hard Rock Impact Plan Amendment to fully understand socioeconomic effects associated with SMC's activities.

Section 4.5.1.2.5 identifies a projected estimate of new households and housing requirements which will occur with the expansion. The 1998 modification to the Hard Rock Impact Plan indicates an in-migrating population of 807 as of December 31, 1997 and a total, after the expansion, of 1,263 employees, equating to an increase of 456. The Plan shows a requirement of 262 housing units as of December 31, 1997 and 424 after the expansion, a total increase of 162 housing units. It is interesting to note the 1997 in-migrating population and housing levels are lower than those reported in 1995, 1996, 1997, equating to a larger increase when compared to these numbers after the expansion. A higher number of individuals are residing outside of Stillwater County and commuting to the mine on a daily basis, due to higher housing costs in Columbus.

7. In the draft EIS there is no attempt to determine the possible effects of Hertzler development on use of two nearby fishing accesses (Castle Rock and Moraine). It is conceivable that activities associated with development will change the use patterns of these areas. To some extent, it might be anticipated that the burden will increase on accesses in the lower portion of the drainage, ie. Cliff Swallow, as well as historical, unofficial accesses near river crossings. There will be an increased potential for trespassing and other problems, including liability for private landowners at these unofficial access sites. Fishing surveys, which are sent out to registered sportsmen *already, provide background information about river area usage. The addition of a couple of appropriately worded (unbiased) questions will provide important information regarding changes in usage patterns, helping all organizations to be proactive in addressing future needs and also helping to access ongoing impacts due to mine development. (28)*

Response: It is not likely people using Castle Rock would be affected by the Hertzler impoundment activities. However, it is possible that people at Moraine might be able to hear construction of the final lift of the impoundment and possibly operation of pumps after such construction. Once the outer slopes are reclaimed, the impoundment would not visually affect Moraine fishing access users. Consequently, it is unlikely the project would increase the potential for trespass on private property elsewhere along the Stillwater River by people using MDFWP's fishing access points.

There is a current mitigation requiring periodic surveys of SMC employees' recreational trends (see **Appendix C**). If MDFWP determines from the surveys that potentially-adverse effects to fishing access points and private lands along the river do exist at that future time, then the agencies would work with MDFWP to develop appropriate mitigations. No additional mitigations were deemed necessary because no adverse effects were identified to be mitigated in the analysis of this proposed action.

8. Attached are copies of the 1997 and 1998 SMC monitoring reports, showing mineral development employment, mineral development students and mineral development population distribution as of Dec 31 of the year preceding the report. You may wish to double-check the Columbus School figures particularly because they were the subject of a concerted reconciliation effort between SMC and the District. (38)

Response: SMC's Hard Rock Impact Plan was revised and finalized after publication of the draft EIS. The numbers from the final Hard Rock Impact Plan have been included in **Section 4.5.1.2** of the final EIS.

9. Please confirm with SMC the current employment level. It may be that employment has already reached the 700 level, which is what the DEIS projects as the post-Hertzler amendment employment level. (38)

Response: SMC's final count of employees as of December 31, 1998 is 655 (SMC 1998). All references in the final EIS regarding employment have been updated.

10. On page 4-36, the DEIS concludes that the increase in employment resulting from the Hertzler amendment would not necessitate any increase in the provision of local government services or facilities. Is this the conclusion of the DEIS preparers, SMC, or the individual affected units of local government? Even a small increase in mine–related population or mine–related student population might tip the balance for a local government service or facility that is at or almost at capacity. (38)

Response: The Hard Rock Mining Impact Act and the associated requirement for the preparation of a Hard Rock Mining Impact Plan are intended to account for a mining project's potential impact to local government services. During the plan's approval process, the applicant negotiates with potentially-affected local agencies to develop an assessment of how the project potentially affects each agency's ability to provide various services and the associated cost. Finally, a proportionate share of the cost to provide these services is determined and assessed to the mining company. SMC's Hard Rock Mining Impact Plan is now approved and appropriate information from the Plan has been included in this EIS.

11. The DEIS suggests that the social and economic effects of all alternatives would be the same, which would not be so. The difference in mine-lifes would affect, in various ways, mine and secondary employees, people residing in the area of the impoundment, taxable valuation and governmental services, and short-term economy of the county. (38)

Response: Based upon the fact that production levels up to 5,000 tpd would be allowed under each of the action alternatives, the draft EIS concludes that socioeconomic impacts for each alternative would not be measurably different. Employment levels are anticipated to vary somewhat with changing production levels (higher production levels could be accomplished only with a greater degree of mechanized mining). While the alternatives considered in the DEIS would effect the production life expectancy of the mine resulting from the ability to dispose of waste rock, there is nothing preventing SMC from evaluating and permitting additional waste rock disposal options at a later date. Therefore, it is probably premature to conclude that the action alternatives would result in an early mine shut down and socioeconomic bust cycle. The economy of the County has been subject to the fluctuation of employment and valuation for many years. Major changes in employment are subject to an amendment to the Hard Rock Impact Plan. Only the No Action alternative would definitively affect the life of the mine and may result in socioeconomic effects. In addition, any production level reduction resulting from the inability to dispose of waste rock would most likely be a gradual one, softening potential socioeconomic effects avoiding the potential for a dramatic bust cycle.

12. 3.5.7.7 p. 3-47 Fire Protection The DEIS indicates the Columbus area district is "inactive". In fact this is an active district. (45)

Response: This information has been revised in the final EIS to correct this error. Please refer to **Section 3.5.7.7** to review the changes.

13. 4.5.1.2.1 p 4-29 Population: The population figures in the DEIS appear to be slightly different than those presented in the SMC Hard Rock Mining Impact Plan amendment. Which figures are correct? (45)

Response: The information on populations was consistent between the two documents at the time the draft EIS was published. However, the Hard Rock Impact Plan was revised since that time. The current revision to the Hard Rock Impact Plan is now final and the information presented in that document and this EIS is consistent.

14. 4.5.1.2.7 p 4-36 Community Services Impacts to Stillwater County Road maintenance services are not addressed in this section of the DEIS. This is one of the consequences as a result of the proposed action and is an important issue. (45)

Response: The proposed project's effects on Stillwater County's road maintenance services was addressed through negotiations between SMC and Stillwater County for the revision to the Hard Rock Impact Plan. Information related to these negotiations have been disclosed in this final EIS.

15. 3.5.7.4 p 3-45 Solid Waste: The DEIS indicates all solid waste collected is disposed of in the Stillwater County landfill. This is inaccurate. Most of the solid waste is disposed of in the Billings landfill. (45)

Response: The final EIS reflects the current situation and notes that the Billings Landfill is the primary disposal site for solid waste from Stillwater County. Please refer to **Section 3.5.7.4** to review the changes.

16. 3.5.6 p. 3-43 Housing: The DEIS identifies a SMC single-family unit subdivision in the Town of Columbus. Is this still accurate? Has this proposed housing project been abandoned? (45)

Response: To date, SMC has not formally withdrawn the application for the proposed Columbus subdivision. However, Stillwater County indicated SMC has relinquished its options on the subject parcels and the current development application is nearing expiration (Beaudry, pers. comm.). Because of the uncertainty of the status of this project, the last paragraph in **Section 3.5.6** on page 3–43 of the draft EIS was removed from the final EIS.

17. 3.5.7.2 p 3-45 Water Supply: Absarokee Water users Association was converted to the Water & Sewer District, created in 1995. (45)

Response: **Section 3.5.7.2** was changed to provide the correct name for the water supplier.

18. Also, in the table on 3-9, it gives an illustration of employment distribution by industry. One thing I noted there was that the total breakdown covered 2,242 people out of the 3,879 employed, and that leaves 1637 people being excluded from the data. And I'd like to see a clarification on that. (46s)

Response: The employment distribution by industry on **Table 3–9** references "covered" employment as defined by the Montana Department of Labor. This category of labor excludes certain employees, such as railroad workers and those paid solely by commission. Therefore, the total of this employment distribution is lower than the total employment shown in the preceding paragraph. A clarification of this difference has been provided in the final EIS following **Table 3-9**.

B.5.2 Property Values

1. Electrical power requirements will more than double to meet 5000 tons per day production volumes. Does this mean that both new electrical transmission lines and towers will be required? What are the aesthetic consequences? Does SMC pay for all these capacity increases? What happens to these transmission lines and towers once the mine ceases production? Their presence affects neighboring property values, and there is an ever present danger for health and safety of citizens. (11)

Response: As discussed in **Sections 2.4.2.4** and **2.4.3.4**, a one-mile segment of transmission line would be constructed from the existing line to Hertzler. This line would follow rights-of-way for existing the power line and roads. The upgrade of the existing power line would result in no noticeable changes as described in Section **2.4.2.4**. SMC would pay for any upgrades and the construction of the new one-mile long segment of power line to Hertzler Ranch. Please refer to this section to review the discussion of power requirements that was expanded for the final EIS.

Affects are already in place for the existing power line. The new one-mile segment would look like the existing power line and would follow existing rights-of-way. The fate of the power lines at the time the mine closes would depend upon the users connected to them. Segments that involve only the mine would be removed and any disturbances would be reclaimed. However, segments providing service to other users in the Stillwater River valley would remain in place.

The presence of power lines may affect the value of properties adjoining those power lines for some people. Because the lines are not high voltage transmission lines, little affect on property values is expected. Additionally, as long as the power lines are maintained properly by the electric companies, these relatively low voltage distribution power lines represent no real danger to the public.

2. The arguments presented on property values (pp. 3-42: 4-33, 35) are incomplete and difficult to accept. The references to the 1980 time frame show no adjustments for inflation, and due to Montana law, exact prices for comparable properties were not obtainable. Since the August/September time frame of 1996 when SMC plans for the Hertzler Tailings Impoundment became known, sales of properties near the Hertzler Ranch have come to a stop, or sellers have had to substantially reduce prices. Realtors in the area confirm this. Moreover, the true affects of Alternative B on property values *will not be known until mining operations extend 8 miles down the Stillwater River (i.e., after the fact) thereby affecting all the adjacent and surround property owners. Not many people rush to buy property next to a mine unless, perhaps, they work there. (11).*

I vigorously oppose SMCs proposed major revision to operating permit #00118, as being irresponsible development of the mining industry in Montana that is not consistent with the spirit of the Hardrock Mining Act. I do not feel that increasing the visual and other impacts from mining by locating a huge tailings pond, borrow pits, LADs and other ground disturbances seven miles further downriver from the existing mine on the Stillwater River is acting responsibly or fairly to neighbors who have invested in Stillwater River Property. (13)

In chapter 4.0 - Environmental Consequences 4.5.1.2.6 Property Values, I must state that I feel very frustrated with the discourse in this section. The author seems to be trying to say that there is no provable and significant impact to individual resale values due to mining operations... I am an accountant by trade, so please don't try to confuse me with skewed statistical findings from analysis based on bad premise... Logic dictates that in a recreational corridor if a property has a beautiful mountain framed by trees for its view, it will sell for more money than that same property with the mountain transformed by bulldozers into a settling pond from a mine's waste slurry. (13)

Property values of surrounding land owners should be protected. (14)

I am a property owner within one mile of the current mine site. I have subjected to the constant noise of the mine and mill, the bright lights, the road being overused and falling to pieces, and the aesthetic value of my home diminish for years now. I feel that private citizens need to have a say in this matter. The economy of the valley should not determine policy. (16)

The latest reevaluation of the value of my property is considerably less than it was. There isn't a resale value. (16)

My parents have what was supposed to be their "retirement" home about ½ mile from the mine/mill site. They will not retire there now because of the mine noise, traffic, lights, etc. Their "peace and quiet" is no longer possible. Also their investment has been destroyed in terms of resale. (17)

Our property value has been severely lowered since the mine is so close to us. After the last reevaluation of the value of our property was decreased by twenty percent, mainly because of our location. Our resale options are non existent. (20)

An analysis of project impacts on surrounding property values should be conducted and mitigations developed to minimize or eliminate negative effects (pp. 4-33-4-36). (27)

We also would like to see the agencies develop a plan for measuring and minimizing the negative impact of activity at the Hertzler site on neighboring property values. Compensation for loss should be part of the plan. (27)

We have seen very little evidence that the agencies have addressed a major concern in the community - that the size and location of the proposed new impoundment represent a significant threat to the quality of life and to the property values of the neighbors. Nor does the DEIS address the concern that an initial expansion to the Hertzler property may be followed by additional activity on that site. (27)

With regard to section 3.5.5 - Property Values (p 3-42) and section 4.5.1.2.6 (p 4-33), it is laudable that this issue be addressed. Private landowners and those who do not derive any direct benefit from the mine's presence will be affected by the proposed expansion. As stated, land values remained relatively stable in the 1983-1989 period. Values are also presented for real estate being sold in the vicinity of the proposed expansion site. My question in this regard is how do these trends compare to "similar" parcels in other areas of Montana that provide similar access to river, public lands, etc. It is difficult to make an evaluation of the impacts unless some additional data is provided for comparison. If similar areas exhibit an identical trend over the same period then it can be argued that the mine expansion would have no effect, however, if the rate of appreciation is greater in these other areas, then the impact is significant and affects other aspects of the Stillwater County economy. (28)

Response: DEQ and CNF evaluated the potential effects to property values using historic information specific to the Stillwater River valley. The evaluation suggests property values overall would not be adversely affected. However, DEQ and CNF recognize and acknowledge the high degree of subjectivity involved in determining the value of properties in the Stillwater River valley to different people. With this in mind and considering the level of public interest in this issue, additional review of this issue was conducted.

Conversations with local real estate agents provided additional insight as to the potential for decreased property values in the Hertzler Ranch area with implementation of the project. While most acknowledged that the properties directly adjacent to the Hertzler Ranch impoundment may be difficult to sell, all of the agents thought that there were only a few properties that would be directly affected by the impoundment and that the activities proposed for the site would not have any dramatic effects to neighboring properties. One agent noted that sales of upper-end properties at the Cathedral Mountain Subdivision, located directly above the mine itself, have been very active with increasing property values. These properties have a direct view of the mine site.

An informal tally of land ownership in the Hertzler area indicates there are about 4 to 5 landowners on the north side of the river near Hertzler, 2 on the south side, and one property that would have a direct view of the site. In general terms, the agents suspected that the vitality of the real estate market in the Stillwater Valley would experience either no or very little slow down from its current active pace, with project implementation.

In conclusion, it appears that properties directly adjacent to the proposed impoundment may not sell as quickly as they would without the project or experience some decrease in value, if they are put on the market. Due to the limited visual and noise impacts projected with the impoundment, it is not anticipated that the project will have any measurable impact on overall property values in the Stillwater River Valley.

B.5.3 Quality of Life

1. 2.2.1.5. (p 2-4). How do the "old" residents of the area view the anticipated changes in the social/economic fabric of the area compared to the "new residents?" Who are most of the "old" residents, what are their occupations vs. the "new?" How do the "old" vs. the "new" interpret "high quality of life?" (9)

Social/Economics identified "quality of life" as an issue. The components defining quality of life do not include elements of lifestyles, such as social organization and social well-being. The analysis doesn't provide a detailed analysis about effects on rural lifestyle. (4)

We have seen very little evidence that the agencies have addressed a major concern in the community - that the size and location of the proposed new impoundment represents a significant threat to the quality of life and to the property values of the neighbors. Nor does the DEIS address the concern that an initial expansion to the Hertzler property may be followed by additional activity on that site. (27)

A "way of life" is difficult to define and measure and that difficulty provides an easy justification for not addressing it effectively in an EIS. In this case the agencies have missed an opportunity to both support expansion at the mine and show respect for the way of life of the neighbors of the operation. (43)

Response: In the area directly adjacent to the proposed tailings impoundment it is clear a change in character would occur from a rural/agricultural area to a mining and industrial use. The lifestyle of residents in close proximity to the impoundment may experience some level of change. At the mine itself, the existing use would not change.

A statistically-based opinion survey was not conducted as part of this MEPA/ NEPA analysis. However, mining activities have been a part of the Stillwater region since the turn of the century. Thus, most long-term residents of the Stillwater River valley understand mining activity is present in the area and recognize its economic importance to the County.

B.5.4 Hard Rock Impact Plan

1. Before the permit is issued, the county Hard Rock Mining Impact Plan should be completed, endorsed by the county, and published for public review (pp. 4-28--4-37; pp 4-64--4-66). (27)

Response: This MEPA/NEPA analysis and the Hard Rock Impact Plan were on independent schedules. However, the 1998 Amendment to SMC's Hard Rock Impact Plan was accepted by SMC and the local units of government affected by the Stillwater Mine in August 1998. Information from the 1998 Amendment was incorporated into this final EIS where applicable.

2. According to the DEIS, employment at the mine would increase from about 628 workers to about 700 workers. Is this based upon a 3,000 tpd or 5,000 tpd throughput? How many workers might be required for 5,000 tpd throughput? Have the socioeconomic impacts of the fluctuating workforce been considered in addressing the potential socioeconomic impacts by the Hardrock Impact Board? (27)

Response: SMC's final count of employees as of December 31, 1998 is 655 (SMC 1998). Thus, employment would increase from 655 to 700.

The analysis was based on an average production rate of 3,000 tpd. SMC has indicated the proposed workforce of 700 could be used to accommodate a range of production levels and that a shift toward mechanized mining may reduce labor intensive practices. Therefore, it is not anticipated that substantial additional employment would be required for market-driven increases in production levels. Additionally, if production increases do require a 15 percent increase in employment at the mine, another amendment to the HRIP would be required to address socioeconomic impacts within the county.

3. On p. 3-39 the draft EIS states that the 1996 labor force was 4135, with employment of 3879 and an unemployment rate of 6.5%. This appears to be relatively in line with figures obtained from the MT labor department's internet web site for 1996 and 1997; 3952, 3774, 4.5% and 4060, 3839, and 5.4%, respectively. However, these number are different. Presumably, they were obtained from the same source, but what is the reason for their disparity? Are these the same figures used in negotiations of the Hard Rock Mining Impact Plan? In table 3-9, there is an illustration of employment distribution by industry. The total for average annual employment presented covers 2242 people. If the figure presented earlier of 3879 employed is correct, the 1637 people have been excluded from the table data. This is approx 42% of the employed labor force unaccounted for by industry affiliation. This obviously results in skewed figures for industry distribution since a large percentage of the population is unaccounted for. (28)

Response: The employment distribution by industry on **Table 3–9** references "covered" employment as defined by the Montana Department of Labor. This category of labor excludes certain employees, such as railroad workers and those paid solely by commission. Therefore, the total of this employment distribution is lower than the total employment shown in the preceding paragraph. A clarification of this difference has been provided in the final EIS following **Table 3–9**.

4. The potential agreement concerning the proposed pipelines and secondary roads 419 and 420 might or might not take the form of an amendment to the HRMI Plan Other processes might take precedence. That will be up to SMC and Stillwater County to determine. (38)

4.8.1.2 p 4-65 Alternative B - Proposed Action Again, the authority for the proposed agreement to install pipelines in the County ROW is the county permit identified in Table 1-1, not an amendment to SMC's Hard Rock Impact Plan. (45)

There is no detailed analysis of the effects of the proposed pipeline to county roads 419 and 420 in the DEIS. The pipeline is an integral component of the preferred alternative. The authority for the proposed agreement for installation of pipelines within County right of way is the county permit identified in Table 1-1, not necessarily an amendment to the SMC Hard Rock Impact Plan as stated in section 2.4.2.5 on page 2-27. Also, federal funding for reconstruction of the section of 419 between Dean and Nye has not be committed yet. The mine related impact to this section of county road has resulted in deterioration of the pavement and increased maintenance costs. (45)

The authority for the proposed agreement for installation of pipelines within county right-of-way is in the county permit identified in Table 1-1, not necessarily an amendment to the SMC Hard Rock Impact Plan, as stated in Section 2.4.2.5 on page 2-27. (46s)

Response: We acknowledge the permit from the county roads department is the discretionary approval required for pipeline installation within the rights-of-way of Highways 419 and 420. The reference to the HRMI Plan was intended to identify the means by which a proportionate share of the cost of associated roadway improvements would be negotiated and assessed to SMC.

5. The DEIS should note that in 1996 the Rural Water Users Association in Absarokee was replaced by a County Water and Sewer district. The District deals only with the Absarokee water system. Sewer services remain under the jurisdiction of the County Commissioners. For further information about the District's perceptions of its impacts from SMC, you might want to talk with Bill Payne, who is manager of the District. (38)

Response: The final EIS has been amended accordingly. Please refer to **Section 3.5.7.7** to review the change.

6. The DEIS might mention the fact of property tax base sharing. Tax base sharing involves the allocation of the taxable valuation of the real and personal property (equipment) at the mine and mill and the taxable valuation of the mine's gross proceeds. The full post-permit increase in the taxable valuation of the mine is divided three times: between the County and Columbus, between the Absarokee and Columbus high school *districts, and among the four affected elementary districts (Absarokee, Columbus, Fishtail, and Nye). The allocation is based where mineral development employees or students reside, as identified in the annual monitoring report. The smelter and the BMR are not included in tax base sharing. All of their valuation goes to the Town of Columbus, the Columbus School Districts, and the County, excluding the County road and bridge funds. (38)*

Response: The information provided in the comment from the Department of Commerce, Local Government Assistance Division was included in the final EIS for informational purposes.

7. ...please confirm with SMC, Stillwater County, and possibly other affected units of local government, how they perceive the Hard Rock Mining Impact Plan amendment that is currently being prepared. Do they consider the current amendment as a "catch-up" for impacts resulting from SMC's moving from 1,000 TPD to 2,000 TPD production; as an amendment that is intended to encompass any impacts resulting from DEQ's approval of the Hertzler Tailings Impoundment and removal of the TPD limit; or both. (38)

Response: The process for revising or amending the Hard Rock Impact Plan is independent of the MEPA/NEPA process that directs the preparation of EISs. The 1988 version of SMC's Hard Rock Impact Plan established the threshold for amendment at the point where the mine workforce exceeds the employment level projected in the 1988 Plan, which is 525 employees. If the number of people employed by SMC had remained below the 1988 Plan's threshold, no amendment or revisions would have been required.

8. Following is a "yes-no" comment. Neither the Hard-Rock Mining Impact Act nor the Metal Mines Reclamation Act would prohibit SMC from engaging in activities authorized by the approval of the Hertzler amendment prior to the approval of an impact plan amendment necessitated by the Hertzler amendment. A large-scale mineral developer may not commence activity under its operating permit prior to the approval and completion of approval-related requirements for a new impact plan. This would also be true if the approved plan itself required that it be reassessed and amended prior to commencement of mine activity, as is the case with the SMC East Boulder and the ASARCO Rock Creek HRMI Plans. The 1988 Amended SMC HRMI Plan requires that SMC and the affected units of local government examine the need for amendment and that they prepare an amendment, if one is necessary to accommodate significant changes in the mining project, such as a 15% increase in employment. But, this does not prevent SMC from proceeding with activities sanctioned by the operating permit amendment while the impact plan amendment is in progress. (38)

Response: Comment noted.

9. In considering cumulative impacts, the DEIS might also explore the possibility that SMC will shift workforce between the Stillwater-Nye mine and the East Boulder project, which has potential implications for both Stillwater and Sweet Grass Counties. For example, the taxable valuation of the mineral development is shared between affected *counties and affected cities or incorporated towns based on where employees of that mineral development reside. If employees might be shifted back and forth between the projects, this needs to be made known so that the affected units of local government and SMC can find a way to address this phenomena in their impact plan for Stillwater-Nye and for the SMC East Boulder project. (42)*

Response: DEQ and CNF acknowledge that some shifts in employees between the two mines may occur. However, information does not exist upon which to base an estimate of the amount of shifting the could occur nor on the locations of those employees. As a result, any attempt by the agencies to define the amount of shifting would be speculative and unacceptable for analysis under MEPA/NEPA. Thus, consideration of shifting of employees is beyond the scope of this analysis. (Although beyond this analysis, shifts of employees that lead to changes in employment at the mines greater than the thresholds identified in the mines' respective Hard Rock Impact Plans would prompt an amendment to the plans, including renegotiations with the counties affected by the shifting.

10. Also, if increased production occurs in response to higher prices or greater economies of production, one result should be higher gross proceeds from the mine, which would affect both the local property tax base (which includes the taxable valuation of the gross proceeds) and the State's metal mines license tax revenue (25 percent of which is returned to the affected counties and, through them, also to affected school districts.) It would be appropriate, I should think, for the EIS to include and examine alternative scenarios of what production at 3,500 or 4,000 or 5,000 TPD might mean in these terms. (42)

Response: The draft EIS evaluated an average production level of 3,000 tpd, which includes peaks of up to 5,000 tpd, and associated social and economic effects. In addition, the HRIP evaluates economic and employment impacts to local government agencies at projected production levels. If SMC's mineral employment does increase or is projected to increase for any reason and the increase exceeds thresholds defined in the 1998 amendment to SMC's Hard Rock Impact Plan, then the Plan would have to be modified to address potential socioeconomic effects. Based on employment, the 1998 Plan Amendment establishes two thresholds for modification. The 1998 Plan Amendment may be modified is in-migrating mineral employment in any affected unit of local government differs by more than 15 percent from the level projected in the amendment. Also, an affected unit of local government may petition for an amendment to the Hard Rock Impact Plan if in-migrating employment at the SMC mineral development is forecast to increase or decrease from the levels projected in the 1998 amendment by at least 75 employees.

Additionally, if the taxable valuation of SMC's mineral development differs more than 15 percent from that projected in the 1998 Plan Amendment, the Amendment may be amended.

11. S-15 Workforce The DEIS states "This increase would trigger a revision to SMC Hard Rock Impact Plan" Please note an amendment to SMC Hard Rock Impact Plan has been in progress for almost a year and is expected to be completed by mid 1998. S-19 1st Paragraph Absarokee Water and Sewer District is also listed in SMC's Amended Hard Rock Impact Plan. (45)

Response: This information has been updated in the EIS.

12. An amendment to the SMC Hard Rock Mining Impact Plan is currently in progress. This amendment was based on SMC employment of 700 people. We did not find any detailed analysis of the impacts of increasing production limits. The social and economic effects presented in section 4.5 indicate effects from 12/31/96 population estimated to population projections associated with SMC employment of 700. If production increased to 3,000-5,000 tons per day, will the social and economic effects presented in this DEIS be valid? A detailed analysis of social and economic effects of increasing production limits, independent of SMC consultant's work, should be included in the Final EIS. (45)

I am concerned with the cyclical fluctuation of employees. If they are running and increasing and decreasing production limits in response to precious metal prices, it's certainly going to have a big fluctuation in the number of employees that they're going to have currently working and the people who are standing around employed waiting for the metal prices to come back up. (46s)

Response: The EIS evaluates an overall area of disturbance or "footprint" for the mine and associated waste disposal facilities and peak production levels up to 5,000 tpd. The 5,000 tpd is estimated to be the highest production level possible with the mine's existing mill facilities. The proposed action removes any production limits to allow SMC flexibility to adjust production levels according to market conditions. Expansion beyond 5,000 tpd would require an expansion of the mill, which if it increases disturbance at that site would require modification of the existing permit and additional environmental review under NEPA. The analysis contained in the EIS is based on a 3,000 tpd production level with peaks reaching 5,000 tpd, and considers the social and economic consequences of up to this production level.

Moreover, the Forest Service only looks at permitting surface effects. Permitting production rates could be perceived as a "taking." DEQ prefers to permit for surface disturbance and regulates production only when it prevents, minimizes, or eliminates an environmental effect.

The Hard Rock Mining Impact Act and associated Hard Rock Impact Plan process requires the evaluation of social and economic consequences of various production levels and requires that mitigation for these impacts be negotiated by the mining company and local government agencies.

Permanent expansion beyond 3,000 tpd would use up storage space for tailings and waste rock at a faster rate and shorten the life of the mine for the permitted disturbance. Any proposal that would increase disturbance beyond one of the action alternatives, if permitted, would be required to undergo additional MEPA/NEPA analysis.

B.6 Tailings Impoundment Stability

Five respondents (2 local, 1 regional, and 2 national) commented on the analysis of effects to tailings impoundment stability. The comments focused on concerns about stability of the impoundment in an earthquake, angles of slope, tailings pipelines, and stability of the east side waste rock storage site.

1. Alternative D does present some concerns. Engineering detail was insufficient to characterize the stability of the resulting tailings impoundments of Alterative D. One reported deficiency of Alternative D was that tailings pipelines would be suspended across the Stillwater River or attached to the bridge. Even this exposure was only slightly higher risk than Alternative B. With Alternative D, wouldn't the total evacuation of both 8" tailings slurry pipelines be similar to that experienced with Alternative B in the event there is a breach of the crossing of the Stillwater's West Fork (pp 4-7, 8). With Alternative D, couldn't pipelines be buried under the river like as in Alternative B? What are the constraints? Could the pipelines be accommodated by the haulage-way under the Stillwater River (reference DEQ 009, approved February 28, 1996)? (11)

Response: NEPA does not require final designs. It only requires sufficient detail for analysis (40 CFR 1502.4(a). Additionally, MMRA 82-4-335(4)(l) MCA requires sufficient detail to ensure structures are safe and stable.

The tailings pipelines for Alternative B would be 7.5 miles long. The tailings pipeline for Alternative D would be 0.78 miles long. Consequently, the maximum volume of tailings in the pipeline under Alternative D would be one-tenth of the volume in the pipeline under Alternative B.

It is operationally impossible to bury the pipe at this location due to a substantial depth of the riverbed and large boulders at this location. In contrast to the West Fork of the Stillwater, there is also no preexisting channel that can be used to divert the water through during construction. The disturbance acreage would also increase to build a diversion and trench the main channel. Additionally, the 4400 level connection may have insufficient space in which to install the pipelines. Finally, the 440 level connection has not been constructed and may not be constructed before the east side impoundment would need to be constructed and available for placement of tailings.

2. 4.6.1 Tailings Impoundment Stability 4.6.1.2 states that insufficient data exist regarding the strength and consistence of the Colorado Shale Units underlying the

Hertzler site to base a meaningful analysis of the potential for a deep bedrock failure of the entire site towards the Stillwater River. The SMC does not know how stable the site is... they are assuming that it is sufficiently stable because that is what they want to believe, not as a result of detailed exploration. Gentlemen, this is not my area of expertise, but I think a second, independent opinion based upon exploration is in order. Does the SMC realize how much water flows from under the hills of the proposed site in the river? Are they sure the underlying aquifer will not be contaminated by their operations? Do they really know how stable the ground is? I would hate to lose the quality of the water in my well because the SMC did not conduct sufficient studies prior to action. (13)

page 4-38: In regard to Hertzler impoundment stability, we are concerned about the statement indicating that, "modeling suggests the Hertzler tailing impoundment exceeds minimum acceptable factors of safety", and that "insufficient data exist regarding the strength and consistency of Colorado Shale units underlying the Hertzler site to base a meaningful analysis of the potential for a deep bedrock failure of the entire site toward the Stillwater River." We recommend that the agencies establish a technical review panel to review and approve the final impoundment design to ensure geotechnical stability of the impoundment prior to construction. (32)

Response: Although a detailed analysis of the potential for a deep bedrock failure of the entire site was not conducted, the conclusions reached in **Section 4.6.1.2** were not based on SMC's wishes for stability. As discussed in this section of Chapter 4, previous analyses suggest the competency of the Colorado Shale Unit is such that as a foundation material, it would no control the stability of the embankment. The only theoretically-feasible mode of failure associated with the Colorado Shale Unit would exist if the entire Hertzler Ranch is an existing landslide area. Any increased wetting of the shale or loading of the top of the slide by the tailings dam could feasiblely trigger movement if there was a slip surface. However, there is no indication that the Hertzler impoundment area is underlain by anything other than competent bedrock. To verify the competency of the Colorado Shale Unit, the agencies have added a new mitigation to **Section 2.4.5** that would require SMC to complete a deep bedrock drilling program and submit the data to the agencies, if one of the alternatives with an impoundment at Hertzler Ranch is selected by the decision makers.

Analyses also were conducted to predict seepage flows throughout the life of the impoundment. Their results suggest a maximum of approximately 35 gpm of tailings water would be collected by the underdrain system. However, the total seepage collected by the underdrain system would reduce to approximately 20 gpm during the later stages of filling as tailings consolidation seepage dominates the majority of the basin. Seepage rates though the HDPE liner (with an effective permeability of at least 1×10^{-10} cm/sec) and into the ground water regime would be less than 0.1 gpm throughout the life of the impoundment, which is a fraction of the discharge rates from springs and wells in the aquifers under Hertzler Ranch (range: 10 to 200 gpm).

3. Investigate whether the currently proposed upstream design for riprap on the East-Side waste rock facility may have a zone of weakness to erosion where two lifts of riprap meet. (22)

Response: Riprap would be of a uniform size. Therefore, it would not be susceptible to segregation of particle sizes during placement minimizing any zone of weakness due to segregation. Riprap sizing would be determined by the design flood event.

4. The Final EIS should state the Richter Scale magnitude and location of the design earthquake, and the magnitude of the horizontal acceleration used to calculate the pseudo-static factors of safety for the tailings impoundments in all the alternatives. (22)

Response: Additional information about pseudo-static analysis has been added to **Section 4.6**. All analyses of minimum safety factors were based on a Maximum Credible Earthquake of magnitude 7.0 along the Emigrant fault, which is about 30 miles from the Hertzler impoundment. Details of the analysis can be reviewed in Knight Piésold 1996..

5. Perform a pseudo-static analysis for the East-Side waste rock storage site. Disclose all the assumptions used in the analysis, including the size and location of the maximum credible earthquake, and the magnitude of the horizontal acceleration used in the analysis. (22)

Response: A pseudo-static analysis was conducted for the east side waste rock storage site. Analyses of the proposed east side waste storage site were conducted using the computer program SLOPE/W. Minimum factors of safety of 2.5 and 1.9 were computed for static and pseudostatic conditions, respectively (Brouwer 1998). These figures, exceeded the standard minimum acceptable factor of safety of 1.5 and 1.0, respectively. The results of this analysis were have been added to **Section 4.6**.

6. Figure 2-5 shows the design for the embankment of the Hertzler tailings impoundment. The upstream slope, facing the interior of the impoundment will have a slope of 2.5H:1V. The downstream side of the embankment is proposed with a slope of 2H:1V. While a 2H:1V minimizes the area covered by the embankment, revegetation of a 2H:1V slope is generally considered to be problematic. (22)

Response: The use of a shallower angle for the downstream face of the tailings impoundment was considered, but there are tradeoffs for the angles of embankment slopes: a shallower angle would result in a either a proportionally higher embankment or larger footprint (area of disturbance) to provide the same storage capacity. Either of these could result in more rather than less visual impact. The proposed slope angle was selected as a balance between storage capacity, area of disturbance, and height. In addition, a mitigation measure was added to have the impoundment built in such a way to have final reclamation conducted on the lower portions of the embankment slope as it increases in height, allowing vegetation a longer time to become established and be monitored. Bond would not be released until successful revegetation has been established. The agencies also would include monitoring and maintenance monies for this area.

7. The seismic stability of cement-amended paste should be considered. The feasibility of disposing of paste amended with cement and without a confining impoundment should be examined, especially since a significant amount of disturbance and construction at the Hertzler site would be devoted to using a very large volume of borrow material to build the impoundment. Additionally, the total amount of water seepage from paste should be compared to that from slurried tailings. (27)

Response: Based on the public's interest in and comments on paste tailings, the agencies reconsidered in more detail the potential use of whole tailings paste and fine tailings paste in both backfill and landfill situations as alternatives to SMC's current methods of handling tailings. The results of this reevaluation are contained in **Appendix H** and are summarized in **Section 2.5.2**. Essentially, the evaluation determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA. The following reasons form the primary foundation for this conclusion:

- ➢ Slurried tailings, fine tailings paste, and whole tailings paste would have average dry densities of 70 pcf, 80 pcf, and 100 pcf, respectively. Thus, 100 pounds of slurried tailings, fine tailings paste, and whole tailings paste would occupy about 1.4 cubic feet, 1.25 cubic feet, and 1 cubic foot, respectively.
- ➢ Fine tailings paste probably could not be used as backfill because it would not have the strength necessary for mining operations. Thus, with fine tailings paste, about 58 percent of the tailings would still be used as sand backfill (coarse tailings) in the mine and about 42 percent of the tailings, primarily the slimes, would report to a tailings impoundment for use as fine tailings paste.
- ➢ If whole tailings paste backfill were implemented, about 68 percent of the tailings would be used as paste backfill in place of the current sand system and 32 percent of the would have to report to the surface for disposal. Under SMC's current system, 58 percent of the tailings report as backfill in the mine and 42 percent report as slurried tailings to the tailings impoundment.
- ➢ The volume of fines tailings paste reporting to a surface impoundment would not reduce the size of the impoundment much over that needed for slurried tailings. For example, to store the same volume of tailings as addressed by Alternative B, an impoundment built at Hertzler using fines tailings paste would cover about 150 acres (compared with 163 acres for Alternative B) and would have a final embankment elevation of 5,025 feet (compared

to 5,036 feet for Alternative B). There would be less than 5 percent reduction in volume and areal extent using whole tailings paste.

- Landfilling fine tailings paste would require a single paste plant at the Hertzler under alternatives B and C or at the east side tailings impoundment under Alternative D. SMC's current sand plant would continue to operate at the mine and deposit tailings in the existing impoundment.
- Whole tailings paste backfill also would probably require that the paste not backfilled into the mine be transported to Hertzler or the east side impoundment sites by truck or conveyor system. Pipeline transport of whole tailings paste to either of these sites would require pumps every 2,000 feet with electrical power lines to each site and several surge ponds along the route. The pipelines would have to be capable of withstanding high pressures and if a pipe were to rupture the pressure could cause more tailings to travel farther than would with slurried tailings. It is predicted that the friction developed along the length of the pipeline could cause the water to separate from the tailings resulting in a stiff material that could plug the pipe increasing the chances of rupture. The tailings could be re-slurried at the mill for transport through a pipeline to the impoundment followed by dewatering to reestablish a paste for disposal at an additional paste plant at the impoundment site. At a minimum, transporting paste by conveyor or truck would substantially increase noise and visual impact, potentially increase impacts to wildlife, and increase the potential for spills, and traffic on Stillwater County Roads 419 and 420. A conveyor would increase surface disturbance and delay reclamation; it may not be possible to build a conveyor where steep slopes constrict the right-of-way without requiring substantial removal of soil material and creating an even steeper slope subject to erosion. Additional land would be disturbed at the Hertzler impoundment site to construct a paste plant there.
- Disturbance at the mine would increase substantially. Whole tailings paste backfill could require the location of as many as 9 to 10 paste plants along the length of the ore body toward East Boulder Mine; fewer plants would be needed if the mine operation expanded primarily downward rather than horizontally down the length of the ore body. SMC would have to construct a 200-foot by 200-foot (0.9 acre) pad at each of the portals where the paste plants would be built. Due to the steep slopes and the need for cut-and-fill construction, disturbance for the pads would encompass much more than one acre (and at least some of the waste rock generated by construction would have to be stored somewhere). The overall slopes on SMC's present system of roads to the upper portals are too steep for loaded cement trucks to negotiate. Each paste plant would require at least 2 truck loads of cement daily. Thus, SMC would

have to construct a new system of roads with shallower slopes for the cement trucks. If SMC did construct a new network of roads, it's still questionable if the cement trucks could access the plants during the winter.

- The addition of the paste backfill system would substantially increase the requirements for electrical power. Each plant would require about 1.5 megawatts of power. With the increases in electrical requirements associated with increased production, Montana Power Company's distribution lines supplying the Stillwater Mine and Stillwater Valley could not handle the additional power for the paste plants, even with the upgrades discussed earlier. The power lines probably would have to be completely reconstructed back to Billings before the power for the paste plants could be supplied.

Although the agencies determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA at this time, DEQ and CNF added another mitigation measure for consideration by the decision makers. If one of the action alternatives is selected, this measure states that within 5 years of the ROD issued for this final EIS, DEQ, CNF, and SMC shall reevaluate the technologies and feasibilities for incorporating paste landfill and paste backfill into SMC's operations at the Stillwater Mine.

At the time the tailings paste landfill issue is reevaluated, the seismic stability of the cement-amended paste will require careful analysis. It is likely that with even minimal amounts of cement, the paste would not be subject to liquefaction induced flow failure, but could be subject to slumping and sliding under earthquake loading. Construction of an outer confining zone of high cement content paste is technically feasible, however the costs associated with providing sufficient cement to assure adequate strengths combined with the difficulties in assuring the quality of the paste, would likely outweigh the benefits. It is likely that an earthfill confining berm would be the most technically feasible approach.

The seepage from the paste would be reduced from that associated with slurry disposal of tailings, however a liner for containment will still be required. The risk of seepage from the lined impoundment would be similar for both the slurry and paste alternatives due to the proposed underdrain system included in the slurry liner system. This underdrain would be installed over the liner and would reduce hydrostatic pressures on the liner, limiting the driving pressure causing seepage.

Total tailings backfill would cost approximately $6.32 to $6.43 per ton of backfill (see **Appendix H**). This compares to $3.27 per ton of sand fill currently being used. Cement amended tailings disposal is estimated to cost

$$6.77 to $6.88 per ton. These estimates include capital costs for development of the containment basin, paste plant, tailings and return water pipelines, and power lines as well as operating costs. Each additional paste plant would cost $7 to $10 million; however, there would only be 4-5 plants operating at the same time because the mill could not generate enough tailings to supply more plants. The plants would be moved to new sites when needed rather than continually purchasing and constructing new plants.

B.7 Aesthetics

Ten respondents (4 local, 4 regional, and 2 national) made comments on the potential effects on aesthetics. Of these, three dealt primarily with visual impacts and two dealt primarily with noise impacts. The other five respondents dealt with both visuals and noise.

B.7.1 General

I have... questions about the Stratton Ranch, What is in the near future as plans for this ranch? ... I think, on page 4-47, the photograph was taken from my deck. So I need to know what I'm going to see down there in the future. (47s)

Response: Three of the comments were interested in the future of Stratton Ranch and how that could affect visual impacts. SMC has no future plans for this property beyond those proposed and evaluated in this EIS. Beyond the life of the mine, it would be used for agriculture/wildlife habitat.

B.7.2 Visual

1. 4.7 (pp 4-41 to 4-64). The idea of "key observation points" is great as are the simulations. However, a KOP viewing the Stratton Ranch and its LAD sites from the country road would be helpful. People traveling that road to and from the wilderness and the Woodbine Campground pass it. A ridge shields KOP 2 from viewing these LAD sites. (9)

Response: The LAD sites would consist only of center-pivot irrigation systems similar to those currently in place at the east side of the mine and those used by local farmers/ranchers. Furthermore, center-pivot irrigation systems can be dismantled and moved easily, so they are not considered to be permanent structures. Because most people can readily visualize these types of irrigation systems and the systems are not permanent, DEQ and CNF decided a visual simulation of the LAD sites would not substantively improve people's understanding of these sites.

2. The ranch's two LAD sites lie on an abandoned open pit gravel operation. While the floor of the gravel pit will be more visually acceptable following revegetation, how *will the walls of the pit be treated? Will they be graded? What is the anticipated success of revegetating the pit walls? How much of the pit is visible from the county road? How far below the road grade is the pit floor? How much water does this pit retain? How does it drain? Figures 4-3a to 4-3c (p 4-47) from site KOP 2 were of no help in assessing what the Stratton Ranch gavel pit will look like from the road. (9)*

Response: The reclamation guidelines for the gravel pit are not part of this analysis nor part of DEQ and CNF's decision on this analysis. The gravel pit on the Stratton Ranch is actually more of an excavated depression as opposed to a pit with defined pit walls. It is being reclaimed in accordance with the open cut permit issued by DEQ for the gravel pit (permit #00549). The disturbed will be graded to 3:1 or flatter and must blend in with the surrounding topography. The regraded area will be topsoiled with 6 inches of soil and revegetated with a seed mix of green needle grass, crested wheatgrass and western wheatgrass. The post mining land use specified in the permit is recreation, residential development with some wildlife and livestock grazing.

3. Electrical power requirements will more than double to meet 5,000 tons per day production volumes. Does this mean that both new electrical transmission lines and towers will be required? What are the aesthetic consequences? Does SMC pay for all these capacity increases? What happens to these transmission lines and towers once the mine ceases production? Their presence affects neighboring property values, and there is an ever present danger for health and safety of citizens. (11)

Response: The transmission lines currently providing the power supply to the mine would be upgraded to provide the additional power needed to increase production to 5,000 tpd. In all cases, this upgrade would involve improvements to the existing line as opposed to the construction of an additional line into the area. Thus, the changes would not be noticeable. SMC would be financially responsible for any upgrades required for the Stillwater Mine. Additional information on this line upgrade has been added to **Section 2.4.2.4** of the EIS.

The fate of the power lines at the time the Stillwater Mine closes would depend upon the users connected to them. Segments that involve only the mine would be removed and any disturbances would be reclaimed. However, segments providing service to other users in the Stillwater River Valley would remain in place.

4. The absence of specific mitigation measures for noise and light disturbance is unacceptable. Explicit mitigation measures should be established (pp 3-56, 57 and 4-33, 63). ... lighting measures should be established which explicitly define output levels and shielding such that lights are not visible to neighbors. (11)

The permit should require that lights at the tailings and mine sites not be visible from neighbors (pp. 4-63-4-64). (27)

Since we are within less than one mile of the mine site and directly across from the proposed east side impoundment... The problem with the lights is another indication of their lack of concern for those living close by. The damage aesthetically has been bad in the past. It will be horrendous in the future with the impoundment hill. There are approximately ten homes within the sight and sound of the mine that have been very greatly effected by the development. (20)

Response: Specific mitigation measures for light were included — the application of the currently specified mitigation of directionally aligned and shielded lights (see **Section 4.7.3.1.6** of the EIS). SMC currently uses shielding on its lights at the mine and mill.

5. 4.7 View on Visual Resources, Alternative B, pp 4-44: The narrative says that KOP 4 (figure 4-5b) along the northern boundary of Hertzler Ranch Stillwater County Road 420 is the only area from which the site would be fully visible. I feel that it should be pointed out that the site is fully visible not only from the county road, but from the access road to Moraine Public Fishing Access which shares the northern property line of the Hertzler property, the access road to Castle Rock Public Fishing Access, and is fully visible to almost all properties above the settlement at Beehive. Contrary to the statement, the facility will dominate the landscape because is does not have natural lines — even after seeding. (13)

These properties and recreational users of both the Moraine Fishing Access and the Castle Rock Fishing Access (0.75 miles north of the Moraine Access) will have an unfettered view of the proposed Tailings Impoundment, LADs and Borrow areas (see figure 2-2). The Stillwater Mining Company's (SMC) proposed major revision to its operating permit #00118 Alternative B and C outlines a plan that is inconsistent with the needs and rights of its neighbors around or near the proposed Hertzler Tailing Impoundment. The proposal Alternatives B and C expand an already large scale operation, and increase the visual impact of mining operation over a much more extensive area. (13)

I vigorously oppose SMCs proposed major revision to operating permit #00118, as being irresponsible development of the mining industry in Montana that is not consistent with the spirit of Hardrock Mining Act. I do not feel that increasing the visual and other impacts from mining by locating a huge tailings pond, borrow pits, LADs and other ground disturbances seven miles further down river from the existing mine on the Stillwater River is acting responsibly or fairly to neighbors who have invested in Stillwater River Property. (13)

Response: The Hertzler Ranch impoundment site would not be fully visible to people using the Moraine and Castle Rock fishing access areas. Although the visual analysis suggests the tailings impoundment would not be visible (as shown on **Figures 4–7a** and **4–7b**), at the most, a small portion of the top of the third stage of the tailings impoundment would be visible during construction. These figures also show that the impoundment would not "dominate" the visual landscape because very little, if any, would be visible from the access points. Residences at Beehive are at least four miles from the proposed impoundment site and the impoundment would not be visible at all to those in the valley. Although the impoundment may be visible from residences on slopes above the valley, the distance and adjoining terrain would ensure the impoundment would not dominate the view from these residences.

As shown on **Figures 4–7a** and **4–7b**, people using the Moraine and Castle Rock fishing access areas would not have an "unfettered view" of the Hertzler tailings impoundment site, LADs, and borrow areas. At most, a small portion of the top of the third stage of the tailings impoundment would be visible during construction. Construction of the impoundment at Hertzler would not violate any mining or zoning regulations. Thus, it would not be inconsistent with any "rights."

It is not likely people in Beehive or people using Castle Rock would be affected by the Hertzler impoundment activities. However, it is possible that people at Moraine might be able to hear construction of the final lift of the impoundment and possibly operation of pumps after such construction. Once the outer slopes are reclaimed, the impoundment would not visually affect Moraine fishing access users. Consequently, it is unlikely the project would increase the potential for trespass on private property elsewhere along the Stillwater River by people using MDFWP's fishing access points.

DEQ and CNF disagree with the respondent's determination that the action alternatives addressed in this EIS are not consistent with the spirit of MMRA. Although MMRA does not directly require development of alternatives, it does require compliance with MEPA (17.24.119 ARM). The action alternatives meet the regulatory requirements of the MEPA. Thus, they meet the spirit of both acts as defined by the Act and the regulations that implement them.

6. *And so I need to know what the future pla for the Stratton Ranch are. What is going to be done with that property? Will they be using it for other things? (47s)*

Response: SMC has no future plans for this property beyond those proposed and evaluated in this EIS. The post-mining land use specified in the permit application is cattle grazing and wildlife habitat.

7. *An advantage of the Hertzler site is that there is plenty of room to construct the tailings facility. The long term appearance of the reclaimed tailings facility will be important to the residents of the valley long after the mine is closed. Since there are no real space restrictions for constructing a waste storage facility, as there are with the tailings storage sites near the mine, the slope of the embankment at the Hertzler site should be designed to minimize the visual impact of the tailings facility after reclamation is complete. A shallower slope angle of the downstream face of the impoundment will also maximize the probability of successfully revegetating the slopes. (22)*

Response: The use of a shallower angle for the downstream face of the tailings impoundment was considered, but there are tradeoffs for the angles of embankment slopes: a shallower angle would result in a either a proportionally higher embankment or larger footprint (area of disturbance) to provide the same storage capacity. Either of these could result in more rather than less visual impact. The proposed slope angle was selected as a balance between storage capacity, area of disturbance, and height. In addition, a mitigation measure was added to have the impoundment built in such a way to have final reclamation conducted on the lower portions of the embankment slope as it increases in height, allowing vegetation a longer time to become established and be monitored. Bond would not be released until successful revegetation has been established. The agencies also would include monitoring and maintenance monies for this area.

B.7.3 Noise

1. 4/7/2/1/2 Noise Effects The narrative does not state how long it would take to construct the facilities at Hertzler Ranch, but that noise levels would be higher for the duration of the project — including after construction (20 years of noise?) Is this proposed construction to take place at night? It is stated that the ridge will mute the sound for southern and eastern properties, but many properties are to the north, including the fishing accesses. Nighttime construction would not be an acceptable situation were it proposed. (13)

I am a property owner within one mile of the current mine site. I have been subject to the constant noise of the mine and mill, the bright lights, the road being overused and falling to pieces, and the aesthetic value of my home diminish for years now. (16)

Since we are within less than one mile of the mine site and directly across from the proposed eastside impoundment, we have always been subject to the noise. We are concerned how much more noise will be created from the expansion. We feel the DEIS does not show enough interest in the noise created at the mine and mill site. The problem with the lights is another indication of their lack of concern for those living close by. The damage aesthetically has been bad in the past. It will be horrendous in the future with the impoundment hill. There are approximately ten homes within sight and sound of the mine that have been very greatly effected by the development. (20)

Measures should be added to the permit requiring noise suppression to confine noise to the mine and tailings sites — during and after construction (pp, 4-60-4-63). (27)

The main thing I noticed was regarding nosie on page 3-56, and the fact that no one thought noise was a factor of enough magnitude to even measure it at the mine and mill site! (29)

Response: No changes are proposed for the mine and mill site, so noise associated with them was not addressed in the EIS. The proposed action does involve the construction of a waste rock storage area at the east side site and there would be daytime noise from heavy equipment emitted from that area during its development. This will be mitigated to some degree by the berm that will be built at the toe of the facility.

Construction of the Hertzler tailings impoundment would occur in three phases spread over a 20- to 25-year period (see **Figure 2–5** for a graphic presentation of the three phases of the tailings embankment). Each phase would likely last from two to four years with the first phase being the longest and the third being shortest (construction of the Hertzler impoundment under alternatives B and C would proceed similarly). Under Alternative D, the east side impoundment would also be constructed in phases over a shorter period. Between phases and after the final phase, the only noise would be from the operational sources described in the EIS. Night construction and operational activities are not planned and would only occur when necessary. In addition, most areas to the north are also shielded by intervening topography (see **Figure 4–7b**).

2. ... there was really nothing concrete on the design and construction of the pipeline. I mean, no specifics on how it's going to be constructed. One question I have, and the people I have consulted, it seems that booster pumps would be almost mandatory on a line of this length. considering it's pumping slurry on a fairly level gradient downgrade. And if so, how often will they be located, what noise pollution should we expect from those? (46s)

... they discussed the line going to the Hertzler on Alternative B ... How deep will the line be buried? ... how many pumping stations, ... would be in the circle between the Nye mine and the Hertzler property? The one concern that I have is, will they be buried below the ground? Will they (pumping stations) be sound-proofed? And this was not addressed as far as noise was concerned. It was addressed as far as the Hertzler location, but as far as pumping, it was not addressed. (47s)

Response: The pipeline would be buried using standard, widely-accepted techniques. As discussed in **Section 2.4.2.2**, the pipelines would be buried about 5 feet deep. Where the pipelines could not be buried a full 5 feet deep they would be insulated and buried as deep as possible. By using steel pipe that will support high pressures in its construction of the tailings pipeline, SMC eliminated the need for one or more booster pump stations along the pipeline's route. Thus, no booster pump stations would be built between the tailings pumping facility at the mine and the terminal station at the Hertzler impoundment.

B.8 Transportation

1. 2.4.2.5. (p 2-7). No discussion about the added SMC traffic due to this alternative nor how it would mix with the additional traffic for people going to and from the campground/wilderness area and other scenic sights. How much additional right-of-

way will roads 419 and 4 20 require to accommodate the pipeline corridor and the upgraded roads? (9)

Response: The increase in the number of employees and contractors from 655 (December 31, 1997) to 700 under the action alternatives would generate an additional 17 trips per day. This increase would bring the total number of estimated trips per day to almost 270. Traffic associated with the Stillwater Mine would account for about 11 percent and 24 percent of the traffic using Stillwater County Roads 419 and 420, respectively. Please refer to **Section 4.8.1.2** to review this information more completely.

No additional rights-of-way would be obtained to accommodate the pipelines. As stated in **Section 2.4.2.2**, the pipelines would be buried under the county roads or within the county roads' existing rights-of-way.

2. 2.4.1.5. (p 2-14) How has traffic volume on 419 and 420 changed over the years? How might it change in the future? Issue 2.2.1.5 implies "new" residents are attached to the area. The wilderness areas is an attractant as is the campground. How much will the use of these areas increase under any of the alternatives? How well will both 419 and 420 handle the anticipated increase in traffic? (9)

Response: Data suggest traffic associated with the Stillwater Mine is accounting for a progressively smaller proportion of the traffic on Stillwater County Roads 419 and 420 (24 percent and 11 percent, respectively). Although the amount of traffic associated with the mine has been increasing, the portion of traffic associated with recreational activities and general growth in population of the area account for most of the traffic. Overall however, the design capacity of Stillwater County Road 419 is well above existing and projected levels of traffic under all three alternatives. A more complete description of anticipated effects to traffic and circulation is included in **Section 4.8.1.2** of the EIS.

3. Many corporations request and encourage employees to car pool in order to alleviate traffic problems, yet SMC has proposed no explicit measures to mitigate traffic. The workforce is projected to increase to 700 workers. Does this total include contract workers (e.g., Redpath employees) who are not directly employed by SMC? (11)

Traffic on 419 when shifts change is heavy and fast. The DEIS recommends removing the existing car pool requirement (pp. 3-57-3-58) but estimates a 13% increase in traffic on 419 and 420 based on trends established with the requirement in effect (p. 4-64). The document adds that SMC has suggested that it might not be legal to require citizens to car pool, but it does not say whether the assertion was ever investigated or legal counsel ever sought to answer the question. (27)

I don't feel that the removal of the car pooling requirement is good, as it will mean that traffic increases with the concomitant increase in accidents and deaths. It might be a good idea to institute a speed limit on the road and perhaps to stagger the mine shifts so *they don't coincide with peak traffic uses on weekends, or during school hours when children are being transported to and from school. (28)*

I am especially concerned about the removal of the car pooling requirement. If DEQ or the Forest Service has employed legal counsel which confirms the statement in the DEIS that car pooling may not be legal, then one solution would be to require SMC to develop a plan for voluntary car pooling with incentives that result in at least three persons per vehicle going to the mine. (44)

The document adds that SMC has suggested that it might not be legal to require car pooling. There is car pooling required all over the country. There must be some way to allow for continuing a project or a process which has been fairly successful at keeping the traffic down... (47s)

The EIS estimates a traffic increase of 13 percent. I don't know from when to when, by reading the document. ... I was told by the DEQ that the traffic trend was calculated based on previous rates of increase, which were held down by the good job the mine was going to encourage car pooling. So the EIS recommends removing the car pool requirement and then estimating the rate of traffic increase based on trends established when that requirement was in effect. (47s)

Response: Contractors are included in the projection of total workforce.

Due to the success of car pooling, the monitoring requirement was dropped in 1994 as unnecessary. Car pooling by SMC's employees continues. Under the proposed expansion, the ADT count would likely increase by 27 vehicles. To ensure car pooling also is encouraged for these additional employees, the agencies would require SMC to develop a plan of incentives for employee car pooling as discussed in **Section 2.4.5**. Text in Chapters 2 and 3 has been modified accordingly.

An assessment of speed limits and recommendations of speed limits to MDOT are beyond the scope of this analysis.

4. Traffic engineers have stated that travel of one fully loaded tractor/trailer rig is equivalent to the passage of 20,000 plus autos in terms of road-bed wear. Consequently, it is reasonable to conclude that SMC traffic (employees and heavy trucks) have seriously affected road deterioration in Stillwater County... it is particularly appropriate for SMC to take a responsible, pro-active role for improving Highway 419 road/traffic conditions independent of whether or not pipeline rights-of-way are granted to SMC. (11)

Response: SMC has taken responsibility through the Hard Rock Impact Plan. The purpose of this plan is to provide a means for counties affected by a mining project to obtain compensation for adverse effects to the counties. Negotiations between the counties and SMC during the recent revision of this plan (finalized during August 1998) determined how much compensation the counties will receive. Additionally, SMC pays other fees and taxes to the counties that also help to offset any adverse effects.

5. It is now proposed (pg 2-16) that trucks would haul waste rock and cross Highway 419 rather than use the haulage-way. Why isn't the underground connection utilized? Perhaps the road grades are to steep, but couldn't conveyor belts be used? (11)

Response: When its constructed, SMC intends to use the 4400 level connection under the Stillwater River between the east and west sides of the Stillwater River for hauling ore. Waste rock from the west side of the river would be transported aboveground as described in **Section 2.4.2.1**. Some limited potential exists for waste rock from below the 5500 level to be hauled through the 4400 level connection. However, waste rock from higher levels would be transported aboveground and across County Road 419, which is the most efficient means to move the rock. To transport rock from these upper levels through the 4400 level connection, SMC would have to haul this rock out from the upper portals (no connections exist for hauling rock to the 4400 level completely underground) and then back underground to access the connection.

The use of conveyor belts across the road and river would be inefficient compared to hauling with trucks, inflexible and less able to respond to changing conditions at the mine. Additionally, it would further affect the visual aesthetics for people traveling along County Road 419 to points south of the Stillwater Mine.

6. Montana Dept of Transportation has two new bridges planned near Nye. Has coordination of pipe and bridge design been under taken? (12)

Response: Coordination has not occurred to date because the agencies had not selected an alternative. If the agencies select an action alternative in their RODs, SMC would then proceed with pipeline design and appropriate coordination with MDOT and Stillwater County's road department.

7. Pipeline is slated to be in the right-of way of the roads. Will it be buried? Interfere with drainage? How will it be repaired and maintained? Montana Dept of Transportation requirements must be met. (12)

Response: The proposed pipelines would be buried. A complete description of the pipelines is contained in **Section 2.4.2.2**, Tailings Production and Management. Because the rights-of-way would be returned to their approximate original contours, the pipelines would not interfere with drainage. SMC would maintain and repair the pipelines and installation of the pipelines would be accomplished in coordination with appropriate state and local requirements.

8. If Alternative B or C becomes a reality (which I sincerely hope does not happen), I feel the mine should put in a new road from Nye to the mine while they are constructing the slurry line. They should also pay for all right-a-ways, etc. (17)

Will protection to the roadway at the pipeline crossing be provided, and will there be adequate traffic control during the construction phase? (26)

Response: As identified in **Section 4.8.1.2** of the EIS, a traffic management plan would be prepared before initiation of the construction phase of the project. This plan would describe items such as construction timing, location of equipment storage and staging areas, phasing plan, road closures and detour routes (if necessary), traffic control, and other details necessary to provide a plan for safe and effective traffic movement during construction. Also, if deemed necessary, alternate plans for employee commuter patterns (during pipeline installation) would be identified.

9. Will the holding ponds become a source of fog? If so, the potential for additional roadway hazards should be evaluated. (26)

Response: Air quality effects associated with the proposed impoundments are discussed in **Section 4.4** of the EIS. It is not anticipated that the LAD holding pond represent a potential source of fog. The LADs could produce fog, not the pond. Furthermore, any fog that results from the LADs is likely to blow away because the wind in the valley prevents the buildup of fog.

10. The EIS should require SMC to schedule shift changes to avoid times when school busses are on the roads (pp. 4-64-4-66). (27)

Response: The current shift change times were developed by SMC and considered traffic peaks as well as other factors. The agencies do not feel the need to address school buses is required at this time. If there is a problem in the future, the agencies can revisit the issue and address changes.

11. The DEIS does not provide sufficient information about reclamation of the pipeline, which would have significant impacts on highway 419. (27)

Response: The pipelines would be buried between the mine site and Hertzler Ranch. Reclamation of the disturbance resulting from installation of the pipelines would involve repaving the portions of the county road surfaces disturbed by the construction and returning the borrow ditches to approximate original contours and reseeding.

12. The state has overruled county recommendations for a speed limit on highway 419. With the additional activity at the mine at Nye, a speed limit no greater than 65 mph (55 mph preferred) should be reestablished to ensure safety (pp. 4-64--4-66). We understand that the DEQ and USFS can not impose speed limits, but, as part of the *assessment of the impacts of expansion at the mine, the agencies should recommend the establishment of a speed limit to the MT Dept of Transportation. (27)*

Response: An assessment of speed limits and recommendations of speed limits to MDOT are beyond the scope of this analysis.

13. A higher level of production would almost certainly mean more employees and contractors, if for nothing else than to transport the ore to the smelter. One would think that increased production would mean greater effort of some sort, which might translate into additional production employees, additional transportation employees, and additional smelter employees. It might also translate into additional trips to the mine by service and maintenance contractors and transporting of additional materials and equipment to the mine. Doubling production would presumably double the number of ore trucks on the road between the mine and the smelter, whether in actual trucks or number of trips per truck per day. Either way, it would mean additional wear and tear on secondary road 419 and 421 and highway 78. (42)

Response: The analysis of effects to transportation considered the number of employees and contractors (700) needed for an average production rate of 3,000 tpd with peaks of production reaching 5,000 tpd. The results of this analysis are presented in **Section 4.8.1.2**. Additional employees beyond the number considered in the EIS and amended Hard Rock Impact Plan (700) above a 15 percent increase (805 employees) would trigger another amendment to the HRIP and a subsequent revisiting of impacts to local governmental services. The mine's impact to road maintenance on Highways 419, 421, and 78 resulting from additional truck traffic would also have to be considered to the extent the County Roads Department is effected.

14. p 2-27 Roads and traffic: The Authority for the proposed agreement for installation of pipelines within County ROW is the country permit identified in Table 1-1. Not as an amendment to SMC's Hard Rock Impact Plan. (45)

There is no detailed analysis of the effects of the proposed pipeline to county roads 419 and 420 in the Draft Environmental Impact Statement. The pipeline is an integral component of the preferred alternative. The authority for the proposed agreement for installation of pipelines within County right of way is the county permit identified in Table 1-1, not necessarily an amendment to the SMC Hard Rock Impact Plan as stated in section 2.4.2.5 on page 2-27 . Also, federal funding for reconstruction of the section of 419 between Dean and Nye has not be committed yet. The mine related impact to this section of county road has resulted in deterioration of the pavement and increased maintenance costs. (45)

Response: The Stillwater County Road Department permit is the discretionary approval required for pipeline installation. The amendment to SMC's Hard Rock Impact Plan would provide for analysis and allocation of a fair share cost for necessary roadway improvements associated with the pipeline installation to provide funding for the project. A description of potential effects from pipeline installation is provided in **Section 4.8.1.2.**

15. 4.1.1.2.4 p 4-6 Hertzler Ranch: The DEIS indicates motorist on County Road 420 might have to drive through mist from the LAD irrigation. Water sprayed on a county road may be a safety hazard and create additional road maintenance problems. This is unacceptable to Stillwater County. (45)

Response: **Section 4.1.1.2.3** identifies several indirect impacts associated with operation of the LAD system. One of these potential impacts is a mist experienced on roadways only when the LAD is directly upwind of the road. Experience with SMC's existing LADs suggests the mist, if any reaches the county road, would not be dense enough to limit visibility or represent a safety hazard. Additionally, the mist would not be sufficiently wet the roadways to cause an increased need for maintenance.

16. 2.4.2.7 p. 2-30 Pipeline Monitoring: Stillwater County should also be notified if there is a rupture in SMC's pipelines located in County ROW. The DEIS only identified Custer National Forest and the Montana DEQ. (45)

Response: This section has been modified to include Stillwater County. Please refer to the discussion to review the change.

17. 3.8 p 3-58 Transportation: The DEIS indicates Highway 78 is a Stillwater County Road. In fact this is a state highway. In addition, an overlay was completed, but there has not been any recent reconstruction on this highway. (45)

Response: This section has been modified to correct the error. Please refer to the discussion to review the change.

18. If any kind of road reconstruction is done, which the county commissioners alluded to in their comments, you know, it really wouldn't be fair to go in and rip up what little road we have left, put the pipeline in, and leave us with a mud hole. So I think the mine should be responsible, or someone should be coming along and repairing that road and bringing it up to some sort of specifications and standards when they do. (46s)

...with the construction that's going to take place, we won't have a road left. Is somebody going to repave it? Who is going to repave it? Because with that heavy equipment working in a very narrow area with a very thin road out there, it's being beat to death by trucks right now. I don't think it's covered in the EIS. (47s)

Response: The need for roadway resurfacing as a result of pipeline installation will be evaluated by the Stillwater County Roads Department and SMC as part of the permitting process. SMC would be responsible for repaving sections of the roads disturbed for installation of the pipelines. Stillwater County and SMC may handle negotiations for installation of the pipeline in a separate agreement or include them as part of an amendment to SMC's Hard Rock Impact Plan.

19. There is no detailed analysis of the effects of the proposed pipeline to County Roads 419 and 420 in the Draft Environmental Impact Statement. (46s)

Response: A description of potential effects from pipeline installation is provided in **Section 4.8.1.2**.

20. ... there's a very sharp corner down on the lower end of our property, about the mid-section of that road between the mine and Carter's Camp. We've killed a number of people on that corner in the past. When we pull them out of the river, it's not a pretty sight. I think that road should be -- that corner should be straightened out and put more onto a even grade and that steep bank backfilled. That will result in taking some of our private property. (46s)

Response: Road realignment for improved site distance and safety would be evaluated by Stillwater County as part of any upgrade or improvement work conducted in association with the project. The analysis of this is beyond the scope of this EIS.

21. Also, federal funding for reconstruction of the section of 419 between Dean and Nye has not been committed yet. The mine-related impact to this section of county road has resulted in deterioration of the pavement and increased maintenance costs. Without federal and SMC participation in the completion of the 419 reconstruction project, this remains an unmitigated transportation impact. (46s)

Response: The direct impact to Highway 419 resulting from mining traffic is being evaluated in SMC's Hard Rock Impact Plan Amendment. The 1998 amendment to the Hard Rock Impact Plan provides for funding from SMC for the reconstruction of this segment of Stillwater County Road 419. SMC would provide a maximum of 20 percent funding or $900,000 (SMC 1998).

22. ... there's been no addressing, if they do go with Alternative B, ... they have to put the pipeline along the road, how are they going to handle the traffic through that area? (47s)

Response: The discussion of the effects to traffic during construction are discussed in **Section 4.8.1.2**. To minimize adverse effects to traffic, a traffic management plan would be prepared before construction would begin. This plan would be prepared in consultation with the MDOT and the County Roads Department to address construction-related impacts to Highway 419 and 420 during pipeline installation and provide plans for traffic detours, temporary closures, hours of construction and other provisions for dealing with traffic during pipeline installation.

B.9 Engineering

Twelve respondents (5 local, 4 regional, and 3 national) commented on the engineering of the alternatives' facilities. The comments focused on concerns about potential breaches of the tailings pipelines, the HDPE liner in the tailings impoundment, and alternatives involving paste backfill or landfill.

1. 4.1.1.2.1 Stillwater Mine Site (pp 4-2 and 4-3). For what design storm were the storm water detention ponds built? (9)

Response: As proposed, the storm detention ponds are sized for the 25-year 24-hour storm event.

2. How much of the data in the HELP model are synthesized or are default? How much are local? If much of the data are synthesized or default, how reliable is the output average infiltration of 2.7 in/yr? How much confidence does one put in that output? This would affect one's confidence in the "... approximately 33 years to infiltrate one port volume...through the waste rock storage site" and in the 11.3 lbs/day N loading from the same site. The program allows one to enter up to 100 years of daily data. Are the input data daily, monthly averages, seasonal averages, annual averages? If averages, one has 50-50 chance of being right. If the bulk of the data are not local but synthesized or default, one's chance of being right declines even further. Most people reading this document tend to believe such numbers are accurate; they truly reflect reality. I firmly believe the author(s) need to be up front about the uncertainty surrounding seemingly absolutely certain, real model results. (9)

Response: Input assumptions reflect site specific area and slope conditions, monthly temperature and precipitation averages, quarterly averages on relative humidity and the modeler's best professional judgement on other climatic and physical characteristics. Additional information about assumptions now supplements the text in Chapter 4. Modeling is used to improve projections of complex situations. Changes in numbers regarding nitrogen loading in **Section 4.1.1.2.1** reflect the final run of the HELP model (Techlink Environmental Inc. and Greystone 1998).

confident about the results generated by the HELP model. The model runs were based on the results of lab analyses, local data, and best professional judgement. Additionally, the model was run by a third-party contractor and reviewed by DEQ and CNF. The report on the HELP analysis is part of the public record and available for review at the agencies' offices.

3. Assuming Figure 2-2 is wrong and 2.4.2.3 is correct, each of the two 800-ft diam. LAD center pivot irrigation systems, operating continuously (24 hrs per day) for 7 months every summer (about 210 days/yr), will produce 300 gpm/pivot. This area receives 15-20 in. precipitation each year. How much additional water does this contribute to the 92+ acres under the pivots and how will this effect those acres? If my computations are correct, each acre under each pivot will receive nearly 290 in. of moisture over and above the annual precipitation, not accounting for evaporation between the spray head and the ground or wind. Given this much added water to these two sites, it seems very certain ground water will mound under the area and that instability of the toe of the colluvial material will occur. It is not a "should ground water mounding" occur issue. What are the consequences of the resulting instability and how might SMC control it? (9)

Response: **Figure 2–2** has been corrected to show the proposed LAD pivots.

In 1996, MSE-HKM (1997) estimated that the two half-pivots at the mine site each sprayed 500 gpm or 322 acre-feet of water resulting in the equivalent of 93.2 inches of rainfall. This is equivalent to five times the annual precipitation of 18.3 inches. The Stratton Ranch is located on the edge of the Stillwater River floodplain. Water within the alluvium recharges the river during all but the highest surface water flow periods, with net flow to the east. The ground water table in this area slopes eastward toward the river (**Figure 3–2**). Review of historic data from the LAD systems at the east side SMC facilities area suggests that mounding doesn't occur. The materials underlying the Stratton Ranch site are suited to handle a large throughput of water with nominal effect to the adjacent slopes as evidenced when a trailer park occupied the site and had a leach field that handled 150 to 250 gpm. **Section 4.1.1.2.2** has been revised to reflect this information.

4. What provision are there for power back-up? Does the computer control system, which monitors and governs tailings pipeline operation, have continuous power? What happens if leaks are undetected by the central control system which is shut down without power? Are there any provisions for redundant control and power systems to help assure reliable operations? What happens to the pipelines if the pumps are without electrical power (pp 2-29, 30 and 4-7)? (11)

Response: The design of the system of pipelines connecting the new impoundment to the mine is preliminary and the final design would have to be submitted to the agencies for approval before construction begins. Currently, SMC does not think backup power is needed to maintain the pipelines' integrity. Additionally, SMC proposes to construct an underground water storage reservoir at the 6500 level that would contain a volume of water adequate to flush the tailings out of both pipelines into the Hertzler tailings impoundment using gravity. SMC's employees would flush the pipelines when necessary if the power is off. However, SMC did not know when the reservoir would be constructed nor how long it would take to fill the reservoir with the volume of water needed to flush the pipelines. To ensure the pipelines' integrity and provide power for flushing the pipelines and maintaining the leak detection system during power outages, DEQ and CNF have identified a new mitigation that requires the installation of a generator for backup power. Please refer to **Section 2.4.5** to review this new measure.

5. Alternative D does present some concerns. Engineering detail was insufficient to characterize the stability of the resulting tailings impoundments of Alternative D. One reported deficiency of Alternative D was that tailings pipelines would be suspended across the Stillwater River or attached to the bridge. Even this exposure was only slightly higher risk than Alternative B. With Alternative D, wouldn't the total evacuation of both 8" tailings slurry pipelines be similar to that experienced with Alternative B in the event there is a breach of the crossing of the Stillwater's West Fork (pp 4-7, 8). With Alternative D, couldn't pipelines be buried under the river like as in Alternative B? What are the constraints? Could the pipelines be accommodated by the haulage-way under the Stillwater River (reference DEQ 009, approved February 28 , 1996)? (11)

Response: NEPA does not require final designs. It only requires sufficient detail for analysis (40 CFR 1502.4(a). Additionally, MMRA 82-4-335(4)(l) MCA requires sufficient detail to ensure structures are safe and stable.

The tailings pipelines for Alternative B would be 7.5 miles long. The tailings pipeline for Alternative D would be 0.78 miles long. Consequently, the maximum volume of tailings in the pipeline under Alternative D would be one-tenth of the volume in the pipeline under Alternative B.

It is operationally impossible to bury the pipe at this location due to a substantial depth of the riverbed and large boulders at this location. In contrast to the West Fork of the Stillwater, there is also no preexisting channel that can be used to divert the water through during construction. The disturbance acreage would also increase to build a diversion and trench the main channel. Additionally, space within the 4400 level connection would be insufficient to install the pipelines. Finally, the 440 level connection has not been constructed and may not be constructed before the east side impoundment would need to be constructed and available for placement of tailings.

6. 2.4 Alternative Description (Alternative B) pp2-32 Following closure of the Hertzler tailings impoundment, SMC states that the pipelines would remain buried in the ground. Why? If SMC put the pipelines in for their convenience, they should be required to remove them as part of the reclamation effort. In the future the pipelines could only become a source of nuisance to any further construction projects if they were required to be disturbed, and could even be a source of danger or the conduit by which contamination could spread. I would point out, that at completion of the project, SMC will not longer monitor the buried pipelines. Why does SMC think it is acceptable to leave the pipeline in the ground? (13)

Response: It is standard practice to abandon pipelines in place. Nevertheless, SMC would have to negotiate this with Stillwater County because the pipelines would be in the County's right-of-way. Digging up a pipeline to remove it causes unnecessary disturbance to surface resources.

Before SMC could abandon the pipelines in place, they would have to clean and flush the pipelines so no containments are left in the pipeline. SMC would flush the pipelines with sufficient quantities of water to remove all traces of the tailings, which would be verified by sampling and testing of the water as its being flushed. Materials flushed from the pipelines would be deposited in the tailings impoundment. The ends of the pipelines would be capped or crushed to prevent further transport of water.

7. We recently heard about the relatively new process called Total Tailing Paste that decreases the space necessary to dispose of waste. More tailings can fit in the same space underground, reducing the need for above-ground disposal. Tailings that must be disposed of above ground are also more compact, further reducing the volume needed *for surface disposal. This should eliminate the need for the Hertzler impoundment! Stillwater Mining Company's 1997 annual report refers to this process on page 16. The DEIS refers to paste backfill on page 2-55. It states implementation of a total tailing backfill system would be unreasonably expensive. (20)*

The seismic stability of cement-amended paste should be considered. The feasibility of disposing of paste amended with cement and without a confining impoundment should be examined, especially since a significant amount of disturbance and construction at the Hertzler site would be devoted to using a very large volume of borrow material to build the impoundment. Additionally, the total amount of water seepage from paste should be compared to that from slurried tailings. (27)

The articles attached strongly support the environmental and concurrent reclamation advantages of paste tech. Those advantages are similarly highlighted in the ASARCO Rk Cr Supp. EIS and numerous supporting documents. Those advantages include improvement in seepage quantity and chemistry, concurrent and long-term reclamation, sedimentation, etc.,. It is difficult to understand how entirely different reasoning can be presented in the Stillwater DEIS in the face of overwhelming contradictory information. This is particularly questionable considering that similar DEQ personnel coordinated both studies, both projects have also involved FS participation, and similar engineering consultants have been used by the both projects to evaluate the technology. This suggests that the information presented has not been objectively evaluated by the agencies, and that the consultants studies are contrived to provide the result desired by the company, rather than a truly independent and objective engineering evaluation. The agencies are strongly urged to conduct additional study of the appl of paste tech. given its inherent environmental advantages that speak directly to many of the public's concerns. As a final example of questionable info contained in the DEIS in this regard, according to the DEIS (p 2-54), the pipeline system would have to be upgraded to a high pressure pipeline with positive displacement pumps, which is more costly and requires more maint. This pipeline also has a higher risk of rupture. The ASARCO Rk Cr proposal, in a manner that would be standard for almost any tailings impoundment located a significant distance from the mill itself, pumps slurry to the tailings impoundment here it is processed into paste, and returns excess water. This more efficient and practical method of tailings slurry transp. in a pipeline, which if employed at Stillwater, eliminates the concerns cited. (27)

The inclusion of these comments appears to make obvious the DEIS's attempt to arbitrarily reject the paste alternative rather than truly evaluate its potential merits. (27)

Paste tailings technology has recently been recognized by industry as an environmentally advantageous method of tailings disposal. Some recent articles on its application and environmental advantages are attached. It has also recently been proposed for application at the ASARCO Rock Creek Mine near Noxon, MT, due to its inherent advantages in terms of seismic and static stability, water quality, erosion control, and both concurrent and long-term reclamation (see Draft EIS, ASARCO Rock Creek mine, 1998). Similar tailings disposal techniques (filtered tailings) are integral in the recently completed permitting for the Coeur-Alaska Kensington project (see Kensington Solid Waste Management Permit Application, 1997). Both mines are underground mines with similar concerns related to water quality and geotechnical *stability, similar to the Stillwater Mining Complex. An additional similarity is that all three mines also have similar geochemical properties of relatively "clean" ore, which has not prevented alternative tailing disposal methods from being considered necessary at Rock Creek and Kensington. The DEIS (p2-53), in rejecting the paste landfill alternative, states that at SMC paste technology would not provide any substantive reduction in tailings volume, would not provide any substantive environmental benefits, and would not provide any advantages for concurrent reclamation over slurried tailings disposal. The DEIS goes on to say that it would substantially increase SMC's costs to dispose of the tailings. Based on information contradictory to that contained in the DEIS fails to include a cost analysis supporting the figure ($4.5/ton) cited, which is inconsistent with the costs for even cement amended tailings at other locations. (27)*

According to the DEIS, more than 70 percent of SMC's tailings (by weight) is finer than 20 microns, which would lead to a fully saturated paste, with low strength characteristics, that could liquefy under seismic loading conditions. These same conditions would also be true of traditional slimes tailings disposal at the Hertzler Ranch site. However, the percent of fine material is for the slimes portion of the tailings only. According to information contained in the industry news magazine Engineering and Mining Journal, provided by the company, the grind of the whole ore is substantially more coarse than 70 percent passing 20 microns (at 60% minus 200 mesh or 74 microns). If paste technology were used, it would most likely be applied to whole tailings, as contained in the attached articles, which would have approx 30% of tailings (by weight) finer than 20 microns. As a result, if whole tailings were used an formed into paste prior to deposition as mine backfill or in a tailing impoundment, the overall volume of tailings density would be increased from about 70 pounds per cubic foot (pcf) to 90 pcf, increasing the in-place density of the tailings about 22%. The increase in density occurs in paste material because fine solid particles occupy interstitial spaces that would otherwise be occupied by less dense air or water. This results in a total decrease in necessary tailings impoundment capacity of approx 50% (as this would also increase the capacity of underground backfilling with paste tailings as well). Finally, it is widely recognized that paste can be amended, with portland cement, or other binders such as fly ash, to significantly increase its strength and durability. Studies have shown that the strength of paste can be doubled by the addition of little as one percent cement. (27)

The DEIS (p 2-53), in rejecting the paste landfill alternative, states that at SMC paste technology would not provide any substantive reduction in tailings volume, would not provide any substantive environmental benefits, and would not provide any advantages for concurrent reclamation over slurried tailings disposal. The DEIS goes on to say that it would substantially increase SMC's costs to dispose of the tailing. Based on information contradictory to that contained in the DEIS, it is apparent that the real criteria for paste technology's rejection is cost alone. Using paste technology with total tailings may provide substantive reduction in the waste stream. It can be effectively stabilized, which means that Alternative D then becomes and even more viable alternative. In addition, reduction of the waste stream reduces the size of the reclamation job required with Alts B & C (as well as D). The costs of implementation are likely offset by the substantial reductions in future costs for reclamation and bonding, as well as, monitoring, etc. It is not unreasonable to assume that over the projected life span of the project, this technology will become even more economically feasible. It is in everyone's interest to look at application of Best Management Practices *to reduce all negative/irreversible effects associated with the project expansion. I would like to see more substantive analysis of this technology. (28)*

In a similar light, the consideration of paste backfill in the underground mine workings is also clearly biased in that the DEIS states reasons for dropping the technology that are contrary to information contained in the attached literature and produced by Stillwater Mining Company for the East Boulder mine. Paste technology has been successfully used at several mines in Canada, and is widely recognized as an important new technology with wide application throughout the mining industry. According to SMC's 1997 annual report, "The Company is investigating the economics of 'paste backfill,' which would use a mixture of thickened tailings and cement to fill excavated slopes. Paste backfill would improve the structural integrity of the fill and allow for 'underhand cut and fill' mining methods under the paste backfill. Additionally, paste backfill reduces dilution because it reduces the amount of sand from fill that is recycled back into the mill. An engineering study is underway to establish the economics of this program, and results are expected by the end of the first quarter in 1998." As previously discussed, paste tailings backfill would significantly decrease the need for placement of tailings on the surface. By its application elsewhere, the backfill system for paste tailing has convincingly not been shown to be technically infeasible or unreasonably expensive. Combined with surface disposal of paste tailings, application of the technology in combination with the consideration of alternative disposal sites might prove to offer more operationally and environmentally advantageous alternative than have been considered in the DEIS. As an example, the application of paste technology to the tailings, and combined with waste rock as suggested by the attached article, could potentially prove the alternative of storage of all tailings and waste rock in close proximity to the mine site to be the most advantageous alternative. (27)

Response: Based on the public's interest in and comments on paste tailings, the agencies reconsidered in more detail the potential use of whole tailings paste and fine tailings paste in both backfill and landfill situations as alternatives to SMC's current methods of handling tailings. The results of this reevaluation are contained in **Appendix H** and are summarized in **Section 2.5.2**. Essentially, the evaluation determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA. The following reasons form the primary foundation for this conclusion:

- Slurried tailings, fine tailings paste, and whole tailings paste would have average dry densities of 70 pcf, 80 pcf, and 100 pcf, respectively. Thus, 100 pounds of slurried tailings, fine tailings paste, and whole tailings paste would occupy about 1.4 cubic feet, 1.25 cubic feet, and 1 cubic foot, respectively.
- Fine tailings paste probably could not be used as backfill because it would not have the strength necessary for mining operations. Thus, with fine tailings paste, about 58 percent of the tailings would still be used as sand backfill (coarse tailings) in the mine and about 42 percent of the tailings, primarily the slimes, would report to a tailings impoundment for use as fine tailings paste.

- ➢ If whole tailings paste backfill were implemented, about 68 percent of the tailings would be used as paste backfill in place of the current sand system and 32 percent of the would have to report to the surface for disposal. Under SMC's current system, 58 percent of the tailings report as backfill in the mine and 42 percent report as slurried tailings to the tailings impoundment.
- ➢ The volume of fines tailings paste reporting to a surface impoundment would not reduce the size of the impoundment much over that needed for slurried tailings. For example, to store the same volume of tailings as addressed by Alternative B, an impoundment built at Hertzler using fines tailings paste would cover about 150 acres (compared with 163 acres for Alternative B) and would have a final embankment elevation of 5,025 feet (compared to 5,036 feet for Alternative B). There would be less than 5 percent reduction in volume and areal extent using whole tailings paste.
- ➢ Landfilling fine tailings paste would require a single paste plant at the Hertzler under alternatives B and C or at the east side tailings impoundment under Alternative D. SMC's current sand plant would continue to operate at the mine and deposit tailings in the existing impoundment.
- ➢ Whole tailings paste backfill also would probably require that the paste not backfilled into the mine be transported to Hertzler or the east side impoundment sites by truck or conveyor system. Pipeline transport of whole tailings paste to either of these sites would require pumps every 2,000 feet with electrical power lines to each site and several surge ponds along the route. The pipelines would have to be capable of withstanding high pressures and if a pipe were to rupture the pressure could cause more tailings to travel farther than would with slurried tailings. It is predicted that the friction developed along the length of the pipeline could cause the water to separate from the tailings resulting in a stiff material that could plug the pipe increasing the chances of rupture. The tailings could be re-slurried at the mill for transport through a pipeline to the impoundment followed by dewatering to reestablish a paste for disposal at an additional paste plant at the impoundment site. At a minimum, transporting paste by conveyor or truck would substantially increase noise and visual impact, potentially increase impacts to wildlife, and increase the potential for spills, and traffic on Stillwater County Roads 419 and 420. A conveyor would increase surface disturbance and delay reclamation; it may not be possible to build a conveyor where steep slopes constrict the right-of-way without requiring substantial removal of soil material and creating an even steeper slope subject to erosion. Additional land would be disturbed at the Hertzler impoundment site to construct a paste plant there.

- Disturbance at the mine would increase substantially. Whole tailings paste backfill could require the location of as many as 9 to 10 paste plants along the length of the ore body toward East Boulder Mine; fewer plants would be needed if the mine operation expanded primarily downward rather than horizontally down the length of the ore body. SMC would have to construct a 200-foot by 200-foot (0.9 acre) pad at each of the portals where the paste plants would be built. Due to the steep slopes and the need for cut-and-fill construction, disturbance for the pads would encompass much more than one acre (and at least some of the waste rock generated by construction would have to be stored somewhere). The overall slopes on SMC's present system of roads to the upper portals are too steep for loaded cement trucks to negotiate. Each paste plant would require at least 2 truck loads of cement daily. Thus, SMC would have to construct a new system of roads with shallower slopes for the cement trucks. If SMC did construct a new network of roads, it's still questionable if the cement trucks could access the plants during the winter.
- The addition of the paste backfill system would substantially increase the requirements for electrical power. Each plant would require about 1.5 megawatts of power. With the increases in electrical requirements associated with increased production, Montana Power Company's distribution lines supplying the Stillwater Mine and Stillwater Valley could not handle the additional power for the paste plants, even with the upgrades discussed earlier. The power lines probably would have to be completely reconstructed back to Billings before the power for the paste plants could be supplied.

Although the agencies determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA at this time, DEQ and CNF added another mitigation measure for consideration by the decision makers. If one of the action alternatives is selected, this measure states that within 5 years of the ROD issued for this final EIS, DEQ, CNF, and SMC shall reevaluate the technologies and feasibilities for incorporating paste landfill and paste backfill into SMC's operations at the Stillwater Mine.

At the time the tailings paste landfill issue is reevaluated, the seismic stability of the cement-amended paste will require careful analysis. It is likely that with even minimal amounts of cement, the paste would not be subject to liquefaction induced flow failure, but could be subject to slumping and sliding under earthquake loading. Construction of an outer confining zone of high cement content paste is technically feasible, however the costs associated with providing sufficient cement to assure adequate strengths combined with the difficulties in assuring the quality of the paste, would likely outweigh the benefits. It is likely that an earthfill confining berm would be the most technically feasible approach.

The seepage from the paste would be reduced from that associated with slurry disposal of tailings, however a liner for containment will still be required. The risk of seepage from the lined impoundment would be similar for both the slurry and paste alternatives due to the proposed underdrain system included in the slurry liner system. This underdrain would be installed over the liner and would reduce hydrostatic pressures on the liner, limiting the driving pressure causing seepage.

Total tailings backfill would cost approximately $6.32 to $6.43 per ton of backfill (see **Appendix H**). This compares to $3.27 per ton of sand fill currently being used. Cement amended tailings disposal is estimated to cost $$6.77 to $6.88 per ton. These estimates include capital costs for development of the containment basin, paste plant, tailings and return water pipelines, and power lines as well as operating costs. Each additional paste plant would cost $7 to $10 million; however, there would only be 4-5 plants operating at the same time because the mill could not generate enough tailings to supply more plants. The plants would be moved to new sites when needed rather than continually purchasing and constructing new plants.

8. Figure 2-5 shows the design for the embankment of the Hertzler tailings impoundment. The upstream slope, facing the interior of the impoundment will have a slope of 2.5H:1V. The downstream side of the embankment is proposed with a slope of 2H:1V. While a 2H:1V minimizes the area covered by the embankment, revegetation of a 2H:1V slope is generally considered to be problematic. (22)

Response: The use of a shallower angle for the downstream face of the tailings impoundment was considered, but there are tradeoffs for the angles of embankment slopes: a shallower angle would result in a either a proportionally higher embankment or larger footprint (area of disturbance) to provide the same storage capacity. Either of these could result in more rather than less visual impact. The proposed slope angle was selected as a balance between storage capacity, area of disturbance, and height. In addition, a mitigation measure was added to have the impoundment built in such a way to have final reclamation conducted on the lower portions of the embankment slope as it increases in height, allowing vegetation a longer time to become established and be monitored. Bond would not be released until successful revegetation has been established. The agencies also would include monitoring and maintenance monies for this area.

9. The DEIS generally refers to the downstream side of the Hertzler tailings impoundment as having a slope of 2H:1V. However, page 4-5 of the DEIS refers to a final slope of 2.5H:1V. This discrepancy should be corrected or explained. (22)

Response: The reference on Section **4.1.1.2.3** was changed to reflect 2H:1V.

10. SPA believes that the mine should line the water return pipe from an impoundment at the Hertzler ranch with an HDPE sleeve to reduce the risk of leaks from this pipe (pp.4-6-4-8, mitigations at p.4-12). (27)

Response: SMC proposed to construct the pipelines of steel so the system would not need booster pumps (non-steel pipelines would not handle the pressures required to operate the system without booster pumps between the mine and Hertzler Ranch). However, the steel pipelines would not handle the abrasive characteristics of the tailings slurry as well as non-steel pipelines. Thus, SMC proposed the HDPE liner to minimize abrasion and aid in pipe sleeve replacement.

The reclaim water pipeline does not require the HDPE liner because abrasion of the pipeline's interior surfaces is not a concern for water. It's only a concern with the tailings slurry.

11. The DEIS lacks any specifics on cathodic protection from the pipelines. Electrical currents in the vicinity of the mine and potentially generated by the flow of slurry through the pipeline may accelerate corrosion of the steel pipes. The DEIS should address this possibility and develop mitigations to prevent any corrosion (pp 4-6--4 -8,4-12). (27)

... what is the methodology of cathodic protection? Because in DC controlled lines where they're using DC current underground, that affects the pipeline and pits it and it will rust out quickly. (46s)

Response: Although the preliminary engineering on the pipelines suggests an epoxy coating on the pipelines would provide adequate protection, the pipeline's design specifications have not been finalized. Thus, the determination of the need for cathodic protection has not been finalized. SMC will have to submit the final design for the pipelines to DEQ and CNF for approval before construction can begin. Unless SMC can convince DEQ and CNF beyond any doubt that an epoxy coating is adequate and cathodic protection is not really needed, the agencies would require cathodic protection at that time.

12. The DEIS mentions SMC will use the same technology currently being used on Alaskan pipelines to prevent freezing. Please describe the specifics of the Alaskan pipeline technology. (27)

Response: The primary technologies SMC would use involve methods of super insulating the pipelines with a thick wrapping of Styrofoam to ensure their contents do not freeze. Details on the specific method or methods are part of final design specifications and are not analyzed in this EIS.

13. Page 2-21, 2.4.2.2 Tailing Production and Management: What is the 8-inch tailing slurry pipeline schedule (sch 40, sch 80)? is the pipeline flanged and bolted? (32)

Page 2-25, 2.4.2.2 Tailing Production and Management: What is the thickness and expected life of the 8-inch pipeline HDPE liner? (32)

Page 2-29, Monitoring, Pipeline Monitoring and Spill Contingency Plan: Is the 8-inch slurry pipeline continuous, non-flanged or flanged? The statement made suggests that if some non-specified degree of wear is observed in the inspection vault pipe spool HDPE liners, the line (and pipe?) could be removed and replaced between any two vaults. However, most of the pipe is buried and the vaults are approximately two mile apart. If the pipeline were flanged, it is possible that the pipeline sections could be disconnected and rotated to distribute the HDPE liner wear, avoiding liner replacement at least in the short term. The sentence at the end of the 3rd paragraph that reads, "Only a portion of the pipeline at each vault would need to be dug up for the replacement process," appears both incorrect and questionably necessary. (32)

Response: The slurry pipeline would be constructed of wrapped, coated, welded, and seamless steel. The exact size and pipe connection details are part of final design specifications and are not analyzed in this EIS.

The HDPE liner would be a flexible liner that could be removed through access points without digging up the pipeline. As described in **Section 2.4.2.7**, SMC would monitor the HDPE liner's wear from inspection vaults. Before wear threatens the integrity of the liner, SMC would shut down the transport of tailings, flush the pipeline, and extract and replace the HDPE liner between access points. The discussion of this maintenance in **Section 2.4.27** was not fully accurate and has been revised to reflect the discussion above.

14. Page 2-55 (bottom), 2-56 (top): a thicker tailings impoundment liner (100 mil) or a second liner is dismissed due to the contention that the single 60 mil liner, with proper bedding and underdrain, will adequately control seepage to protect ground water. It is stated that the additional costs of a thicker liner, or a second liner, are too great to justify incremental reduction in seepage , however, estimated costs for construction of a thicker liner or a second liner are not presented, nor are corresponding estimates of reduced impoundment seepage with a thicker liner or a second liner. We believe that such information should be presented to better substantiate the reasoning for dismissal of a thicker impoundment liner or a second liner. (32)

Response: A thicker liner (100 mil) was used at the existing tailings impoundment to address local meteorological conditions, not to address concerns about leakage of water out of the impoundment. SMC quickly discovered upon initial construction of the existing tailings impoundment that a thinner liner was to light to handle the high-velocity winds often present at the mine. Essentially, the winds would pick up portions of the liner that were not sufficiently covered. The local winds do not pick up or otherwise disturb the 100-mil liner.

Winds at Hertzler Ranch do not begin to approach the velocities of winds at the mine (Gelhaus 1989 and 1997) because the valley at Hertzler is much wider than at the mine. Thus, the winds would not be funneled over the Hertzler impoundment at high velocities. Calculations of water flows suggest a 60-mil liner provides more than adequate protection of the ground water from inflows of water out of the Hertzler tailings impoundment (Knight Piésold 1996).

Additional narrative was added to the discussion of liners in Section **2.5.2** to describe the relationship of the winds and 100-mil liner at the existing impoundment versus the Hertzler tailings impoundment.

15. Page 2-23, Hertzler Tailing Impoundment: What is the design permeability and total seepage rate (gpm) through the 60-mil thick HDPE liner? Will the selected specifications achieve continuous compliance with the State ground water standard and permit? What is the design thickness of the clay soil material to be bedded under t his liner and the design permeability? What quantity of this 10^{-6} cm/sec permeability fine glacial till material is required? Is there a sufficient quantity of this material on the Hertzler Ranch to meet clay liner design requirements? Is the clay source on the ranch then to be reclaimed? (32)

Response: SMC is planning to use the existing glacial/alluvial till as the base below the HDPE liner, after smoothing and compacting it. It is 50 to 100 feet in thickness. Construction would occur under the supervision of a professional engineer. In the event that the engineer is concerned about coarse-grrained materials, a 12-inch layer of clay-rich soil material would be spread and compacted. The clay soil to be bedded under the liner is to be comprised of the natural glacial till soils which have an average permeability of approximately $1x10^{-5}$ cm/sec, with a range of a $1x10^{-3}$ to less than $1x10^{-7}$ cm/sec. Higher permeability materials would be removed where exposed in the tailings basin and replace with low permeability material, as required. There is no specific minimum thickness for the low permeability material, however the minimum thickness that can be removed and replaced by construction equipment would typically be more than 1 foot. The quantity of material will be defined by actual field conditions as observed during construction. Suitable material can be developed from the embankment borrow areas and would be expected to be a small fraction of the total material required. The borrow areas would be reclaimed.

16. Page 2-25, 2.4.2.2 Tailings Production and Management: What are the tailings reclaim dredge barge "operational procedures" that would ensure the impoundments HDPE liner is not compromised (torn)? (32)

Response: The barges on both the existing impoundment and Hertzler impoundment would be operated using the procedures SMC has been using effectively with the barge on the existing impoundment for years. Essentially, these procedures involve training of all operators and keeping the intake in deep areas so an adequate buffer between the intake and liner is maintained. Nothing in the proposal involves any changes the procedures; therefore, they are not being reviewed for change.

17. Page 4-5, 4.1.1.2.3 Hertzler Ranch: What is the meaning of the first sentence in the 3rd paragraph that states "The use of an HDPE liner on a clay liner, coupled with an overlying seepage collection system would minimize the potential for ground water..."? What does the seepage system overlay? (32)

Response: The overlying seepage collection system consists of underdrain pipes covered with a filter media (6-inch perforated corrugated polyethylene (CPT) pipe spaced a maximum of 300 feet apart in a 1-foot thick layer of sand) to allow drainage of water collecting on top of the HDPE liner. This reduces the hydraulic pressure acting to force water through the HDPE and clay liner, which reduces the potential for sufficient seepage through the liner and into ground water. Please see **Section 2.4.2.2** to review this information.

18. Also I find no mention on the inboard slope's for the dam, of the water impoundment. I build many stock, fish, and diversion fills of soil, all had to have 3 to 1 slope on the inboard or water side. (39)

Response: The saddle dams for the LAD water impoundment at Hertzler would be constructed similarly to the Hertzler tailings impoundment. Thus, the inboard face of the dams would have a 2.5 to 1 slope.

19. The DEIS states that a high pressure pipeline would be necessary to pump paste from the mine site to a disposal site. In contrast, the Rock Creek EIS states that tailings would be slurried to the disposal site and made into paste there. (40)

Response: A high pressure pipeline would be needed if paste could be transported via pipeline. However, a lower pressure would exist if the tailings are transported to the tailings impoundment as a slurry and then converted to paste. Then, the high pressure pipeline would exist only between the paste plant near the impoundment and the impoundment. Please refer to **Section 2.5** to review a revised discussion about paste landfill and backfill alternatives.

20. Reclamation of mine facilities should be further described in the final EIS. Irrigation of the LAD areas which will "...maintain saturation within the soil" (p. 4-6) may produce a vegetation mix which will not survive when LAD eventually stops. Revegetating these areas with native plants should be required. In addition, the slopes of both the tailings facility and waste rock dump should be shallow enough for long-term reclamation to be possible, including minimizing the potential for future erosion from storm events. The steep slopes proposed (2:1 to 3:1) may not support long-term reclamation. These slopes should be decreased to at least 3:1. (40)

Response: Operation of the LAD system at Hertzler and Stratton will change species composition from both the increase in water as well as nitrates in the water. The agencies expect the plant communities would become dominated by water-tolerant species over the years in spite of SMC's attempts to seed to a diverse mix of more native species for wildlife at the request of the agencies. Species such as Garrison creeping foxtail, smooth bromegrass, timothy, and other improved introduced forage grasses would dominate over time, even though they would not be planted.

After closure of the LAD system, native species would not reinvade these sites dominated by these aggressive introduced species. Some native species may reinvade in small quantities, but they would never become dominant. This is an unavoidable effect of the operation of the water management system to control water pollution to the Stillwater River. These abandoned LAD sites would still have some forage value for wildlife as is documented by various unirrigated improved pastureland in the area today. The post-mine land user may continue irrigation of the sites. The loss of native forage in exchange for introduced forage on the LAD areas should not have a substantial effect on the winter mule deer herd that uses the area. The agencies do not feel that a mitigation is required to destroy the introduced community at closure and replant the site to natives.

Seed mixes used at current operations and proposed for use under this proposal do involve native plant species. The vegetative composition under each LADs pivot at closure and reclamation would be evaluated. If necessary, SMC would reseed or interseed to the areas under the LAD pivots to ensure the areas achieve vegetative cover suitable for the post-mining land uses. Because SMC owns these lands, it would determine the post-mining uses for the Hertzler and Stratton ranches.

The use of a shallower angle for the downstream face of the tailings impoundment was considered, but there are tradeoffs for the angles of embankment slopes: a shallower angle would result in a either a proportionally higher embankment or larger footprint (area of disturbance) to provide the same storage capacity. Either of these could result in more rather than less visual impact. The proposed slope angle was selected as a balance between storage capacity, area of disturbance, and height. In addition, a mitigation measure was added to have the impoundment built in such a way to have final reclamation conducted on the lower portions of the embankment slope as it increases in height, allowing vegetation a longer time to become established and be monitored.

21. There is little substantiation for the excessive costs cited in the DEIS. Apparently SMC has reported in its 1997 Annual Report that the company was studying the costs of paste tailings. The results of this study should be included in the final EIS. (40)

Response: Paste tailings (both backfill and landfill) were reconsidered along with SMC's proposal for an experimental paste plant. However, the overall result of this reevaluation was the same. Paste landfill, paste backfill, or a combination of the two (fines tailings paste or whole tailings paste) are not reasonable alternatives for the existing Stillwater Mine operation (please see the explanation for comment 7 under **Section B.9** of this appendix). The discussion in **Section 2.5.2** has been expanded to more thoroughly describe the analysis' conclusions.

A full description of SMC's experimental paste plant and its goals for the testing was added to Chapter 2. Please refer to **Section 2.4.1.2.1** to review this description. A discussion of costs and assumptions have been provided in **Appendix H**. Total tailings backfill would cost approximately \$ 6.32 to \$6.43 per ton of backfill. This compares to \$3.27 per ton of sand fill currently being used. Cement amended tailings disposal is estimated to cost \$6.77 to \$6.88 per ton. These estimates include capital costs for development of the containment basin, paste plant, tailings and return water pipelines, and power lines as well as operating costs.

In addition, DEQ and CNF added another mitigation measure for consideration by the decision makers. This measure states that within 5 years of the ROD issued for this final EIS, DEQ, CNF, and SMC shall reevaluate the technologies and feasibilities for incorporating paste landfill and paste backfill into SMC's operations at the Stillwater Mine.

22. *... there was really nothing concrete on the design and construction of the pipeline. I mean, no specifics on how it's going to be constructed. One question I have, and the people I have consulted, it seems that booster pumps would be almost mandatory on a line of this length, considering it's pumping slurry on a fairly level gradient downgrade. And if so, how often will they be located, what noise pollution should we expect from those? (46s)*

... they discussed the line going to the Hertzler on Alternative B.... How deep will the line be buried? .. how many pumping stations,...would be in the circle between the Nye mine and the Hertzler property? The one concern that I have is, will they be buried below the ground? Will they (pumping stations) be soundproofed? And this was not addressed as far as noise was concerned. It was address as far as the Hertzler location, but as far as pumping, it was not addressed. (47s)

... they discussed the line going to the Hertzler on Alternative B.... How deep will the line be buried? .. how many pumping stations,...would be in the circle between the Nye mine and the Hertzler property? The one concern that I have is, will they be buried below the ground? (47s)

Response: SMC would construct the pipelines using standard, widely-accepted techniques. By using steel pipe that will support high pressures in its construction of the tailings pipeline, SMC eliminated the need for one or more booster pump stations along the pipeline's route. Thus, no booster pump stations would be built between the tailings pumping facility at the mine and the terminal station at the Hertzler impoundment.

As discussed in **Section 2.4.2.2**, the pipelines would be buried about 5 feet deep, including under all streambed, drainage crossings, and the West Fork of the Stillwater River.

23. *Someplace in here, I saw it addressed how close the pipeline would be to the road. But for a considerable distance through that areas, it's within 40 feet of the river, even if you put it on the other side of the road. So that, I think has not been really addressed as far as pipeline break and pollution. Now, we did hit, in the EIS, somewhat on, you know, the shutoff stuff on the pipeline. But I don't think that's been addressed in the EIS nearly as much as it should, in my opinion. (47s)*

Response: Overall, the pipelines would be installed within 5 to 10 feet of the roads within the previously disturbed portions of the rights-of-way or beneath the roadbed where the right-of-way is constrained by steep slopes. The system SMC proposes for monitoring the pipelines for leaks is discussed in **Section 2.4.2.7**. As discussed there, the leak detection system would be automated. Thus, as soon as one or more of the system's pressure sensors detects a rapid drop in pressure or one or more of the moisture sensors detect moisture between the HDPE liner and the steel pipe, the system would sound an alarm and shutdown the pumps.

B.10 Reclamation

Fifteen respondents (7 local, 4 regional, and 4 national) commented on the analysis of reclamation. Concerns included reclamation of the LADs, control of noxious plants, bonding of the new facilities, and species used in seed mixes.

B.10.1 General

1. *Will topsoil of the gravel pit and its wall be required? What will be the source of the topsoil; and if in storage for many years, what will be its quality? What amendments will it require to restore its fertility and tilth? (9)*

The ranch's two LAD sites lie on an abandoned open pit gravel operation. While the floor of the gravel pit will be more visually acceptable following revegetation, how will the walls of the pit be treated? Will they be graded? What is the anticipated success of revegetating the pit walls? How much of the pit is visible from the county road? How far below the road grade is the pit floor? How much water does this pit retain? How does it drain? Figures 4-3a to 4-3c (p 4-47) from site KOP 2 were of no help in assessing what the Stratton Ranch gavel pit will look like from the road. (9)

Response: The reclamation guidelines for the gravel pit are not part of this analysis nor part of DEQ and CNF's decision on this analysis. The gravel pit on the Stratton Ranch is actually more of an excavated depression as opposed to a pit with defined pit walls. It is being reclaimed in accordance with the open cut permit issued by DEQ for the gravel pit (permit #00549). The disturbed will be graded to 3:1 or flatter and must blend in with the surrounding topography. The regraded area will be topsoiled with 6 inches of soil and revegetated with a seed mix of green needle grass, crested wheatgrass and western wheatgrass. The post mining land use specified in the permit is recreation, residential development with some wildlife and livestock grazing.

2. 4.2.3 (p 4-20). Once the LAD systems shut down with mine closure, the drawing card of a more palatable and nutritious forage will disappear. What effect will this have on foraging wildlife species? How long will the return of native plant species to dominance take? (9)

Response: Years of research at several Agricultural and Range Experiment Stations in the western United States and Canada have documented changes in species composition from irrigation and fertilization of native rangeland. Operation of the LAD system at Hertzler and Stratton will change species composition from both the increase in water as well as nitrates in the water. The agencies expect the plant communities would become dominated by water-tolerant species over the years in spite of SMC's attempts to seed to a diverse mix of more native species for wildlife at the request of the agencies. Species such as Garrison creeping foxtail, smooth bromegrass, timothy, and other improved introduced forage grasses would dominate over time, even though they would not be planted.

After closure of the LAD system, native species would not reinvade these sites dominated by these aggressive introduced species. Some native species may reinvade in small quantities, but they would never become dominant. This is an unavoidable effect of the operation of the water management system to control water pollution to the Stillwater River. These abandoned LAD sites would still have some forage value for wildlife as is documented by various unirrigated improved pastureland in the area today. The post-mine land user may continue irrigation of the sites. The loss of native forage in exchange for introduced forage on the LAD areas should not have a substantial effect on the winter mule deer herd that uses the area. The agencies do not feel that a mitigation is required to destroy the introduced community at closure and replant the site to natives.

3. Several Alopesurus spp. are non-native. Is it the intention of SMC to introduce non-native species? (9)

Response: Garrison creeping foxtail is not native and was proposed by SMC and has been used at the Stillwater Mine on the existing LADs because of its nitrate and water use characteristics. SMC is not proposing any species of plants that are not already in use in other parts of the Stillwater valley. The agencies have added a mitigation to revise the seed mix to all natives. However, this will not prevent the non-native species from becoming introduced over the life of the proposed LAD operations. This will be an unavoidable effect for the use of irrigation and fertilization on the site.

4. 2.4.1.8 (p 2-14). Final reclamation lasts how long? What workforce will this require? How long is SMC committed to insure successful reclamation? (9)

Pages S-21, 2-24, and 3-60: The seed mixture for reclamation with the names of the seeds to be used at the different sites should be included in the EIS and should not include any nonnative plant species. Other than saying that creeping meadow foxtail will not be used, the seed mixture is not explained. The disturbed areas should be restored to native vegetation if possible. Many introduced nonnative plants have become invaders and noxious weeds on public lands. (33)

SPA supports the use of native vegetation for reclamation and contouring to restore it as much as possible and to minimize visual impacts during and after use of the tailings impoundment. Revegetation should achieve equal or greater productivity than that of the current rangeland, and no fertilizers should be required to maintain the productivity of the revegetated area. (27)

Response: Final reclamation can take more than ten years to complete because the tailings impoundments need to dry out over time. The workforce required would be minimal compared to the operational workforce and a large portion of the work would be completed by subcontractors. SMC is committed to successful reclamation until the final bond is released. Water treatment bonding may take a lot longer than the actual reclamation and revegetation activities at the site. The agencies would hold the bond until a determination is made that SMC has completed the work as per the plan and no state or federal regulations are being violated.

The agencies realize that reclamation information in the EIS is very general or nonspecific, but the reclamation experience at the mine site to date has been very encouraging. SMC has proven it can reclaim disturbances adequately. SMC has voluntarily completed as much of the reclamation on the historic chrome tailings that have blown around in the Stillwater Valley for decades. The reclamation success onsite using the established methods has eliminated the concern over the efficiency of the proposed reclamation. SMC is using standard reclamation and revegetation techniques that have been developed over 25 years of reclamation experience at mine sites in the western United States. The existing reclamation plan for the mine, which was approved in 1993, is 82 pages long and contains information on slope angles, figures, seed mixes, etc. The reclamation plan was developed over ten years of mining and reclamation experience at the site and the existing plan was analyzed specifically in the 2,000 tpd EIS for the site. The reclamation plan is supported by stability, surface hydrology, limnological, and other studies that define the concerns and risks, collect the necessary data, conduct the necessary analyses, and make the necessary recommendations to determine reclamation needs. Standards and objectives are clearly stated in terms of specific slope angles and vegetation criteria specific to all affected areas and are bonded accordingly in the existing reclamation plan. The action alternatives, if selected, would be bonded accordingly. The agencies opted to limit the EIS to dealing with limited information on reclamation details because of the EIS completed on the 2,000 tpd expansion that specifically addressed reclamation plan updates.

The seed mixes to be used are the same as those developed on the site over the last ten years of reclamation experience and are listed in the 1993 reclamation plan. The seed mixes are largely native species. The only non-native species include annual ryegrass (*Lolium multiflorum*), an annual species used for quick cover until the perennial species become established and white dutch clover (*Trifolium repens*), a legume used in seed mixes because of its nitrogen-fixing ability and wildlife use. One other optional forb that could be used is Rocky Mountain penstemon (*Penstemon strictus*), which is a native forb, but it is not native in the Stillwater Valley. The agencies can eliminate these species at any time, if they show any aggressive tendencies. The agencies are trying to find native forbs that have competitive abilities to reduce competition from spotted knapweed and other noxious weeds in the area. Some of the legumes commonly used, such as alfalfa, white dutch clover, and yellow sweetclover, can tap the same ecological niche as spotted knapweed, providing an alternative species with some forage value for wildlife and livestock.

The disturbed areas would be seeded to native species. The agencies have concluded the LAD areas would not stay native over a 30-year span of irrigation and fertilization. The agencies expect the LAD sites to become dominated by species such as Garrison creeping foxtail, smooth bromegrass, and timothy. This is an unavoidable effect of the LAD process to dispose of water from the mine. These species already exist in the valley. They could spread onto other irrigated or sub-irrigated areas.

The agencies agree with SPA's objectives listed in the comment. The agencies feel that reclamation to date on the mine site has achieved productivity equaling or exceeding native rangeland. The agencies agree that no fertilizers should be used to maintain the productivity of the revegetated sites. DEQ would gladly take the SPA on a tour of the reclaimed sites at the Stillwater Mine to review the reclamation plan and solicit their input into reclamation plan changes that might be needed.

5. There is no explicit definition or engineering description of how to determine when mining disturbance will cease or has ceased in an area. So, how does one determine reclamation should commence? If the mine decides to substantially reduce or suspend *production due to economic conditions in the world-wide market and/or lack of financial strength, could reclamation be extended indefinitely? (11)*

There is no revegetation standard proposed in the DEIS. Without a revegetation standard the regulator does not have any firm guidelines to apply in judging whether revegetation has been successful, and the mine operator is completely subject to the discretion of the inspector when the time comes for final release of the reclamation bond. (22)

Information on reclamation contained in the DEIS is very general and non-specific, and does not allow for meaningful assessment of the efficacy of the proposed reclamation. The DEIS should contain specific and substantive information on reclamation plans for all areas. The DEIS should be supported by stability, surface hydrology, limnologic, and other studies that define the concerns or risks, collect the necessary data, conduct the necessary analyses, and make the necessary recommendations to determine reclamation needs. Standards and objectives should be clearly stated, in terms of specific slope angles and vegetation criteria specific to all affected areas. (27, 28)

Response: The Rules and Regulations Governing the Metal Mine Reclamation Act, section 17.24.150, specifically address what the mining company must do to verify a legitimate temporary cessation. The mining company could argue to extend reclamation indefinitely, as long as it did interim reclamation and maintenance measures, such as controlling noxious weeds, controlling erosion, managing water resources, etc. However, the Forest Service under its CFR regulations also can address the issue (36 CFR 228, Subpart A). The agencies are currently requiring final reclamation at two mines in Montana. One started to seal the surface rights to its holdings, which DEQ argued was a decision to never reopen the mine. The other property has been for sale and the Forest Service under the CFR regulations is forcing closure after numerous attempts at sales have failed. The bottom line is that the agencies would insist on interim reclamation and maintenance, and if that is not done, an order to reclaim would be issued.

The revegetation standard used by the agencies is "comparable stability and utility" as cited in the Metal Mine Reclamation Act. The agencies look at the proposed reclamation areas ready for bond release. They look for evidence of active erosion as well as potential for mass wasting. They compare the vegetation on the site with adjoining areas and decide whether it meets the proposed post-mine land use goals for cover, productivity, erosion control, noxious weed control, etc. The agencies also consider the issue of geotechnical stability. The water quality data are reviewed to identify water quality changes over time, which may indicate a problem with geotechnical stability. The agencies also have data on file for the ore and waste rock at the mine to identify potential geochemical problems over time. The agencies feel that a site-specific revegetation standard is not needed on this site because of the reclamation success to date as well as the inert nature of the ore, waste rock, and tailings. On a site with potential long-term geochemical problems, like the New World deposit, the agencies were developing site-specific standards to address the concerns. Before any bond release is approved, the agencies must publish the bond release request in the newspapers. The public at that time has the opportunity to review the inspector's recommendations for bond release. The landowner also is contacted to ensure he agrees that the reclamation meets his post-mine land use objectives.

6. It is unclear if Land Application Disposal (LAD) areas will be reclaimed. Reclamation of LAD areas should be a requirement.... All re-seeding mixtures should be with plants that are appealing for consumption by wildlife and domestic animals. (11)

Response: The LAD areas do not need reclamation. They would be seeded if the proposed expansion is approved, as soon as LAD is needed to a native seed mix using plants that are native and species that use water and nitrates effectively. There would be no redisturbance at closure.

7. Does reclamation include the removal of unsightly and dangerous high voltage power lines? If not, why isn't this included in the measures to mitigate long-term disturbances created by mining activities? (11) (see 1200-27)

Response: The fate of the power lines at the time the mine closes would depend upon the users connected to them. Segments that involve only the mine would be removed and any disturbances would be reclaimed. However, segments providing service to other users in the Stillwater River valley would remain in place.

8. This is hard rock tailing. Is it radioactive? Fill at the deposit sites will be 50 to 75 feet deep. What will be used to prevent wind erosion and wind transport of materials off site when the site is used up? (12)

Response: Neither the waste rock materials nor tailings materials have shown any radioactivity. Upon their closure, the storage facilities would be covered with growth medium and seeded. The resulting vegetative cover would protect materials from erosion via wind and water.

9. 2.4 Alternatives Descriptions (Alternative B) pp2-32 Following closure of the Hertzler tailings impoundment, SMC states that the pipelines would remain buried in the ground. Why? If SMC put the pipelines in for their convenience, they should be required to remove them as part of the reclamation effort. In the future the pipelines could only become a source of nuisance to any future construction projects if they were required to be disturbed, and could even be a source of danger or the conduit by which contamination could spread. I would point out, that at completion of the project, SMC will no longer monitor the buried pipelines. Why does SMC think it is acceptable to leave the pipeline in the ground? (13)

Response: It is standard practice to abandon pipelines in place. Nevertheless, SMC would have to negotiate this with Stillwater County because the pipelines would be in the County's right-of-way. Digging up a pipeline to remove it causes unnecessary disturbance to surface resources.

Before SMC could abandon the pipelines in place, they would have to clean and flush the pipelines so no contaniments are left in the pipeline. SMC would flush the pipelines with sufficient quantities of water to remove all traces of the tailings, which would be verified by sampling and testing of the water as its being flushed. Materials flushed from the pipelines would be deposited in the tailings impoundment. The ends of the pipelines would be capped or crushed to prevent further transport of water.

10. Details on bonding to ensure reclamation should be included in the EIS. Reclamation plans should be detailed. (14)

Response: Bonding is a mandated function of the agencies and the procedures are proscribed by regulations of both the State (82-4-328 MCA) and the Forest Service. Bonds must be in an amount not less than $200 nor more than $2,500 per acre disturbed. Despite these limits; however, the bond must not be less than the estimated cost to the State of reclaiming the disturbed lands. The bond would not be released until the State and CNF determine that reclamation has been successfully completed. The Forest Service may require additional bonding if it feels the bond held by the State is not adequate for reclamation of National Forest System lands or available for Forest Service requirements.

Public comments are helpful in identifying the elements that must be included in the bonding process, but the bonding process is conducted solely by the agencies. SMC has provided the agencies an estimate of reclamation costs for each of the previous permit modifications and would do the same for the action alternative selected by the agencies. The agencies would then determine if that estimate is valid and appropriate. The reclamation costs would include any long-term monitoring and maintenance activities. Then the bond amount would be established. The bonding agreement typically includes contingencies for temporary shut-downs and for early closure.

Before any bond is released, the agencies must advertise in the local newspapers. The public again has the opportunity to review the agencies' decision before any bond is released. The agencies also check with the landowner or landowners to see if their land use plans have been met.

The agencies' determination on the inclusion of detailed reclamation plans is explained in the response to Reclamation comment number B.10.1.4 above.

11. An advantage of the Hertzler site is that there is plenty of room to construct the tailings facility. The long term appearance of the reclaimed tailings facility will be important to the residents of the valley long after the mine is closed. Since there are no *real space restrictions for constructing a waste storage facility, as there are with the tailings storage sites near the mine, the slope of the embankment at the Hertzler site should be designed to minimize the visual impact of the tailings facility after reclamation is complete. A shallower slope angle of the downstream face of the impoundment will also maximize the probability of successfully revegetating the slopes. (22)*

Figure 2-5 shows the design for the embankment of the Hertzler tailings impoundment. The upstream slope, facing the interior of the impoundment will have a slope of 2.5H:1V. The downstream side of the embankment is proposed with a slope of 2H:1V. While a 2H:1V minimizes the area covered by the embankment, revegetation of a 2.5H :1V slope is generally considered to be problematic. (22)

More definition of reclamation needs to be offered, especially for the land application systems (pp, 4-17-4-11). When operations stop and the LAD systems stop supplying water and nutrients, the currently employed vegetation will die, leaving an opportunity for noxious weeds to flourish. In addition, SPA believes that supporting evidence should be supplied to demonstrate that the slopes and borrow material intended for the impoundments will allow successful, long-term reclamation. SPA believes that shallower slopes would allow for more successful reclamation and is skeptical of the suitability of the borrow material as a soil replacement. Please see Mr. Kuipers' comments for more information. (27)

A 3H:1V slope for the downstream face would be optimal, instead of the 2H:1V proposed in the DEIS. (22)

Response: The use of a shallower angle for the downstream face of the tailings impoundment was considered, but there are tradeoffs for the angles of embankment slopes: a shallower angle would result in a either a proportionally higher embankment or larger footprint (area of disturbance) to provide the same storage capacity. Either of these could result in more rather than less visual impact. The proposed slope angle was selected as a balance between storage capacity, area of disturbance, and height. In addition, a mitigation measure was added to have the impoundment built in such a way to have final reclamation conducted on the lower portions of the embankment slope as it increases in height, allowing vegetation a longer time to become established and be monitored. Bond would not be released until successful revegetation has been established. The agencies also would include monitoring and maintenance monies for this area.

The agencies are very aware of reclamation problems on 2:1 slopes. The reclamation plan approved for the existing tailings impoundment was analyzed in the 2,000 tpd EIS. The plan for the Hertzler embankment is essentially the same. The plan on page 3–23 of the application calls for a mosaic of soil and rock to be established on the final reclaimed surface. This is shown in the visual simulations in Chapter 4 of the EIS. This visual mosaic also limits the slope length for soil before a rock mosaic is encountered to less than 150 feet. This significantly reduces erosion potential on the reclaimed surface. The agencies also have mitigated the proposed plan by requiring the Stage 1 embankment to be completed in Stage 1 to final size instead of waiting to Stage 2 and redoing a slope that has been reclaimed in the interim. Any problems in reclamation of the Stage 1 embankment can be modified by applying section 82-4-337 of the Metal Mine Reclamation Act, which allows DEQ to change the reclamation plan at any time if environmental problems are found in the field.

The agencies believe the LAD areas do not need reclamation at closure. They are planted now and would be replanted at inception of LAD activities. Please see the responses to comments 4 and 6 in **Section B.10.1** of this appendix for more detail on the LAD reclamation question. The agencies do not necessarily agree that the LAD area vegetation will die after cessation of the LAD system. The post-mine land use may be to continue irrigation of the areas. Even if the post-mine land use does not call for supplemental irrigation, the vegetation will not die necessarily, but may be reduced to what the normal precipitation can support. Many abandoned irrigated hay meadows exist across the state of Montana. The vegetation community certainly shifts in dominance and production drops, but this does not necessarily mean that the site is in need of reclamation. The agencies would have at least several years to watch the change in the plant community after closure. SMC would still have to use the LAD areas to help dry out the impoundment at closure. If an environmental problem existed at final closure and bond release time, the agencies could impose the Metal Mine Reclamation Act section 82-4-337 to ensure the reclamation is completed.

The agencies do not agree with the contention that the borrow materials will not support reclamation. Much of the reclamation completed to date at the Stillwater Mine site has been completed with a mixture of soil, Tunnel Boring Machine (TBM) wastes, waste rock, and alluvial and glacial borrow materials. The agencies have modified the reclamation plan to reclaim Stage 1 embankment immediately. This would allow soil replacement and mosaic construction in the early stage of impoundment construction. The agencies are convinced that a surface lift of soil will be available to reclaim the embankment face so that borrow materials would not have to be used for surface soils. The agencies may require segregation of soils in the final design of the impoundment to separate soils with a large rock fragment content (35 to 50 percent rock by volume) for use on these steep embankment slopes. However, the soil and rock mosaic mitigation added to Section 2.4.5 limits the need for this mitigation, but the agencies would review the need as soils are stripped in the area, if a proposed action alternative is selected.

The agencies do not agree that 3:1 slopes are optimal for the downstream face; a combination of slopes may be the most appropriate. However, the applicant has proposed 2:1 and the agencies has evaluated the potential reclaimability and believe that it can be done successfully as proposed. If any problems arise on implementation, the agencies can require a modification of the proposed and mitigated reclamation plan.

12. In the DEIS it is proposed that "A minimum of 12 inches of growth media (soil, soil substitute, or both) would be placed on the outer surface of the embankment and revegetated with an approved seed mix." (DEIS, p 2-31) However, 24 inches of soil or soil substitute are proposed to cover the tailings surface. (DEIS, p 2-32) The sloping face of the embankment will be more prone to erosion than will the level surface of the impoundment. It would be better to place the same, thicker layers of soil on embankment face as is proposed for the surface of the impoundment. (22)

Response: The agencies understand the concern of the commenter but have to disagree with the conclusions. The agencies have evaluated the reclamation from the return to "comparable stability and utility" basis. The native soils in the area today are thicker in swales and level areas and thinner on slopes. The agencies have altered SMC's proposed plan to reflect this natural soils pattern with thinner soils on the slopes and more soil on the surface. In addition, the agencies have asked for the mosaic pattern of rock and soil on the slopes to limit the potential for erosion on the slopes. The agencies do not want to waste a soil resource.

B.10.2 Bonding

1. With Alternative B, the total disturbance area increases more than 2 ½ fold. Does this imply the reclamation bond would increase approximately 2 ½ times current bonding if Alternative B were approve? Even if this were to be true, it appears as though the total bond would be just a pittance... (11)

Some calculations using the volume, yield and price of platinum indicated that the value of the platinum asset alone exceeds 10 billion dollars. Since this not the only product of the mining process, the value of the total assets is somewhat higher. For the sake of illustration, this would put the current bonding level of 3.174 million dollars at 0.03% of the asset value. One question would be how this might compare to other operations and bonding. Clearly, however, the current level and reasonable levels applied in the future are not an onerous burden in relation to the value of the asset. Additionally, waste rock sites represent a reservoir for leaching of chemicals and minerals into water bodies. Dealing with these potential sites should be included in reclamation and bonding policies. (28)

Response: The general answer to this question is yes. Bonding is based on a dollar per acre figure calculated to be able to reclaim that acre. As the amount of disturbed acreage increases, the bond increases. The value of the minerals is not a consideration in calculations of bonds.

The agencies have not identified any chemicals of concern leaching from the water rock or tailings to date. Sampling of tailings and waste rock will continue throughout the life of the mine to identify any potential problems.

2. Under Chapter 2.0 (2 .4.2.7) Monitoring: "the sampling program would continue for the life of the mine: (we would like to know who will be responsible after that time?) and is followed by "would be expanded to include any new storage sites." How many more storage sites are we looking at and which locations is this referring to? Would there be more studies, public hearings, an environmental impact statement? We would like an answer to these questions, please. (21)

Response: SMC is responsible for monitoring until DEQ and CNF have determined reclamation of the mine's facilities and disturbances meets the standards established in the Reclamation Plan. At that time DEQ and CNF would return any bond funds remaining and terminate operating permit #000118. At that time, all activities, including monitoring, at the mine would end. The bond includes the cost of monitoring in case the mine closes and the company leaves.

No additional storage sites have been identified. However, the need for additional sites 20 to 30 years from now cannot be discounted. If the need arises in the future, those changes would require additional MEPA/NEPA analyses and opportunities for public involvement and disclosure.

3. The EIS has made no analysis of the increased bond that will be required from the expanded operation. It is common for EIS's for mines to quantify reclamation/bonding costs by analyzing, on a year-by-year basis, the reclamation items to be accomplished and the cost associated with each item. This is typically done by constructing a table that lists reclamation/bond items in the rows, and the yearly costs in the columns. By performing this analysis the regulatory agencies document what the expected reclamation/bond costs will be. This also usually allows the mine operator to adjust the bond amount in escrow on a year-by-year basis, minimizing the bond outlay for the operator. In addition to reclamation bond outlay, there should be a bond provision for both Long Term Monitoring and Maintenance (LTMM), and Water Treatment. LTMM includes surface and ground water monitoring, after closure of the mine, and repairs necessary to maintain the tailings dams and slopes of the waste rock piles that will be there in perpetuity. Water treatment, if it is projected to be required after closure of the mine, must also have a long term fun ding source. The costs of LTMM and long term water treatment should not be borne by the public. (22)

I believe that the bonding is inadequate. To protect the state and the local citizens bonding must be too much rather than insufficient. (25)

Bonding requirements are entirely undefined in the DEIS. We would like to see bonding amounts available for review before the final EIS is published, and we believe that a realistic approach would include bonding for contingencies, including assumptions that operations may not continue under current management and that the Stillwater Mine might, in response to market or other factors, abandon operations earlier than planned. (27)

The DEIS (p 2-33) does not contain an estimate for the increased bond that would be required for the company proposed action or other alternatives. The bond, according to *the DEIS, includes costs for long-term maintenance of water treatment facilities, such as percolation ponds and diversion ditches (which are not water treatment but water discharge facilities: earth movement and soil placement; seedbed preparation; and revegetation. The bond should also include costs for long-term maintenance and operation of water treatment facilities including advanced wastewater treatment for nutrients until they are no longer significant. The cost of demolition of buildings and other facilities, including the underground pipeline, will likely be greater for the proposed action. Similarly, the area of disturbance will be significantly greater for the proposed action, with correspondingly increased reclamation costs. It is recommended that a detailed reclamation schedule, along with detailed reclamation costs, and the basis for such costs, be provided in the EIS, to justify any assumption made by the agencies with response to bonding. This should also include a detailed cost estimate for long-term operation and maintenance of wastewater treatment and discharge facilities. To not provide this information is inconsistent with other EIS processes being undertaken by DEQ at other similar mining operations, particularly the ASARCO Rock Creek and Golden Sunlight Mines. (27)*

The DEIS (p 2-33) does not contain an estimate for the increase bond that would be required for the company proposed action or other alternatives. A detailed reclamation schedule, along with detailed reclamation costs, and the basis for such costs, should be provided in the EIS, to justify any assumption made by the agencies with respect to bonding. This should also include a detailed cost estimate for long-term operation and maintenance of wastewater treatment and discharge facilities. To not provide this information is inconsistent with other EIS processes being undertaken by DEQ at other similar mining operations, particularly the ASARCO Rock Creek and Golden Sunlight Mines. (28)

Page 2-33, 2.4.2.9 Bonding: Does the bond include contingency funding (design, engineering, agency oversight, contractor overhead, capital and operating costs) for water quality correction/improvement of possible contaminated ground water degradation to Stillwater River water quality? EPA suggests, as an alternative to the present design, that it could prove prudent and cost-effective to address and correct potential ground water and subsequent surface water quality problems sooner rather than later. (32)

Bonding amounts are not specified and reclamation is clearly outlined only for the slopes of the impoundment, not for the LAD areas, pipelines or other areas affected by the expanded operation. (43)

...In the current draft, on page 2-33, it doesn't contain an estimate for the increased bond that would be required for the proposed actions or alternatives. A detailed reclamation schedule, along with detailed reclamation costs and the basis for such costs, should be provided to justify any assumption made by the agency with respect to bonding. (46s)

Response: Bonding is a mandated function of the agencies and the procedures are proscribed by regulations of both the State (82-4-328 MCA) and the Forest Service. Bonds must be in an amount not less than $200 nor more than $2,500 per acre disturbed. Despite these limits however, the bond must not be less than the estimated cost to the State of reclaiming the disturbed lands. The bond would not be released until the State and the Forest Service determine that reclamation has been successfully completed. The Forest Service may require additional bonding if it feels the bond held by the State is not adequate for reclamation of National Forest System lands or available for Forest Service requirements.

Bonds are calculated once an alternative is selected and approved. However, estimated ranges of total bond for the mine have been provided for the action alternatives in Chapter 2. They range from $11 to $13 million for Alternative B, from $10 to $12 million for Alternative C, and $5 to $7 million for Alternative D. If long term water treatment was required and additional $9 to $12 million would be needed for each alternative. These numbers are only rough estimates; the actual amount of the bond will depend upon final facility designs and reclamation plan details. Detailed bonds were not provided in the Rock Creek and Golden Sunlight mines EISs, only preliminary estimates were provided.

Public comments are helpful in identifying the elements that must be included in the bonding process, but the bonding process is conducted solely by the agencies. SMC has provided the agencies an estimate of reclamation costs for each of the previous permit modifications and would do the same for the proposed action. The agencies would then determine if that estimate is valid and appropriate. If, however, another alternative is selected, then SMC would have to recalculate the reclamation costs. The reclamation costs would include any long-term monitoring and maintenance. Then the bond amount would be established. The bonding agreement typically includes contingencies for temporary shut-downs and for early closure.

LAD areas do not need reclamation at closure (see responses to comments 6 and 11 in **Section B.10.1** of this appendix). Additionally, disturbances associated with the construction of pipelines are reclaimed immediately after construction and the pipelines remain in place at closure. Consequently, bonds would not be required for either of these facilities.

B.10.3 Noxious Weeds

1. The soil and surface areas which are disturbed will become very receptive to proliferation of weeds unless specific control measures are taken concurrent with development and operation. Although the draft EIS contains a description of noxious weeds (pp 3-60, 63), there are no protective measure specific for spraying affected surface areas and cleaning the heavy machinery/equipment which are employed. The eradication of all noxious weeds should be a requirement throughout all phases of the project. (11)

Revegetation should include efforts to prevent the spread of noxious weeds. (27)

Response: Revegetation is, by itself, considered a method of combating the spread of noxious weeds. As part of the revegetation monitoring that SMC would conduct during operations and following closure, any areas where noxious weeds begin to invade would be treated to minimize infestations of weeds.

The previous environmental documents include measures to combat the spread of noxious weeds, and the agencies would require those measures be continued as part of this project. SMC and Stillwater County have an existing agreement on weed control.

B.11 Cultural Resources

Four respondents (2 local, 1 regional, and 1 national) commented on the analysis of effects to cultural resources. Concerns focused on potential effects to the Keogh Buffalo Jump Site and the lack of an issue statement for cultural resources.

1. 4.10 (pp 4-79 to 4-8 2). Section 3.10 presents a chronology of the area's archaeology. This section focuses on several archaeological sites. Missing, however, is any mention of how the present day Native Americans, especially the Shoshoni and Absaroka/Crow, feel about this project and what cultural affect it might have on them. I cannot imagine they are indifferent to it. (9)

There is no issue statement for cultural resources, but there is a section on environmental consequences for cultural resources. Also, should the description and analysis of cultural resources include Native American religious sites? (4)

Response: Native American groups were contacted about the project during preparation of the draft EIS. However, none of the groups responded with any concerns about the project.

No issue statement was developed for cultural resources because no one identified any concerns about cultural resources during project scoping. Discussion of cultural resources and the alternatives' likely effects on those resources were included in Chapters 3 and 4 to disclose the agencies' consideration of cultural resources in the impact analysis. Although no adverse effects were identified, the agencies wanted to disclose the results of the analysis because many members of the public already know about the cultural resources present in and near the project area.

2. The cultural resources is something that I'm very closely tied with. The Keogh Jump Site, which is on the National Historic Register, is on our property, and the proposed pipeline will go right through it. I believe you gave a false assumption in there that the existing disturbed area is adequate to improve the road and construct the line. ... the assumption is that they are not going to go outside of the disturbed area of the old *county road. I don't think that the archeological study that was done, the fellow was very competent and his methods were correct, however, it was very limited in what he looked at. And that needs to be gone through, and really gone through with a trowel and shovel, to determine what's in that area before you start construction of the pipeline. (46s)*

Also, I did note that the State Historic Preservation Office was not consulted and there's no mention of their comment in the Draft EIS. I believe that is required. (46s)

Response: DEQ and CNF think the information collected on the Keogh Buffalo Jump Site to date is sufficient to adequately delineate the site and evaluate the potential effects of the alternatives on the site. The right-of-way for County Road 419 was disturbed over its full extent when the road was constructed. Thus, any objects and information associated with this site that were present within the right-of-way originally were removed during the road's construction. Because the pipelines would be constructed within this previously-disturbed right-of-way, additional disturbance to the Keogh Buffalo Jump Site is not anticipated.

B.12 Planning

Forty respondents (32 local, 4 regional, and 4 national) provided comments on concerns that did not specifically relate to one of the defined issue statements. These concerns included editorial comments on the document, questions and concerns about alternatives that were not considered in detail, mitigation measures, legal questions, and other miscellaneous questions.

B.12.1 Planning

2. Common sense would dictate that in order to minimize the footprint of the mine on the land then the mine's impact should be localized and not scattered over miles. This premise is especially relevant when one considers that possibly seven years of production is the only reason standing between keeping the mine's footprint small or expanding it for miles and forever changed the natural aesthetics of the Stillwater River Valley... Would it not be prudent to consider that the mine maybe prematurely closed within the twenty three year time frame due to external forces outside of SMC's control? (5)

Response: The MEPA/NEPA process is intended to provide a basis for choices among the action alternatives. As a consequence of the analysis documented in this EIS, a number of options are available for the decision makers. Any force that may serve to close the mine prematurely is beyond the agencies' control. It is most prudent to plan on the basis of the best known facts available and not on the basis of speculation.

3. The mine will continue to employ 628 workers until production shut down. How many people will SMC employ during reclamation and closure? Who will be responsible for monitoring following closure, for how many years, and from what funds will they be paid? The same type question about lab analysis of samples and interpretation of results? (9)

Response: The number of workers employed during the reclamation phase of the project would depend upon how final reclamation is incorporated into the mine's shut down. Most likely, SMC would shift mine workers to reclamation tasks as production at the Stillwater Mine ends. SMC would be responsible for all monitoring of reclamation. However, DEQ and CNF would continue monitoring of SMC's work, which is paid by state- or federal-appropriated funds. If the mining company abandons the mine, the bond contains provisions for monitoring costs.

4. What will driving through wind blown mist from the LAD sprinklers do to vehicle paint finishes, engines, and drive trains? As a dust deterrent, what will the wetted road surface do to the vehicle frames and undercarriage? (9)

Response: The center pivots are not on the roads and the mist from the pivots would not wet road surfaces. Because the water applied using the LADs has to meet certain water quality standards, the spray is not expected to have a negative effect on vehicles. SMC has been using LADs for disposal of water for several years and reports no identifiable damage to vehicles driven downwind from the mist.

5. 3.5.7.7 (p 3-47). How is fire protection handled at SMC? How are hazardous wastes, if any handled? (9)

Response: SMC has its own equipment to handle small or routine fires. However, it relies on assistance from local fire departments when needed. Hazardous materials and wastes, such as petroleum products and waste oils, are handled according to a state permit and emergency response plan.

6. 1.1.1. (p 1-2). This section refers to SMC as the "...only significant source... outside South Africa and Russia." Also that SMC produced about five percent of the world's demand but only a portion of the US demand. What other sources of platinum/ palladium exist in the US and the America's? What portion of the US demand does SMC provide? (9)

Response: The United States has only one active platinum-group metals (PGM) mine, the Stillwater Mine. During 1997, SMC produced almost 11 metric tons of platinum-group metals (primarily palladium) and the United States imported 171 metric tons of refined platinum and palladium for consumption. Small quantities of PGM were also recovered as byproducts of copper refining by two companies in Texas and Utah. Sources of the platinum imported during 1997 were South Africa (60 percent), Russia (10 percent), the

United Kingdom (10 percent), Germany (5 percent) and other countries (15 percent). Sources of imported palladium in 1997 were Russia (47 percent), South Africa (22 percent), the United Kingdom (10 percent), Belgium (8 percent), and other countries (13 percent).

7. Once the mine shuts down, what does this mean to the US and to the world demand? What might its mean to the US trade balance? (9)

Response: The analysis of the United States' demand for platinum-group metals and these metals' role in the trade balance is beyond the scope of this analysis.

8. Should there be approval from the U.S. Environmental Protection Agency? (4)

Response: The EPA reviews the EIS and comments on it, but does not have any authority for approval for any of the permits associated with the project. However, EPA does have review authority on MPDES permit applications.

9. Should the analysis include environmental justice? (4)

Response: A discussion of environmental justice has been added to the final EIS. Please refer to **Section 4.14** to review this material.

10. It is now proposed (pg 2-16) that trucks would haul waste rock and cross Highway 419 rather than use the haulage-way. Why isn't the underground connection utilized? Perhaps the road grades are too steep, but couldn't conveyor belts be used? (11)

Response: SMC intends to use the 4400 level connection under the Stillwater River between the east and west sides of the Stillwater River for hauling ore. Waste rock from the west side of the river would be transported aboveground as described in **Section 2.4.2.1**. Some limited potential exists for waste rock from below the 5500 level to be hauled through the 4400 level connection. However, waste rock from higher levels would be transported aboveground and across County Road 419, which is the most efficient means to move the rock. To transport rock from these upper levels through the 4400 level connection, SMC would have to haul this rock out from the upper portals (no connections exist for hauling rock to the 4400 level completely underground) and then back underground to access the connection.

The use of conveyor belts across the road and river would be inefficient compared to hauling with trucks, inflexible and less able to respond to changing conditions at the mine. Additionally, it would further affect the visual aesthetics for people traveling along County Road 419 to points south of the Stillwater Mine.

11. What provisions are there for power back-up? Does the computer control system, which monitors and governs tailings pipeline operations, have continuous power? What happens if leaks are undetected by the central control system which is shut down without power? Are there any provisions for redundant control and power systems to help assure reliable operation? What happens to the pipelines if the pumps are without electrical power (pp 2-29, 30 and 4-7)? (11)

Response: The design of the system of pipelines connecting the new impoundment to the mine is preliminary and the final design would have to be submitted to the agencies for approval before construction begins. Currently, SMC does not think backup power is needed to maintain the pipelines' integrity. To ensure the pipelines' integrity, DEQ and CNF have identified a new mitigation that requires the installation of backup power. Please refer to **Section 2.4.5** to review this new measure.

Additionally, SMC proposes to construct an underground water storage reservoir at the 6500 level that would contain a volume of water adequate to flush the tailings out of both pipelines into the Hertzler tailings impoundment using gravity. SMC's employees would flush the pipelines when necessary if the power is off.

12. Electrical power requirements will more than double to meet 5,000 tons per day production volumes. Does this mean that both new electrical transmission lines and towers will be required? What are the aesthetic consequences? Does SMC pay for all these capacity increases? What happens to these transmission lines and towers once the mine ceases production? Their presence affects neighboring property values, and there is an ever present danger for health and safety of citizens. (11)

In our scoping comments we raised questions about the explanation of power requirement needs and how they will be met. That concern was not clarified in the DEIS. The document states that 12 megawatts is currently used at 2,000 tons per day, and an additional 12 megawatts of power may be needed (page 2-6) Yet the highest power usage estimated in the comparison of alternatives (table S-1) is 16 megawatts. Why isn't 24 megawatts reflected in this table and how will this power demand be met, since the current power line is only capable of providing up to 18 megawatts of power (page 2-13)? (22)

The DEIS implied that power requirements at the mine are not a concern in any of the alternatives, since there is no discussion of power requirements other than in the description of alternatives. (27)

Power requirements are another area of concern for mitigation. My calculation says that means that with 5,000 tons peak capacity, which must be obviously powered for, one already needs to add additional power lines going toward the mine. And that would be an additional six megawatts at least. Where are those power lines going to be? What are they going to look like? What are the mitigation measures that you're taking for handling that effort? (47s)

Response: The transmission lines currently providing the power supply to the mine would be upgraded to provide the additional power needed to increase production to 5,000 tpd. In all cases, this upgrade would involve improvements to the existing line as opposed to the construction of an additional line into the area. Additional information on this line upgrade has been added to **Section 2.4.2.4** of the EIS.

The effect under all action alternatives would essentially be the same. NEPA and MEPA focus the analysis on the key issues. See 40 CFR 1500.4 (b,c,g), 1501.1(d), and 1501.7(3) and ARM 17.4.615(c,d), 17.4.616(2), and 17.4.617(3) .

13. This is hard rock tailing. Is it radioactive? Fill at the deposit sites will be 50 to 75 feet deep. What will be used to prevent wind erosion and wind transport of materials off site when the site is used up? (12)

Is the material hazardous? Acid or corrosive in nature? How will the liquid impact ground water? (12)

Response: The tailings material is not radioactive. When the site is used up, it will be reclaimed to control erosion as described in **Section 4.9.3** of the EIS. Ground water effects are described in **Section 4.1** of the EIS. The material is not classified as hazardous and is not acidic or corrosive.

When the an impoundment reaches its maximum capacity for storage of tailings, SMC would begin closure, which would involve three distinct steps. They are dewatering, grading, and revegetating the tailings. Dewatering would involve pumping free water out of the impoundment and promoting evaporation. After the tailings have been dewatered sufficiently to support construction equipment, the surface of the tailings would be graded to control surface runoff and differential settlements and a final cap of soil and growth medium would be placed on top of the tailings. This cap would then be revegetated using procedures identified in SMC's Reclamation Plan, which was approved by the agencies in 1993. The successful capping and revegetating of the tailings would provide the long-term control of erosion.

14. I feel that private citizens need to have a say in this matter. The economy of the valley should not determine policy. (16)

Response: The NEPA/MEPA process provides opportunities for public participation during scoping and public review of the draft EIS. Under MEPA, NEPA, and state and federal permit and mission-related statutes and regulations, the agencies make the final decision on the proposed action (ARM 17.4.629 and 40 CFR 1505.2) and prepare a record of decision documenting the decision and the rationale behind it.

15. The fact that wildlife habitats have not changed should not be grounds for excluding a discussion and documentation of those habitats by referencing earlier documents. Many readers do not have access to those documents. (22)

Response: Tiering, which is the process of incorporating information published in earlier documents by reference, is a procedure used to keep NEPA documents to a manageable length. By repeating much of the earlier information, the present DEIS would have been considerably longer and more difficult to review because the discussion would not have focused on the primary issues identified through scoping. MEPA and NEPA direct the agencies to focus on significant issues (ARM 17.4.615 (2) (e) and 40 CFR 1500.1 (b), 1500.4) and use the scoping process to determine the scope of the analysis (40 CFR 1501.7). We recognize that many readers do not have ready access to all the previous documents. However, copies of many of the documents are present in libraries and copies of all documents are available for public review at DEQ, and CNF's offices and can be obtained from DEQ for the cost of copying.

16. Issue monitoring reports each year. Include as part of the annual review (or more frequently) an opportunity for the public to meet with you to go over this monitoring data. Is the company complying with the terms of its permit? Are expected conditions being met? If not; are appropriate actions being taken to protect the water, air, soils, and wildlife resources of the area and to minimize disruptions to the rural character of the area? (22)

Response: All SMC's annual monitoring reports are public information and can be obtained from the agency with jurisdiction. CNF has requested, but not yet received, funds to prepare annual monitoring reports. All DEQ's inspections and monitoring data (when obtained) are available for public review. The agencies would be available to meet with SPA or other citizens to review annual monitoring reports.

17. Recommendation: There should be some projection, or at least some discussion, of the ultimate amount of space required for tailing disposal at the Stillwater Mine, and whether the Hertzler impoundment area could accommodate those tailings. (22)

Response: Because the ore reserve is continuously being updated, it is not possible to provide an accurate projection of ultimate tailings disposal requirements for the Stillwater Mine beyond the current 30-year estimate. Also, future changes in technology and prices for the metals could influence the ultimate amount of tailings requiring disposal. The tailings also may prove to be a marketable product in the future.

18. Set up a community advisory body that will meet regularly to discuss items related to monitoring, socioeconomic issues, and long term planning. (22)

In an ongoing effort to identify needs and adjustments that are required no matter which alternative is implemented, it would be good to have a citizen advisory group. This group would participate in and review the results of monitoring and testing programs. The results should be provided and disseminated to the public on a regular basis, and comments invited for consideration by the agencies. The citizen advisory group should also be informed on any proposed future changes or deviation from the permits and ensure that adequate analysis is performed to provide the public and agencies with adequate data for meaningful evaluation. (28)

Response: A citizen's advisory group is not planned. SMC could establish such a group but there is no law that allows the agencies to require it. In fact, the Federal Advisory Committee Act precludes the Forest Service from setting up such a group without Congressional approval. All monitoring reports are public information and can be obtained from the agencies with jurisdiction. Also, all proposed changes to the project would be communicated to the public through the public forums required by each permitting regulation. Because these mechanisms are already in place, a specific group would not be needed. However, the agencies would be available to meet with SPA or other citizens to review annual monitoring reports.

19. The Program and Policy Analysis Bureau of the Transportation Planning Division will be MDT's point of contact throughout this review process. Please submit all further correspondence to this bureau. These comments supersede the previous MDT comments transmitted from the Billings District Office. (26)

Response: Thank you for your comment.

20. SPA questions the reasoning behind the major premise of the EIS -that it is best to remove any cap on production at the mine in Nye and that a 30-year solution to waste management at the mine must be defined and permitted now, based on today's technology and today's best practices. We know that technologies and processes (like paste landfill) for disposing of tailings and waste rock currently exist and will continue to develop. Using them could reduce the need for impoundment and storage facilities now and in the impoundment at the Hertzler site and review it again in a subsequent EIS when additional storage may be required (a possible version of Alternative C) or to permit an amended version of Alternative D after the appropriate engineering analyses have been done to weigh the risks of seismic and other effects on the proposed riverside impoundments and the pipeline over the river. (27)

SMC proposed to remove any limit on daily production for the next 30 years (pg. S-14 and Chapter 3,4). If approved, this means the "door is open" to unlimited production and concomitant potential environmental and socio-economic disasters. Production controls should not be abandoned. The volume limits could be changed to increase (or decrease) incrementally, but, if and only if, SMC proved its operational results have not, (or have) had adverse consequences over some reasonably tractable operation interval. (11)

Have any other mining corporations whose operations extend into the domain of private property residences been given 30 year, unlimited production ? If not, will this EIS, if approved as is, establish new precedents? (11)

I do not understand the need to grant permission for expansion to a new site, with plans for a 15-million ton impoundment, justified by the need for a 30-year solution. All businesses I am familiar with expect waste management, as well as most other processes and procedures, to improvement dramatically during a 30 year period. I suspect that an investment by Stillwater Mining in a "30-year" impoundment would result in a disincentive for adoption of better waste management techniques as they are developed by the mining industry. (44)

... the call for reconsideration of need to provide a tailings impoundment to support production at a 3,000-tons-per-day for 30-years. (43)

Why are we rushing to approve a 30-year solution, in fact rejecting alternatives because they do not meet that purpose and need? (47s)

The first is to question the reasoning behind the driving major premises of the EIS: That it is best to remove any cap on production at the mine in Nye and that a 30-year solution to waste management at the mine must be defined and completely provided for now, based on today's technology and today's best practices. (47s)

... With the approval of a 30-year solution, the agencies remove the primary reason for requiring an EA or and EIS as future expansions occur. That removes most of the requirement for public participation and much of the actual input from the public. Periodic reviews would allow for the addition of requirements to adopt new technologies that better manage tailings and waste rock, as well as practices that will be proved effective elsewhere. (47s)

... we have serious reservations about the "purpose and need" defined in the document which results in evaluating the alternatives based on their ability to provide a 30-year solution to waste management for the Nye operation. (27)

Response: Many mining projects are approved based on an estimated amount of total production and corresponding amount of total disturbance. Most permits are issued based on the total amount of disturbance allowed and not the annual production rate. Also, the Forest Service does not have authority to limit production. The Organic Act gives the Forest Service authority for surface management and the 1872 Mining Law grants property rights for valid claims. Therefore, a production limit could be considered a "taking".

DEQ prefers not to limit mine production rates unless it is necessary to minimize or eliminate significant environmental effects. Production rates are usually defined by the overall mine plan, which is developed to most efficiently develop the resource. Also, this project would use lands owned by SMC and County rights-of-way.

The demand for platinum/palladium and SMC's position in that market is discussed in **Section 1.1.1** of the EIS. This indicates that long-term planning is warranted. Also, the proponent can determine the amount and duration of its depositional need (i.e. purpose and need of project) and MEPA/NEPA require that all action alternatives considered in detail must at least partially meet the purpose and need. Additionally, in the past, citizens have expressed concern about "incremental permitting" and wanted to know the long-term plans of SMC.

Finally, Alternative D evaluates a 23-year depositional life versus a 30-year depositional life.

21. We also find that the DEIS not only reaches conclusions without presenting sufficient data to help the public reach informed decisions to accept or reject the conclusions, but also rejects, out-of-hand, potential alternatives and mitigations without evidence of serious considerations, appropriate data or logic. (27)

Response: DEQ and CNF believe sufficient information exists to support their conclusions. However, they also recognize some of that information exists in other documents referenced in this document through tiering and many people are not overly familiar with the concept of tiering. Consequently, DEQ and CNF have expanded the information presented in several sections of this final EIS, including sections on alternatives considered but eliminated **(Section 2.5)** and monitoring **(Sections 2.4.1.7, 2.4.2.7, 2.4.3.7,** and **2.4.4.7)** and the inclusion of additional mitigation measures **(Section 2.4.5)**..

22. If Alt B is implemented, the impoundment should be no taller than the highest immediate surrounding terrain, i.e. the contour of East Ridge, not including Bush Mountain (pp. 4-41-4-60). (27)

Response: As proposed by SMC, the Hertzler impoundment would exceed the height of the adjacent topography to the southwest by 20 to 30 feet. The agencies have provided two alternatives that would modify the Hertzler impoundment. Alternative C has a slightly smaller impoundment and would top the ridge by less than 10 feet. There is no impoundment at the Hertzler Ranch under Alternative D.

23. ... the DEIS states that in 1995 SMC studied the feasibility of paste tails disposal and examined the use of both slimes-based paste and total tails paste (p. 2-53, Paste Landfilling). The remainder of the discussion in this section of the DEIS seems to apply only to the results of slimes-based paste. No results of total tails paste are discussed - a grave omission, especially since total tails paste promises much greater benefits than slimes-based paste. Additionally, no mention is made of the cost study which SMC cites in its 1997 annual report (p. 16). (27)

... make a careful study of the paste technology for backfill and landfill. Use of this technology could, at the least, postpone the construction of another tailings pond which means that the capital investment could be deferred. The savings on interest on this investment could well offset any increased cost associated with the implementation of paste technology. Moreover, if it subsequently became necessary to create a new disposal area, it could be done without building more tailings ponds in the new location. While the DEIS says that past technology has been considered and discarded, there is no information given to lend credence to this statement. (10)

Response: Based on the public's interest in and comments on paste tailings, the agencies reconsidered in more detail the potential use of whole tailings paste and fine tailings paste in both backfill and landfill situations as alternatives to SMC's current methods of handling tailings. The results of this reevaluation are contained in **Appendix H** and are summarized in **Section 2.5.2**. Essentially, the evaluation determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA. The following reasons form the primary foundation for this conclusion:

- Slurried tailings, fine tailings paste, and whole tailings paste would have average dry densities of 70 pcf, 80 pcf, and 100 pcf, respectively. Thus, 100 pounds of slurried tailings, fine tailings paste, and whole tailings paste would occupy about 1.4 cubic feet, 1.25 cubic feet, and 1 cubic foot, respectively.
- Fine tailings paste probably could not be used as backfill because it would not have the strength necessary for mining operations. Thus, with fine tailings paste, about 58 percent of the tailings would still be used as sand backfill (coarse tailings) in the mine and about 42 percent of the tailings, primarily the slimes, would report to a tailings impoundment for use as fine tailings paste.
- If whole tailings paste backfill were implemented, about 68 percent of the tailings would be used as paste backfill in place of the current sand system and 32 percent of the would have to report to the surface for disposal. Under SMC's current system, 58 percent of the tailings report as backfill in the mine and 42 percent report as slurried tailings to the tailings impoundment.
- The volume of fines tailings paste reporting to a surface impoundment would not reduce the size of the impoundment much over that needed for slurried tailings. For example, to store the same volume of tailings as addressed by Alternative B, an impoundment built at Hertzler using fines tailings paste would cover about 150 acres (compared with 163 acres for Alternative B) and would have a final embankment elevation of 5,025 feet (compared to 5,036 feet for Alternative B). There would be less than 5 percent reduction in volume and areal extent using whole tailings paste.

- Landfilling fine tailings paste would require a single paste plant at the Hertzler under alternatives B and C or at the east side tailings impoundment under Alternative D. SMC's current sand plant would continue to operate at the mine and deposit tailings in the existing impoundment.
- Whole tailings paste backfill also would probably require that the paste not backfilled into the mine be transported to Hertzler or the east side impoundment sites by truck or conveyor system. Pipeline transport of whole tailings paste to either of these sites would require pumps every 2,000 feet with electrical power lines to each site and several surge ponds along the route. The pipelines would have to be capable of withstanding high pressures and if a pipe were to rupture the pressure could cause more tailings to travel farther than would with slurried tailings. It is predicted that the friction developed along the length of the pipeline could cause the water to separate from the tailings resulting in a stiff material that could plug the pipe increasing the chances of rupture. The tailings could be re-slurried at the mill for transport through a pipeline to the impoundment followed by dewatering to reestablish a paste for disposal at an additional paste plant at the impoundment site. At a minimum, transporting paste by conveyor or truck would substantially increase noise and visual impact, potentially increase impacts to wildlife, and increase the potential for spills, and traffic on Stillwater County Roads 419 and 420. A conveyor would increase surface disturbance and delay reclamation; it may not be possible to build a conveyor where steep slopes constrict the right-of-way without requiring substantial removal of soil material and creating an even steeper slope subject to erosion. Additional land would be disturbed at the Hertzler impoundment site to construct a paste plant there.
- Disturbance at the mine would increase substantially. Whole tailings paste backfill could require the location of as many as 9 to 10 paste plants along the length of the ore body toward East Boulder Mine; fewer plants would be needed if the mine operation expanded primarily downward rather than horizontally down the length of the ore body. SMC would have to construct a 200-foot by 200-foot (0.9 acre) pad at each of the portals where the paste plants would be built. Due to the steep slopes and the need for cut-and-fill construction, disturbance for the pads would encompass much more than one acre (and at least some of the waste rock generated by construction would have to be stored somewhere). The overall slopes on SMC's present system of roads to the upper portals are too steep for loaded cement trucks to negotiate. Each paste plant would require at least 2 truck loads of cement daily. Thus, SMC would have to construct a new system of roads with shallower slopes for the cement trucks. If SMC did construct a new network of roads,

it's still questionable if the cement trucks could access the plants during the winter.

- The addition of the paste backfill system would substantially increase the requirements for electrical power. Each plant would require about 1.5 megawatts of power. With the increases in electrical requirements associated with increased production, Montana Power Company's distribution lines supplying the Stillwater Mine and Stillwater Valley could not handle the additional power for the paste plants, even with the upgrades discussed earlier. The power lines probably would have to be completely reconstructed back to Billings before the power for the paste plants could be supplied.

Although the agencies determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA at this time, DEQ and CNF added another mitigation measure for consideration by the decision makers. If one of the action alternatives is selected, this measure states that within 5 years of the ROD issued for this final EIS, DEQ, CNF, and SMC shall reevaluate the technologies and feasibilities for incorporating paste landfill and paste backfill into SMC's operations at the Stillwater Mine.

At the time the tailings paste landfill issue is reevaluated, the seismic stability of the cement-amended paste will require careful analysis. It is likely that with even minimal amounts of cement, the paste would not be subject to liquefaction induced flow failure, but could be subject to slumping and sliding under earthquake loading. Construction of an outer confining zone of high cement content paste is technically feasible, however the costs associated with providing sufficient cement to assure adequate strengths combined with the difficulties in assuring the quality of the paste, would likely outweigh the benefits. It is likely that an earthfill confining berm would be the most technically feasible approach.

The seepage from the paste would be reduced from that associated with slurry disposal of tailings, however a liner for containment will still be required. The risk of seepage from the lined impoundment would be similar for both the slurry and paste alternatives due to the proposed underdrain system included in the slurry liner system. This underdrain would be installed over the liner and would reduce hydrostatic pressures on the liner, limiting the driving pressure causing seepage.

Total tailings backfill would cost approximately $ ____ per ton of backfill (see **Appendix H**). This compares to $_____ per ton of sand fill currently being used. Cement amended tailings disposal is estimated to cost $____ per ton. These estimates include capital costs for development of the containment basin, paste plant, tailings and return water pipelines, and power lines as well as operating costs. Each additional paste plant would cost $7 to $10 million; however, there would only be 4-5 plants operating at the same time because the mill could not generate enough tailings to supply more plants. The plants would be moved to new sites when needed rather than continually purchasing and constructing new plants.

24. According to the DEIS (p S-1), the average milling rate is expected to be around 3,000 tpd, but may peak as high as 5 ,000 tpd occasionally, and the proposed facilities would allow SMC to continue mining platinum group metals for about 30 years. The difference between 3 ,000 and 5,000 tpd is significant inferring a potential increase from present production of 150%. What rate is the 30 year permitted project lifetime based? The public has repeatedly expressed concerns with respect to increase capacity and associated environmental and socioeconomic impacts. (27)

Response: The 30-year life is based on the projected average production of 3,000 tpd.

25. It would also provide a good perspective to evaluate the long term impacts of the project by defining land use scenarios after mining has ceased and reclamation has occurred. It is reasonable to assume that SMC would not retain possession of the land in perpetuity and thus would probably sell the property at some point in time. What would be the potential for development in this area? Would there be any restrictions on its use? For example, the LAD system would be employed to dispose of nitrogen from the mine waste water, but also it would distribute other components, including heavy metals. Would these substances accumulate in the area and present a potential risk or are these substances somehow leached into the ground water and dissipated? Is the Hertzler site then usable for residential, recreational or other uses? (28)

Response: It is likely that the property would be owned by SMC or another mining company for the foreseeable future. As long as environmental standards are met, there are many options for post-mining land use. It would probably be managed for the proposed post-mining land uses of cattle grazing and wildlife habitat. SMC's decision to sell or not sell the property is beyond the scope of this analysis.

26. Page 1-3 and S-53, Chapter 1, History of Project: EPA requests additional detail (does not need to be in the EIS) on the Stillwater Mine tailings backfill/dewatering technology related to the very fine mill grind. The DEIS states that approx 58% of the coarser fraction of mill tailings are used as backfill in mined-out stopes. The mill grind, however, is indicated to be more than 70% passing 20 microns. This is a very find grind which may be difficult to backfill. What chemical(s), if any, are used to stabilize the underground tailing stope backfill? What volume percentage of a given stope is filled? What unit operation steps are included in the tailings dewatering process? What dewatering equipment is used? What are the underground minestope filling procedures? How is the stope-to-be-filled supernatant water handled? What percentage of the adits discharge water is supernatant water? (32)

Response: A discussion of SMC's backfill and dewatering technology was not included in this EIS because decisions on this technology were part of earlier MEPA/NEPA analyses. Additionally, decisions on this technology are not part of this analysis. The information requested in this comment is in the mine plan and permit documents that are available for review at DEQ's offices in Helena, Montana.

27. Page 2-25, 2.4.2.2 Tailing Production and Management: Please quantify the flushing volume in terms of equivalent 8-inch pipeline volume/s available from the 6500 foot elevation mine reservoir. (32)

Response: No underground reservoir currently exists at the 6500 level. SMC would determine the volume of water necessary to flush both tailings pipelines upon final design of the pipelines and construct an underground reservoir adequately sized to provide the volume of water required.

28. Page 2-15, 2.4.2.1 Waste Rock Production and Management: Waste rock is to be placed in four areas (Figure 2-1). What is the rock content in the fifth area near the shop and warehouse. (32)

Response: The waste rock disposal area near the shop and warehouse is one of the four areas described in the EIS (near the 5300 west portal). The smaller area near the shop and warehouse is for temporary storage of larger rocks to be used for riprap or reclamation as described on **Figure 2-1**.

29. ...I am concerned about the concept of peaking. The DEIS recommends removing the cap on production and then evaluates alternatives based on requirement to support production of 3,000 tons per day, the average cited by SMC. The DEIS says that production would occasionally "peak" at 5,000 tons per day. In order to "peak" a business must have the infrastructure in place to support peak performance. For the mine to be able to peak it must have in place the electrical power, equipment and staff to support 5,000 tons per day. Therefore, all evaluations should have been done against those measures. For example, power requirements were treated in all alternatives as unimportant, yet it is apparent that supporting production at 5,000 tons per day - even for an occasional peak - would require at least six megawatts more power than currently is delivered to the site. No information was presented in the DEIS to indicate how that would be done or what it would mean to the community. (43)

Response: The analyses for all resources that would be affected by a production rate peaking at 5,000 tpd were incorporated into the EIS. In some cases, an average rate of 3,000 tpd was used but even this average considers peaks of up to 5,000 tpd.

The transmission lines currently providing the power supply to the mine would be upgraded to provide the additional power needed to increase production to 5,000 tpd. In all cases, this upgrade would involve improvements to the existing line as opposed to the construction of an additional line into the area. Additional information on this line upgrade has been added to **Section 2.4.2.4** of the EIS. SMC would rely more on mechanized mining than the addition of staff to increase production to 3,000 to 5,000 tpd. In the event that SMC would increase staff by greater than 15 percent, the Hard Rock Impact Plan would have to be updated.

30. I have....questions about the Stratton Ranch, What is in the near future as plans for this ranch? ...I think, on page 4-47, the photograph was taken from my deck. So I need to know what I'm going to see down there in the future. (47s)

And so I need to know what the future plans for the Stratton Ranch are. What is going to be done with that property? Will they be using it for other things? (47s)

Response: SMC has no long-term plans for other uses of the Stratton Ranch beyond the current plans to use this area for the LAD sites discussed in the EIS. Beyond the life of the mine, it would be used for agriculture/wildlife habitat.

B.12.2 Editorial

1. Table of Contents (P age iv), and Section 3.10 - some sub-sections are incorrectly labeled as 3.12, instead of 3.10. Table S-1 and Table 2-3 - For Alternative D, the final crest elevation of the East Stillwater tailings impoundment is 5085 feet, not 5100. Figure S-3 and Figure 2-7 - The wrong footprint is shown for the Hertzler Impoundment. It should be larger, as shown on Figure 2-9. Page 2-42, (2nd Paragraph) - The final crest elevation for the East Stillwater tailings impoundment is 5085 feet, not 5080. (7)

Page 4-27 (section 4 .4.1.3) - For Alt C the Hertzler impoundment would be 34 acres smaller than for Alt B, not 72 acres as stated. (7)

Table 2-1 on page 2- 8 under Notes: 1. This "issues" - should read issue. 2.4.4.9 on page 2-47 , last sentence of paragraph replacement: "seeded" propagation; - should read seed bed (?) Figure 4/3b on page 4/47, East Side Waste Rock "Facility" - should read Facility (7)

3.12.2 to 3.12.5 (pp 3-66 to 69). A typo. These should be 3.10.2 to 3.10.5. (9)

2.4.1.6 (P 2-14). A typo in the first sentence; delete "would" and insert "remain. " (9)

The summary table doesn't include information about aesthetics. (4)

For accuracy and consistency, the reference on pg. 2-59 to the Buffalo Jump Ranch should also include: Section 31 and 32, 4S 16E, and Section 5, 5S 16E. (11)

... in section 4.7.1 .2 - Cumulative Effects, I believe that authors are trying to reference section 4.5.1.2.6 as opposed to the nonexistent 4.5.2.6. (28)

SMC would like to eliminate any potential misunderstanding on the issue of noise. In section 3.7.2.1, on page 3-56, it is stated "However, SMC has fitted all surface vehicles with mass-sensitive backup alarms that only sound when objects are present behind the vehicle" This is not entirely correct. SMC has fitted some surface equipment that is operated during evening and night time hours with these backup alarm sensors, however has not fitted all surface vehicles with the sensors, as stated. (34)

Response: These revisions have been made to the final EIS.

2. Figure 2-2. This comment essentially applies to all location of facilities maps. One cannot distinguish between the Borrow Areas and the Waste Rock Storage Areas. Nye is not identified, nor is either the Stratton or the Hertzler Ranch. County Road 420 is not labeled. The legend should include buildings which appear as little brown and somewhat larger black square dots. None show the power lines, existing or proposed. (9)

The proposed Alternative B, pages S-23, figure S-2 shows the overall locations of the primary facilities comprising the proposed action alternative. Figure S-2 does not show the location for the LAD system referred to. However figure S-3 does show the proposed location as it overlaps the access road to the 2 rental homes. (15)

Response: The figures have been revised to include these features.

3. Why isn't HELP referenced in Ch. 9? (9)

Response: Chapter 9 contains references cited in the EIS. HELP is not a text or literature, but a model used to estimate seepage. Therefore, it is not appropriate for citation. It has been added to the glossary.

4. 4.1.1.2.2 Stratton Ranch (pp 4-3 and 4-4). Figure 2-2 shows no LAD sites at Stratton Ranch although 2.4.2.3 and Adit Water under this section refers to LAD sites at both the Stratton and Hertzler Ranches (p 2-26). Figures 2-7 (Alternative C) and 2-10 (Alternative D) do show LAD sites at Stratton Ranch. (9)

Response: The LAD sites have been added to **Figure 2-2**.

5. There is a biological assessment and a biological evaluation in Appendices C and D but these are not referenced in the text. (9)

Response: A reference to these appendices was added. Please note, in the final EIS, these appendices have different letter identifiers.

6. Figure 2-2 shows no storage ponds at the Stratton Ranch LAD sites, although 2.4. 2.3 and Adit Water does make reference to them. Where will these ponds be located? Part 2, Figure 3-2 shows no pond that one can identify as such. (9)

Response: Both **Figures 2–2** and **3–2** show small square-shaped ponds (unlabeled) located just uphill from the LAD sites on Stratton Ranch.

7. There is no issue statement for cultural resources, but there is a section on environmental consequences for cultural resources. Also, should the description and analysis of cultural resources include Native American religious sites? (4)

Response: There is no issue statement for cultural resources because it was not raised as an issue during scoping. This does not mean it isn't important. It was included in the EIS document because it is required in order to comply with Section 106 of the National Historic Preservation Act.

8. The DEIS generally refers to the downstream side of the Hertzler tailings impoundment as having a slope of 2H:1V. However, page 4-5 of the DEIS refers to a final slope of 2.5H:1V. This discrepancy should be corrected or explained. (22)

Response: The reference on **Section 4.1.1.2.3** was changed to reflect 2H:1V.

9. Table S-1 erroneously lists the power requirements of each alternative (except for Alt A) as 16 megawatts. The mine must be powered to support the desired 5,000 tdp peak performance, which would require 24 megawatts - 6 over the current supply. (27)

Response: **Table S–1** has been modified.

10. Figure 4.7a is mislabeled. I believe that the direction should be southwest instead of northwest. With Figures 4-5 a and b. I believe it is laudable to try to give the public some ideas with regard to what the visual impacts are going to be. In addition to the pile illustrated, what should be included in some visual representation of roads/ vehicular activity that will be associated with ongoing building and concurrent reclamation at the Hertzler. (28)

Response: **Figure 4–7a** has been changed. Activity cannot be shown on the simulation **(Figure 4–5a and b)** because one photograph shows existing conditions and one shows reclaimed conditions where no activity is taking place.

11. Page S-30: The Summary Table for Alternative B shows no increase in overall mine discharge. However, page 2-10 states a possible increase from 1,000 gallons/ minute to 1,900 gallons/minute. (33)

Response: The summary table has been changed.

12. Footnote 1 states that metals concentrations are total recoverable. However, the table shows both total recoverable and dissolved. The footnote appears to be incorrect. (33)

Tables 3-4, 3-5, and 3-6: Footnote 1 states that metals concentrations are total recoverable. This disagrees with the tables, which show metals concentrations as dissolved. (33)

Response: The tables have been changed.

13. Table 3-4: The human health standard for chromium is listed as 0.0 mg/L rather than 0.10 mg/L. (33)

Response: The table has been revised.

14. On most figures, waste-rock areas and borrow areas are both shown as yellow areas. The two are very difficult to discern from one another. (33)

Response: Figures have been modified for better clarity.

15. Page 2-25, 2.4.2.2 Tailings Production and Management: Please define "bulk tailings" in the Glossary. (32)

Response: Bulk tailings has been added to the glossary.

16. Page 2-25 to 2-27: For the purpose of clarification/understanding, please consider summarizing the functions of the four pipelines in the right-of-way. (32)

Response: As described in the referenced section, there will be four pipelines within the right-of-way: two of these will carry tailings slurry (a combination of tailings and adit water) from the mine to the tailings impoundment at Hertzler Ranch, one will carry mine adit water to the LAD sites at Stratton and Hertzler Ranches, and one will carry reclaimed water from the tailings impoundment at Hertzler Ranch back to the mine to be used for process water.

17. Pages S-14 and 2-26: It is stated for alternative B, that SMC proposed to add LAD systems at the Stratton and Hertzler Ranches, yet no LAD systems are shown in Alternative B, Figure S-2 and Figure 2-2, at the Stratton Ranch. Why is this? Also, the existing land application sites are not shown on any maps. Where is the existing LAD in relationship to monitoring locations? (32)

Response: The LAD sites proposed for the Stratton Ranch have been added to the figures. The east side waste rock storage site would cover the existing LADs.

18. Attached are copies of the 1997 and 1998 SMC monitoring reports, showing mineral development employment, mineral development students and mineral development population distribution as of Dec 31 of the year preceding the report. You may wish to double-check the Columbus School figures particularly because they were the subject of a concerted reconciliation effort between SMC and the District. (38)

Response: The school numbers have been updated in the EIS.

19. The employment, student and population data on page S-19 and S-20 is inconsistent with similar data on page S-31, Table S-2 and elsewhere. (38)

Response: The numeric inconsistencies have been corrected.

20. The potential agreement concerning the proposed pipelines and secondary roads 419 and 420 might or might not take the form of an amendment to the HRMI Plan. Other processes might take precedence. That will be up to SMC and Stillwater County to determine. (38)

The authority for the proposed agreement for installation of pipelines within county right-of-way is in the county permit identified in Table 1-1, not necessarily an amendment to the SMC Hard Rock Impact Plan, as stated in Section 2.4.2.5 on page 2-27. (46s)

Response: We acknowledge the permit from the county roads department is the discretionary approval required for pipeline installation within the rights-of-way of Highways 419 and 420. The reference to the HRMI Plan was intended to identify the means by which a proportionate share of the cost of associated roadway improvements would be negotiated and assessed to SMC.

21. ...I found 104 references cites at the end of the document, but none of them, that I could find, cited in the body of the text, parenthetically or in footnotes. (47s)

Response: The referenced listed in Chapter 9 were double checked to ensure at least one citation exists somewhere within the text of the document.

B.12.3 Alternatives

1. Of particular importance is the Paste landfill alternative. I do not feel your analysis was just to eliminate the proposal on an economic basis if you consider the total cost the pipeline, new road, tailings pond construction, reclamation, etc. especially when SMC annual report mentions they are doing an economic feasibility of paste landfill. (23)

Please consider the importance and cost effectiveness of the Paste landfill alternative, as an alternative to any further tailings dam construction, pipelines, etc. (168–24)

An alternative of paste tailings must be included in the final EIS currently considered for Stillwater Mining Co. If a savings of half the area needed is a possibility how can this method of tailings disposal be ignored? (36)

In addition, isn't it possible that emerging technologies such as paste backfilling and paste landfilling may become refined enough in the next twenty y ears to be feasible at SMC's mine. Supposedly, one of the reasons that these alternatives were eliminated was because they were relatively new and uncertain technologies (refer to pages 2-53 through 2-55 of the draft EIS). (5)

... make a careful study of the paste technology for backfill and landfill. Use of this technology could, at the least, postpone the construction of another tailings pond which

means that the capital investment could be deferred. The savings on interest on this investment could well offset any increased cost associated with the implementation of paste technology. Moreover, if it subsequently became necessary to create a new disposal area, it could be done without building more tailings ponds in the new location. While the DEIS says that paste technology has been considered and discarded, there is no information given to lend credence to this statement. (10)

...full consideration should be given by the DEQ and USFS to select an alternative using the technology called "paste tailings". This could reduce the capacity required by SMC to surface disposal by 50%! Referencing a study done by SMC in 1995, the DEIS said that "slimes-based paste would not substantially reduce SMCs requirements for storage of the tailings. We are not talking about "slimes-based paste, but total tailings paste" that would bring the most benefit. I feel that cost alone should not be the reason that such the alternative is not developed to consider paste tailings. (14)

Of the four alternatives for the Stillwater Mining Company, none are satisfactory. The company needs to use paste tailing. Then there would be no need for the Hertzler's impoundment. The paste tailings can be reclaimed immediately and will produce less water seepage. Environmentally, this is the only option that makes sense. (16)

I am wondering why the Paste Tailings process was not considered as one of the alternatives? It certainly sounds like the best option since it would reduce the need for as much space for Waste Rock Impoundment. (17)

We recently heard about the relatively new process call Total Tailing Paste that decreases the space necessary to dispose of waste. More tailings can fit in the same space underground, reducing the need for above-ground disposal. Tailings that must be disposed of above ground are also more compact, further reducing the volume needed for surface disposal. This should eliminate the need for the Hertzler impoundment! Stillwater Mining Company's 1997 annual report refers to the process on page 16. The DEIS refers to paste backfill on page 2-55. It states implementation of a total tailing backfill system would be unreasonably expensive. (20)

Cost should not be the determining factor in this decision. This is an Environmental Impact Statement. Our environment is what is being discussed and decided, not profit for a big company, jobs, economy for the area or any other issues. Only if this expansion can be done without harming the quality of our water, air, wildlife, etc., should it be permitted to go forth. Quality of life for the people close to the mine should also be considered! If Paste Tailings is the best solution for our environment, and we believe it is, it should be the preferred alternative in the final EIS. Please consider this. (20)

Recommendation: Either incorporate the whole tailings backfill/surface disposal scheme into Alternative D or create another alternative similar to Alternative D that includes whole tailings backfill/surface disposal. (22)

On page 16 of the 1997 Stillwater Mining Company annual report the company tells, with some pride, its stockholders of this relatively new process. I don't believe this disposal method can be dismissed as being too expensive. In light of its substantial *potential benefit it must be studied... This technique was listed as a preferred alternative in the ASARCO Rock C reek mine DEIS. I'm certainly not an engineer and realize that there might be addition problems with waste water. (25)*

SPA believes that a new alternative should be developed before completing the final EIS in light of the proven benefits of paste technology which include: -significant reduced volume of waste resulting from the use of total tails for backfill and landfill, - the use of paste to replace other material in the construction of an impoundment, and - potential for concurrent revegetation and reclamation because paste requires no settling period. The DEIS give reasons for rejecting paste technology for slimes, but does not address the potential benefits of total tailings paste. The DEIS says that using paste tailings for backfill would "require a major change in mine backfill methods and associated capital and operating costs would be excessive" (p. 2-55). We have been told by the authors of the DEIS that no cost analysis was conducted to substantiate that assertion. Even though the 1997 SMC Annual Report indicated that study of paste technology is being conducted by the Stillwater Mining Company, the DEIS rejects the use of paste - before the company data is available. (27)

According to the DEIS, more than 70 percent of SMC's tailings (by weight) is finer than 20 microns, which would lead to a fully saturated paste, with low strength characteristics, that could liquefy under seismic loading conditions. These same conditions would also be true of traditional slimes tailings disposal at the Hertzler Ranch site. However, the percent of fine material is for the slimes portion of the tailings only. According to information contained in the industry news magazine Engineering and Mining Journal, provided by the company, the grind of the whole ore is substantially more coarse than 70 percent passing 20 microns (at 60% minus 200 mesh or 74 microns). If paste technology were used, it would most likely be applied to whole tailings, as contained in the attached articles, which would have approx 30 % of tailings (by weight) finer than 20 microns. As result, if whole tailings were used and formed into paste prior to deposition as mine backfill or in a tailing impoundment, the overall volume of tailings density would be increased from about 70 pounds per cubic foot (PMF) to 90 PMF, increasing the in-place density of the tailings about 22%. The increase in density occurs in paste material because fine solid particles occupy interstitial spaces that would otherwise be occupied by less dense air or water. This results in a total decrease in necessary tailings impoundment capacity of approx 50% (as this would also increase the capacity of underground backfilling with paste tailings as well). Finally, it is widely recognized that paste can be amended, with portland cement, or other binders such as fly ash, to significantly increase its strength and durability. Studies have shown that the strength of paste can be doubled by the addition of little as one percent cement. (27)

Paste tailings technology has recently been recognized by industry as an environmentally advantageous method of tailings disposal. Some recent articles on its application and environmental advantages are attached. It has also recently been proposed for application at the ASARCO Rock Creek Mine near Noxon, MT, due to its inherent advantages in terms of seismic and static stability, water quality, erosion control, and both concurrent and long-term reclamation (see Draft EIS, ASARCO Rock Creek mine, 1998). Similar tailings disposal techniques (filtered tailings) are integral in the recently completed permitting for the Coeur-Alaska Kensington project (see Kensington Solid Waste Management Permit Application, 1997). Both mines are under *ground mines with similar concerns related to water quality and geotechnical stability, similar to the Stillwater Mining Complex. An additional similarity is that all three mines also have similar geochemical properties of relatively "clean" ore, which has not prevented alternative tailing disposal methods from being considered necessary at Rock Creek and Kensington. The DEIS (p2-53), in rejecting the paste landfill alternative, states that at SMC paste technology would not provide any substantive reduction in tailings volume, would not provide any substantive environmental benefits, and would not provide any advantages for concurrent reclamation over slurried tailings disposal. The DEIS goes on to say that it would substantially increase SMC's costs to dispose of the tailings. Based on information contradictory to that contained in the DEIS fails to include a cost analysis supporting the figure (S4.5/ton) cited, which is inconsistent with the costs for even cement amended tailings at other locations. (27)*

The DEIS (p 2-53), in rejecting the paste landfill alternative, states that at SMC paste technology would not provide any substantive reduction in tailings volume, would not provide any substantive environmental benefits, and would not provide any advantages for concurrent reclamation over slurried tailings disposal. The DEIS goes on to say that it would substantially increase SMC's costs to dispose of the tailing. Based on information contradictory to that contained in the DEIS, it is apparent that the real criteria for paste technology's rejection is cost alone. Using paste technology with total tailings may provide substantive reduction in the waste stream. It can be effectively stabilized, which means that Alternative D then becomes and even more viable alternative. In addition, reduction of the waste stream reduces the size of the reclamation job required with Alts B & C (as well as D). The costs of implementation are likely offset by the substantial reductions in future costs for reclamation and bonding, as well as, monitoring, etc. It is not unreasonable to assume that over the projected life span of the project, this technology will become even more economically feasible. It is in everyone's interest to look at application of Best Management Practices to reduce all negative/irreversible effects associated with the project expansion. I would like to see more substantive analysis of this technology. (28)

Why was paste backfill dropped from consideration as an alternative? It certainly sounds like the only method that should be considered in the final EIS. (29)

My husband and I are distressed by DEQs rejection of paste tailings as an alternative technology for disposal of tailings at Stillwater Mining Company's Hertzler Ranch. We have learned that use of this technology could reduce the space necessary for disposal of tailings by as much as 50%. (31)

I urge you to consider paste tailings disposal as the "preferred alternative" in the final EIS for the Stillwater Mining Co. As you know, tailings disposal has become a divisive issue in this community. It is my understanding that total tailings paste would reduce surface space requirements by 50%. In addition, paste tailings can be reclaimed immediately, produce less water seepage and can even be placed without an impoundment. (35)

There is little substantiation for the excessive costs cited in the DEIS. Apparently SMC has reported in its 1997 Annual Report that the company was studying the costs of paste tailings. The results of this study should be included in the final EIS. (40)

The DEIS seems to underestimate or discount the benefits of paste technology, such as significant volume reduction, potential for concurrent reclamation, stability (especially with cement added),and decrease life-time water seepage. For paste landfill, the document discusses only paste created from fine tailings and fails to report the results of the Stillwater Mining Company's (SMC) study of total tailings paste. For paste backfill, the DEIS simply states the 100% of the tailings could be backfilled, erroneously implying that anything less the 100% backfill would not be worth consideration. (40)

I believe Paste Backfill should be the preferred method of tailings disposal. I believe that because it would reduce the amount of tailings on the surface. (41)

It appears that paste backfill and paste landfill could significantly reduce the volume of tailings at the mine, but the DEIS dismisses the possibility without full analysis and without even endorsing the concept of waste reduction. (43)

DEQ and the Forest Service could have developed an alternative providing for a much smaller impoundment and put in place incentives for SMC to adopt other practices as they are identified, including the use of paste technology to reduce the volume of tailings. No serious analysis of paste tailings technology is presented or analysis done relative to this operation and the potential to reduce the magnitude of the impoundment requirements. (43)

Paste Tailings should be a high priority for the Proposed Stillwater Mining Tailings. (19)

The seismic stability of cement-amended paste should be considered. The feasibility of disposing of paste amended with cement and without a confining impoundment should be examined, especially since a significant amount of disturbance and construction at the Hertzler site would be devoted to using a very large volume of borrow material to build the impoundment. Additionally, the total amount of water seepage from paste should be compared to that from slurried tailings. (27)

The DEIS states that a high pressure pipeline would be necessary to pump paste from the mine site to a disposal site. In contrast, the Rock Creek EIS states that tailings would be slurried to the disposal site and made into paste there. (40)

Response: Based on the public's interest in and comments on paste tailings, the agencies reconsidered in more detail the potential use of whole tailings paste and fine tailings paste in both backfill and landfill situations as alternatives to SMC's current methods of handling tailings. The results of this reevaluation are contained in **Appendix H** and are summarized in **Section 2.5.2**. Essentially, the evaluation determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA. The following reasons form the primary foundation for this conclusion:

- Slurried tailings, fine tailings paste, and whole tailings paste would have average dry densities of 70 pcf, 80 pcf, and 100 pcf, respectively. Thus, 100 pounds of slurried tailings, fine tailings paste, and whole tailings paste would occupy about 1.4 cubic feet, 1.25 cubic feet, and 1 cubic foot, respectively.
- Fine tailings paste probably could not be used as backfill because it would not have the strength necessary for mining operations. Thus, with fine tailings paste, about 58 percent of the tailings would still be used as sand backfill (coarse tailings) in the mine and about 42 percent of the tailings, primarily the slimes, would report to a tailings impoundment for use as fine tailings paste.
- If whole tailings paste backfill were implemented, about 68 percent of the tailings would be used as paste backfill in place of the current sand system and 32 percent of the would have to report to the surface for disposal. Under SMC's current system, 58 percent of the tailings report as backfill in the mine and 42 percent report as slurried tailings to the tailings impoundment.
- The volume of fines tailings paste reporting to a surface impoundment would not reduce the size of the impoundment much over that needed for slurried tailings. For example, to store the same volume of tailings as addressed by Alternative B, an impoundment built at Hertzler using fines tailings paste would cover about 150 acres (compared with 163 acres for Alternative B) and would have a final embankment elevation of 5,025 feet (compared to 5,036 feet for Alternative B). There would be less than 5 percent reduction in volume and areal extent using whole tailings paste.
- Landfilling fine tailings paste would require a single paste plant at the Hertzler under alternatives B and C or at the east side tailings impoundment under Alternative D. SMC's current sand plant would continue to operate at the mine and deposit tailings in the existing impoundment.
- Whole tailings paste backfill also would probably require that the paste not backfilled into the mine be transported to Hertzler or the east side impoundment sites by truck or conveyor system. Pipeline transport of whole tailings paste to either of these sites would require pumps every 2,000 feet with electrical power lines to each site and several surge ponds along the route. The pipelines would have to be capable of withstanding high pressures and if a pipe were to rupture the pressure could cause more tailings to travel farther than would with slurried tailings. It is predicted that the friction developed along the length of the pipeline could cause the water to separate from the tailings resulting in a stiff material that could plug the pipe increasing the chances of rupture. The tailings could be re-slurried at the mill for transport through a pipeline to the impoundment followed by dewatering to reestablish a paste for disposal at an additional paste plant at the impoundment site. At a

minimum, transporting paste by conveyor or truck would substantially increase noise and visual impact, potentially increase impacts to wildlife, and increase the potential for spills, and traffic on Stillwater County Roads 419 and 420. A conveyor would increase surface disturbance and delay reclamation; it may not be possible to build a conveyor where steep slopes constrict the right-of-way without requiring substantial removal of soil material and creating an even steeper slope subject to erosion. Additional land would be disturbed at the Hertzler impoundment site to construct a paste plant there.

- Disturbance at the mine would increase substantially. Whole tailings paste backfill could require the location of as many as 9 to 10 paste plants along the length of the ore body toward East Boulder Mine; fewer plants would be needed if the mine operation expanded primarily downward rather than horizontally down the length of the ore body. SMC would have to construct a 200-foot by 200-foot (0.9 acre) pad at each of the portals where the paste plants would be built. Due to the steep slopes and the need for cut-and-fill construction, disturbance for the pads would encompass much more than one acre (and at least some of the waste rock generated by construction would have to be stored somewhere). The overall slopes on SMC's present system of roads to the upper portals are too steep for loaded cement trucks to negotiate. Each paste plant would require at least 2 truck loads of cement daily. Thus, SMC would have to construct a new system of roads with shallower slopes for the cement trucks. If SMC did construct a new network of roads, it's still questionable if the cement trucks could access the plants during the winter.
- The addition of the paste backfill system would substantially increase the requirements for electrical power. Each plant would require about 1.5 megawatts of power. With the increases in electrical requirements associated with increased production, Montana Power Company's distribution lines supplying the Stillwater Mine and Stillwater Valley could not handle the additional power for the paste plants, even with the upgrades discussed earlier. The power lines probably would have to be completely reconstructed back to Billings before the power for the paste plants could be supplied.

Although the agencies determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA at this time, DEQ and CNF added another mitigation measure for consideration by the decision makers. If one of the action alternatives is selected, this measure states that within 5 years of the ROD issued for this final EIS, DEQ, CNF, and SMC shall reevaluate the technologies and feasibilities for incorporating paste landfill and paste backfill into SMC's operations at the Stillwater Mine.

At the time the tailings paste landfill issue is reevaluated, the seismic stability of the cement-amended paste will require careful analysis. It is likely that with even minimal amounts of cement, the paste would not be subject to liquefaction induced flow failure, but could be subject to slumping and sliding under earthquake loading. Construction of an outer confining zone of high cement content paste is technically feasible, however the costs associated with providing sufficient cement to assure adequate strengths combined with the difficulties in assuring the quality of the paste, would likely outweigh the benefits. It is likely that an earthfill confining berm would be the most technically feasible approach.

The seepage from the paste would be reduced from that associated with slurry disposal of tailings, however a liner for containment will still be required. The risk of seepage from the lined impoundment would be similar for both the slurry and paste alternatives due to the proposed underdrain system included in the slurry liner system. This underdrain would be installed over the liner and would reduce hydrostatic pressures on the liner, limiting the driving pressure causing seepage.

Total tailings backfill would cost approximately $ ____ per ton of backfill (see **Appendix H**). This compares to $_____ per ton of sand fill currently being used. Cement amended tailings disposal is estimated to cost $____ per ton. These estimates include capital costs for development of the containment basin, paste plant, tailings and return water pipelines, and power lines as well as operating costs. Each additional paste plant would cost $7 to $10 million; however, there would only be 4-5 plants operating at the same time because the mill could not generate enough tailings to supply more plants. The plants would be moved to new sites when needed rather than continually purchasing and constructing new plants.

2. The documentation goes on to say that the valves have performed reliably for the preceding eight years and I wager that they are still in service today. I base my confidence on the fact that two identical valves were installed in Montana Power's Mystic Lake Hydro-Electric Power house in 1924 and have performed trouble-free since. But why even worry about 2,000 foot heads? Why not build a pipe and tank system to step the slurry to it's intended destination. That is, segment the elevation that needs to be obtained into a series of tanks, pumps, containment barriers, and connecting pipes. This method would provide several small containment areas for spills and drawdowns... rather than one large containment area and also reduce head pressure concerns. (5)

Furthermore, I am not convinced that all other alternatives were given adequate thought. For example, on page 2-52 of the Draft Environmental Impact Statement it is suggested by a member of the public that the tailings could be transported to the Nye

Creek drainage. The suggestion was eliminated from further consideration due to it being supposedly technologically unfeasible. It is assumed that the tailings would be pumped to the drainage. Was the use of a high inclined bucket conveyor system or a series of bucket elevators even considered? (5)

... so lets take a look at the option of pumping the tailings. SMC's rationale behind dropping the alternative from further consideration was that "few if any steel pipes can withstand a 2,000 foot or more head without bursting" and that "it would require construction of a significant catchment basin at the minesite for surge control and to capture spills, and drawdowns for accidents or maintenance." Now, if I calculate the pressure equivalent to a 2,000 foot head regardless of the diameter of pipe being used and using the standard weight density of liquid (i.e. 62.4 lb./cubic ft. and I assume that SMC's tailings slurry is at or close to this value since the tailing particles must be suspended in the water at some instant and thus be buoyant, then according to Archimedes' Principle the particles' weight must be equal to or less than the weight of the fluid that it displaces) the result is approximately 876psi at the bottom of the pipe. Now applying Barlow's Formula for determining the bursting pressure of pipe to a 7-inch diameter C-Grade seamless double extra strong pipe, the ultimate bursting pressure is 3951 psi. Assuming that the pressure will increase gradually (as opposed to suddenly 0-psi to Maximum psi) one can apply a safety factor of 4, thus 3951psi/4 = 988psi. Therefore, pipes do exist that will withstand a 2,000 foot head. Indeed, I know of the existence of documentation dated 1923 from the Pelton Water Wheel Company of San Francisco (a manufacturer of prime mover equipment for the hydroelectric generation industry) stating that in 1915, seven 28" isolation valves designed for heads of 1800 feet to 2500 feet were put into service in Norway. Since these valves have flange fittings and thus are designed to be connected to pipe, it would be reasonable to assume that the pipe must be rated for at least the same head requirements. (5)

Response: While pipes are available to withstand 2,000-foot head are available, they would need to be very thick and would be very expensive. This option was rejected as much on the basis of economic feasibility as technical feasibility.

The discussion in **Section 2.5.2** about a tailings impoundment in the Nye Creek drainage has been expanded. Established technology considered for the transport of tailings to an impoundment up Nye Creek included a multiple-stage pumping system consisting of a series of pumps, with surge tanks and reclaim ponds and a single stage pumping system and a high pressure pipeline. Use of multiple pumps would require significant site disturbance to develop each pumping station, to provide all-weather vehicle access, provide surge tanks, provide electrical power, and provide emergency containment. Capital and operating costs would increase with each additional pump station installed. As discussed in **Section 2.5.2**, installation of a tailings impoundment in the Nye Creek drainage and the use of a multiple-stage pumping system was not considered a reasonable alternative due to technical and economic considerations.

The analysis of the option of tailings disposal in the Nye Creek drainage focused on piping tailings. Conveyors and elevators were not considered because they would be even less feasible from a technical, economic, and/or environmental perspective than a pipeline. The construction costs for conveyors and buckets for longer distances are considerably higher than pipelines. The operational costs are also higher because more energy is required for uphill movement and maintenance requirements are higher because of the many additional moving parts. Also, there is spillage associated with buckets and conveyors both along the lines and at transfer points where they change direction.

An initial estimate of the costs for operation of a tailings impoundment at the Nye Creek site suggests costs would be on the order of $4.09 per ton of tailings, or about 25 percent higher than similarly-based costs for Alternative B ($3.27 per ton of tailings). The primary reason for the higher costs associated with this alternative is the increased capital costs to develop the impoundment site at Nye Creek with associated tailings pipeline and water reclaim lines as well as the requirement to pump tailings 1 mile to a site that is about 1,600 feet above the Stillwater Mine's mill. See **Appendix H** for more detail on costs.

3. Page 2-34, (Section 2.4.3.2) - The document suggests that the two tailings impoundments for Alt C would be operated separately with the modified center line expansion of the existing facility being filled to capacity prior to commencing operations at the Hertzler tailings impoundment. However, these facilities would likely be operated concurrently, similar to the concept proposed for Alts B and D. (7)

Response: The two facilities would not be operated concurrently. The agencies specifically developed this alternative to respond to the public's concerns about the impoundment at Hertzler Ranch. By not operating the impoundments concurrently, the construction of the impoundment at Hertzler could be delayed, which also would delay the effects.

4. 2.4.2.4. (p 2-27). How much additional land will the upgraded power line right-of way require? (9)

Response: The one mile of additional power line to Hertzler Ranch would require a right-of-way about 20 feet wide adjacent to the road.

5. ... it is not clear why Alternative B is preferable to Alternative D (pp S-19, 20). Tables S-1, S-2, 2-3 , and 2-4 display salient parameters, issues ,and resources. Note when Alternative D is compared to Alternative B, it is either better than Alternative B or "about the same as B" in essentially every major category. (11)

Response: Alternative B is preferred over Alternative D because it potentially limits the long-term disturbance associated with tailings disposal. While Alternative D results in less initial impact than Alternative B, it would provide less capacity than Alternative B, thereby not fully satisfying the purpose and need. After both impoundments in Alternative D reach capacity, another tailings impoundment would have to be constructed (probably at Hertzler) to continue to provide a place to place tailings. The application for that additional facility would be subject to additional environmental analysis and public comment. Additionally, two tailings impoundments constructed immediately across the Stillwater River from each other with the toes of both occurring within the floodplain raised concerns by the decision makers about the potential problems during floods or earthquakes. This increases the risk of impacts from potential failure of both impoundments. Locating the new impoundment at the existing mine site creates more problems for successful reclamation due to sand blasting than at Hertzler Ranch and there are relatively fewer people near the Hertzler Ranch site to be affected by construction of an impoundment at that site.

6. In S-16 Eighteen Tailings Facilities Sites First identified in 1985, most of the reasons stated for eliminating these sites have to do with the difficulties or cost of locating the tailings pond at any location other than the Hertzler Ranch site. Why not just simply state that this is the cheapest way to dispose of the tailings rather than the only way? Lets face it, the Hertzler site can be reached with pipelines along existing gradients-roads, construction by Stillwater County. It is the cheapest way for SMC to get the job done. But, in this case, is cheapest the best? I would submit that it is not the best or fairest solution to all involved, and that SMC has both the technological, physical, and monetary capability to arrive at a solution that is more compatible with the needs and desires of its neighbors. (13)

Response: The MEPA/NEPA process requires that the evaluated alternatives be implementable (i.e. something that could be developed if approved) and economic feasibility in part defines whether or not something could go forward or is reasonable. See 40 CFR 1500.1(e) and 1502.14 for a discussion of the need for reasonable alternatives in the NEPA process. Also, CEQ's 40 Most Asked Questions about NEPA (Question 2a) state that reasonable means both technically and economically feasible. **Table 2–2 in Section 2.5.1** of the EIS provides more discussion and reasons for dismissing the original 18 sites, primarily geotechnical and hydrogeological concerns. The three sites that were reevaluated were dismissed for several reasons, one of which was cost.

7. One of criticisms of Alternative D is that the tailings pipeline would be suspended across the Stillwater River to the East Side tailings impoundment , as would a wastewater pipeline to the Stratton Ranch. The EIS does not explain why these pipelines could not be buried under the river as would be the case for Alternative A. Burying the pipelines would significantly lessen the probability of a damaging break near the river. (22)

Response: As discussed in **Section 2.4.4.2**, the pipeline would be suspended on the bridge instead of buried because of restrictions associated with construction within the Stillwater River.

8. All analyses in the DEIS should be performed with a 5,000 tdp assumption since all infrastructure must support peak performance as defined by SMC. (27)

Response: The analyses for all resources that would be affected by a production rate peaking at 5,000 tpd was incorporated in the EIS. In some cases, an average rate of 3,000 tpd was used but even these effects portrayed in the final EIS considers peaks of up to 5,000 tpd.

9. It is recommended that the DEIS include evaluation and discussion of the Hertzler Ranch site's capacity to store additional tailings should the mine life be expanded beyond that addressed in the DEIS. Capacity for future expansion is an important issue, and should be part of the decision/selection process. Given that the evaluation of alternative tailings facilities sites indicates other sites may not be viable, what would be the likely impact of future expansion of the Hertzler Ranch site, as a reasonably foreseeable action? (27)

The DEIS should include evaluation and discussion of the Hertzler Ranch site's capacity to store additional tailings should the mine life be expanded beyond that addressed in the DEIS. Capacity for future expansion is an important issue, and should be part of the decision/selection process. Given that the evaluation of alternative tailings facilities sites indicated other sites may not be viable, what would be the likely impact of future expansion of the Hertzler ranch site, as a reasonably foreseeable action (section 2-6, pp 2-57-2-59 and section 2-7 pp 2-59 - 2-60). My understanding is that this type of scenario has been proposed with other operations. (28)

Response: It is possible that Hertzler Ranch could store additional tailings in the future if more capacity is needed. However, storage beyond the Hertzler impoundment as proposed has not been looked at in detail because consideration of such additional storage is not considered reasonably foreseeable no such need has yet been identified. A preliminary review of the property suggests some additional capacity exists in the drainage where the LAD storage pond is proposed and where the southern borrow area would be located. Additionally, these areas would probably encompass an area similar in areal extent to the 163 acres that the Hertzler impoundment would encompass. However, without detailed analysis, one cannot determine if sufficient fill material exists on Hertzler to construct another tailings impoundment. If sufficient fill material does not exist at Hertzler, then the feasibility of another impoundment would depend, in part, on the availability of an suitable supply of fill material. This is discussed in **Section 2.7.1** of the EIS.

10. Page 3-2: In the second full sentence of the first paragraph, the period of record from station 06202510 is 11 years, rather than 7 years as stated. Also, for clarification, recommend adding 'on the Stillwater River above Nye Creek' after that station number. Figure 3-2: The symbol for US Geological Survey gaging station 06202510 appears to be located on Nye Creek. The gage is located on the Stillwater River, 200 feet upstream from the confluence with Nye Creek. Table 3-3: The chronic aquatic-life standard for lead is 0.0005 mg/L, rather than 0 .00005 mg/L, for a hardness of 25 mg/L. (33)

Response: Changes have been made in the text.

11. Engineering analyses are missing for all alternatives except the recommended one, so it is difficult to endorse an otherwise attractive alternative that keeps mining activity at the mine site and provides for tailings disposal on both sides of the river. (43)

Response: NEPA requires the alternatives to be properly defined in order to estimate the effects [40 CFR 1502.4(a)] and this was accomplished. Sufficient engineering information is provided for all alternatives evaluated in detail in the EIS to allow a comparison of the environmental effects of each as required by NEPA in 40 CFR 1502.14. More data are available for the preferred alternative because SMC had to develop it for its required permit application for the project.

B.12.4 Mitigation

1. If there are any planned activities which will disturb or destroy these (geodetic control) monuments, NGS requires not less than 90 days' notification in advance of such activities in order to plan for their relocation. NGS recommends that funding for this project includes the cost of any relocation(s) required. (2)

Response: The National Geodetic Survey's database was searched over the world wide web for locations of geodetic control monuments. The search engine failed to identify any monuments within several miles of the proposed facilities comprising the action alternatives. Thus, no concerns exist about potential disturbances to or destruction of geodetic control monuments.

2. If a winter program of removing road-killed wildlife within the project area is instituted, we also concur that the proposed project will not affect the bald eagle. (3)

Response: As a result of past prescribed mitigation (see FONSI on the 1989 EA), SMC currently implements a year-round road-kill removal program between the mine and Nye. This measure will extend into the new project area.

3. If successful habitat mitigation does not occur in the near future the Stillwater bighorn population will be lost. We urge your agency and Stillwater Mining Company, in consultation with the Stillwater Bighorn Recovery Task Force, to investigate and implement an aggressive large scale habitat manipulation project as part of the mitigation package for the activities proposed by SMC in this DEIS. Some suggested manipulations that should be explored include large scale prescribed burns as well as more intensive livestock grazing on the traditional winter range as well as the East Sid e. (8)

Response: As stated in the EIS in Section **4.2.1.2.2**, the proposed project is not expected to have any direct impacts on the bighorn sheep. In addition, it also states that bighorn mitigation measures previously required by the agencies for mine-related impacts would continue to be implemented by SMC. There would be indirect effects due to competition for forage on winter range with mule deer, so an additional mitigation has been added (see **Section 2.4.5**).

4. We would suggest that SMC pursue conservation easement on portions of the Hertzler and Stratton Ranch areas to protect these winter ranges from further human encroachment by either subdivision or occasional sales of small home sites. Maintaining these properties in agriculture and native range will ensure their use by mule deer in perpetuity. (8)

Response: This is beyond the scope of this analysis. SMC has indicated it would not pursue easements at this time at Hertzler or Stratton Ranches so as not to interfere with current and planned uses of these properties.

5. ... lighting measures should be established which explicitly define output levels and shielding such that lights are not visible to neighbors. (11)

Response: Specific measures for light were included in the EIS — the application of the existing approved operational procedures required for the mine of using directionally-aligned and shielded lights. See **Section 3.7.1.1** of the EIS.

6. The absence of specific mitigation measures for noise and light disturbance is unacceptable. Explicit mitigation measures should be established (pp 3 -56, 57 and 4-33, 63). Both average and peak dBA levels should be monitored with maximum thresholds established so that neighbors are not adversely affected. (11)

Response: Specific measures for light were included in the EIS in Chapters 2 and 3 — the application of the existing mitigation of using directionally aligned and shielded lights. While no monitoring requirements nor action thresholds were developed for noise, noise mitigation was included (berm at east side and insulated housing for pumps at Hertzler). Other noise sources would primarily be associated with construction equipment whose noise generation is mitigated to the extent possible by mufflers.

7. Perhaps if the Sprinkler system was modified to lower the sprinkler heads and other control designs were made, the water maybe contained in the immediate area and not overlap the access road. (15)

Response: The agencies do not believe the mist from the LAD areas would impact the road surface or passing vehicles. Because this land is owned by SMC, SMC would make arrangements with the lessee of the ranch relative to impacts to the access road from the sprinklers.

8. We also would like to see the agencies develop a plan for measuring and minimizing the negative impact of activity at the Hertzler site on neighboring property values. Compensation for loss should be part of the plan. (27)

The second is to suggest further mitigation measures -- measures to protect property values, land uses, and a valued way of life for residents of the area -- as the mine expands. (47s)

Response: The EIS indicates in Section 4.5.1.2.6 that overall property values are not expected to be affected by the proposed project, although some individual properties may be affected. The agencies do not have the authority to require SMC to compensate for losses in property values.

9. Extra protection should be required where the pipeline passes through unstable areas and close to the river (pp. 4-6--4-8, 4-12). (27)

Response: The analysis in the EIS discloses that the pipelines are adequately protected as proposed.

10. The EIS should require SMC to schedule shift changes to avoid times when school busses are on the roads (pp. 4-64-4-66). (27)

It might be a good idea to institute a speed limit on the road and perhaps to stagger the mine shifts so they don't coincide with peak traffic uses on weekends, or during school hours when children are being transported to and from school. (28)

Response: The current shift change times were developed by SMC and considered traffic peaks as well as other factors. The agencies do not feel the need to address school buses is required at this time. If there is a problem in the future, the agencies can revisit the issue and address changes.

11. A mitigation measure requiring the mine to develop a plan, prior to permitting, with incentives for car pooling would certainly be legal, would help reduce traffic today, and would insure that future operators of the mine would continue the program. (27)

The document adds that SMC has suggested that it might not be legal to require car pooling. There is car pooling required all over the country. there must be some way to allow for continuing a project or a process which has been fairly successful at keeping the traffic down... (47s)

Response: While car pooling is no longer be required by the agencies, the agencies have developed a mitigation measure for SMC to encourage car pooling among its employees.

12. Measures should be added to ensure that additional power lines would be added to existing lines and that no additional visual disturbance or other impact resulting from the increase would occur. (27)

Response: The transmission lines currently providing the power supply to the mine would be upgraded to provide the additional power needed to increase production to 5,000 tpd. In all cases, this upgrade would involve improvements to the existing line as opposed to the construction of an additional line into the area. Additional information on this line upgrade has been added to **Section 2.4.2.4** of the EIS.

13. No mitigation measures have been suggested to place limitations on noise, light or even traffic disturbances at the site; the DEIS simply refers to current practices at the mine that address those issues. We would like to see all such practices - many of which exist because of stipulations in previous EIS documents - recommended as mitigations in this EIS and written into the permit so that best practices will continue even if management, ownership, mind set or operations at the mine change. (27)

Response: All previously required mitigation measures are carried forward unless their removal is specifically discussed in this EIS. Appendix C has been added to the EIS, which summarizes all currently in-place mitigation measures.

14. If a "30-year" solution is permitted the mine should be allowed to use above-ground disposal for no more than the currently requested volume of tailings over the next thirty years. (27)

Response: The mine would be limited to the proposed above-ground volume. Any more would require a permit modification. The agencies permit surface disturbance and design capacity. If SMC finds ways to increase storage without exceeding permitted effects, that would be allowable and encourages efficiency.

15. In a similar light, the consideration of paste backfill in the underground mine workings is also clearly biased in that the DEIS states reasons for dropping the technology that are contrary to information contained in the attached literature and produced by Stillwater Mining Company for the East Boulder mine. Paste technology has been successfully used at several mines in Canada, and is widely recognized as an important new technology with wide application throughout the mining industry. According to SMC's 1997 annual report, "The Company is investigating the economics of 'paste backfill,' which would use a mixture of thickened tailings and cement to fill excavated slopes. Paste backfill would improve the structural integrity of the fill and allow for 'underhand cut and fill' mining methods under the paste backfill. Additionally, paste backfill reduces dilution because it reduces the amount of sand from fill that is recycled back into the mill. An engineering study is underway to establish the economics of this program, and results are expected by the end of the first quarter in 1998." As previously discussed, paste tailings backfill would significantly decrease the need for placement of tailings on the surface. By its application elsewhere, the backfill system for paste tailing has convincingly not been shown to be technically infeasible or unreasonably expensive. Combined with surface disposal of paste tailings, application of the technology in combination with the consideration of alternative disposal sites might prove to offer more operationally and environmentally advantageous alternative *than have been considered in the DEIS. As an example, the application of paste technology to the tailings, and combined with waste rock as suggested by the attached article, could potentially prove the alternative of storage of all tailings and waste rock in close proximity to the mine site to be the most advantageous alternative. (27)*

The articles attached strongly support the environmental and concurrent reclamation advantages of paste tech. Those advantages are similarly highlighted in the ASARCO Rk Cr Supp. EIS and numerous sup porting documents. Those advantages include improvement is seepage quantity and chemistry, concurrent and long-term reclamation, sedimentation, etc.,. It is difficult to understand how entirely different reasoning can be presented in the Stillwater DEIS in the face of overwhelming contradictory infor. This is particularly questionable considering that similar DEQ personnel coordinated both studies, both projects have also involved FS participation, and similar engineering consultants have been used by the both projects to evaluate the technology. This suggests that the infor presented has not been objectively evaluated by the agencies, and that the consultants studies are contrived to provide the result desired by the company, rather than a truly independent and objective engineering evaluation. The agencies are strongly urged to conduct additional study of the appl of paste tech. given its inherent environmental advantages that speak directly to many of the public's concerns. As a final example of questionable info contain in the DEIS in this regard, according to the DEIS(p 2-54), the pipeline system would have to be upgraded to a high pressure pipeline with positive displacement pumps, which is more costly and require more maint. This pipeline also has a higher risk of rupture. The ASARCO Rk Cr proposal, in a manner that would be standard for almost any tailings impoundment located a significant distance from the mill itself, pumps slurry to the tailings impoundment here it is processed into paste, and returns excess water. This more efficient and practical method of tailings slurry transp. in a pipeline, which if employed at Stillwater, eliminates the concerns cited. (27)

The inclusion of these comments appears to make obvious the DEIS's attempt to arbitrarily reject the paste alternative rather than truly evaluate its potential merits. (27)

Response: Based on the public's interest in and comments on paste tailings, the agencies reconsidered in more detail the potential use of whole tailings paste and fine tailings paste in both backfill and landfill situations as alternatives to SMC's current methods of handling tailings. The results of this reevaluation are contained in **Appendix H** and are summarized in **Section 2.5.2**. Essentially, the evaluation determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA. The following reasons form the primary foundation for this conclusion:

- Slurried tailings, fine tailings paste, and whole tailings paste would have average dry densities of 70 pcf, 80 pcf, and 100 pcf, respectively. Thus, 100 pounds of slurried tailings, fine tailings paste, and whole tailings paste would occupy about 1.4 cubic feet, 1.25 cubic feet, and 1 cubic foot, respectively.

- Fine tailings paste probably could not be used as backfill because it would not have the strength necessary for mining operations. Thus, with fine tailings paste, about 58 percent of the tailings would still be used as sand backfill (coarse tailings) in the mine and about 42 percent of the tailings, primarily the slimes, would report to a tailings impoundment for use as fine tailings paste.
- If whole tailings paste backfill were implemented, about 68 percent of the tailings would be used as paste backfill in place of the current sand system and 32 percent of the would have to report to the surface for disposal. Under SMC's current system, 58 percent of the tailings report as backfill in the mine and 42 percent report as slurried tailings to the tailings impoundment.
- The volume of fines tailings paste reporting to a surface impoundment would not reduce the size of the impoundment much over that needed for slurried tailings. For example, to store the same volume of tailings as addressed by Alternative B, an impoundment built at Hertzler using fines tailings paste would cover about 150 acres (compared with 163 acres for Alternative B) and would have a final embankment elevation of 5,025 feet (compared to 5,036 feet for Alternative B). There would be less than 5 percent reduction in volume and areal extent using whole tailings paste.
- Landfilling fine tailings paste would require a single paste plant at the Hertzler under alternatives B and C or at the east side tailings impoundment under Alternative D. SMC's current sand plant would continue to operate at the mine and deposit tailings in the existing impoundment.
- Whole tailings paste backfill also would probably require that the paste not backfilled into the mine be transported to Hertzler or the east side impoundment sites by truck or conveyor system. Pipeline transport of whole tailings paste to either of these sites would require pumps every 2,000 feet with electrical power lines to each site and several surge ponds along the route. The pipelines would have to be capable of withstanding high pressures and if a pipe were to rupture the pressure could cause more tailings to travel farther than would with slurried tailings. It is predicted that the friction developed along the length of the pipeline could cause the water to separate from the tailings resulting in a stiff material that could plug the pipe increasing the chances of rupture. The tailings could be re-slurried at the mill for transport through a pipeline to the impoundment followed by dewatering to reestablish a paste for disposal at an additional paste plant at the impoundment site. At a minimum, transporting paste by conveyor or truck would substantially increase noise and visual impact, potentially increase impacts to wildlife, and increase the potential for spills, and traffic on Stillwater County Roads 419 and 420. A conveyor would increase surface disturbance and delay reclamation; it may not be

possible to build a conveyor where steep slopes constrict the right-of-way without requiring substantial removal of soil material and creating an even steeper slope subject to erosion. Additional land would be disturbed at the Hertzler impoundment site to construct a paste plant there.

- Disturbance at the mine would increase substantially. Whole tailings paste backfill could require the location of as many as 9 to 10 paste plants along the length of the ore body toward East Boulder Mine; fewer plants would be needed if the mine operation expanded primarily downward rather than horizontally down the length of the ore body. SMC would have to construct a 200-foot by 200-foot (0.9 acre) pad at each of the portals where the paste plants would be built. Due to the steep slopes and the need for cut-and-fill construction, disturbance for the pads would encompass much more than one acre (and at least some of the waste rock generated by construction would have to be stored somewhere). The overall slopes on SMC's present system of roads to the upper portals are too steep for loaded cement trucks to negotiate. Each paste plant would require at least 2 truck loads of cement daily. Thus, SMC would have to construct a new system of roads with shallower slopes for the cement trucks. If SMC did construct a new network of roads, it's still questionable if the cement trucks could access the plants during the winter.
- The addition of the paste backfill system would substantially increase the requirements for electrical power. Each plant would require about 1.5 megawatts of power. With the increases in electrical requirements associated with increased production, Montana Power Company's distribution lines supplying the Stillwater Mine and Stillwater Valley could not handle the additional power for the paste plants, even with the upgrades discussed earlier. The power lines probably would have to be completely reconstructed back to Billings before the power for the paste plants could be supplied.

Although the agencies determined alternatives based on the use of fines tailings paste or whole tailings paste are not reasonable alternatives under MEPA/NEPA at this time, DEQ and CNF added another mitigation measure for consideration by the decision makers. If one of the action alternatives is selected, this measure states that within 5 years of the ROD issued for this final EIS, DEQ, CNF, and SMC shall reevaluate the technologies and feasibilities for incorporating paste landfill and paste backfill into SMC's operations at the Stillwater Mine.

At the time the tailings paste landfill issue is reevaluated, the seismic stability of the cement-amended paste will require careful analysis. It is likely that with even minimal amounts of cement, the paste would not be subject to liquefaction induced flow failure, but could be subject to slumping and sliding under earthquake loading. Construction of an outer confining zone of high cement content paste is technically feasible, however the costs associated with providing sufficient cement to assure adequate strengths combined with the difficulties in assuring the quality of the paste, would likely outweigh the benefits. It is likely that an earthfill confining berm would be the most technically feasible approach.

The seepage from the paste would be reduced from that associated with slurry disposal of tailings, however a liner for containment will still be required. The risk of seepage from the lined impoundment would be similar for both the slurry and paste alternatives due to the proposed underdrain system included in the slurry liner system. This underdrain would be installed over the liner and would reduce hydrostatic pressures on the liner, limiting the driving pressure causing seepage.

Total tailings backfill would cost approximately $ ____ per ton of backfill (see **Appendix H**). This compares to $_____ per ton of sand fill currently being used. Cement amended tailings disposal is estimated to cost $____ per ton. These estimates include capital costs for development of the containment basin, paste plant, tailings and return water pipelines, and power lines as well as operating costs.

16. The agency mitigations for the tailings impoundment identified for Alt D should be included in the final preferred alternative, regardless of the site chosen. (27)

The agency mitigations for the tailings impoundment identified for Alternative D should be included in the final preferred alternative, regardless of the site chosen. (28)

Response: The agency mitigations identified in **Section 2.4.5** apply to all action alternatives, unless the facilities referenced in the mitigation are not part of a specific alternative. They are not exclusive to Alternative D, although the proximity of the mitigation section (2.4.5) to the final sections on Alternative D (2.4.4) can give that impression.

17. Eagles are considered to be relatively tolerant to human activity. It would be best if there were substantive studies of the population and ongoing monitoring of eagles to assess impacts of development. These studies could enlist local community members to monitor eagle populations and activities and would be useful in the assessment of development effects. Additionally, fish population studies should be implemented to monitor changes that may affect eagle activities in the area. (28)

... I'd like to suggest that some fish population and dynamic studies would be included to corroborate some of this information and would be useful in the future. (46s)

... what I'd like to see proposed maybe is that, as far as the eagles are concerned, it could be a community effort and we could have people in the community do a census and collect data and help out. Because I think that would be valuable. (46s)

Response: Several existing water quality and aquatic monitoring studies would continue to be implemented that would measure the potential for impacts to fish. See **Section 4.3.3** of the EIS and **Appendix C**. Mitigation is only appropriate when adverse effects are anticipated. Because none are anticipated (as discussed in the Biological Assessment in **Appendix F**), no mitigation is needed.

18. Because of the uncertainties in predicting the effect of the increase in nitrate loads in various areas, monitoring the ground water in unconsolidated aquifers and bedrock aquifers near source areas, as hydrologically appropriate, would seem prudent. (33)

Response: As described in the discussion of water quality under **Section 2.4.2.7 Monitoring**, DEQ and CNF would require SMC to modify its water monitoring plan to incorporate the placement of additional monitoring wells in areas proposed for new facilities, including the Hertzler tailings impoundment, waste rock storage site, and new LAD sites.

19. In Figure 3-1, the Hertzler (irrigation) Ditch is shown to intersect the three western land application areas. The Robinson Draw ephemeral flow joins the ditch in the 1st (left to right) LAD pivot area. The Stanley Coulee (indicated to flow year-round) joins the Hertzler Ditch in the 3rd LAD pivot area. Both the Stanley Coulee and the Tandy Coal Mine Draw spring (said to flow year-round) flow into the 4th LAD pivot area. In regards to the heavy metals discharges at the site (adit discharges, spring runoff and ephemeral flows in Robinson Draw, Stanley Coulee and Tandy Coulee), EPA requests that consideration be given to design which would collect, contain and treat deleterious heavy metal discharges and flows. For example, one possible flowsheet for water treatment is to obtain heavy metal precipitation through lime precipitation in a redesigned (geomembrane-lined) Hertzler storage pond followed by pH adjustment prior to the point-of-compliance release to the LAD pivot system. (32)

Response: SMC plans to pipe irrigation water through the LAD areas to ensure that the downstream water user has the opportunity to use native water, undisturbed by mining activities. Any heavy metals from the LAD are anticipated to be tied up by fine grained soil particles. Ground water in the mixing zone will meet human health standards. The revised Chapter 3 better characterizes the limited incidence of elevated metals concentrations in Robinson Draw, Stanley and Tandy Coulees, and SMC has no plans nor obligation to treat this water.

20. Plant some fish in the water ponds, let the public fish from time to time to prove how little harm there is in it. Put these tailings out for recycle as another industry use as (paint, plaster, fire retardants, cement, to name a few). Grade and sort this waste rock, *and offer for other use (road topping for one). Offer this mine water for Agr, use to others along the way. (39)*

I do support more emphasis on reducing and finding usable products that could be made out of this waste instead. (46s)

Response: Alternative uses for waste rock have been used to a very limited extent in the past (e.g., riprap). The limiting factor for such uses is the transportation cost from the mine to the point of use. If SMC could find a market for water or waste rock, it would take advantage of it because it would reduce disposal costs. Also, allowing the public to recreate at an operating mine is not legal or safe.

21. The EIS should consider permitting a smaller expansion to allow for review of available technology again in a shorter period of time, or it should consider establishing a schedule for review of mining and waste disposal methods to provide an incentive for SMC to adopt new technologies. (40)

Response: The demand for platinum/palladium and SMC's position in that market is discussed in **Section 1.1.1** of the EIS. This indicates that long-term planning is warranted. Also, the proponent can determine the amount and duration of their depositional need (i.e. purpose and need of project) and MEPA/NEPA requires that all action alternatives considered in detail must at least partially meet the purpose and need. Additionally, in the past, citizens have expressed concern about "incremental permitting" and wanted to know the long term plans of SMC.

22. I am concerned that the DEIS lists only three mitigation measures with none for traffic, noise or visual pollution. The DEIS seems to assume that the current SMC best practices will continue without mitigation requirements. This is not realistic, especially over a 30-year period during which management, corporate visions, priorities and goals inevitably will change. (44)

It is difficult to understand what mitigations from previous environmental impact statements and other amendment procedures are recommended to go forward. (43)

I was surprised to see that the DEIS recommended only three mitigation measures. I would like to see mitigation measures to require that today's effective pollution control measures go forward with the new permit and to require the company to encourage car pooling and control light and noise pollution at the mine and at any impoundment site. (43)

We might have looked to our oversight agencies to lay out mitigation measure to reduce traffic and noise, to reduce the size and visibility of the proposed impoundment and to ensure that best practices are used going forward. (43)

Response: The current mitigation measures required for the mine will continue to be enforced and these are now listed in **Appendix C**. The mitigation measures discussed in this EIS only add measures needed to address impacts specifically associated with the proposed Revised Waste Management Plan.

23. ... there's a very sharp corner down on the lower end of our property, about the mid-section of that road between the mine and Carter's Camp. We've killed a number of people on that corner in the past. When we pull them out of the river, it's not a pretty sight. I think that road should be -- that corner should be straightened out and put more onto a even grade and that steep bank backfilled. That will result in taking some of our private property. (46s)

Response: Stillwater County would determine what road reconstruction specifications would be required. SMC is committed to work with the County on this issue.

24. If any kind of road reconstruction is done, which the county commissioners alluded to in their comments, you know, it really wouldn't be fair to go in and rip up what little road we have left, put the pipeline in, and leave us with a mud hole. So I think the mine should be responsible, or someone should be coming along and repairing that road and bringing it up to some sort of specifications and standards when they do. (46s)

Response: As stated in the EIS, SMC would work with the County to determine the standards that would be used for road reconstruction associated with the pipeline burial.

25. One of the things that this document or the EIS can do is to provide the mitigation measures that makes sure the best practices that occur in the operation are carried forward in the event that management or ownership changes. There aren't any provisions like that in this document currently. (47s)

Tiering makes it impossible to seriously evaluate conclusions and action plans which may or may not be based on bringing forward some but not necessarily all of the previous mitigation measures and analyses from earlier EISs and Records of Decision. (47s)

Response: **Appendix C** contains a list of all mitigation measures currently required for the project. All permit conditions are automatically transferred with the permit to a new owner.

B.12.5 Legal

1. I ask you; is it the public's concern how much it costs SMC to responsibly contain their waste? If SMC cannot mine their ore and economically control their waste, then maybe they should not be in the mining business at all. (5)

Response: The EIS process requires that the evaluated alternatives be implementable (i.e. something that could be developed if approved) and economic feasibility in part defines whether or not something could go forward or is reasonable. See 40 CFR 1500.1(e) for a discussion of the need for reasonable alternatives in the NEPA process. Also, CEQ's 40 Most Asked Questions about NEPA state that reasonable means both technically and economically feasible.

2. It is mentioned that SMC would negotiate an agreement with the county for road upgrades to the Hertzler Ranch to allow for installation of buried pipelines in the rights-of-ways (pp 2-27, 28). It is further advanced that SMC may consider use of the "power of eminent domain" to claim pipeline rights-of-way. Yet, as we understand, this could only be accomplished if SMC were to prove that the rights-of-way, so claimed, would be for specific public uses. What might these public uses include? Is Stillwater County being held hostage by threats of SMC? (11)

Response: Eminent domain is provided for mining companies by Montana Code Annotated Section 70–30–102 (1995). The language in subsection 5 of section 70–30–102 provides that:

> The right of eminent domain may be exercised in behalf of the following public uses:
>
> (5) roads, tunnels, ditches, flumes, pipes, and dumping places for working mines…; also outlets, natural or otherwise, for the flow, deposit, or conduct of tailings or refuse matter from mines…

SMC's proposed pipelines seem to fit squarely within this language.

3. Under the provisions of Montana Code Ann S 76-2-101 et seq. (1995), a zoning petition was submitted to the Stillwater County Commissioners April 1, 1997, revised and resubmitted May 18, 1997. Subsequently, affidavits were obtained for some signers to verify their signatures, and various legal issues were addressed (February 5, 1998). The petition requests that a planning and zoning district be established which encompasses approximately 7 miles of the Stillwater River (a downstream path from Nye to Riddle Cliff). This proposed zoning district is called the "Stillwater River Corridor," and contains more than 13,000 acres, including a portion of the former Hertzler Ranch where the proposed tailings impoundment would be located. The petition encourages agriculture, residential, recreational and neighborhood commercial land uses: and it excludes industrial, manufacturing, and waste disposal uses, such as disposal or storage of mining waste and tailings. The County is still reviewing this matter. (11)

We signed the petition that succeeded in getting the required 60%of the landowners who want the area from Nye and downstream approximately 10 miles along the Stillwater River zoned for agriculture and recreation, which is the historical use of this area. Those of use who signed the petition have made our intentions known and voiced our opinion by way of the petition. (21)

Response: The commentor has correctly identified the existence of the Stillwater River Corridor zoning petition. According to John Beaudry, Stillwater County Planning Director, the zoning petition has been formally accepted with the necessary signatures and, pursuant to Montana State Code, the Stillwater River Corridor Planning and Zoning District was recently formed. Additionally, a zoning commission has also been established. To date, the commission has not approved any formal land use or development density changes for the corridor, which includes a portion of the Hertzler Ranch site. Until the time when such zoning changes are formally approved by the commission, we cannot evaluate the potential consequences on the action alternatives. Information on this petition has been added to the EIS in **Section 2.7.2.**

4. ... it seems more appropriate that the responsible government agencies (Montana Department of Environmental Quality and the US Forest Service) establish limits and incrementally review changes within shorter time-frames (e.g. 5 year intervals) thereby allowing SMC to demonstrate the social, economic, biological and physical consequences of its operation, while at the same time, witnessing the evolution of technologies which shape the future. (11)

Response: Both MEPA and NEPA require incremental review of project effects. This review is documented in Inspection and Monitoring Documentation. Also, SMC has been operating for 13 years and has had numerous amendments to their original Plan of Operations with each triggering MEPA/NEPA and public review. There are also requirements for 5-year review of Reclamation Bond Adequacy and MPDES permit renewal with public participation. Changes in socioeconomic effects to governmental entities are dealt with through the mitigation required by the Hard Rock Impact (HRI) Plan with oversight by the Hard Rock Impact Board and Stillwater County. Changes in mine employment greater than 15 percent requires an HRI update. Limits on the amount of allowed disturbance and subsequent biological and physical impacts are established by the permit and compliance is ensured through regular inspections.

5. Although Highways 419 and 420 are county roads administered by Stillwater County, what legal basis does the county have to convey rights-of-way to SMC? What if county residents opposed such action? (11)

Response: The County has jurisdiction over all county roads. Residents would have to contact the County with any questions or comments about rights-of-way.

6. Set up a community advisory body that will meet regularly to discuss items related to monitoring, socioeconomic issues, and long term planning. (22)

The EIS should require the establishment of a citizens' advisory group with which the mine would share information to provide greater public insight into ongoing and *potential activity and expansion at the mine and to help the mine develop voluntary measures to protect the area. (27)*

Through the auspices of the DEQ and FS, citizen involvement in ensuring the term of the various mine permits are achieved should be facilitated. A citizen advisory group should be established which will participate in and review the results of monitoring and testing programs. The results should be provided and disseminated to the public on a regular basis, and comments invited for consideration by the agencies. The citizen advisory group should also be informed of any proposed future changes or deviation from the permits, and ensure that adequate analysis is performed to provide the public and agencies with adequate data for meaningful evaluation. It is recommended that the agencies exercise whatever in fluence they can in providing for meaningful citizen involvement in the on-going monitoring and compliance of the mine operations. (27)

In an ongoing effort to identify needs and adjustments that are required no matter which alternative is implemented, it would be good to have a citizen advisory group. This group would participate in and review the results of monitoring and testing programs. The results should be provided and disseminated to the public on a regular basis, and comments invited for consideration by the agencies. The citizen advisory group should also be informed on any proposed future changes or deviation from the permits and ensure that adequate analysis is performed to provide the public and agencies with adequate data for meaningful evaluation. (28)

Response: A citizen's advisory group is not planned. SMC could establish such a group but there is no law that allows the agencies to require it. In fact, the Federal Advisory Committee Act precludes the Forest Service from setting up such a group without Congressional approval. All monitoring reports are public information and can be obtained from the agencies with jurisdiction. Also, all proposed changes to the project would be communicated to the public through the public forums required by each permitting regulation. Because these mechanisms are already in place, a specific group would not be needed. However, the agencies would be available to meet with SPA or other citizens to review annual monitoring reports.

7. Issue monitoring reports each year. Include as part of the annual review (or more frequently) an opportunity for the public to meet with you to go over this monitoring data. Is the company complying with the terms of its permit? Are expected conditions being met? If not; are appropriate actions being taken to protect the water, air, soils, and wildlife resources of the area and to minimize disruptions to the rural character of the area? (22)

Response: All SMC's annual monitoring reports are public information and can be obtained from the agency with jurisdiction. CNF has requested, but not yet received, funds to prepare annual monitoring reports. All DEQ's inspections and monitoring data (when obtained) are available for public review. The agencies would be available to meet with SPA or other citizens to review annual monitoring reports.

8. The state has over-ruled county recommendations for a speed limit on highway 419. With the additional activity at the mine at Nye, a speed limit no greater than 65 mph (55 mph preferred) should be re-established to ensure safety (pp. 4-64 to 4-66). We understand that the DEQ and USFS can not impose speed limits, but, as part of the assessment of the impacts of expansion at the mine, the agencies should recommend the establishment of a speed limit to the MT Dept of Transportation. (27)

Response: An assessment of speed limits and recommendations of speed limits to MDOT are beyond the scope of this analysis.

9. After examining the document and speaking with DEQ and Forest Service personnel it is clear that the appropriate engineering analyses and cost analyses were done only on the preferred alternative. In fact, the DEIS not only lacks critical information, but also does not effectively reference other available sources. This is due in part to tiering which the document described as "referencing information presented in other previously prepared NEPA/MEPA documents... to minimize repetition" and in part to the absence of either footnote or parenthetical references in the text to analyses or other information on which conclusions are based. There are 104 references listed at the end of the document, but few references to them in the body of the text. To find that data and reasoning for conclusions it was easier for us to call the people who did the EIS and ask for the appropriate reference than to guess which reference might be pertinent. While the individuals we called were extremely responsive and helpful, this was a very inefficient and incomplete solution. (27)

Engineering analyses are missing for all alternatives except the recommended one, so it is difficult to endorse an otherwise attractive alternative that keeps mining activity at the mine site and provides for tailings disposal on both sides of the river. (43)

The goals of tiering are laudable, in that they try to reduce the document size so that it is more manageable to interested parties and can be reviewed and evaluated more thoroughly. However, efforts should be implemented that makes the supporting documentation easier to access. Many private citizens cannot get to the location of these documents without making sacrifices in terms of time and lost wages. In the scientific community, the burden is upon the author to utilize exact references that are readily available in the public domain by those who request them. Certainly it would be possible to place copies of pertinent documents in local libraries or public areas without too much expense. Additionally, many of the latest documents are prepared on computers, making it relatively easy to convey this information to interested parties. Also, many government documents and maps are available over the internet. (28)

The third is to focus on the EIS document, which does not itself contain enough information and does not effectively reference other available sources.... This is due in part to the tiering, which the document describes as, quote, "referencing information presented in other previously prepared NEPA/MEPA documents to minimize repetition," and in part to the absence of references in the body of the test to engineering analyses of other information on which the conclusions are based. (47s)

Tiering makes it impossible to seriously evaluate conclusions and action plans which may or may not be based on bringing forward some but not necessarily all of the *previous mitigation measures and analyses from earlier EISs and Records of Decision. (47s)*

Response: NEPA encourages tiering to reduce document length [40 CFR 1500.4(a-q)]. While tiering may not always be the most effective solution, NEPA/MEPA requires agencies to focus on the issues at hand and to provide sufficient information for the decision-makers [ARM 17.4.615(2(d)); 17.4.625]. Tiering is recommended to minimize redundancy in EIS documents. This is discussed in Section 1.6 of the EIS and can also be found in NEPA in 40 CFR 1500.1(b) and 1500.2(b) and MEPA in ARM 17.4.615(2(d)) and 17.4.625. All previously-required mitigation measures are carried forward unless their removal is specifically discussed in this EIS. See Appendix C for a list of all currently applied mitigation measures. The previous NEPA/MEPA documents are public documents and are available for public review. They are available at CNF's offices in Red Lodge, DEQ's offices in Helena, and in some local libraries. The supporting mine permit documents are too voluminous for most libraries but are available at SMC, CNF, and DEQ's offices.

10. ... the DEIS states that in 1995 SMC studied the feasibility of paste tails disposal and examined the use of both slimes-based paste and total tails paste (p. 2-53, Paste Landfilling). The remainder of the discussion in this section of the DEIS seems to apply only to the results of slimes-based paste. No results of total tails paste are discussed - a grave omission, especially since total tails paste promises much greater benefits than slimes-based paste. Additionally, no mention is made of the cost study which SMC cites in its 1997 annual report (p. 16). (27)

Response: Paste tailings (both backfill and landfill) were reconsidered along with SMC's proposal for an experimental paste plant. However, the overall result of this reevaluation was the same. DEQ and CNF do not think paste landfill, paste backfill, or a combination of the two (fines tailings paste or whole tailings paste) are feasible technologies for the existing Stillwater Mine operation (please see the explanation for comment 15 under **Section B.12.4** of this appendix). The discussion in **Section 2.5.2** has been expanded to more thoroughly describe DEQ and CNF's conclusions.

11. The DEIS does not provide sufficient information from current water quality permits, which should be included in the EIS. Therefore it is difficult to understand measures that are proposed to protect water quality. (27)

Response: More information summarizing the water quality permits has been added to the EIS in the monitoring section for each alternative analyzed in detail in Chapter 4.

12. Additionally, no stipulations have been written to address the concern that unforeseen activity may be proposed for the Hertzler site. With the approval of the "30-year" impoundment the likelihood that an EIS and EA would be triggered in response to *proposal for additional activity at the site is greatly diminished, reducing the opportunity for public participation in such decisions and exposing the neighbors to further threats to both their property values and way of life. In putting forward a proposal that reduces the requirements for public review in the future the agencies should include rigorous mitigations and spell out provisions for ongoing oversight that includes public participation. (27)*

Response: The 30 years is not a cap on development but merely an estimate of how long it will take to develop and use the proposed facilities. Under the terms of this proposed amendment, SMC would be limited by the types and sizes of proposed facilities at Hertzler Ranch and the amount of corresponding disturbance. If additional facilities are proposed in the future that would exceed this amount of approved disturbance, another amendment would be necessary with corresponding public input.

13. There is no reference to the 1997 SMC annual report which mentions two extremely relevant studies. One is being conducted to establish the optimum size for the Stillwater mine which would give us a greater in sight into the likely plans for production in Nye. The other examines the feasibility and cost of employing paste tailings technology at the mine because of potential operating benefits. Both are supposed to have been completed at this time. The DEIS should be revised to include all the relevant permits and reports that are related to impacts associated with activity at the mine - especially the impact plan prepared with the county. (27)

Response: While the SMC 1997 Annual Report was not specifically referenced, tailings paste and the proposed optimum size of mine (up to 5,000 tpd) were discussed. In addition, more information has been added to **Section 2.5** of the EIS regarding the experimental program being implemented at the mine to test the feasibility of using whole tailings paste for backfilling.

Paste tailings (both backfill and landfill) were reconsidered along with SMC's proposal for an experimental paste plant. However, the overall result of this reevaluation was the same. DEQ and CNF do not think paste landfill, paste backfill, or a combination of the two (fines tailings paste or whole tailings paste) are feasible technologies for the existing Stillwater Mine operation (please see the explanation for comment 15 under **Section B.12.4** of this appendix). The discussion in **Section 2.5.2** has been expanded to more thoroughly describe DEQ and CNF's conclusions.

14. Any mining of metals other than platinum group metals at Nye should require a separate EIS and permit, and if other mining or new processes are proposed they should trigger a separate permitting process. (pp. 2-57--2-60) Public notification should be required for specific events such as sustained production levels of 3,000 tpd or greater or when sampling exceeds approved limits. (27)

Response: The agencies are permitting surface effects associated with the project. As long as the operation is in compliance and the permitted effects are not exceeded, SMC has the right to develop the ore body within their claims.

This EIS does not address the metals being mined at the Stillwater Mine or the processes SMC uses for mining. If SMC wishes to change its target minerals or conduct mining in a manner not covered by the previous MEPA/NEPA analyses, EISs, EAs, Records of Decision, or FONSIs, the changes first would have to be evaluated in and approved through a new MEPA/NEPA analysis.

15. The DEIS does not pull together all of the reports, plans and permits that govern mine activity and does not even reference all of them, so public evaluation of the full picture of the projected impacts is extremely difficult. The county Hard Rock Mining Impact is not included or referenced in any detail. The air quality permit is referenced, but there is no detail on the multiple water permits for the operation which are being developed separately. (27)

Response: The EIS does identify and discuss all applicable permits/ approvals in Chapter 1 and also discusses and references them in the appropriate resource sections in Chapters 3 and 4 (air, water, socioeconomics, etc).

16. In the discussion on USDA FS (p1-9), in order to best inform the public the DEIS should include reference to 36 CFR 228A. These regulations state, in part, that all operations shall be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources, including complying with all applicable federal and state air and water quality standards. All practicable measures must be taken to harmonize operations with scenic values and maintain and protect fisheries and wildlife habitat that may be affected by the operation. It is recommended that this responsibility to minimize adverse environmental impacts on National Forest surface resources be clearly stated and adherence to the regulations demonstrated in the Final EIS. (27)

Response: Any of the action alternatives would meet the CNF's requirements to minimize adverse effects to National Forest surface resources. The only National Forest System lands involved in any of the action alternatives is some property crossed by the pipelines between the mine site and Stratton Ranch. Because the pipelines would be in the previously-disturbed right-of-way for Stillwater County Road 419, CNF believes it the alternatives meet the intent of these regulations. Information on 36 CFR 228A can be found in **Section 1.4.2.3**.

17. Since it is stated that DEQ and the FS consider public participation a crucial component in defining the scope of the environmental analysis (S-7) and presumably this interest continues throughout the entire process, it is certainly not technically impossible, nor economically unfeasible to implement some measure to improve public access to the pertinent supporting documentation. Additionally, tiering assumes that those individuals who render the decision are completely familiar with the contents of previous studies. This is possible if the decision maker has been in their current position *for some length of time, otherwise, they need to undertake the necessary steps to locate, read and evaluate the corroborative information. Some of this effort as well as the efforts of interested public parties could be met if the synopses like those contained in the current draft contained a little more substantive summarization of pertinent data. (28)*

The next subject is about the tiering... One of my concerns, as a private citizen, is it's hard for me to get out to the places I need to get to, to find the supporting documents and the corroborating information. A suggestion I would make there is that maybe in the future, permitting documents could be placed in locations within the communities, such as the Fishtail Community Center, Absarokee Library, Columbus Library, to help with the access of information. (46s)

... many of these documents are prepared using computers, and so that helps to, to get, to make the information a little bit more easily distributed. And if you can get some information from the Internet at the various State locations, that would certainly help the citizens evaluate the document. (46s)

Response: NEPA encourages tiering to reduce document length [40 CFR 1500.4(a-q)]. While tiering may not always be the most effective solution, MEPA/NEPA requires agencies to focus on the issues at hand and to provide sufficient information for the decision-makers [ARM 17.4.615(2(d)); 17.4.625]. Tiering also is recommended to minimize redundancy in EIS documents. This is discussed in Section 1.6 of the EIS and can also be found in NEPA in 40 CFR 1500.1(b) and 1500.2(b) and MEPA in ARM 17.4.615(2(d)) and 17.4.625.

All previously-required mitigation measures are carried forward unless their removal is specifically discussed in this EIS. A new appendix (Appendix C) has been added, which contains a list of all currently-applied mitigation measures. The State is required to put EISs on the State Bulletin Board which has been replaced by agency web pages. The Final EIS will be on DEQ's web page at www.mt.gov. The mine permit, revision application, and baseline material are not in a form that can be placed on the internet (non-electronic files, maps, etc).

18. I don't feel that the removal of the car pooling requirement is good, as it will mean that traffic increases with the concomitant increase in accidents and deaths. (28)

I am especially concerned about the removal of the car pooling requirement. If DEQ or the Forest Service has employed legal counsel which confirms that statement in the DEIS that car pooling may not be legal, then one solution would be to require SMC to develop a plan for voluntary car pooling with incentives that result in at least three persons per vehicle going to the mine. (44)

The document adds that SMC has suggested that it might not be legal to require car pooling. There is car pooling required all over the country. There must be some way to allow for continuing a project or a process which has been fairly successful at keeping the traffic down... (47s)

Response: Due to the success of car pooling, the monitoring requirement was dropped in 1994 as unnecessary. Car pooling by SMC's employees continues. Under the proposed expansion, the ADT count would likely increase by 27 vehicles. To ensure car pooling also is encouraged for these additional employees, the agencies would require SMC to develop a plan of incentives for employee car pooling as discussed in **Section 2.4.5**.

19. This DEIS lacks a mine plan, details on mined areas and the bed sources and surface locations of adit water discharge from the Stillwater underground mine. The outline of the ore deposit shown in Figure 2-1 is insufficient in this regard. The DEIS does not establish w here and how much ore has been removed from the claim area, the location of the back-filled stopes or where the 30-years of the minable ore reserve is located. (32)

Response: A brief description of key features as they apply to this analysis is included in Chapter 2. The mine plan is included in summary form in the previous NEPA/MEPA documents that this EIS is being tiered to. It is also included in the previous mine permit applications available at the mine, CNF, and DEQ's offices. Claim locations are on file with CNF, BLM, and Stillwater County. The amount, grade, and location of minerals within the claims are considered proprietary information.

20. ...I got the impression that it's based on a lot of old data that needed updating. (46s)

Response: The various sections of the existing documents were reviewed and sections of this EIS were developed with the most accurate and up-to-date data available. New data were collected for water quality, cultural resources, wildlife, and other resources.

21. ...I noticed that the subject of wolves wasn't addressed in the current document. My understanding is that it was addressed in the 1992 study, but since that time, wolves have been reintroduced and have made their way into the -- into this part of the country. (46s)

Response: Since the previous NEPA documents were published, the gray wolf's status in the project area changed. As noted in the comments, the wolf was reintroduced into the greater Yellowstone environment. These individuals comprising the reintroduction were outfitted with radio collars to facilitate their tracking. Based on the information accumulated from the tracking data and other sources, USFWS decided it had no substantive concerns about the wolf and the proposed project. Also, the wolves reintroduced into Yellowstone do not have the same protected status as native wolves because they are considered to be a *non-essential experimental population*. Therefore, it did not include the wolf on its list of species DEQ and CNF needed to consider during the analysis, which, under the Endangered Species Act, is the primary list of species to which DEQ and CNF must respond. Additionally, no other responses to the scoping document identified the wolf as an issue of concern.

22. Do we take into consideration in the EIS study on the viability of the corporation? You know, what are they doing? Is their cash flow good? How are they going to get the money to address it? Where the platinum market is up and down, I think that's something that should be looked at in the EIS study. (47s)

Response: This is beyond the scope of the EIS. The company must post the reclamation bond to ensure the mine site would be reclaimed.

23. But the underlying management goals as defined by the Forest Service clearly are to facilitate and encourage the exploration, development, and production of energy and mineral resources from National Forest System lands -- (47s)

Response: The Forest Service goal for minerals management is taken from the 1970 Minerals Policy Act passed by Congress.

B.13 Governmental Agency Letters

Attached to this appendix are the letter received from federal, state, and local agencies.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
MONTANA FIELD OFFICE
100 N. PARK, SUITE 320
HELENA, MT 59601
PHONE (406) 449-5225, FAX (406) 449-5339
EMAIL heles@initco.net

M.19 Custer NF (I)

April 27, 1998

Mr. Pat Pierson, Project Coordinator
Beartooth Ranger District
HC49, Box 3420
316 North 26th St.
Red Lodge, Montana 59068

Dear Mr. Pierson:

Thank you for the opportunity to review the Draft Environmental Impact Statement for Stillwater Mine Revised Waste Management Plan and Hertler Tailings Impoundment on the Custer National Forest.

Mr. Mike Bonar, Wildlife Biologist for Greystone, on August 29, sent our office a letter regarding Stillwater Mining Company's proposed Tailings Impoundment and Waste Management Plan in Sweetgrass County, Montana. On 16 September 1997, our office informed Greystone of the responsibilities of the Forest Service and the threatened and endangered species which may occur in the project area include the peregrine falcon (Falco peregrinus), bald eagle (Haliaeetus leucocephalus), and black-footed ferret (Mustela nigripes).

The Biological Assessment for the Stillwater Mining Company's Revised Waste Management Plan determined that direct, indirect, and cumulative impacts to the peregrine falcon and the bald eagle are not expected to occur as a result of the proposed project. Based on both the lack of potentially-suitable habitat and documented occurrences within the project area, the direct, indirect, and cumulative impacts of the preferred alternative are "not likely to adversely affect" the black-footed ferret, and grizzly bear. The determination of effects for the preferred alternative for all previously discussed threatened and endangered species and their habitats is "not likely to adversely affect".

We concur with your determination that the proposed project will not affect the peregrine falcon, black-footed ferret and grizzly bear. If a winter program of removing road-killed wildlife within the project area is instituted, we also concur that the proposed project will not affect the bald eagle.

We appreciate the Forest Service's efforts to consider and conserve fish and wildlife resources, including threatened and endangered species. If you have questions regarding this letter, please contact Mr. Lou Hanebury of my staff at (406) 247-7366.

Sincerely,

for Kemper M. McMaster
Field Supervisor
Montana Field Office

LRH\lrh
cc: Billings Suboffice, ES, Billings, MT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

RECEIVED
MAY 26 1998
CUSTER NATIONAL FOREST
BEARTOOTH DISTRICT

May 19, 1998

Ref: 8EPR-EP

Nancy Curriden, Forest Supervisor
Custer National Forest
HC49, Box 3420
Red Lodge, MT 59068

Mark Simonich, Director
MT Dept. of Environmental Quality
P.O. Box 20091
Helena, MT 59620-0901

Re: DEIS Review - Rating EC-2
Stillwater Mine, Hertzler Tailings

Dear Ms. Curriden and Mr. Simonich:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the Region VIII Office of the Environmental Protection Agency (EPA) has reviewed the *Draft Environmental Impact Statement (DEIS) for the Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment*, dated March 1998. We offer the following concerns and comments for your consideration as you complete the Final Environmental Impact Statement (FEIS). EPA's most significant issues are listed below. The specifics of our concerns are in the attached detailed comments.

Our main concerns regard water quality. Additional information is needed on the water balance, variations in pollutant loadings over time, the effects of run-on to the Hertzler Ranch, and treatment capacity of the land application and percolation ponds. The Final EIS should also improve disclosure and presentation of proposed wastewater discharge volumes and pollutant loadings at each discharge location. The linkage should be strengthened between environmental effects and environmental permits/regulations. For example, how do the projected environmental consequences compare to non-degradation water quality standards applied through ground water or NPDES permits?

Based on the procedures EPA uses to evaluate the potential effects of proposed actions and the adequacy of the information in the DEIS, the Preferred Alternative identified by the DEIS for the Stillwater Mine, Hertzler Tailings will be listed in the Federal Register in the category EC-2. This means that the review has identified environmental impacts that should be avoided in order to fully protect the environment and the DEIS does not contain sufficient information to thoroughly assess environmental impacts that should be avoided to fully protect the environment. Attached is a summary of EPA's rating definitions.

We appreciate your interest in our comments. Please contact Dana Allen at (303) 312-6870 if you have any questions about these comments.

Sincerely,

for

Cynthia Cody
Chief, NEPA Unit
Office of Ecosystems Protection
and Remediation

Enclosure

cc: Pat Pierson, Beartooth RD
Kathleen Johnson, MT DEQ
Elaine Suriano, EPA HQ

EPA's Detailed Comments on Draft Environmental Impact Statement
Stillwater Mine Revised Waste Management Plan and
Hertzler Tailings Impoundment

May 19, 1998

Note: high priority issues are marked with a ✔.

1. Page S-9: The two statements under "Fisheries" that the proposed tailings impoundment would be approximately 0.25 mile linear distance from the Stillwater River, and that the down-gradient distance from the tailings impoundment to the Stillwater River would be approximately 0.5 mile, are confusing. If the impoundment is located 0.25 mile linear distance from the Stillwater River how can the river be 0.5 mile down-gradient?

2. Pages S-14 and 2-26: It is stated for alternative B, that SMC proposes to add LAD systems at the Stratton and Hertzler Ranches, yet no LAD systems are shown in Alternative B, Figure S-2 and Figure 2-2, at the Stratton Ranch. Why is this? Also, the existing land application sites are not shown on any maps. Where is the existing LAD in relationship to monitoring locations?

3. Pages 1-3 and 2-53, Chapter 1, History of Project: EPA requests additional detail (does not need to be in the EIS) on the Stillwater Mine tailings backfill/ dewatering technology related to the very fine mill grind. The DEIS states that approximately 58% of the coarser fraction of mill tailings are used as backfill in mined-out stopes. The mill grind, however, is indicated to be more than 70% passing 20 microns. This is a very fine grind which may be difficult to backfill. What chemical(s), if any, are used to stabilize the underground tailing stope backfill? What volume percentage of a given stope is filled? What unit operation steps are included in the tailings dewatering process? What dewatering equipment is used? What are the underground mine stope filling procedures? How is the stope-to-be-filled supernatant water handled? What percentage of the adits discharge water is supernatant water?

4. This DEIS lacks a mine plan, details on mined areas and the bed sources and surface locations of adit water discharge from the Stillwater underground mine. The outline of the ore deposit shown in Figure 2-1 is insufficient in this regard. The DEIS does not establish where and how much ore has been removed from the claim area, the location of the back-filled stopes or where the 30-years of the minable ore reserve is located.

✔ 5. Page 2-10, 2.4.1.3 Water Management and Disposal: The DEIS does not contain a water balance. A schematic water balance should be developed for each alternative; and include climate-related precipitation and evaporation , adit flows, ephemeral flows, process water flows, storm water flows, groundwater seep flows, discharge(s) to groundwater, treatment capacity, etc. The water balance should address different weather cycles such, wet, dry and average precipitation years.

✔ 6. Page 2-10: In 2.4.1.3 Water Management and Disposal, it is stated that current discharges of mine adit water total 1,000 gpm. The approved expansion of the mine to 2,000 tpd rate of production resulted in the lead agencies estimate for the average total discharge for adit water to be as much as 1,900 gpm. What are the mine water discharge rates for a possible range of ore production rates in the range 3,000 tpd-5,000 tpd?

7. Page 2-13, Tailings and Process Water: Are the reported sulfates in process water a product of oxidation of sulfides in the basal unit of the Stillwater Complex or from reagent additions, or both?

8. Page 2-13, Section 2.4.1.3: A major issue regarding the protection of local ground-water resources is the proposed use of an Anoxic Biotreatment Cell (ABC) system to remove nitrates from adit water. Based on a review of the data provided in the DEIS, the concern for ground-water quality degradation and inputs through discharge to surface waters is primarily associated with nitrates. However, the DEIS provides very limited information on the proposed ABC system. It is recommended that additional data be included in the Final EIS on the efficiency of this system to meet nitrate standards.

9. Page 2-13, 2.4.1.3 Water Management and Disposal and Page 3-12, 3.1.2.3 Hertzler Ranch: The DEIS describes the use of ABC cells for nitrate removal and land application. However, it is not clear how wastestreams with both nitrogen and heavy metal pollution will be treated such as mine water or storm water. For example, Table 3-3 (adit water quality) and the narrative in section 3.1.2.3 indicate metal pollutants at levels of concern. How will these waste streams be treated?

10. Page 2-26: The discussion of proposed water management and disposal for the preferred alternative does not clearly specify quantities of wastewater disposal using the various wastewater disposal options at the different locations (i.e., percolation ponds, the ABC system, and LAD systems at Hertzler and Stratton Ranches). The anticipated allocation of the 1,900 gpm (over 3,000 acre-ft annually) of adit wastewater discharges to these many proposed wastewater disposal systems should be more clearly presented. How much of the anticipated 1,900 gpm maximum anticipated excess adit water (page 2-10) would be disposed of: via seepage in percolation ponds and unlined LAD storage ponds at the Stratton Ranch; via irrigation at the Stratton Ranch; via seepage through percolation ponds and LAD storage ponds at the Hertzler Ranch; via irrigation at the Hertzler Ranch; and via discharge of treated ABC system effluent and where would treated ABC effluent be discharged? Such information is necessary to understand loading of contaminants to groundwater at each disposal location.

11. There appear to be some discrepancies in LAD capacity. On Page 2-6, Section 2.4.2.3 -- "The capacity of the Hertzler LAD system could be designed to handle flows in excess of 2,000 gpm. "However, on page 2-13 it is stated that the ABC system could "handle flows up to 500 gpm." Later in the DEIS, the impacts to ground-water quality from the LAD systems is evaluated based on the nitrate levels which are believed to be after ABC system treatment. How can these projections be accurate if flow volumes up to 2,000 gpm are encountered and the ABC system can only handle flow volumes of 500 gpm? It is recommended that the discrepancy between these flow volumes be addressed in the Final EIS.

12. Page 2-55 (bottom), 2-56 (top): A thicker tailings impoundment liner (100 mil) or a second liner is dismissed due to the contention that the single 60 mil liner, with proper bedding and underdrain, will adequately control seepage to protect groundwater. It is stated that the additional costs of a thicker liner, or a second liner, are too great to justify incremental reduction in seepage, however, estimated costs for construction of a thicker liner or a second liner are not presented, nor are corresponding estimates of reduced impoundment seepage with a thicker liner or a second liner. We believe that such information should be presented to better substantiate the reasoning for dismissal of a thicker impoundment liner or a second liner.

✓ 13. Section 3.1 Affected Environment-Water Resources: Water quality standard exceedances are noted several times in the DEIS. These water quality problems should be linked to a discussion and summary of the surface water and ground water discharge permits in this section. The EIS should disclose how the State's permits will prevent water quality standard exceedances. How will the mine expansion affect pollutant loadings, discharge limits and water quality standard exceedances?

✓ 14. Section 3.1: The DEIS should address application of the non-degradation water quality standard for the mine expansion, especially at the new tailing impoundments, LAD sites and percolation ponds. For example, the DEIS should explain how much additional nitrogen, zinc, etc. can be discharged without exceeding the State's non-degradation standard.

15. On Page 3-7: Heavy metal-bearing flows out of three coulees/draw (Robinson, Stanley and Tandy) are advised to be (primarily) ephemeral with a maximum flow rate of 15.62 cfs or 7348 gpm (June 1980-June 1981 sampling period). These flows "appear to flow into the irrigation (Hertzler Irrigation) ditch." Are these continuous and ephemeral flows to be sampled and evaluated? How will these large flows effect the use of the LAD site? For example, will the center pivots be applying water into the coulees or draw? Will LAD be allowed if the streams are flowing?

✓ 16. In Figure 3-1, the Hertzler (irrigation) Ditch is shown to intersect the three western land application areas. The Robinson Draw ephemeral flow joins the ditch in the 1st (left to right) LA pivot area. The Stanley Coulee (indicated to flow year-round) joins the Hertzler Ditch in the 3rd LA pivot area. Both the Stanlee Coulee and the Tandy Coal Mine Draw spring (said to flow year-round) flow into the 4th LA pivot area.

In regards to heavy metals discharges at the site (adit discharges, spring runoff and ephemeral flows in Robinson Draw, Stanley Coulee and Tandy Coulee). EPA requests that consideration be given to a design which would collect, contain and treat deleterious heavy metal discharges and flows.

For example, one possible flowsheet for water treatment is to obtain heavy metal precipitation through lime precipitation in a redesigned (geomembrane-lined) Hertzler storage pond followed by pH adjustment prior to the point-of-compliance release to the LAD pivot system.

17. Page 2-15, 2.4.2.1 Waste Rock Production and Management: Waste rock is to be placed in four areas (Figure 2-1). What is the rock content in the fifth area near the shop and warehouse?

18. Page 2-21, 2.4.2.2 Tailings Production and Management: What is the 8-inch tailing slurry pipeline schedule (sch 40, sch 80)? Is the pipeline flanged and bolted?

19. Page 2-23, Hertzler Tailings Impoundment: What is the design permeability and total seepage rate (gpm) through the 60-mil thick HDPE liner? Will the selected specifications achieve continuous compliance with the State ground water standards and permit? What is the design thickness of the clay soil material to be bedded under this liner and the design permeability? What quantity of this 10-6 cm/sec permeability fine glacial till material is required? Is there a sufficient quantity of this material on the Hertzler Ranch to meet clay liner design requirements? Is the clay source on the ranch then to be reclaimed?

20. Page 2-25, 2.4.2.2 Tailings Production and Management: Please define "bulk tailings" in the Glossary.

21. Page 2-25, 2.4.2.2 Tailings Production and Management: What are the tailings reclaim dredge barge "operational procedures" that would ensure the impoundments HDPE liner is not compromised (torn)?

22. Page 2-25, 2.4.2.2 Tailings Production and Management: Please quantify the flushing volume in terms of equivalent 8-inch pipeline volume/s available from the 6,500-foot elevation mine reservoir.

23. Page 2-25, 2.4.2.2 Tailings Production and Management: What is the thickness and expected life of the 8-inch pipeline HDPE liner?

24. Page 2-26, 2.4.2.3 Water Management and Disposal: What is the design percolation rate to groundwater in gpm of the unlined 80 million gallon LAD storage pond designed to "minimize percolation?" Also, in conjunction with LAD and percolation pond design, describe how the pond design will achieve the State ground water standards and permit requirements, including non-degradation.

✔ 25. Pg 2-26, 2.4.2.3 Water Management and Disposal: It is stated in alternative B, "SMC would continue to handle adit water using existing percolation ponds, the ABC and LAD systems." On Page 3-8, 3.1.2 Surface Water Quality, 4th paragraph, it is stated "concentration of cadmium, copper, iron, lead, and zinc at sites upstream and downstream of the mine site have been above (exceeds) water quality standards set by DEQ (Hydrometrics 1997)....These elevated

levels (metal concentrations) are a result of weathering of ultra basic rocks of the Stillwater Complex and as a result of LAD application of adit water enriched in these constituents."

The EIS should expand on these water quality issues. In particular, what is the history of degradation of the Stillwater River? It would be very helpful to include graphs of water quality over time for nitrogen compounds and heavy metal (i.e. zinc). The EIS states that "exceedances occur only rarely" is insufficient information in that the monitoring that detected these exceedances is not continuous. Do the lead agencies have a strategy for SMC's identification, engineering and correction of the mine-related problems which have led to the violation of water quality standards?

✓ 26. It is the suggestion of EPA's technical experts that a detailed mine East and West adits water quality discharge investigation be both initiated and designed to characterize the water quality of all sources of water that constitute each adit discharge, paying specific attention to any waters that come in contact with the sulfidic basal members of the Stillwater Complex. A detailed examination is recommended of the mine operations records. For example, if a mine sump is blasted into a sulfidic member of the Stillwater Complex, this mine pool may be a pollution source when the pool is occasionally pumped to join the adit discharge. The pumping of a mine pool would normally be reported by the shift foreman in his/her shift report. The reported variations in mine adit discharge water quality suggest that the problem(s) could be traced to operational procedures.

27. Pages 2-25 to 2-27: For the purpose of clarification/understanding, please consider summarizing the functions of the four pipelines in the right-of-way.

28. Page 2-29, Monitoring, Pipeline Monitoring and Spill Contingency Plan: Is the 8-inch slurry pipeline continuous, non-flanged or flanged? The statements made suggest that if some non-specified degree of wear is observed in the inspection vault pipe spool HDPE liners, the liner (and pipe?) could be removed and replaced between any two vaults. However, most of the pipe is buried and the vaults are approximately two miles apart. If the pipeline were flanged, it is possible that the pipeline sections could be disconnected and rotated to distribute the HDPE liner wear, avoiding liner replacement at least in the short term.

The sentence at the end of the 3rd paragraph that reads, "Only a portion of the pipeline at each vault would need to be dug up for the replacement process," appears both incorrect and questionably necessary.

✓ 29. Page 2-33, 2.4.2.9 Bonding: Does the bond include contingency funding (design, engineering, agency oversight, contractor overhead, capital and operating costs) for water quality correction/improvement of possible contaminated groundwater degradation to Stillwater River water quality? EPA suggests, as an alternative to the present design, that it could prove prudent and cost-effective to address and correct potential groundwater and subsequent surface water quality problems sooner rather than later.

30. The use of the term "water treatment facilities" for percolation ponds and diversion ditches is considered misleading by EPA. The latter are more properly referred to as "management practices." Typically, high flow percolation ponds function mainly as water discharge sites. It is unclear how much "treatment" is provided by percolation ponds. The LAD and percolation

ponds may be found acceptable for some degree of nitrogen removal, but may not be successful in the removal of the heavy metals as known to occur in Stillwater adit discharges.

31. Page 3-9, 3.1.2.1 Stillwater Mine Site, Table 3-1: What is the flow parameter, cfs or gpm?

32. Page 3-11, 3.1.2.1 Stillwater Mine Site, Geochemical Characterization: Was copper analyzed?

33. Page 3-13, 3.1.3.1 Stillwater Mine Site, Table 3-3: Assuming that the deleterious heavy metal mine adit discharges are more design and operations-related and that adit discharges are not continuously sampled, is it appropriate to state that the west side and east side adit discharges "rarely exceed" Montana's aquatic or human health water quality standards?

34. Page 3-15, Section 3.1.3.1: "Elevated nitrogen values are found in the monitoring wells down gradient of the west side percolation ponds and increases have been detected between the upstream and downstream sites in the Stillwater River." How do these detections compare with compliance levels as set by the ground-water discharge permit that the State of Montana developed for this facility? In regard to the ground-water discharge permit, has there been any times where the facility has been out of compliance? It is recommended that this information be provided in the Final EIS.

35. Page 3-8: It is stated that the concentrations of cadmium, copper, iron , lead and zinc in the Stillwater River have exceeded water quality standards. It is further stated that these elevated levels are a result of the weathering of ultra basic rocks of the Stillwater Complex, <u>and as a result of LAD application of adit water enriched in these constituents</u>. Although review of Table 3-1 does not show that the level of water quality standards criteria exceedances for these metals is very large (except zinc maximum), we are concerned about any contribution of SMC's LAD application of adit water that causes or aggravates water quality standards criteria exceedances in the Stillwater River. The MDEQ should reevaluate metals loading to the Stillwater River, and if necessary, develop wastewater discharge permit requirements to address water quality standards criteria exceedances resulting from or exacerbated by SMC discharges.

36. It is stated (page 3-12) that the presence of sensitive aquatic invertebrates in the West Fork of the Stillwater River suggests that the quality of the West Fork of the river is good. The discussion of aquatic macroinvertebrates beginning on page 3-34 appears to indicate that the Stillwater River biota above and below the SMC Complex also shows dominance of clean water taxa. However, we note that biological data for the Stillwater River appears to be limited, with sampling data limited to 1980, 1981, and 1997. The recent 1997 sampling <u>showed a drop in abundance of macroinvertebrates from the 1980-81 data</u>. This drop in abundance is attributed to much higher flows that were experienced during 1997 sampling.

We believe that additional biological sampling and data collection would be worthwhile to better evaluate this drop in abundance and verify that environmental stress related to migration of mine contaminants is not involved in the drop in abundance observed between 1980-81 and 1997.

We recommend that a long term water resources and aquatic monitoring program be developed to evaluate migration of contaminants to the Stillwater River. Such monitoring should include routine macroinvertebrate and periphyton sampling in the river above and below mine features. At the very least station SW-1 (above SMC Complex) and SW-4 (below Hertzler impoundment) should be monitored to evaluate mine impacts upon Stillwater River aquatic biota. It would also be worthwhile to collect data at stations SW-2 (Stratton Ranch) and SW-3 (above Hertzler impoundment) to focus in on sources of potential contamination and to provide additional river biota information.

37. Page 3-9, Table 3-1: Why does not Table 3-1 show the total nitrogen levels in the Stillwater River downstream of the SMC complex? The maximum measured phosphorus levels in the river are shown to increase from 0.11 mg/l upstream of the SMC Complex to 0.14 mg/l downstream. The amount of increase for total nitrogen in the Stillwater River below the SMC complex would be of great interest.

38. Page 3-11: It is stated that the concentrations of nitrate + nitrite ranged from 0.08 to 0.25 mg/l at monitoring station SMC-11. This appears to be inconsistent with Table 3-1 which shows nitrate + nitrite to range from 0.06 to 0.55 mg/l.

39. Page 3-20, Section 3.1.3.1: "Concentrations of nitrate plus nitrite have shown a ten-fold increasing trend from baseline..." The DEIS then goes on to provide three potential factors for this ground-water quality degradation -- all based on current mining operations. The statements provided here in the DEIS indicate that current operations are adversely impacting ground-water resources. What practices will be employed in the proposed plans to account for greater protection of ground-water quality? The Final EIS should further address this issue for all potential sources of contamination to ground-water and surface-water resources.

40. Page 4-3, Section 4.1.1.2.1: An estimated nitrogen loading rate of 11.3 lbs/day from the waste rock storage site is provided. Based on the ground-water flow modeling performed for the facility and chemical mass balance calculations, what would be the projected impacts to ground-water quality from this input? It is recommended that an estimation of the water quality effects of this discharge to ground water and evaluation of compliance with water quality standards be provided in the Final EIS.

41. Page 4-6, Section 4.1.1.2.3: "Mixing projections for the Hertzler Ranch site assume LAD application rates of 2,000 gpm with nitrate-nitrogen concentrations of 7.5 mg/l." These assumptions do not correspond to the figures provided in Section 2.4.1.3 regarding the ABC system (see comments 2 and 3 above). It is recommended that the discrepancies in flow volumes and concentrations as provided in the DEIS be clarified in the Final EIS.

42. Page 4-7, Section 4.1.1.2.4: "In the event of a breach at a crossing of the West Fork of the Stillwater River, flow in the channel would increase briefly until the system shuts off." In Section 2.4.2.2 it is stated that "the pipelines would be buried about 5 feet deep, including under all streambeds, drainage crossings, and the West Fork of the Stillwater River". The statement in Section 4.1.1.2.4 needs to be clarified based on the planned buried nature of the pipelines. It is recommended that this clarification be addressed in the Final EIS.

✓ 43. Pages 4-4 to 4-8: The discussion of water quality and quantity for the preferred alternative indicates significant quantities of nutrients (primarily nitrogen, although some phosphorus is also present) are likely to discharge to groundwater. Sources of potential groundwater contaminant discharge appear to be:

1) Seepage/runoff from the east side waste rock pile (estimated load of 11.3 lbs of nitrogen per day, page 4-3), and old LAD systems and LAD storage ponds and percolation ponds (undisclosed loading).

2) Seepage from the Hertzler tailings impoundment and waste storage area (undisclosed nitrogen load).

3) Seepage from west side SMC Complex existing tailings impoundment and percolation ponds (undisclosed nitrogen load).

4) Seepage from unlined LAD storage ponds and percolation ponds at the Stratton Ranch and from irrigation water applied via two 800 ft diameter LAD center pivot irrigation systems at the reclaimed gravel pit at the Stratton Ranch.

5) Seepage from unlined LAD storage ponds and percolation ponds at the Hertzler Ranch and from irrigation water applied via four 1,000 ft diameter LAD center pivot irrigation systems. We note that LAD systems are stated (page 4-4) for permitting purposes to provide 80 percent nutrient uptake, but could only be used 7 months per year. The maximum nitrogen loading of 1,900 gpm of adit water at 7.5 mg/l total nitrogen would appear to be 172 lbs nitrogen per day (without factoring in vegetative uptake of nitrogen for that (undisclosed) portion of the adit water that would be used for irrigation, or for that portion (500 gpm?) that would be treated via the ABC system). The allocation of adit wastewater (and thus nitrogen loading) to the Hertzler vs. Stratton Ranches LAD systems is not clearly disclosed.

Are there other sources of groundwater pollutant loading? The estimated amount and quality of seepage and groundwater loading of contaminants, including nutrients, from all wastewater disposal and mine runoff sources should be estimated and disclosed. Presentation of an overall water balance for the preferred alternative would be very helpful in describing water sources, water volumes, water management and wastewater disposal.

44. Page 4-5, 4.1.1.2.3 Hertzler Ranch: What is the meaning of the first sentence in the 3rd paragraph that states "The use of an HDPE liner on a clay liner, coupled with an overlying seepage collection system would minimize the potential for groundwater...." ? What does the seepage system overlay?

45. Page 4-6: The discussion of the pipeline corridor in the water resources section does not indicate if wetlands would be impacted by proposed pipeline construction. We note that it is stated on page 4-73 that pipeline construction will result in some direct and unavoidable disturbance to approximately 1.5 acres of waters of the U.S., including wetlands. It is also stated that wetland and stream crossing methods are detailed in SMC's Wetland Mitigation Plan (Western Technology and Engineering Inc., 1997c). We would like to request a copy of SMC's Wetland Mitigation Plan. Please send one copy to Mr. Dick Blodnick in our EPA Montana Office in Helena. We would also like to request a copy of the pipeline operation monitoring, inspection, leak detection, and spill contingency plan prepared by Western Technology and Engineering Inc., (page 4-79). We note that if wetland losses would occur as a result of pipeline construction, wetland mitigation to compensate for those losses will need to be developed.

✓ 46. Page 4-24: We are pleased that SMC has agreed to carry out ground water monitoring "in several wells upgradient of the Stillwater River; and to carry out surface water monitoring at several sites"; and will implement a state approved macroinvertebrate and periphyton biomonitoring program. Such monitoring is needed to identify, measure and document actual water quality and aquatic impacts.

Existing monitoring data appears to show that nutrient loads from the SMC mining operations and wastewater disposal have not caused significant impacts upon Stillwater River biota at this time, however, we believe a long term water resources and aquatic monitoring plan should be in place to measure nitrogen and phosphorus levels in the river and to determine aquatic species abundance and diversity (i.e., macroinvertebrates and periphyton) so that actual impacts upon water quality and biota can be determined as the mine expansion occurs and wastewater loads increase. We believe that the water monitoring and biological monitoring programs should be presented as an appendix in the FEIS (e.g., sampling location, frequency, parameters, analytical methods, data reporting, QA/QC, etc.,).

✓ 47. Page 4-38: In regard to Hertzler impoundment stability, we are concerned about the statements indicating that, "modeling suggests the Hertzler tailings impoundment exceeds minimum acceptable factors of safety", and that " insufficient data exist regarding the strength and consistency of Colorado Shale units underlying the Hertzler site to base a meaningful analysis of the potential for a deep bedrock failure of the entire site toward the Stillwater River." We recommend that the agencies establish a technical review panel to review and approve the final impoundment design to ensure geotechnical stability of the impoundment prior to construction.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Denver Federal Center, Building 56, Room 1003
P.O. Box 25007 (D-108)
Denver, Colorado 80225-0007

ER 98/166

MAY 08 1998

uff

Ms. Nancy Curriden
Forest Supervisor
Custer National Forest
HC 49, Box 3420
Red Lodge, Montana 59068

Dear Ms. Curriden:

The Department of the Interior has reviewed the Draft Environmental Impact Statement for the Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment, Custer National Forest, outside Nye, Stillwater County, Montana, and has the following comments.

GENERAL COMMENT

Because of the uncertainties in predicting the effect of the increase in nitrate loads in various areas, monitoring of ground water in unconsolidated aquifers and bedrock aquifers near source areas, as hydrologically appropriate, would seem prudent.

SPECIFIC COMMENTS

Pages S-21, 2-48, and 3-60: The seed mixture for reclamation with the names of the seeds to be used at the different sites should be included in the EIS and should not include any nonnative plant species. Other than saying that creeping meadow foxtail will not be used, the seed mixture is not explained. The disturbed areas should be restored to native vegetation if possible. Many introduced nonnative plants have become invaders and noxious weeds on public lands.

Page S-30: The Summary Table for Alternative B shows no increase in overall mine discharge. However, page 2-10 states a possible increase from 1,000 gallons/minute to 1,900 gallons/minute.

On most figures, waste-rock areas and borrow areas are both shown as yellow areas. The two are very difficult to discern from one another.

Page 3-2: In the second full sentence of the first paragraph, the period of record for station 06202510 is 11 years, rather than 7 years as stated. Also, for clarification, recommend adding 'on the Stillwater River above Nye Creek' after the station number.

Figure 3-2: The symbol for U.S. Geological Survey gaging station 06202510 appears to be located on Nye Creek. The gage is located on the Stillwater River, 200 feet upstream of the confluence with Nye Creek.

Table 3-3: The chronic aquatic-life standard for lead is 0.0005 mg/L, rather than 0.00005 mg/L, for a hardness of 25 mg/L.

Table 3-3: No data for total-recoverable zinc are listed. Is this an omission or are no data available? Also, are data available for metals other than those listed?

Footnote 1 states that metals concentrations are total recoverable. However, the table shows both total recoverable and dissolved. The footnote appears to be incorrect.

Tables 3-4, 3-5, and 3-6: Footnote 1 states that metals concentrations are total recoverable. This disagrees with the tables, which show metals concentrations as dissolved.

Page 3-13: The last paragraph discusses the quality of water discharged from adits. The discussion fails to note that the mean total-recoverable copper concentration for adit water exceeds the acute and chronic aquatic standards.

Table 3-4: The human health standard for chromium is listed as 0.0 mg/L rather than 0.10 mg/L.

The discussions of hydrology of springs do not include estimates of the potential effect of the proposed expansion on flow or quality of springs in the area.

Page 3-20: The first full paragraph states that the data in Table 3-5 show dissolved chromium exceeds the human health water quality standard. However, the data in Table 3-5 indicate that even maximum chromium concentrations are less than the standard. Either the data or the statement is in error.

Page 4-4: The statement that evapotranspiration will result in lower nitrate concentrations in soil or ground water is incorrect. Any loss of moisture in the root zone would cause concentrations of all dissolved constituents to increase. This comment also applies to similar statements on page 4-6.

Page 4-6: The estimated nitrate concentration (0.789 mg/L) in ground water downgradient from the land application area might not be reasonable. Concentrations in ground water downgradient from the current LAD have been higher, with an average of about 3 mg/L (page 4-4, second paragraph). Second, water with 7.5 mg/L NO3-N is to be applied to four 1,000-foot diameter pivots (total area of 72 acres) at 2,000 gallons/minute for 7 months. The calculated annual rate of nitrate application is about 525 pounds/acre. This rate is higher than typical fertilizer application rates in the corn belt of the midwestern United States, where increases in nitrate concentration in ground water have been observed to be much higher.

Page 4-6: The predicted increase in nitrate concentration of 0.017 mg/L in the Stillwater River appears to be unreasonably low. The current operations have resulted in an increase in nitrate concentration of 0.2 mg/L in the Stillwater River (page 4-4). The planned application of two to three times as much mine water and leaching of the additional waste rock could result in concentration increases in the river that are larger than those observed for the existing operation.

Section 4.1.1.2: The discussion of nitrate loading could be clarified by indicating the anticipated amount of nitrate loading, in pounds per day, from all the potential nitrate sources. Adding this discussion would facilitate comparison of anticipated loading with the permitted maximum loading rate of 100 pounds per day. An estimated loading rate is provided for the waste-rock pile (page 4-3) but not for the new LAD areas or for the unlined water storage pond. Some nitrate loading also is likely through surface runoff from the LAD sites because soil moisture will be maintained at saturation.

Appendix B: The air-monitoring measures shown in this appendix for air quality are quite progressive. Monitoring of dust in the air should be conducted with the goal of reducing the PM10 emissions. The name of the chemical stabilizer used on the roads should be mentioned on page 4-26.

Thank you for the opportunity to comment.

Sincerely,

Robert F. Stewart

Robert F. Stewart
Regional Environmental Officer

RECEIVED

APR - 6 1998

CUSTER NATIONAL FOREST
BEARTOOTH DISTRICT

UNITED STATES DEPARTMENT OF COMMERCE
Office of the Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

April 1, 1998

Pat Pierson
Beartooth Ranger District
HC49, Box 3420
Red Lodge, MT 59068

Dear Mr. Pierson:

Enclosed are comments on the Draft Environmental Impact Statement for Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment Stillwater County Nye, Montana. We hope our comments will assist you. Thank you for giving us an opportunity to review this document.

Sincerely,

Susan Fruchter

Susan B. Fruchter
Acting NEPA Coordinator

Enclosure

MEMORANDUM FOR: Susan B. Fruchter
Acting NEPA Coordinator

FROM: Charles W. Challstrom
Acting Director, National Geodetic Survey

SUBJECT: DEIS-9803-09-Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment Stillwater County Nye, Montana

The subject statement has been reviewed within the areas of the National Geodetic Survey's (NGS) responsibility and expertise and in terms of the impact of the proposed actions on NGS activities and projects.

All available geodetic control information about horizontal and vertical geodetic control monuments in the subject area is contained on the NGS home page at the following Internet World Wide Web address: http://www.ngs.noaa.gov. After entering the NGS home page, please access the topic "Products and Services" and then access the menu item "Data Sheet." This menu item will allow you to directly access geodetic control monument information from the NGS data base for the subject area project. This information should be reviewed for identifying the location and designation of any geodetic control monuments that may be affected by the proposed project.

If there are any planned activities which will disturb or destroy these monuments, NGS requires not less than 90 days' notification in advance of such activities in order to plan for their relocation. NGS recommends that funding for this project includes the cost of any relocation(s) required.

For further information about these monuments, please contact Rick Yorczyk; SSMC3, NOAA, N/NGS; 1315 East West Highway; Silver Spring, Maryland 20910; telephone: 301-713-3230 x142; fax: 301-713-4175.

COUNTY OF STILLWATER
STATE OF MONTANA
STILLWATER COUNTY COMMISSIONERS
BOX 970
COLUMBUS, MONTANA 59019

Custer National Forest
c/o Pat Pierson, Project Coordinator
HC 49, Box 3420
Red Lodge, MT 59068

MT Department of Environmental Quality
c/o Kathleen Johnson, Project Coordinator
P.O. Box 200901
Helena, MT 59620-0901

April 28, 1998

RE: DEIS - SMC Revised Waste Management Plan and Hertzler Tailings Impoundment

Dear Project Coordinators,

Please accept the following comments on the Draft Environmental Impact Statement for the Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment. Our comments include the impact of the proposed pipeline to county roads 419 and 420 and the cumulative fiscal impacts associated with increasing production limits.

An amendment to the SMC Hard Rock Mining Impact Plan is currently in progress. This amendment was based on SMC employment of 700 people. We do not find any detailed analysis of the impacts of increasing production limits. The social and economic effects presented in section 4.5 indicate effects from 12/31/96 population estimates to population projections associated with SMC employment of 700. If production increases to 3,000 - 5,000 tons per day, will the social and economic effects presented in this DEIS be valid? A detailed analysis of social and economic effects of increasing production limits, independent of SMC consultant's work, should be included in the Final EIS.

Phone (406) 322-4546 or (406) 322 4392 e-mail Commish@wtp.net FAX (406) 322-4698

There is no detailed analysis of the effects of the proposed pipeline to county roads 419 and 420 in the Draft Environmental Impact Statement. The pipeline is an integral component of the preferred alternative. The authority for the proposed agreement for installation of pipelines within County right of way is the county permit identified in Table 1-1, not necessarily an amendment to the SMC Hard Rock Impact Plan as stated in section 2.4.2.5 on page 2-27. Also, federal funding for reconstruction of the section of 419 between Dean and Nye has not been committed yet. The mine related impact to this section of county road has resulted in deterioration of the pavement and increased maintenance costs. Without federal and SMC participation in the completion of the 419 reconstruction project, this remains an unmitigated transportation impact.

A list of specific comments on the DEIS follows:

S-15 Workforce

The DEIS states "This increase would trigger a revision to SMC Hard Rock Impact Plan" Please note an amendment to SMC Hard Rock Impact Plan has been in progress for almost a year and is expected to be completed by mid 1998.

S-19 1st Paragraph

Absarokee Water & Sewer District is also listed in SMC's Amended Hard Rock Impact Plan.

2.4.2.5
p. 2-27 Roads and Traffic

The Authority for the proposed agreement for installation of pipelines within County ROW is the county permit identified in Table 1-1. Not as an amendment to SMC's Hard Rock Impact Plan.

2.4.2.7
p. 2-30 Pipeline Monitoring

Stillwater County should also be notified if there is a rupture in SMC's pipelines located in County ROW. The DEIS only identifies Custer National forest and the Montana DEQ.

3.5.6
p. 3-43 Housing

The DEIS identifies a SMC single-family unit subdivision in the Town of Columbus. Is this still accurate? Has this proposed housing project been abandoned?

3.5.7.2 p. 3-45	Water Supply Absarokee Water Users Association was converted to a Water & Sewer District, created in 1995.
3.5.7.4 p. 3-45	Solid Waste The DEIS indicates all solid waste collected is disposed of in the Stillwater County landfill. This is inaccurate. Most of the solid waste is disposed of in the Billings landfill.
3.5.7.7 p. 3-47	Fire Protection The DEIS indicates the Columbus area district is "inactive". In fact this is an active district.
3.8 p. 3-58	Transportation The DEIS indicates Highway 78 is a Stillwater County Road. In fact this is a state highway. In addition, an overlay was completed, but there has not been any recent reconstruction on this highway.
4.1.1.2.4 p. 4-6	Hertzler Ranch The DEIS indicates motorist on County Road 420 might have to drive through a mist from the LAD irrigation. Water sprayed onto a county road may be a safety hazard and create additional road maintenance problems. This is unacceptable to Stillwater County.
4.5.1.2.1 p. 4-29	Population The population figures in the DEIS appear to be slightly different than those presented in the SMC Hard Rock Mining Impact Plan amendment. Which figures are correct?
4.5.1.2.7 p. 4-36	Community Services Impacts to Stillwater County Road maintenance services are not addressed in this section of the DEIS. This is one of the consequences as a result of the proposed action and is an important issue.
4.8.1.2 p. 4-65	Alternative B - Proposed Action Again, the authority for the proposed agreement to install pipelines in County ROW is the county permit identified in Table 1-1, not an amendment to SMC's Hard Rock Impact Plan.

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment. Please carefully consider all public comment before completing the Final EIS. Alternative B - Proposed Action will require Mitigation Measures to address the impact of the proposed pipeline to county roads. Also, please note, Stillwater County does not object to Alternative D . These two alternatives should receive further consideration before the Final EIS is completed and a Record of decision is issued.

Sincerely,
Board of County Commissioners

L. Harold Blattie, Chairman   Clifford A. Bare   Charles E. Egan

Montana Department
of
Fish, Wildlife & Parks

2300 Lake Elmo Drive
Billings, MT 59105
May 12, 1998

Rand Herzberg
Beartooth Ranger District
HC 49, Box 3420
Red Lodge, MT 59068

Dear Rand,

Our review of the DEIS for the proposed Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment has generated some concerns for mule deer and bighorn sheep habitat and populations in the upper Stillwater valley.

Waste rock treatment on the East Side will result in a decline in habitat available as mule deer winter range. Reduction of winter range in this area could well result in more deer using areas preferred by bighorns, thus increasing competition between these species. Given that the present bighorn population is at a critically low level, where extirpation is a very real possibility, it is essential that any and all steps be taken to maintain all available bighorn habitat in its most productive state. Past bighorn habitat mitigation measures have apparently produced minimal results. We suspect that such poor response has been the result of inadequate sized treatment areas.

If successful habitat mitigation does not occur in the near future the Stillwater bighorn population will be lost. We urge your agency and Stillwater Mining Company, in consultation with the Stillwater Bighorn Recovery Task Force, to investigate and implement an aggressive large scale habitat manipulation project as part of the mitigation package for the activities proposed by SMC in this DEIS. Some suggested manipulations that should be explored include large scale prescribed burns as well as more intensive livestock grazing on the traditional winter range as well as the East Side.

The Hertzler tailings impoundment will certainly impact one of the traditional mule deer winter ranges in the upper Stillwater. This area has also been frequently used by white-tailed deer in recent years. Mule deer in the upper Stillwater have declined significantly in the last 30 years. The first decline occurred in the mid-1970's and corresponded to mule deer declines throughout much of Montana. Unfortunately, unlike those in the rest of the state, the mountain/migratory mule deer herds in the upper Stillwater did not recover in subsequent years. Rather their population levels remained rather stagnate until the early 1990's when further declines occurred.

These declines have accelerated over the last 3 years due to extremely poor fawn production and survival.

Obviously, SMC's activities to date have had little direct impact on the overall trend of mule deer in this area. The indirect impacts are difficult to quantify but certainly need to be considered. The most significant habitat loss for mule deer has been through the development of small home sites on winter range. While some of this activity would be occurring with or without SMC's presence, the rate of development in the upper Stillwater has certainly been accelerated because of the mine. However, mule deer populations have now reached a point where additional losses of habitat can not be tolerated without mitigation.

We would suggest that SMC pursue conservation easements on portions of the Hertzler and Stratton Ranch areas to protect these winter ranges from further human encroachment by either subdivision or occasional sales of small home sites. Maintaining these properties in agriculture and native range will ensure their use by mule deer in perpetuity.

Thank you for consideration of these comments.

Sincerely,

Dick Ellis by Dennis Hagenston (acting)

Dick Ellis
Region Five Supervisor

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MAR 3 0 1998
CUSTER NATIONAL FOREST

MONTANA STATE HISTORIC PRESERVATION OFFICE
NHPA Section 106 \ Other Consultation

This form constitutes a record of your consultation with the Montana Historic Preservation Officer on a particular project and is the official SHPO reply. The dates of SHPO actions appear in the appropriate boxes.

Please Route This Form To:	Pat Pierson Custer NF HC 49, POB 3420 Red Lodge, MT 59068				
Your Agency Requested Consultation with the Montana State Historic Preservation Officer (SHPO) on this Project under this Law or Regulation:			**Section 106, NEPA**		
PROJECT NUMBER		**AGENCY**	USFS	**OTHER Agency**	
PROJECT NAME and Other Descriptions	DEIS Stillwater Mine Waste Management Plan Hertzler Tailings	**Dates and Separate Requests to SHPO on This Project**	03/18/98	Stan	
THIS FORM documents			**individual actions.**		
Memo(s) to Sender	Dear Pat: Thank you for the opportunity to comment on this DEIS. We do have several suggestions. We request the following changes on page 1-11. Change *cultural resource clearance* to "Historic Properties consultation." Change *and the SHPO before construction activities* to "and concurrence by the SHPO before agency approval." Table 3-16 does not make it clear whether *Evaluation* refers only to agency evaluations or to formal determinations made in consultation with SHPO or the Keeper. Our records on consensus determinations and unresolved eligibility indicate a number of those sites listed as ineligible as unresolved and a couple of cases were sites are listed as ineligible where in fact they have been determined Eligible (e.g. Southworth Homestead). We have attached a copy of previous correspondence addressing some of these questions. We note that we have not been consulted on the need for additional inventory at Spring 15 or the Stratton Ranch LAD APEs. At 4.10. We suggest that a statement referring to the need for a USFS finding of effect under NHPA section 106 to be reach with either SHPO or ACHP. We do not at this time concur that there will be no effects to Historic Properties , and there remain a number of sites with unresolved eligibility. There is also the question of need for addition inventory/testing as mentioned above.				

DETERMINATION OF ELIGIBILITY **The SHPO Has Considered Whether, per Your Request, Sites Either Meet or Do Not Meet the Criteria of the National Register of Historic Places. The Finding of the SHPO Is as Follows:**	**Sites which Meet National Register Criteria**		**Sites Not Meeting National Register Criteria**
Criterion A Findings	**Criterion B Findings**	**Criterion C Findings**	**Criterion D Findings**

Montana Historic Preservation Consultation form Page 2 March 27, 1998

<table>
<tr><td colspan="2" rowspan="2">DETERMINATIONS OF EFFECT
The shpo has considered whether this undertaking will have an affect on significant historic properties. The finding of the shpo is as follows:</td><td colspan="2">No Eligible or Listed Properties Are Within the Area of</td><td colspan="2">The Project Will Have NO EFFECT on These</td></tr>
<tr><td>Potential Effect</td><td></td><td>Eligible Properties</td><td></td></tr>
<tr><td rowspan="3">Descriptions of Effects on Eligible Property Using 36 CFR 800.9</td><td colspan="3" rowspan="3">Unresolved</td><td colspan="2">The Effect on These Properties Is:</td></tr>
<tr><td>Adverse</td><td></td></tr>
<tr><td>Not Adverse.</td><td></td></tr>
<tr><td colspan="6">Other Comments:</td></tr>
<tr><td rowspan="2">Reviewer Signatures</td><td colspan="3">Stan Wilmoth, Ph.D.
HPO</td><td>03/26/98</td><td rowspan="2">:Dates</td></tr>
<tr><td colspan="3"></td><td></td></tr>
</table>

copy to Kathleen Johnson
DEQ
POB 200901
Helena, MT 59620-0901

State Historic Preservation Office
Montana Historical Society
1410 8th Avenue • PO Box 201202 • Helena, MT 59620-1202 • (406) 444-7715 • FAX (406) 444-6575

August 8, 1995

Dr. Larry Lahren
Anthro Research
POB 1218
Livingston, MT 59047

RE: Request for information on Section 106 Review for Stillwater Mine Project

Dear Larry:

Sorry it has taken me this long to get back to you. We had quite a time pulling files out of storage. I have included a list of those file titles in the event that you wish to look at them yourself.

In terms of inventory report adequacy, our office has already expressed a number of concerns. See enclosed copy of Marcella's letter of March 24, 1982. The inventory was apparently conducted at BLM Class III intensity level so that was apparently not a concern. However, the level of recordation and research necessary for evaluation was not felt to be adequate for many sites. Now, 15 years later, standards of recordation and research have improved substantially. Many sites which might not have been deemed eligible under the earlier standards could now be determined eligible given current levels of assessment. Further, field conditions can change in 15 years - eligible sites may lose integrity, ineligible sites may become eligible due to increased surface visibility, development of regional or property contexts, etc. In this case, we also have the concern that a number of amendments and other changes to the initial mine plan may have occurred over the years, and we may no longer have a adequate definition of the area of potential effect (APE). My recommendation at this time is that the permitting agencies should define the area of potential effect for the new permit/undertaking and compare that area to the previous inventory as a first step. We can better comment on adequacy with a clearly defined APE. Once that has been resolved, and it is an permitting agency decision ultimately, in consultation with SHPO; the agencies should review the status of site eligibility.

I was able to locate very few sites on the map you provided for which eligibility has been resolved. 24ST0401 was determined eligible by Fed. Highways on 7/25/92, as was the Guthrie Ring Site 24ST0054. Please find updated site forms enclosed. Judging from the information at hand, it seems likely that there remain unrecorded features at both sites.

The eligibility of 24ST0067 Mouat Mine Homestead, 24ST0061 Stone Feature, 24ST0058 Nickel Camp, and 24ST0062 Powder House, may have been resolved as part of a MOA with the FS dated 8/2/85. However, our records do not include a copy of the agreement signed by Stillwater Mining or the ACHP, so at this time I can not tell you if the MOA was accepted and implemented, or if the eligibility and effect findings from that time remain unresolved. In either case I suspect these sites may no longer exist. Halcyon should be able to clarify the finalization of the MOA; and site visits, and reevaluations may be warranted.

Two other sites in the vicinity have also been determined eligible which have the same name as sites listed in the 1980 inventory, but which have different legals and expanded definitions: the Southworth Homestead 24ST251 was determined eligible 7/25/92 (5S/16E/31) but does not appear to be in the project APE nor does it appear to be the same site as 24ST0053 of the same name and with unresolved eligibility. 24ST0222, the Mouat Mine and Mt. View Townsite was determined Eligible by the DSL 4/18/90. It is not clear how the Mouat Mine Homestead 24ST0067 (or 24ST0060 "Mouat Features") and 24ST0222 may be associated. It would appear that this association should be addressed.

Marcella's letter of 3/24/82 recommends a number of additional sites as appearing eligible, though we have no record of eligibility having been resolved with a federal agency for those not discussed above. I would recommend at a minimum that site visits and updates appear warranted, in order to provide current information for evaluation at current standards.

The following sites appear to be in the APE on the basis of your map, previous correspondence, and the 1980 inventory; though eligibility has not apparently been resolved: 24ST0068, 24ST0051, 24ST0071, 24ST0064, 24ST0063, 24ST0056, 24ST0057 and 24ST0070.

So for Section 106 completeness, I would say we need FS comments and findings on current APE with a definition of the undertaking (which takes into account the expanded and broadened definition in the 1992 amendments to the NHPA), their recommendations on the adequacy of inventory and recordation (which clearly have changed over the years), a statement regarding which sites are in the APE, their Eligibility status, and an effect finding with the required documentation. Kathy Huppe's letters from 1991 (enclosed) point to a couple of unresolved issues along these lines. It appears to us that sites visits, updates and reevaluations, at a minimum, is warranted in many cases.

I hope this information is useful, please feel free to come by and use the files if you need to. I will keep them handy in anticipation of consultation with the Custer NF.

Sincerely,

Stan

Stan Wilmoth, Ph.D.
Archaeologist

File C NF/Stillwater Mine/95

Montana Department
of Transportation

Marc Racicot, Governo

Billings District
P. O. Box 20437
Billings, Montana 59104-0437

(406) 252-4138
FAX (406) 256-6487
Toll Free 1-888-863-8465

RECEIVED
MAY 18 1998
CUSTER NATIONAL FOREST
BEARTOOTH DISTRICT

May 15, 1998

Pat Pierson, Project Coordinator
Beartooth Ranger District
HC49, Box 3420
Red Lodge, MT 59068

Subject: Draft Environmental Impact Statement
Stillwater Mine Revised Work Management Plan and Hertzler Tailings Impoundment

The following are comments on the Draft Environmental Impact Statement:

1. Pipeline is slated to be in the right-of-way of the roads. Will it be buried? Interfere with drainage? How will it be repaired and maintained? Montana Department of Transportation requirements must be met.

2. Will protection to the roadway at the pipe crossing be provided?

3. This is hard rock tailing. Is it radioactive? Fill at the deposit sites will be 50 to 75 ft. deep. What will be used to prevent wind erosion and wind transport of materials off site when the site is used up?

4. Is the material hazardous? Acid or corrosive in nature? How will the liquid impact ground water?

5. Does the mine have adequate water rights to transport the slurry?

6. Will the holding ponds become a source of fog?

7. Montana Department of Transportation has two new bridges planned near Nye. Has coordination of pipe and bridge design been under taken?

8. Page 2 - 13 "concentrations present in the tailings water pose no human health or environmental hazard." At what concentration do human and environmental hazards exist? What happens when water evaporates and concentrations of reagents increase?

Thank you for the opportunity to comment on this project. Call me at (406)252-4138 if I can provide additional information.

Gary Neville

Gary Neville, P.E.
District Engineering Services Supervisor

gn:bw:t:rd:67 nployer

Montana Department
of Transportation

Marc Racicot, Governor

RECEIVED
MAY 20 1998
CUSTER NATIONAL FOREST
BEARTOOTH DISTRICT

May 18, 1998

Nancy T. Curriden,
Forest Supervisor
Custer National Forest
HC 49, Box 3420
Red Lodge, MT 59068

Subject: Draft Environmental Impact Statement (EIS)
Stillwater Mine Revised Work Management Plan and Hertzler Tailings Impoundment

The MDT is aiding in the design of off-system bridges near Nye. If any crossings are planned at bridge locations, MDT should be notified to ensure coordinated review and design of these structures.

Although the roads directly impacted by this proposed revised management plan/tailings impoundment are not under MDT jurisdiction, the MDT has interest in the statewide transportation systems. The following comments are provided as potential impacts that should be considered in the interests of Stillwater County.

- Will protection to the roadway at the pipeline crossings be provided, and will there be adequate traffic control during the construction phase?
- Is this hard rock tailings radioactive? What will be used to prevent wind erosion and wind transport of materials off site? Any contaminated materials should not be re-deposited within the right-of-way limits.
- Is this material hazardous or corrosive in nature? How will this impact the ground water? Any monitoring systems should also ensure that any hazardous plumes do not enter the right-of-way.
- Will the holding ponds become a source of fog? If so, the potential for additional roadway hazards should be evaluated.
- Page 2-13 states "concentrations present in the tailings water pose no human health or environmental hazard." At what concentrations do human and environmental hazards exist? Will the concentration of the reagents increase to hazardous levels as the water evaporates? Measures should be taken to ensure that any accidental spillage/depositing of non-hazardous reagent levels within right-of-way will remain at non-hazardous levels through time.

The Program and Policy Analysis Bureau of the Transportation Planning Division will be MDT's point of contact throughout this review process. Please submit all further correspondence to this bureau. These comments supercede the previous MDT comments transmitted from the Billings District Office.

Thank you for the opportunity to comment on this project. If you have any questions about these comments or need additional information please contact myself at 444-7692, or Jim Skinner at 444-9233.

Sandra Straehl

Sandra S. Straehl, Chief
Program and Policy Analysis
Transportation Planning Division

Attachment

cc: Patricia Saindon, Transportation Planning Division Administrator – MDT
Bruce Barrett, Billings District Administrator- MDT
Gary Larson- Secondary Roads Supervisor – MDT
Bill Wandersee- Billings District - MDT

MONTANA
DEPARTMENT OF COMMERCE

Local Government Assistance Division
1424 9th Avenue PO Box 200501
Helena, MT 59620-0501

Phone: (406) ~~444~~-3757
FAX: (406) ~~444~~-4482
TDD: (406) ~~444~~-2978

March 20, 1998

Kathleen Johnson, Project Coordinator
Stillwater Nye - Hertzler Tailings Impoundment
Montana Department of Environmental Quality
PO Box 200901
Helena, MT 59620

MAY 22 1998

Re: *Follow-Through*: DEIS for Stillwater Nye - Hertzler Tailings Impoundment

Dear Kathy:

Oops. This time, attached as advertised, are copies of the 1997 and 1998 SMC monitoring reports, showing mineral development employment, mineral development students and mineral development population distribution as of December 31 of the year preceding each report. As I mentioned, the Columbus School figures were the subject of a concerted reconciliation effort between SMC and the District.

I would question one underlying assumption of the DEIS, which I "walked around" but did not focus on specifically in my letter of May 18, 1998. The DEIS appears to address the impacts from the construction and operation of the Hertzler tailings impoundment and to disregard, for the most part, the social and economic effects over time of changing from a TPD limit to a "footprint" limit as the basis for further permit amendments. This implies that the DEQ and the USFS do not consider that the anticpated fluctuations in production would have potentially significant social and economic consequences. That is, I think, a highly questionable assumption, which appears based solely on SMC's expectations that greater mechanization would allow them to maintain a relatively stable employment level.

A higher level of production would almost certainly mean more employees and contractors, if for nothing else than to transport the ore to the smelter. One would think that increased production would mean greater effort of some sort, which might translate into additional production employees, additional transportation employees, and additional smelter employees. It might also translate into additional trips to the mine by service and maintenance contractors and transporting of additional materials and equipment to the mine. Doubling production would presumably double the number of ore trucks on the road between the mine and the smelter, whether in actual trucks or number of trips per truck per day. Either way, it would mean additional wear and tear on secondary roads 419 and 421 and highway 78.

Also, if increased production occurs in response to higher prices or greater economies of production, one result should be higher gross proceeds from the mine, which would affect both the local property tax base (which includes the taxable valuation of the gross proceeds) and the State's metal mines license tax revenue (25 percent of which is returned to the affected counties and, through them, also to affected school districts.)

It would be appropriate, I should think, for the EIS to include and examine alternative senarios of what production at 3,500 or 4,000 or 5,000 TPD might mean in these terms.

In considering cumulative impacts, the DEIS might also explore the possiblity that SMC will shift workforce between the Stillwater-Nye mine and the East Boulder project, which has potential implications for both Stillwater and Sweet Grass Counties. For example, the taxable valuation of the mineral development is shared between affected counties and affected cities or incorporated towns based on where employees of that mineral development reside. If employees might be shifted back and forth between the projects, this needs to be made known so that the affected units of local government and SMC can find a way to address this phenomna in ther impact plans for Stillwater-Nye and for the SMC East Boulder project.

Sorry the *monitoring reports* were overlooked with the May 18th letter. Again, thank you for the opportunity for commenting on the DEIS. Again and as always, the comments are my own and not those of the Hard-Rock Mining Impact Board.

Sincerely,

Carol

Carol L Ferguson
Administrative Officer
Hard-Rock Mining Impact Board
Phone: 406-444-4478
FAX: 406-444-4482

enc

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APR 27 1998

April 23, 1998

Montana Department of Commerce
Hard-Rock Mining Impact Board
PO Box 200501
Helena, MT 59601-0501

To All Concerned:

Enclosed is Stillwater Mining Company's (SMC's) 1997 Annual Impact Monitoring Report for SMC's mine site employees. Data used in compiling this report was provided by SMC employees for year end, 1997.

During mining and construction activities in 1997, various local contractors were also involved with either working at, or servicing the mine site. These local contractors' employees were annualized as Full Time Employees (FTE's), and are accounted for in the attached Tax Base Sharing Report.

There were also a small number of contractors from outside of the area for a period during the summer of 1997 during a tailings pond liner addition project. Those contractor employees did not bring their families, and were provided temporary, single status, housing at SMC's Beartooth Ranch while they were working at the mine site. Due to the nature of this project, any impacts to Stillwater County as a result of those temporary contractor employees is considered to be negligible.

As in previous years, student numbers presented in these reports have reconciled, and agreed upon, with the School Districts involved. Dependents of several former (In-Migrating) SMC employees who still reside in Stillwater County were included in impact student numbers where appropriate.

If you have any questions or need any additional information, please contact me at in Big Timber at 932-4646, or at the mine site, at 328-8528, or contact Jim Richter at the mine site, at 328-8529.

Sincerely,

James F. Richter. FOR:

Bruce E. Gilbert
Environmental Affairs Manager

JFR/

Enclosure

Stillwater Mining Company
HC 54, Box 365 • Nye, MT 59061 • 406-328-6400 • Fax: 406-328-8506

Stillwater Mining Company
Impact Monitoring Report - 12/31/97
Stillwater County

	DEVELOPMENT			IN-MIGRATING EMPLOYEES & STUDENTS				
RESIDENCE	Total Employees	Students Residing In District	Total Living In Household	Employees	Trigger	Attending Students	IMDS Trigger	Actual School Enrollment
Town of Columbus	127		340	71				
Rural Columbus	47		167	27				
Absarokee & Rural Absarokee	202		607	112				
Fishtail	33		75	16				
Nye	59		109	36				
Stillwater County Total	***468***		***1,298***	***262***				
Other	187		550					
Total All Districts	***655***		***1,848***	***262***				
HIGH SCHOOL DISTRICTS								
Columbus	174	23				12		194
Absarokee	294	56				28		114
Other	187	32						
Total	***655***	***111***				***40***		
JR. HIGH DISTRICTS								
Columbus	174	17				11		107
Absarokee	261	42				29		69
Fishtail	33	2				1		3
Other	187	24						
Total	***655***	***85***				***41***		
ELEM. SCHOOL DISTRICTS								
Columbus	174	85				47		356
Absarokee	202	89				54 *		179
Fishtail	33	4				4 **		15
Nye	59	14				8		13
Other	187	70						
Total	***655***	***262***				***113***		

* (1) Nye in-migrating student attending Absarokee
** (1) Nye in-migrating student attending Fishtail

Stillwater Mining Company
Tax Base Sharing Report - 12/31/97
Stillwater County

	DEVELOPMENT			LOCAL CONTRACTORS				
RESIDENCE	*Total Employees*	*Students Residing In District*	*Total Living In Household*	*(FTE) Employees*	*Calculated Living In Household*	*Calculated Students In Household*	*IMDS Trigger*	*Actual School Enrollment*
Town of Columbus	127		340	3	8			
Rural Columbus	47		167					
Absarokee & Rural Absarokee	202		607	6	17			
Fishtail	33		75					
Nye	59		109	2	6			
Total	***468***		***1,298***	***11***	***31***			
HIGH SCHOOL DISTRICTS								
Columbus	174	23		3		1		194
Absarokee	294	56		8		1		114
Total	***468***	***79***		***11***		***2***		
JR. HIGH DISTRICTS								
Columbus	174	17						107
Absarokee	261	42						69
Fishtail	33	2						3
Total	***468***	***61***						
ELEM. SCHOOL DISTRICTS								
Columbus	174	85		3		2		356
Absarokee	202	89		6		3		179
Fishtail	33	4						15
Nye	59	14		2		1		13
Total	***468***	***192***		***11***		***6***		

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MAY 22 1997

May 7, 1997

Hard-Rock Mining Impact Board
Room C-11
Cogswell Building
Capitol Station
Helena, MT 59620

To All Concerned:

Enclosed is Stillwater Mining Company's (SMC's) 1996 Annual Impact Monitoring Report for SMC's mine site employees. Data used in compiling this report was provided by SMC employees for year end, 1996.

During construction activities associated with completion of SMC's production shaft and expansion facilities, various temporary contractor employees were also at the mine site throughout 1996. Although daily contractor employee "head counts" are available, SMC estimates that there was a daily average of approximately 80 contractor employees working at the mine site for most of the year. Impacts to Stillwater County as a result of those contractor employees was very minor, and temporary in nature; very few were on site throughout the construction period, and most of who were, did not bring their families. The majority of contractors' employees were provided temporary, single status, housing at SMC's Stratton Ranch "Man Camp" while they were working at the mine site.

Submittal of this report was slightly delayed due to reconciliation of impact student numbers with the Absarokee and Columbus School Districts, yesterday, May 6th. As a part of this reconciliation, dependents of several former (In-Migrating) SMC employees who still reside in Stillwater County were included in impact student numbers.

If you have any questions or need any additional information, please contact me at in Big Timber at 932-4646, or at the mine site, at 328-8528, or contact Jim Richter at the mine site, at 328-8529.

Sincerely,

James F. Richter FOR:

Bruce E. Gilbert
Environmental Affairs Manager

JFR/

Enclosure

IMPACT MONITORING REPORT
DECEMBER 31, 1996

	DEVELOPMENT			IN-MIGRATING EMPLOYEES & STUDENTS					
RESIDENCE	Total Employees	Students Residing In District	Total Living In Household	Employees	Trigger	Attending Students		IMDS Trigger	Actual School Enrollment
Town of Columbus	109		329	64					
Rural Columbus	37		124	18					
Absarokee & Roscoe	193		581	121					
Fishtail	33		70	16					
Nye	57		121	38					
Stillwater County Total	*429*		*1,225*	*257*					
Red Lodge & Luther	42		129	21					
Other	107		299	47					
Total All Districts	*578*		*1,653*	*325*					
HIGH SCHOOL DISTRICTS									
Columbus	146	22				16			186
Absarokee	283	65				37			137
Red Lodge & Luther	42	11				6			212
Other	107	8				3			
Total High School Districts	*578*	*106*				62			
JR HIGH SCHOOL DISTRICTS									
Columbus	146	12				6			104
Absarokee	283	43				20			76
Red Lodge & Luther	42	3				1			96
Other	107	14				8			
Total Jr High School Districts	*578*	*72*				35			
ELEMENTARY SCHOOL DISTRICTS									
Columbus	146	77				42			341
Absarokee	193	82				57			176
Fishtail	33	3				4	*		17
Nye	57	12				6			14
Red Lodge	37	10				5			232
Luther	5	3				0			33
Other	107	33				21			
Total Elementary Districts	*578*	*220*				*135*			

* 2 In-migrating students from Nye

DIRECTORS, continued

COPY

Sharon Meadows -	Director
Ted Schwinden -	Director
Michael Shea -	Director, and Secretary
W. Thomas Stephens -	Director
Peter Steen -	Director
Richard B. Von Wald -	Director

ADDRESS: Stillwater Mining Company
HC 54, Box 365
Nye, MT 59061
TELEPHONE: (406) 328-6400

Item A-2, MDEQ Form (New Form) PAYROLL & CONTRACTED EMPLOYEES:

In 1996 extensive short-term construction projects associated with facilities expansion required the use of several contracting companies. Contractor employee numbers varied weekly, depending on specific activity. Many, but not all contractor employees were housed at SMC's Stratton Ranch man camp, and reliable contractor employee numbers are unavailable. SMC payroll employee numbers listed below are from SMC payroll records, however contractor employee numbers are estimated. In all cases, the employee numbers exclude employees at SMC's Smelter/BMR complex in Columbus, and represent only mine site employees.

STILLWATER MINING COMPANY
H. C. 54, BOX 365
NYE, MONTANA 59061

ATTACHMENT TO 1995 ANNUAL REPORT FOR OPERATING PERMIT #00118
Page 3

Item A-2, MDEQ Form (New Form) PAYROLL & CONTRACTED EMPLOYEES, continued:

1996	SMC Payroll (SMC Records)	Contractor (Estimated)	Total
January to March -	482	150	632
April to June -	519	150	669
July to September -	537	100	637
October to December -	581	50	631

Item A-2, MDEQ Form (New Form) PAYROLL & CONTRACTED EMPLOYEES:

Construction projects associated with facilities expansion at the mine site will be largely completed by the end of the First Quarter, 1997, and contractor employee numbers will return to normal levels. SMC payroll employee numbers listed below are projected for 1997, and contractor employee numbers are estimated.

1997	SMC Payroll (Projected)	Contractor (Projected)	Total
January to March -	585	25	610
April to June -	590	25	615
July to September -	595	50	645
October to December -	600	25	625

STILLWATER MINING COMPANY
H. C. 54, BOX 365
NYE, MONTANA 59061

ATTACHMENT TO 1995 ANNUAL REPORT FOR OPERATING PERMIT #00118
Page 2

DIRECTORS, continued

COPY

Sharon Meadows -	Director
Ted Schwinden -	Director
Michael Shea -	Director, and Secretary
W. Thomas Stephens -	Director
Peter Steen -	Director
Richard B. Von Wald -	Director

ADDRESS: Stillwater Mining Company
HC 54, Box 365
Nye, MT 59061
TELEPHONE: (406) 328-6400

Item A-2, MDEQ Form (New Form) <u>PAYROLL & CONTRACTED EMPLOYEES:</u>

In [redacted] extensive short-term construction projects associated with facilities expansion required the use of several contracting companies. Contractor employee numbers varied weekly, depending on specific activity. Many, but not all contractor employees were housed at SMC's Stratton Ranch man camp, and reliable contractor employee numbers are unavailable. SMC payroll employee numbers listed below are from SMC payroll records, however contractor employee numbers are estimated. <u>In all cases, the employee numbers exclude employees at SMC's Smelter/BMR complex in Columbus, and represent only mine site employees.</u>

Item A-2, MDEQ Form (New Form) PAYROLL & CONTRACTED EMPLOYEES, continued:

1996	SMC Payroll (SMC Records)	Contractor (Estimated)	Total
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MAY 22 1997

May 7, 1997

Hard-Rock Mining Impact Board
Room C-11
Cogswell Building
Capitol Station
Helena, MT 59620

To All Concerned:

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During construction activities associated with completion of SMC's production shaft and expansion facilities, various temporary contractor employees were also at the mine site throughout 1996. Although daily contractor employee "head counts" are available, SMC estimates that there was a daily average of approximately 80 contractor employees working at the mine site for most of the year. Impacts to Stillwater County as a result of those contractor employees was very minor, and temporary in nature; very few were on site throughout the construction period, and most of who were, did not bring their families. The majority of contractors' employees were provided temporary, single status, housing at SMC's Stratton Ranch "Man Camp" while they were working at the mine site.

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If you have any questions or need any additional information, please contact me at in Big Timber at 932-4646, or at the mine site, at 328-8528, or contact Jim Richter at the mine site, at 328-8529.

Sincerely,

James F. Richter FOR:
Bruce E. Gilbert
Environmental Affairs Manager

JFR/

Enclosure

IMPACT MONITORING REPORT
DECEMBER 31, 1996

RESIDENCE	DEVELOPMENT: Total Employees	DEVELOPMENT: Students Residing In District	DEVELOPMENT: Total Living In Household	IN-MIGRATING EMPLOYEES & STUDENTS: Employees	IN-MIGRATING EMPLOYEES & STUDENTS: Trigger	IN-MIGRATING EMPLOYEES & STUDENTS: Attending Students	IMDS Trigger	Actual School Enrollment
Town of Columbus	109		329	64				
Rural Columbus	37		124	18				
Absarokee & Roscoe	193		581	121				
Fishtail	33		70	16				
* Nye	57		121	38				
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JR HIGH SCHOOL DISTRICTS								
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Absarokee	283	43				20		76
Red Lodge & Luther	42	3				1		96
Other	107	14				8		
Total Jr High School Districts	*578*	*72*				*35*		
ELEMENTARY SCHOOL DISTRICTS								
Columbus	146	77				42		341
Absarokee	193	82				57		176
Fishtail	33	3				4*		17
Nye	57	12				6		14
Red Lodge	37	10				5		232
Luther	5	3				0		33
Other	107	33				21		
Total Elementary Districts	*578*	*220*				*135*		

* 2 In-migrating students from Nye

MONTANA
DEPARTMENT OF COMMERCE
Local Government Assistance Division
1424 9th Avenue PO Box 200501
Helena, MT 59620-0501
Phone: (406) 444-3757
FAX: (406) 444-4482
TDD: (406) 444-2978

MAY 20 1998

March 18, 1998

Kathleen Johnson, Project Coordinator
Stillwater Nye - Hertzler Tailings Impoundment
Montana Department of Environmental Quality
PO Box 200901
Helena, MT 59620

Re: DEIS for Stillwater Nye - Hertzler Tailings Impoundment

Dear Kathy:

Following are my comments on the DEIS for the proposed Hertzler Tailings Impoundment and "footprint" amendment to the operating permit for the SMC Nye Mine in Stillwater County.

Pages S-13, S-15, S-19 and S-20, S-31 & Table S-2, 2-14, 2-28, 2-63, 3-38, 3-44, 3-45, 4-29, 4-33, and 5-36.

The employment, student and population data on pages S-19 and S-20 is inconsistent with similar data on page S-31, Table S-2, and elsewhere.

Please confirm with SMC the *current* employment level. It may be that employment has already reached the 700 level, which is what the DEIS projects as the post-Hertzler amendment employment level.

Attached are copies of the 1997 and 1998 SMC monitoring reports, showing mineral development employment, mineral development students and mineral development population distribution as of December 31 of the year preceding the report. You may wish to double-check the Columbus School figures particularly because they were the subject of a concerted reconciliation effort between SMC and the District.

Also, please confirm with SMC, Stillwater County, and possibly other affected units of local government, how they perceive the Hard-Rock Mining Impact Plan amendment that is currently being prepared. Do they consider the current amendment as a "catch-up" for impacts resulting from SMC's moving from 1,000 TPD to 2,000 TPD production; as an amendment that is intended to encompass any impacts resulting from DEQ's approval of the Hertzler Tailings Impoundment and removal of the TPD limit; or both.

On page 4-36, the DEIS concludes that the increase in employment resulting from the Hertzler amendment would not necessitate any increase in the provision of local government services or facilities. Is this the conclusion of the DEIS preparers, SMC, or the individual affected units of local government? Even a small increase in mine-related population or mine-related student population might tip the balance for a local government service or facility that is at or almost at capacity.

Page S-20.

The DEIS suggests that the social and economic effects of all alternatives would be the same, which would not be so. The difference in mine-life would affect, in various ways, mine and secondary employees, people residing in the area of the impoundment, taxable valuation and governmental services, and the short-term economy of the county.

Pages 1-7, 4-36.

Following is a "yes-no" comment. Neither the Hard-Rock Mining Impact Act nor the Metal Mines Reclamation Act would prohibit SMC from engaging in activities authorized by the approval of the Hertzler amendment prior to the approval of an impact plan amendment necessitated by the Hertzler amendment. A large-scale mineral developer may not commence activity under its operating permit prior to the approval and completion of approval-related requirements for a *new* impact plan. This would also be true if the approved plan itself requires that it be reassessed and amended prior to commencement of mining activity, as is the case with the SMC East Boulder and the ASARCO Rock Creek HRMI Plans.

The 1988 Amended SMC HRMI Plan requires that SMC and the affected units of local government examine the need for amendment and that they prepare an amendment, if one is necessary to accommodate to significant changes in the mining project, such as a 15 percent increase in employment. But, this does not prevent SMC from proceeding with activities sanctioned by the operating permit amendment while the impact plan amendment is in progress.

Page 2-27.

The potential agreement concerning the proposed pipelines and secondary roads 419 and 420 might or might not take the form of an amendment to the HRMI Plan. Other processes might take precedence. That will be up to SMC and Stillwater County to determine.

Page 3-31.

The DEIS might mention the fact of property tax base sharing. Tax base sharing involves the allocation of the taxable valuation of the real and personal property (equipment) at the mine and mill and the taxable valuation of the mine's gross proceeds. The full post-permit increase in the taxable valuation of the mine is divided three times: between the County and Columbus, between the Absarokee and Columbus high school districts, and among the four affected elementary districts (Absarokee, Columbus, Fishtail and Nye). The allocation is based where mineral development employees or students reside, as identified in the annual monitoring report.

The smelter and the BMR are not included in tax base sharing. All of their valuation goes to the Town of Columbus, the Columbus School Districts, and the County, excluding the County road and bridge funds.

Page 3-45.

The DEIS should note that in 1996 the Rural Water Users Association in Absarokee was replaced by a County Water and Sewer District. The District deals only with the Absarokee water system. Sewer services remain under the jurisdiction of the County Commissioners. For further information about the District's perceptions of its impacts from SMC, you might want to talk with Bill Payne, who is manager of the District.

Thank you for the opportunity for commenting. As always, the comments are my own and not those of the Hard-Rock Mining Impact Board.

Sincerely,

Carol Ferguson

Carol L Ferguson
Administrative Officer
Hard-Rock Mining Impact Board
Phone: 444-4478

Appendix C — Previously-Required Mitigation

APPENDIX C
PREVIOUSLY REQUIRED MITIGATION

Over time, SMC has requested several changes to its Operating Permit. Each modification is specific to the requested change and does not affect any other terms of the existing permit. This means that all plans and commitments contained in the existing permit, remain in effect, except as specifically modified by the most current request. These modifications will be specified in the agencies' approval as documented in a record of decision (ROD). In addition, mitigation measures attached to SMC's existing mine approvals remain in full force and effect. Thus SMC would continue to abide by the mitigation measures set forth in Operating Permit 00118 as amended. SMC would also follow Best Management Practices of the CNF, as established in the U.S. Forest Service "Soil and Water Conservation Practices Handbook," May 1988, FSH 2509.22.

Some terms used in the status column of this Appendix are defined as follows:

Superseded: The mitigation measure has been replaced by a later document, but the same or a similar mitigation measure is still in effect and being implemented.

Ongoing: The mitigation measure is still in effect and is being implemented.

Discontinued: The need for or the reason to implement the mitigation measure no longer exits.

Completed: The mitigation measure involved a specific action or process and after completion, the mitigation measure no longer needs to be in effect.

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
WILDLIFE		
1989 EA, FONSI, & Decision Notice	SMC along with other cooperating agencies will be required to pull any road-kill fauna and remove from the road surface the carcass from Highways 419 and 420 and Forest Service Roads 846 and 400 from November to April of each year.	Ongoing
1989 EA, FONSI, & Decision Notice	SMC personnel should be instructed about the nature of the various wildlife species, especially raptors, that inhabit the area, and the potential impacts of these species.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
BIGHORN SHEEP		
1985 EIS 1986 ROD	SMC will prepare for DSL and USFS approval a plan to monitor the effects of mine development and operation on the Stillwater bighorn sheep herd. The plan will describe the objectives, methods, cooperative work schedules and reporting requirements for undertaking such studies and will outline a bighorn sheep impact mitigation contingency plan. The plan shall be submitted for agency review prior to initiating mine development activity undertaken under the Operating Permit and approved Plan of Operations. Initial research activity specified in the plan such as vehicular traffic monitoring along FAS 419 in the area of bighorn sheep wintering range will be implemented prior to mine development. Approval of the full monitoring and impact mitigation contingency plan will be obtained from the DSL and USFS within 90 days of the date of approval of the Plan of Operations by the USFS.	Superseded in 1992 ROD. The bighorn sheep monitoring plan was developed and accepted by the agencies.
1985 EIS 1986 ROD	SMC will carry out an employee education program about the adverse effects of disturbance on bighorn sheep and discourage nonessential entry into bighorn range during winter months.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1989 EA, FONSI, & Decision Notice	SMC will cooperate with federal and state agencies and private landowners to develop and implement a winter range management plan, and by other means, if necessary, to compensate for the winter range area lost to development. This plan would ensure coordination, implementation and long term monitoring of mitigation measures on bighorn sheep. Specific actions to be taken are as follows:	Ongoing
	• The Forest Service would implement a seasonal road closure on Forest Service Roads #400 at Forest boundary and Road #846, and an area closure on identified bighorn sheep winter range. This closure would be implemented from December 1-April 15, and would preclude any use of these roads unless access is needed for an existing permitted use. In addition Forest Service would work with Stillwater County in obtaining agreement to close Forest service Road 400 approximately one mile to the south of road junction #846 and #419.	Completed & discontinued due to no beneficial result to bighorn sheep
	• The Stillwater Mining Company would begin to utilize a dirt road for access to Beartooth Ranch during the closure period. This will lessen the impact and overall disturbance to bighorn sheep since this road is located on the border of the bighorn winter range. In addition SMC will take measures to reduce overall traffic to the Beartoth Ranch by car pooling whenever possible.	Completed & discontinued due to no beneficial result to bighorn sheep
	• The Forest Service and the Stillwater Mining Company will institute a program of interseeding and fertilization of Forest Service, and private lands surrounding and including the Beartooth Ranch in order to improve overall vegetative conditions. Fertilization and interseeding will be accomplished in 1989 and 1990. Fertilization will continue until such time as range production, trend, and vigor have improved to a level acceptable by the Forest Service and DSL.	Completed & discontinued due to no beneficial result to bighorn sheep
	• SMC will take action to reduce the amount of horse use on lands which they control. This reduction will amount to approximately 50% and will be implemented in conjunction with a pasture rotation plan. The overall number of horses will be reduced from 45 to 25 head on rotated pastures.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
	• SMC in cooperation with the Montana Fish and Wildlife and Parks Department will begin a medicated feed program to reduce the lungworm disease problem in the sheep. This program will be a short-term mitigation measure until other mitigation actions have shown to benefit the sheep population.	Ongoing
	• SMC will initiate an internal and external education program to advise their employees and the public about the existing problems with the bighorn sheep. As part of this program, signing will be done along Highway #419 to educate the public to problems relating to disturbance of bighorn sheep while on their winter range. In addition a sign explaining the reason for road closures will be developed.	Ongoing
	Cooperative Mitigation Measures (Not a Condition of Approval)	
	• Montana Fish, Wildlife and Parks will evaluate reduction and/or elimination of hunting of the Stillwater Bighorn Sheep Herd.	Completed
	• Montana Fish, Wildlife, and Parks will evaluate increased harvest or mule deer in this area in an attempt to reduce possible competition and habitat overlap between mule deer and bighorn sheep.	Ongoing
1992 EIS & ROD	SMC must use the information from cooperative palatability studies to undertake offsite habitat improvements designed to encourage sheep to graze areas other than the toe dike. Habitat improvements must be undertaken in consultation with the Coordinated Bighorn Sheep Management Committee. Plans must be submitted for agency approval and the results of these efforts must be monitored annually and submitted to the agencies and the sheep committee.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
COMPLIANCE WITH MITIGATION MEASURES		
1992 EIS & ROD	Whenever in the mitigation measures, SMC is required to develop a study, plan, specification, design, or other document, that study, plan, design, specification, or other document must be submitted to the DSL and the CNF, with copies to DHES as appropriate, for approval. Wherever approval is required, this approval requirement means that: • If approval is not granted, the study, plan, design, specification, or other document may not be implemented and no other action, aside from revision and resubmittal, may be undertaken pursuant to the study, plan, design, specification or other document; and • If approval, or approval with modification, is granted, SMC must conduct its operations in accordance with the study, plan, design, specification, or other document, as approved and amended.	Ongoing
1992 EIS & ROD	Wherever, in SMC's application or the mitigation measures, size, volume, height, tonnage, or other measurable units or rates have been used as a basis for environmental analysis, such measurable units or rates are considered, to the extent practicable, the maximum allowable under this permit. Exceptions will be granted only after written documentation to the agencies that the exceedances are within the intent and understanding of the original approximations and analyses.	Ongoing
CULTURAL RESOURCES		
1989 EA, FONSI, & Decision Notice	If any cultural values are observed during any phase of the construction/rehabilitation operation, they will be left intact and the District Ranger, Beartooth Ranger District and DSL, will be notified. The agencies would then conduct an evaluation of the cultural values to establish suitable mitigation measures.	Ongoing
1992 EIS & ROD	If any previously unidentified cultural resource site is encountered, SMC must notify the District Ranger, the DSL's Hard Rock Bureau and the State Historic Preservation Office and not proceed until the agencies give approval.	Ongoing
FISHERIES		
1985 EIS 1986 ROD	SMC will periodically survey employees as to their recreation usage patterns in the Stillwater River basin and provide such data to the Department of Fish, Wildlife, and Parks for assessment of fishing pressure and use of fishing access sites.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1992 EIS & ROD	SMC must submit a plan to sample periphyton to the agencies for agency approval within 6 months of the BHES decision. The periphyton monitoring plan must be designed to assess existing conditions relative to baseline studies for this expansion. Natural and artificial substrates must be included to assess algal biomass and community structure.	Ongoing
GEOTECHNICAL STABILITY		
1985 EIS 1986 ROD	SMC will annually report to the Department of State Lands and the U.S. Forest Service (USFS) the results of crown pillar testing in slopes not mined by cut-and-fill stoping, including such remedial actions taken, if necessary, to provide post-mining support to prevent surface subsidence. SMC will submit such crown pillar data to an independent testing company for review and comment if requested to do so by the DSL and USFS.	Discontinued. SMC tested and characterized the ore zone and performed rock mechanics for the under-river areas. The analyses indicated stable conditions and were accepted by the agencies. Crown and pillar testing is now conducted on an as-needed basis.
1996 EIS & ROD	SMC must adopt comparable crown pillar design standards, monitoring, and mitigation for all ore recovery which occurs under any area overlain by or crossed by West Fork of the Stillwater River, Cathedral Creek, and Nye Creek. Replacement pages, reflecting this standard must be incorporated into SMC's plan of operations on file at the DEQ and the CNF within 30 days of permit issuance.	Ongoing. However, the testing and reporting requirement was restricted to the area under the W. Fork Stillwater River, and is on an as-needed basis.
1996 EIS & ROD	SMC may not, at any time, mine or remove rock from the crown pillar under the Stillwater River.	Ongoing
WATER RESOURCES		
1992 EIS & ROD	No hazardous wastes may be generated from this treatment and disposal of waste must comply with all applicable state and federal rules.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
WATER TREATMENT		
1992 EIS & ROD	SMC must submit an updated map delineating LAD areas for agency approval. This will be included with the updated water management plans as described in stipulation 1 above. This map must include the LAD groundwater monitoring well locations and soil types based on the most recent soil survey information. Each soil type must be sampled at two locations annually for soil pH, cation exchange capacity (CEC) and appropriate trace elements. Samples must be taken at 0 to 6 inches, 6 to 12 inches, and greater than 12 inches. SMC must maintain soil pH greater than 6.5. Additional sites with the capacity for SMC to land apply mine discharge must be incorporated into SMC's permit area. Results of the soils sampling must be included in SMC's annual report.	Ongoing
RECLAMATION/SOIL SALVAGE		
1985 EIS 1986 ROD	SMC will salvage soils from the tailing impoundment area and other disturbed areas as feasible, in two lifts and stockpile subsoils and topsoils separately to the extent practical. Two lift soil salvage will be undertaken when there is a clear distinction between topsoil and subsoil.	Superseded in 1992 ROD which required additional sampling, stream channel reclamation, and specific procedures for reclaiming and capping the tailings impoundment.
1985 EIS 1986 ROD	SMC will increase the seeding rate specified in the Application for Operating Permit for portions of high altitude (above 5,300 feet) lands disturbed by mining. Herbaceous ground cover and woody plant survival will be evaluated and if excessive bare ground or erosion is observed, the ground will be reseeded.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1992 EIS & ROD	SMC must conduct field tests prior to closure of the in-place tailing, at sufficient grid spacing and depth, to define the range of impounded tailing materials properties and submit the results to the agencies for review and approval. As a result of the field and lab testing, SMC must determine the degree of consolidation and settlement, including: • An estimation of the amount of settlement that may result from primary consolidation; • An estimation of the amount of settlement that would occur due to the addition of the waste rock and soils at the time of reclamation; and • An estimation of the long-term secondary consolidation. The information acquired from the testing must then be used to plan the depths and volumes of reclamation cap fill that will be required to achieve necessary post-settlement gradients. Consolidation data and plans for fill must be submitted for agency approval prior to completion of capping.	Ongoing
1985 EIS 1986 ROD	SMC will refertilize all seeded areas one year after initial seeding, if necessary, and will restrict domestic animal grazing to the extent possible on lands owned or controlled by SMC on reclaimed areas for at least two years after initial revegetation.	Ongoing
1992 EIS & ROD	Maintenance of the percolation ponds is necessary until mine discharge meets acceptable water quality limits. Once the water quality reaches acceptable limits, the ponds must be breached and reclaimed and mine drainage must be channeled through a perennial stream to reach a natural drainage course. For bonding purposes, SMC must submit a 5-year maintenance plan for the ponds. A perennial stream channel design must be submitted 12 months prior to closure.	Ongoing
ROADS/TRANSPORTATION		
1985 EIS 1986 ROD	SMC will provide the USFS with engineered plans and typical cross-sections for the design of adit site yard areas and new adit site access roads on National Forest System land for review and approval prior to road or yard area construction.	Ongoing
1985 EIS 1986 ROD	SMC will provide the USFS specific design information for the relocated sections of FAS 419 and FR 846 for review and approval prior to undertaking construction of the relocated roadways. SMC will grant the USFS right-of-way for the relocated sections.	Completed design information was submitted and approved. The roads were relocated.

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1985 EIS 1986 ROD	SMC will implement an employee busing or van/car pooling program with a target of reducing the traffic on FAS 419 to ⅓ of the number of vehicle trips that could be expected if each worker commuted individually to the workplace. The results of this program will be reported annually to the USFS and the DSL. In the event that the targeted reduction in traffic levels on FAS 419 is consistently not achieved by the busing and car/van pooling program for any year of mine operations, and the DSL and USFS determine that additional mitigation measures are necessary, SMC will undertake additional mitigation directed toward achieving the targeted traffic reduction goal.	Superseded by Amendment 8 to SMC's Operating Plan. SMC gathered data from its employees and implemented a car pooling program. However, employees living less than 10 miles from the mine formed a group that was too dispersed to mandate specific routes, and that group of employees was exempted. SMC then reached the target goal of reduced traffic on FAS 419.
1985 EIS 1986 ROD	SMC will enter into a road maintenance agreement with Stillwater County for that portion of FAS 419 which is to be used by any ore haulage trucks and with the USFS for that portion of FR 846 similarly used.	Completed. An agreement was in place for relocation and repaving of portions of FAS 419 and the work was completed. A new agreement for road reconstruction will be negotiated if and when final road plans are approved.

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1989 EA & FONSI	The relief requested by SMC in meeting traffic reduction goals will not be granted, however, vehicles coming from 2 miles or less will not be used in figures for monitoring this requirement. The intent of this mitigation measure is to minimize conflicts of recreation traffic and private residences along access routes to the mine. Commuter mine traffic within 2 miles of the mine would have little effect on recreation traffic and private residences.	Superseded by Amendment 8 to SMC's Operating Plan. The DSL required SMC to analyze its ridership plan. After exempting employees beyond 10 miles from the mine (see above) and within 2 miles of the mine because of the limited practical effects of those groups of employees, car/van pooling at the SMC mine achieved its target reduction goal.
TAILINGS IMPOUNDMENT		
1992 EIS & ROD	An updated reclamation plan for the tailing impoundment must be submitted within 12 months for agency review and approval. The updated plan must include: • Reclamation of the tailings embankment slope to 2:1; • Placement of a mosaic of rock armor asymmetrically across the slope to break slope length to 150 feet or less and to increase soil to rock ratios; • An evaluation of volumes of glacial till and alluvium with a coarse fragment content of 50 percent or less, using existing soil survey information; • Incorporation of till and alluvium as a subsoil layer in the revegetation plan so that soil replacement depths on all disturbed acres approximate premining depths; and • Revision of the revegetation plan for final reclamation which incorporates forbs, shrubs, and trees into the existing native grassland mix. The objective of the mix is to increase biological and visual diversity and maximize visual screening.	Completed. The Reclamation Plan was completed and accepted by the agencies. The Plan is in effect and directs how SMC conducts reclamation.

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1992 EIS & ROD	SMC must conduct field tests prior to closure of the in-place tailing, at sufficient grid spacing and depth, to define the range of impounded tailing materials properties and submit the results to the agencies for review and approval. As a result of the field and lab testing, SMC must determine the degree of consolidation and settlement, including: • an estimation of the amount of settlement that may result from primary consolidation; • An estimation of the amount of settlement that would occur due to the addition of the waste rock and soils at the time of reclamation; and • An estimation of the long-term secondary consolidation. The information acquired from the testing must then be used to plan the depths and volumes of reclamation cap fill that will be required to achieve necessary post-settlement gradients. Consolidation data and plans for fill must be submitted for agency approval prior to completion of capping.	Ongoing
1992 EIS & ROD	SMC must sample the waste rock from geologic structures with significant quantities of iron disulfides and tailing and must conduct acid base analysis once a year to test and verify the lack of acid-producing potential in the waste rock and tailing mass. Results must be submitted to the agencies annually with volumes of material that each test is representing.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
VISUALS		
1985 EIS 1986 ROD	SMC will take measures to reduce the visibility of project operations by planting mixed conifer shelterbelts along the west side of FAS 419 and along the northern boundary of project operations. Such shelterbelts will be planted along the highway and along the northern property boundary in a manner designed to lessen the visibility of the project activities from vehicles traveling along FAS 419.	Superseded in 1992 ROD. Initial plantings were unsuccessful because of wind-driven particulate matter. The shelterbelt requirement remains in effect but will be postponed until tailings impoundments, waste rock areas, and roads are reclaimed and revegetated.
1985 EIS 1986 ROD	SMC will use natural poles and insulators in constructing the electric transmission line between the mill substations and the Mountain View shaft site, and paint mine buildings earth tone colors.	Ongoing
1989 EA, FONSI, & Decision Notice	SMC will be required to utilize earth tone "Jersey" barriers on the switchback road which leads to the mine adits, where earth tone rock berms can not be constructed.	Ongoing
1992 EIS & ROD	SMC must submit for agency approval a visual management plan, within 6 months of this decision, which addresses the following: • The establishment of a complex land form on the tailings embankment based on available construction materials and site characteristics at the time of final reclamation. • Use of boulders (singly or in groups), and random massing of large and small native shrubs, and large and small native tree specimens to interrupt the flat line formed by the top of the dam. Establishment of shrubs or trees on the impoundment should only be undertaken at final reclamation.	Completed. The Plan is still in effect.

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
WATER RESOURCES		
1985 EIS 1986 ROD	SMC will prepare for DSL and USFS approval a spring flow monitoring program to collect hydrologic data designed to ascertain the effects of mine development on nearby springs. The plan will specify springs to be monitored, monitoring methods, frequency of monitoring and reporting requirements. The initial phase of the monitoring program will be implemented concurrently with the beginning of mine development activity undertaken with the Operating Permit and approved Plan of Operations.	Superseded in 1992 ROD. The Plan was prepared, has been modified over time due to approved amendments expanding the permit area and is still in effect.
1985 EIS 1986 ROD	SMC will prepare for DSL and USFS approval a water quality compliance monitoring plan. The plan will specify monitoring sites, sampling frequency, parameters, sampling and analytical methods and reporting procedures that will be used to analyze ground and surface water potentially affected by the project. SMC will implement the plan in accordance with a schedule outlined in the plan. The initial phase of the monitoring program will be implemented concurrently with the beginning of mine development activity undertaken with the Operating Permit and approved Plan of Operations. If monitoring shows any changes in water quality, SMC is required by state law to take corrective action.	Superseded in 1992 ROD. The Plan was prepared, has been modified over time with agency approval, but is still in effect.
1985 EIS 1986 ROD	SMC will prepare for DSL and USFS approval a spring flow monitoring program to collect hydrologic data designed to ascertain the effects of mine development on nearby springs. The plan will specify springs to be monitored, monitoring methods, frequency of monitoring and reporting requirements. The initial phase of the monitoring program will be implemented concurrently with the beginning of mine development activity undertaken with the Operating Permit and approved Plan of Operations.	Superseded in 1992 ROD. The Plan was prepared, has been modified over time with agency approval, but is still in effect.
1989 EA, FONSI, & Decision Notice	Water compliance monitoring plan in the permit will be continued to ensure any changes in water quality can be detected. SMC is required by State law to take immediate corrective action if monitoring shows any changes in water quality.	Ongoing
1989 EA, FONSI, & Decision Notice	State-of-the-art design of the double-pipe system and emergency spill containment pond with an alarm to insure detection of any leaks will be utilized reducing chance of discharge into the Stillwater River. This emergency spill containment pond has a capacity of 6 hours of maximum discharge from pipeline leakage.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1989 EA, FONSI, & Decision Notice	Impacts to water resources could be reduced by minimizing the area of disturbance to that absolutely necessary for the construction and operation of mining activities and reclaiming these areas as soon as possible. A detailed erosion control, revegetation, and rehabilitation plan is contained in the application for permit.	Ongoing
1989 EA, FONSI, & Decision Notice	SMC will be required to drill ahead of tunnel construction systems (either the TBM or conventional methods) in order to attempt to locate and avoid to the extent possible any underground aquifer systems.	Ongoing
1989 EA, FONSI, & Decision Notice	The ongoing water quality monitoring plan will continue to determine any effects of the mining operation on water quantity within the area.	Ongoing
1989 EA, FONSI, & Decision Notice	SMC has committed to and is mandated under the Montana Metal Mine Reclamation Act to replace lost water rights with water of comparable quality and quantity.	Ongoing
1989 EA, FONSI, & Decision Notice	SMC will be required to take measures to minimize the disruption of underground water flows. These measures may include grouting and packing of fractures, or other measures applicable to a specific condition.	Ongoing
1992 EIS & ROD	SMC must submit an updated water management plan, for agency review and approval, which reflects the standards established by the BHES, within 6 months of the BHES decision. If such plans involve the disturbance of additional acreage, then additional soils, cultural resource and wetlands inventories must be completed for the proposed disturbance areas not previously surveyed. The water management plan must explain: • how SMC will dispose of excess adit water; • how the new and enlarged source will be treated; and • how that treatment will meet the requirements of ARM 16.20.631 and the Water Quality Act.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1992 EIS & ROD	The water resources monitoring plan must be updated and submitted for agency approval within 6 months of the BHES decision to: • Incorporate lower detection limits, where appropriate and achievable. The current practice of using EPA approved analytical procedures must be maintained. • Sample Stillwater Valley Ranch (SVR) monitoring wells (MW 12A, 13A, 14A, and 15A) monthly during the period of the year when the percolation ponds are in use. The parameters to be sampled monthly include nitrite plus nitrate, ammonia, and total dissolved solids (TDS). • Add additional surface water and groundwater monitoring locations within all major land application areas, downgradient of the SVR percolation ponds, near the compliance boundary (see preceding modification), and where the groundwater intercepts the river. These locations must be approved by the agencies.	Ongoing
	• Design the groundwater plan to assure that the effect of the existing and enlarged west side drain field is monitored. An annual evaluation of monitoring data must include analysis of phosphorus and nitrogen loading. • Submit an updated groundwater map including the east and west side, upon completion of additional wells and collection of data. The frequency of monitoring and the number of parameters analyzed may be reduced if, after consultation with the agencies, these parameters are considered redundant. The number of currently existing sites which are monitored may also be reduced if, after consultation with the agencies, these sites are considered redundant.	
1992 EIS & ROD	The compliance point for ground water quality will be the limits of the mixing zone granted by the BHES. If a mixing zone is not granted, the agencies would use the permit boundary as the ground water compliance point.	Ongoing 8/1/98 Approval of MPDES Permit MT .0024716 designated alluvial mixing zone compliance wells as MW-14A, MW-7A, 7B, and 7C.
1992 EIS & ROD	All water quality data must be submitted to the agencies as hard copy and in an electronic format compatible with the agencies' data management system, as per each individual agency's needs.	Ongoing

Date & Type of MEPA/NEPA Analysis	Mitigation Measure	Status and Rationale
1992 EIS & ROD	Implementation of the water management plan through construction of water treatment plants, emergency storage impoundments or other facilities may not disturb more than 5 additional acres and must be located in the area to the west and north of the mill building. No more than eight 4,000-gallon water trucks daily may be used to haul waste stream effluent offsite.	Ongoing
WETLANDS		
1992 EIS & ROD	The Environmental Protection Agency, the DSL, and the CNF, must be notified if impacts to wetlands or riparian areas not otherwise predicted in this EIS are likely to occur and obtain appropriate permits.	Ongoing

Appendix D — Water Balance Calculations

Alternatives A & D - No Action & Modified Cenerline Expansion & East Stillwater Impoundment

2,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	927	Perc Ponds	Evaporation	7
Potable Water	48		Percolation	586
Ore Moisture	26		LAD	168
Precipitation	59	Tailings	Spray Evap.	112
			Evaporation	61
			Entrainment	96
		Other		35
TOTAL	1061			1065

Alternatives B & C - Proposed Action & Modified Centerline Expansion & Herztler

2,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	927	Perc Ponds	Evaporation	7
Potable Water	48		Percolation	288
Ore Moisture	26		LAD	325
Precipitation	124	Tailings	Spray Evap.	225
			Evaporation	154
			Entrainment	96
		Other		35
TOTAL	1125			1130

Alternative D - Modified Cenerline Expansion & East Stillwater Impoundment

2,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	927	Perc Ponds	Evaporation	7
Potable Water	48		Percolation	586
Ore Moisture	26		LAD	168
Precipitation	59	Tailings	Spray Evap.	112
			Evaporation	61
			Entrainment	96
		Other		35
TOTAL	1061			1065

Alternative A - No Action Alternative

2,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	927	Perc Ponds	Evaporation	7
Potable Water	48		Percolation	586
Ore Moisture	26		LAD	168
Precipitation	59	Tailings	Spray Evap.	112
			Evaporation	61
			Entrainment	96
		Other		35
TOTAL	1061			1065

Alternatives B & C - Proposed Action & Modified Centerline Expansion & Herztler

3,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	1159	Perc Ponds	Evaporation	7
Potable Water	20		Percolation	288
Ore Moisture	39		LAD	1044
Precipitation	124	Tailings	Spray Evap.	225
			Evaporation	154
			Entrainment	144
		Other		63
TOTAL	1342			1924

Alternative D - Modified Cenerline Expansion & East Stillwater Impoundment

3,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	1159	Perc Ponds	Evaporation	7
Potable Water	20		Percolation	586
Ore Moisture	39		LAD	410
Precipitation	59	Tailings	Spray Evap.	112
			Evaporation	61
			Entrainment	144
		Other		63
TOTAL	1277			1383

Alternative A - No Action Alternative

2,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	927	Perc Ponds	Evaporation	7
Potable Water	48		Percolation	586
Ore Moisture	26		LAD	168
Precipitation	59	Tailings	Spray Evap.	112
			Evaporation	61
			Entrainment	96
		Other		35
TOTAL	1061			1065

Alternatives B & C - Proposed Action & Modified Centerline Expansion & Herztler

4,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	1449	Perc Ponds	Evaporation	7
Potable Water	20		Percolation	288
Ore Moisture	52		LAD	1044
Precipitation	124	Tailings	Spray Evap.	225
			Evaporation	154
			Entrainment	192
		Other		63
TOTAL	1645			1972

Alternative D - Modified Cenerline Expansion & East Stillwater Impoundment

4,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	1449	Perc Ponds	Evaporation	7
Potable Water	20		Percolation	586
Ore Moisture	52		LAD	410
Precipitation	59	Tailings	Spray Evap.	112
			Evaporation	61
			Entrainment	192
		Other		63
TOTAL	1580			1430

Alternative A - No Action Alternative

2,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	927	Perc Ponds	Evaporation	7
Potable Water	48		Percolation	586
Ore Moisture	26		LAD	168
Precipitation	59	Tailings	Spray Evap.	112
			Evaporation	61
			Entrainment	96
		Other		35
TOTAL	1061			1065

Alternatives B & C - Proposed Action & Modified Centerline Expansion & Herztler

5,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	1811	Perc Ponds	Evaporation	7
Potable Water	20		Percolation	288
Ore Moisture	65		LAD	1044
Precipitation	124	Tailings	Spray Evap.	225
			Evaporation	154
			Entrainment	239
		Other		63
TOTAL	2020			2020

Alternative D - Modified Cenerline Expansion & East Stillwater Impoundment

5,000 TPD

Source	GPM	Source		GPM
Mine Ground Water	1811	Perc Ponds	Evaporation	7
Potable Water	20		Percolation	586
Ore Moisture	65		LAD	410
Precipitation	59	Tailings	Spray Evap.	112
			Evaporation	61
			Entrainment	239
		Other		63
TOTAL	1955			1478

ASSUMPTIONS FOR DETAILED MINE WATER BALANCE
(GOLDER ASSOCIATES)

SINKS (LOSSES)

Concentrate drying:	Based on a constant concentration ratio of 90:1, 22% moisture in the filter cake.
Entrained Backfill:	Based on 14% contained moisture in final drainage of backfilled stopes, 58% of mill tails recovered as sand.
Entrained in pond:	Based on 59% solids final compaction in the tailings pond; 42% of mill tails reports to pond as slimes.
Spray evaporation:	2 pumps @ 450 gpm, 6 months a year, 24hrs/day, 7 days/week. Average daily evaporation rate is 25% of water pumped to sprays. 4 pumps total @ 450 gpm each with the addition of the Hertzler impoundment.
Evaporation in pond:	36" per year of evaporation, 33 acres of wetted pond surface; 83 acres with the Hertzler impoundment.
Evap. in perc. ponds:	36" per year of evaporation, 3.5 acres of wetted pond surface. Same w/ Hertzler.
Percolation:	824 gpm for 6 winter months, 324 gpm for summer months during LAD for the 1000 tpd case. Percolation reduced w/ the addition of the Hertzler impoundment during the summer months. Excess flow is disposed of via LAD.
Land Application (LAD):	1060 gpm, 13 hrs/day, 5 days/week during the 6 summer months for 1000 tpd case. Fluctuates to dispose of excess water in expanded production scenarios. One extra pivot added at Hertzler site pumping 530 gpm for 5000 tpd case.

SOURCES

Ore water:	Ore fed to the concentrator is 7% moisture by weight.
Reagent water:	Source is potable water. 1.0 lb/ton CMC @ 2% solution 0.1 lb/ton PAX @ 10% solution 0.09 lb/ton 3477 @ 20% solution
Potable water:	Based on annual flows through the flow meter at the head tank. This flow is included in the East & West mine water discharges. Flow is reduced to 20 gpm in expanded scenarios. Replace drill water w/ clarified mine water.

Potable water to mill: Spray and launder water. Calculated from the difference in cyclone overflow slurry density and final tailings slurry density. Cyclone overflow is typically 41% solids as opposed to the tails at 33% solids. All but 20 gpm replaced w/ pond water in expanded cases.

Precipitation: 25" per year, 46 acres of tailings pond area; 96 w/ Hertzler impoundment.

Precipitation: 25" per year, 3.5 acres of percolation pond area. Unchanged w/ Hertzler.

East & West mine water: Based on 1995 data collected from the field. 25% increase with each 1000 tpd increase in production.

Transfer to Pond: Based on the annual flow difference between pond sources and losses. The tailings must be wetted to prevent dusting. Excess water comes from mine ground water (thickener overflow).

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

STILLWATER MINING COMPANY
MINE WASTE MANAGEMENT PLAN

MINE WATER DISCHARGE REQUIREMENTS VERSUS MILL THROUGHPUT

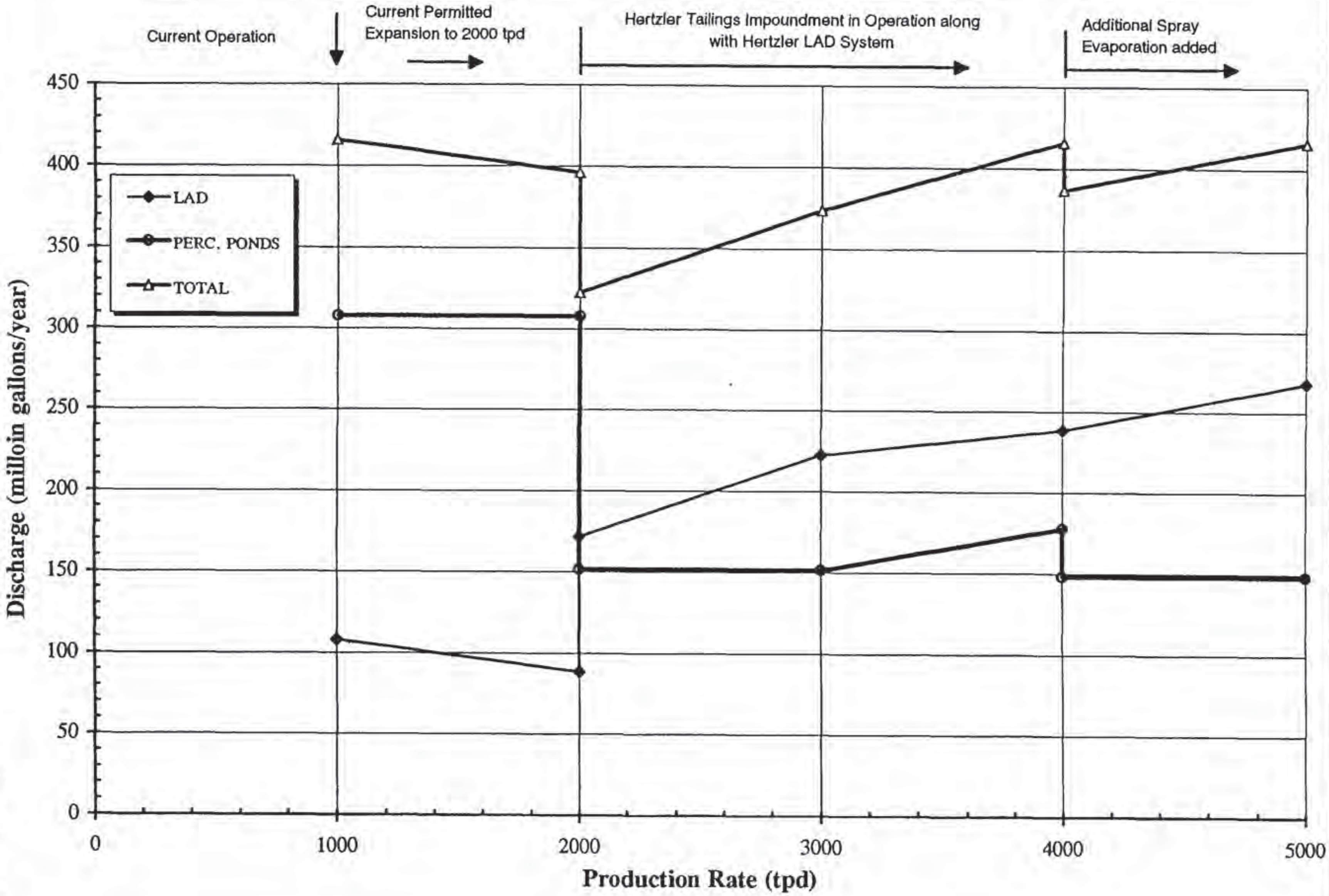

FIGURE 3.13

Appendix E — Preliminary Determination of the Air Quality Permit Application

DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMITTING AND COMPLIANCE DIVISION
Air and Waste Management Bureau

MARC RACICOT, GOVERNOR

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STATE OF MONTANA

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HELENA, MONTANA 59620-0901

PRELIMINARY DETERMINATION ON PERMIT APPLICATION

Date of Mailing: March 6, 1998

Name of Applicant: Stillwater Mining Company

Source: An underground platinum/palladium mine, ore processing plant and tailings disposal facility.

Proposed Action: The department proposes to issue a permit, with conditions, to the above-named applicant. The application was assigned permit application number 2459-08.

Proposed Conditions: See attached.

Public Comment: Any member of the public desiring to comment must submit such comments in writing to the Permitting and Compliance Division of the Department of Environmental Quality at the above address. Comments may address the department's analysis and determination, or the information submitted in the application. In order to be considered, the comments must be postmarked by May 19, 1998. Copies of the application and the department's analysis may be inspected at the division's office in Helena. For more information you may contact the division at 444-3490

Departmental Action: The department intends to make a decision on the application within 30 days of issuance of the final supplemental Environmental Impact Statement. A copy of the decision may be obtained at the above address. The permit shall become final 16 days from the department's decision unless an appeal is made to the Board of Environmental Review (Board).

Procedures for Appeal: Any person jointly or severally adversely affected by the final action may request a hearing before the Board. Any appeal must be filed within 15 days after the department renders its decision. The request for a hearing shall contain an affidavit setting forth the grounds for the request. Any hearing will be held under the provisions of the Montana Administrative Procedures Act. Submit requests for a hearing in triplicate to: Chairman, Board of Environmental Review, P.O. Box 200901, Helena, Montana 59620.

For the department,

Richard Knatterud
Air Permitting Section Supervisor

RK:bjd
Enclosures

AIR QUALITY PERMIT

Issued to: Stillwater Mining Company
HC 54, Box 365
Nye, MT 59061

Permit #2459-08
Application Complete: 04/26/96
Preliminary Determination: 03/06/98
Department Decision:
Final Permit:

An air quality permit is granted to Stillwater Mining Company (Stillwater Mining) pursuant to Sections 75-2-204 and 211 of the Montana Code Annotated (MCA) as amended, and the Administrative Rules of Montana (ARM) 17.8.701, *et seq.*, as amended, for the following:

Section I. Permitted Facilities

A. Permitted Facility:

An underground platinum/palladium mine, ore processing plant, and tailings disposal facilities known as the Stillwater Mining Company, Stillwater Project.

B. Current Permitting Action:

Stillwater Mining requested a production limit increase from 730,000 tons per year (TPY) or 3,500 tons per day (TPD) to 1,825,000 TPY or 5,000 TPD. In addition, Stillwater Mining plans to construct and operate a new tailings impoundment located approximately 7 miles northeast of the mine site (2 miles northeast of Nye), install a pipeline system along Stillwater County Road 420 and reclaim the resulting surface disturbance, and expand the waste rock storage area located on the east side of the Stillwater River at the mine site.

The increased activity at the mine will result in an increase in PM-10 emissions of approximately 48 TPY. This facility is not a Prevention of Significant Deterioration (PSD) source because the facility is not a listed source nor does the facility's potential to emit (excluding fugitive emissions) exceed 250 tons per year of any pollutant. Therefore, a PSD review was not required for the proposed production increase. Permit #2459-08 replaces permit #2459-07.

SECTION II. Permit Terms

A. *Limitations and Conditions*

1. Stillwater Mining shall control particulate stack emissions from the concentrate dryer by employing a fabric filter collector (Micro-Pulsaire, Model 645-10-TR, pulse jet baghouse) such that stack emissions do not exceed 0.05 grams per dry standard cubic meter. Within 180 days after initial start-up of the baghouse and every four years thereafter, Stillwater Mining shall conduct performance tests to verify compliance with this limitation. The department reserves the right to require additional emission testing to determine compliance with the emission limitation. [ARM 17.8.340]

2. Stack emissions from the concentrate dryer are subject to an opacity limitation of 7 (seven) percent. [ARM 17.8.340]

3. Process fugitive emissions are subject to an opacity limitation of 10 (ten) percent. [ARM 17.8.340]

4. If the department determines it to be necessary, Stillwater Mining shall install a sprinkler system or provide equivalent mitigative measures to control wind-blown emissions from the tailings facilities. The department shall determine the necessity of the control measures above on the basis of personal observation, results of ambient air quality monitoring, complaints, or any combination of the above. [ARM 17.8.715]

5. Stillwater Mining shall continue a dust suppression program on all dirt roads. The necessity for additional measures on other portions of the road or the entire road will be determined by the department through on-site inspections, ambient air quality monitoring, complaints, or any combination of the above. [ARM 17.8.710]

6. Mine production and milling rates shall not exceed 1,825,000 tons per year or 5,000 tons per day. [ARM 17.8.710]

7. Compliance with emission and opacity standards and testing requirements shall be as specified in 40 CFR Part 60, where applicable. [ARM 17.8.710]

8. If the department determines it to be necessary, Stillwater Mining shall provide mitigative measures to control wind-blown emissions from the east side waste rock disposal area. The department shall determine the necessity of the control measures above on the basis of personal observation, results of ambient air quality monitoring, complaints, or any combination of the above. [ARM 17.8.710]

B. Testing and Notification Requirements

1. The department may require testing. [ARM 17.8.105]

2. All tests must be conducted in accordance with the Montana Source Test Protocol and Procedures Manual. [ARM 17.8.106]

C. Operational Reporting Requirement

Stillwater Mining shall supply the department with annual production information for all emission points, as required by the department in the annual emission inventory request. The request will include, but is not limited to, the amount of ore and waste handled, a description of any dust suppression program, fuel consumption and other related information the department may request. With respect to the dust suppression program, the information shall include the areas of application, frequency of application, and amount. This report may be included with the annual report required in the Monitoring Plan (Attachment 1). [ARM 17.8.710]

Production information shall be gathered on a calender-year basis and submitted to the department by the date required in the emission inventory request. Information shall be in the units required by the department. This information may be used for calculating operating fees, based on actual emissions from the facility, and to verify compliance with permit limitations. [ARM 17.8.505]

Stillwater Mining shall notify the department of any construction or improvement project conducted pursuant to ARM 17.8.705(1)(q) that would change the facility's annual emission inventory. The notice must be included with the annual emission inventory submitted to the department and must include information sufficient to calculate the facility's estimated actual emissions. [ARM 17.8.708]

D. Ambient Air Monitoring

Stillwater Mining shall operate an ambient air quality monitoring network around the project area. The monitoring requirements are more fully described in the Monitoring Plan (Attachment 1). Exact monitoring locations must be approved by the department prior to installation or relocation. [ARM 17.8.710]

The proposed east side waste rock storage site will be located in the area were the downwind PM-10 sampler is located. Therefore, the downwind PM-10 sampler will have to be relocated. Stillwater Mining will move the sampling site to a different location, approved by the department. Within 90 days after a final permit is issued Stillwater Mining shall start air quality monitoring at the new downwind site. [ARM 17.8.710]

Section III. General Conditions

A. Inspection - Stillwater Mining shall allow the department's representatives access to the source at all reasonable times for the purpose of making inspections, surveys, collecting samples, obtaining data, auditing any monitoring equipment (CEMS, CERMS) or observing any monitoring or testing, and otherwise conducting all necessary functions related to this permit.

B. Permit Inspection - As required by ARM 17.8.716, Inspection of Permit, a copy of the air quality permit shall be made available for inspection by department personnel at the location of the permitted source.

C. Compliance with Statutes and Regulations - Nothing in this permit shall be construed as relieving the permittee of the responsibility for complying with any applicable federal or Montana statute, rule or standard, except as specifically provided in ARM 17.8.701, *et seq*. [ARM 17.8.717]

D. Enforcement - Violations of limitations, conditions and requirements contained herein may constitute grounds for permit revocation, penalties or other enforcement as specified in Section 75-2-401, *et seq.*, MCA.

E. Waiver - The permit and all the terms, conditions, and matters stated herein shall be deemed accepted if Stillwater Mining fails to appeal as indicated below.

F. Appeals - Any person or persons jointly or severally adversely affected by the department's decision may request, within fifteen (15) days after the department renders its decision, upon affidavit setting forth the grounds therefor, a hearing before the Board of Environmental Review (Board). A hearing shall be held under the provisions of the Montana Administrative Procedures Act. The department's decision on the application is not final unless fifteen (15) days have elapsed and there is no request for a hearing under this section. The filing of a request for a hearing postpones the effective date of the department's decision until the conclusion of the hearing and issuance of a final decision by the Board.

G. Permit Fees - Pursuant to Section 75-2-220, MCA, as amended by the 1991 Legislature, failure to pay the annual operation fee by Stillwater Mining may be grounds for revocation of this permit, as required by that Section and rules adopted thereunder by the Board.

H. Construction Commencement - Construction must begin within three years of permit issuance and proceed with due diligence until the project is complete or the permit shall be revoked. [ARM 17.8.731]

Attachment 1

AMBIENT AIR MONITORING PLAN
STILLWATER MINING COMPANY
#2459-08

1. This ambient air monitoring plan is required by air quality permit #2459-08 which applies to the Stillwater Mining Company's (Stillwater Mining) mine, ore processing plant and tailings disposal facilities near Nye, Montana. This monitoring plan may be changed from time to time by the department, but all current requirements of this plan are also considered conditions of the permit.

2. Stillwater Mining shall operate and maintain two ambient air quality monitoring stations in the vicinity of the Nye mine and ore processing plant. Stillwater Mining shall relocate their downwind air monitoring site (AIRS #30-095-002) to a site down drainage (northeast) from the current location. The new site shall be at the property boundary and represent ambient air conditions. The new monitoring site must be approved by the department and meet all siting requirements contained in the Montana Quality Assurance Project Plan, including revisions, the EPA Quality Assurance Manual, including revisions, and Parts 50, 53, and 58 of the Code of Federal Regulation, or any other requirements specified by the department.

3. Stillwater Mining shall start air quality monitoring at the new downwind site within 90 days after a final permit is issued and continue monitoring at both sites for at least one year. At that time, the air monitoring data will be reviewed by the department and the department will determine if continued monitoring or additional monitoring is warranted. The department may require continued air monitoring to track long-term impacts of emissions from the facility or require additional ambient air monitoring or analyses if any changes take place in regard to quality and/or quantity of emissions or the area of impact from the emissions.

4. Stillwater Mining shall monitor the following parameters at the sites and frequencies described below:

AIRS # and Site Name	UTM Coordinates	Parameter	Frequency
30-095-0001 Upwind #1	UTM Zone 12 E 588600 N 5025600 Elev. 5000 ft.	PM-10[1]	Every third/sixth day[2]
30-095-xxxx New Downwind #3	UTM Zone 12 E 58xxxx N 50xxxxx Elev. xxxx ft.	PM-10[1]	Every third/sixth day[2]
		PM-10 Collocated[3]	

[1]PM-10 (particulate matter less than 10 microns).
[2]Every third day during May-October; every sixth day during November-April.
[3]The requirement for a collocated PM-10 sampler may be waived if the monitor operator operates a collocated PM-10 sampler at another site.

5. Data recovery for all parameters shall be at least 80 percent computed on a quarterly and annual basis.

6. Any ambient air quality monitoring network changes proposed by the Stillwater Mining must be approved in writing by the department.

7. Stillwater Mining shall utilize air quality and meteorological monitoring and quality assurance procedures which are equal to or exceed the requirements described in the Montana Quality Assurance Project Plan, including revisions, the EPA Quality Assurance Manual, including revisions, and Parts 50, 53 and 58 of the Code of Federal Regulation, or any other requirements specified by the department.

8. Stillwater Mining shall submit quarterly data reports within 45 days after the end of the calendar quarter and an annual data report within 90 days after the end of the calendar year. The annual report may substitute for the fourth quarter report, as long as it also includes the requirements of 9 below.

9. The quarterly report shall consist of a narrative data summary and a data submittal of all data points in AIRS format. This data may be submitted in ASCII files on 3½" or 5¼" high or low density floppy disks, in IBM-compatible format, or on AIRS data entry forms. The narrative data summary shall include:

   a. A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the mine and facilities and the general area;

   b. A hard copy of the individual data points;

   c. The quarterly and monthly means, per site, for PM-10;

   d. The first and second highest 24-hour concentrations for PM-10;

   e. A summary of the data collection efficiency;

   f. A summary of the reasons for missing data;

   g. A precision and accuracy summary (audit);

   h. A summary of any ambient standard exceedances; and

   i. Calibration information.

10. The annual data report shall consist of a narrative data summary containing:

   a. A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the mine and facilities and the general area;

   b. A pollution trend analysis;

c. The annual means, per site, for PM-10;

d. The first and second highest 24-hour concentrations, per site, for PM-10;

e. An annual summary of data collection efficiency;

f. An annual summary of precision and accuracy (audit) data;

g. An annual summary of any ambient standard exceedances; and

h. Recommendations for future monitoring.

11. The department may audit, or may require Stillwater Mining to contract with an independent firm to audit, the air monitoring network, the laboratory performing associated analyses and any data handling procedures at unspecified times. On the basis of the audits and subsequent reports, the department may recommend or require changes in the air monitoring network and associated activities in order to improve precision, accuracy and data completeness.

Permit Application Analysis
Stillwater Mining Company
Permit #2459-08

I. Introduction

A. Permit History

Permit #2459 was issued for the Stillwater Mine on March 29, 1988 to Stillwater Mining Company. It was based on 1000 tons per day of ore production.

Permit #2459A was an alteration issued October 21, 1988 to extend mining to the east side of the Stillwater River with no increase in ore production but a slight increase in particulate emissions.

Permit #2459A-2 was issued March 11, 1991 to clarify language relative to the annual production limitation.

Permit #2459-03 was issued August 14,1992 to increase the ore production rate from 1000 to 3500 tons per day and from 365,000 to 730,000 tons per year.

Permit #2459-04 was a modification issued on April 27, 1993.

Permit #2459-05 was a modification to clarify the performance testing requirement on the wet scrubber controlling emissions from the concentrate dryer. The permit was also updated to include a more specific listing of applicable regulations.

Permit #2459-06 was an alteration issued October 18, 1995 to replace the concentrate dryer wet scrubber with a fabric filter collector (baghouse). Notification and testing requirements relative to the baghouse were also added.

Permit #2549-07 was a modification issued on April 17, 1997 to add crushing, screening, and hauling of bedding material to the emission inventory in the permit analysis. It had been inadvertently taken out of the emission inventory in a previous permitting action. Permit number citations in the permit and analysis were also updated.

B. Current Permitting Action

Stillwater Mining requested a production limit increase from 730,000 tons per year (TPY) or 3,500 tons per day (TPD) to 1,825,000 TPY or 5,000 TPD. The increased activity at the mine will result in an increase in PM-10 emissions of approximately 48 TPY. A PSD review was not required for the proposed production increase because the facility is not a listed source nor does the facility's potential to emit (excluding fugitive emissions) exceed 250 tons per year of any pollutant.

In addition, Stillwater Mining plans to construct and operate a new tailings impoundment located approximately 7 miles northeast of the mine site (2 miles northeast of Nye), install a pipeline system along Stillwater County Road 420 and reclaim the resulting surface disturbance, and expand the waste rock storage area located on the east side of the Stillwater River at the mine site. The application review addresses potential emissions from the new tailings impoundment and east side waste rock storage area. The department's review of the application did not address emissions generated during the construction of the tailings impoundment or the pipeline system. During the construction activities, Stillwater Mining is responsible to comply with applicable requirements.

Permit #2459-08 replaces permit #2459-07.

C. Facility Description

The Stillwater Mine is located in Stillwater County near Nye. It is an underground platinum/palladium (platinum group metals) mine. The operation includes ore and waste excavation, crushing, conveying, grinding, flotation concentration, concentrate drying (direct propane-fired), and tailings disposal. The concentrate is trucked to Stillwater Mining Company's Columbus Smelter for further processing.

II. Applicable Rules and Regulations

The following are partial quotations of some applicable rules and regulations which apply to the operation. The complete rules are stated in the Administrative Rules of Montana and are available upon request from the department. Upon request, the department will provide references for locations of complete copies of all applicable rules and regulations or copies where appropriate.

A. ARM 17.8, Subchapter 1, General Provisions, including, but not limited to:

1. ARM 17.8.101, Definitions. This rule is a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.105, Testing Requirements. Any person or persons responsible for the emission of any air contaminant into the outdoor atmosphere shall, upon written request of the department, provide the facilities and necessary equipment, including instruments and sensing devices, and shall conduct tests, emission or ambient, for such periods of time as may be necessary, using methods approved by the department.

3. ARM 17.8.106, Source Testing Protocol. The requirements of this rule apply to any emission source testing conducted by the department, any source, or other entity as required by any rule in this chapter, or any permit or order issued pursuant to this chapter, or the provisions of the Montana Clean Air Act, 75-2-101, *et seq.*, MCA.

4. <u>ARM 17.8.110, Malfunctions</u>. The the department must be notified promptly by phone whenever a malfunction occurs that can be expected to create emissions in excess of any applicable emission limitation, or to continue for a period greater than 4 hours.

5. <u>ARM 17.8.111, Circumvention</u>. No person shall cause or permit the installation or use of any device or any means which, without resulting in reduction in the total amount of air contaminant emitted, conceals or dilutes an emission of air contaminant which would otherwise violate an air pollution control regulation.

   No equipment that may produce emissions shall be operated or maintained in such a manner that a public nuisance is created.

B. ARM 17.8, Subchapter 2, Ambient Air Quality, including, but not limited to:

The following ambient air quality standards or requirements may apply, including but not limited to:

ARM 17.8.204, Ambient Air Monitoring,
ARM 17.8.210, Ambient Air Quality Standards for Sulfur Dioxide,
ARM 17.8.211, Ambient Air Quality Standards for Nitrogen Dioxide,
ARM 17.8.212, Ambient Air Quality Standards for Carbon Monoxide,
ARM 17.8.220, Ambient Air Quality Standards for Settled Particulate Matter,
ARM 17.8.221, Ambient Air Quality Standards for Visibility,
ARM 17.8.222, Ambient Air Quality Standard for Lead, and
ARM 17.8.223, Ambient Standards for PM-10.

The applicant must comply with the applicable ambient air quality standards. Reference Existing Air Quality and Air Quality Impacts Sections.

C. ARM 17.8, Subchapter 3, Emission Standards, including, but not limited to:

1. <u>ARM 17.8.304, Visible Air Contaminants</u>. No person may cause or authorize emissions to be discharged into the outdoor atmosphere from any source installed after November 23, 1968, that exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

2. <u>ARM 17.8.308, Particulate Matter, Airborne</u>. No person shall cause or authorize the production, handling, transportation, or storage of any material unless reasonable precautions to control emission of airborne particulate matter are taken. Such emissions of airborne particulate matter from any stationary source shall not exhibit an opacity of 20% or greater averaged over six consecutive minutes.

3. <u>ARM 17.8.309, Particulate Matter, Fuel Burning Equipment</u>. No person shall cause, suffer, allow or permit particulate matter caused by the combustion of fuel to be discharged from any stack or chimney into the atmosphere in excess of the hourly rate set forth.

4. ARM 17.8.310, Particulate Matter, Industrial Processes. No person shall cause, suffer, allow, or permit to be discharged into the outdoor atmosphere from any operation, process or activity, particulate matter in excess of the amount shown.

5. ARM 17.8.315, Odors. No person shall cause, suffer, or allow any emissions of gases, vapors, or odors beyond his property line in such a manner as to create a public nuisance. A person operating any business or using any machine, equipment, device or facility or process which discharges into the outdoor air any odorous matter or vapors, gases, dusts, or any combination thereof which create odors, shall provide, properly install, and maintain in good working order and in operation such odor control devices or procedures as may be specified by the department.

6. ARM 17.8.322, Sulfur Oxide Emissions--Sulfur in Fuel. Commencing July 1, 1972, no person shall burn liquid or solid fuels containing sulfur in excess of 1 pound of sulfur per million Btu fired. Commencing July 1, 1971, no person shall burn any gaseous fuel containing sulfur compounds in excess of 50 grains per 100 cubic feet of gaseous fuel, calculated as hydrogen sulfide at standard conditions.

7. ARM 17.8.340, Standard of Performance for New Stationary Sources. The owner and operator of any stationary source or modification, as defined and applied in 40 CFR Part 60, shall comply with the standards and provisions of 40 CFR Part 60. (NSPS), listed below: Subpart LL - Metallic Mineral Processing Plants - Requires an opacity limitation of 10 percent on process fugitive emissions, a stack emission limitation of 0.05 grams per dry standard cubic meter, and a stack opacity limitation of 7 percent.

8. ARM 17.8.341, Emissions Standards for Hazardous Air Pollutants. The owner or operator of any existing or new stationary source, as defined and applied in 40 CFR Part 61, shall comply with the standards and provisions of 40 CFR Part 61.

D. ARM 17.8, Subchapter 5, Air Quality Permit Application, Operation and Open Burning Fees, including but not limited to:

1. ARM 17.8.504, Air Quality Permit Application Fees. Concurrent with the submittal of an air quality permit application, as required in ARM Title 17, Chapter 8, Subchapter 7 (Permit, Construction and Operation of Air Contaminant Sources), or ARM Title 17, Chapter 8, Subchapter 8 (Prevention of Significant Deterioration of Air Quality), the applicant shall submit an air quality permit application fee. A permit application is incomplete until the proper application fee is paid to the department. Stillwater Mining submitted an application fee with permit application #2459-08.

2. ARM 17.8.505, Air Quality Operation Fees. An annual air quality operation fee must, as a condition of continued operation, be submitted to the department by each source of air contaminants holding an air quality permit, excluding an open burning permit, issued by the department. The air quality operation fee is based on the actual or estimated actual amount of air pollutants emitted during the previous calendar year.

   The annual assessment and collection of the air quality operation fee, as described above, shall take place on a calendar-year basis. The department may insert into any final permit issued after the effective date of these rules such conditions as may be necessary to require the payment of an air quality operation fee on a calendar-year basis, including provisions which pro-rate the required fee amount.

E. ARM 17.8, Subchapter 7, Permit, Construction and Operation of Air Contaminant Sources, including, but not limited to:

1. ARM 17.8.704, General Procedures for Air Quality Preconstruction Permitting. An air quality preconstruction permit shall contain requirements and conditions applicable to both construction and subsequent use.

2. ARM 17.8.705, When Permit Required. Except as hereafter specified, no person shall construct, install, alter or use any air contaminant source or stack associated with any source without first obtaining a permit from the department or the board.

3. ARM 17.8.706, New or Altered Sources and Stacks, Permit Application Requirements. The air quality permit, if granted, shall authorize the construction and operation of the source subject to the conditions in the permit and to the requirements of this subchapter. The application form shall contain a certification by the person signing the application that all information contained therein is true.

4. ARM 17.8.707, Waivers. The department may, as specified in 75-2-211, MCA, waive or shorten the time required for the submission of an application.

5. ARM 17.8.710, Conditions for Issuance of Permit. Any permit issued under the provisions of this subchapter may be issued with such conditions as are necessary to assure compliance with all applicable rules and standards. This rule requires that the source demonstrate compliance with applicable rules and standards before a permit can be issued. The source has demonstrated compliance with applicable rules and standards as required for permit issuance.

6. ARM 17.8.715, Emission Control Requirements. The owner or operator of a new or altered source for which an air quality permit is required by this subchapter shall install on the new or altered source the maximum air pollution control capability which is technically practicable and economically feasible, except that best available control technology shall be utilized. This section requires that BACT be applied. (See Section V. BACT Determination)

7. ARM 17.8.716, Inspection of Permit. Air quality permits shall be made available for inspection by the department at the location of the source or stack for which the permit has been issued.

8. ARM 17.8.717, Compliance with Other Statutes and Rules. Nothing in this subchapter shall be construed as relieving any permittee of the responsibility for complying with any applicable federal or Montana statute, rule or standard except as specifically provided in this subchapter.

9. ARM 17.8.720, Public Review of Permit Applications. The applicant must notify the public, by means of legal publication in a newspaper of general circulation in the area affected by the application, of its application for permit. Stillwater Mining published a notice in the *Stillwater County Newspaper* for permit application #2459-08.

10. ARM 17.8.731, Duration of Permit. An air quality permit shall be valid until revoked or modified as provided in this subchapter, except that a permit issued prior to construction of a new or altered source may contain a condition providing that the permit will expire unless construction is commenced within the time specified in the permit, which in no event may be less than one year after the permit is issued.

11. ARM 17.8.733, Modification of Permit. An air quality permit may be modified for the following reasons:

    (a) changes in any applicable rules and standards adopted by the board; or
    (b) changed conditions of operation at a source or stack which do not result in an increase in emissions because of the changed conditions of operation. A source may not increase its emissions beyond those found in its permit unless the source applies for and receives another permit except as specifically provided in the regulations.

12. ARM 17.8.734, Transfer of Permit. An air quality permit may be transferred from one location to another if written notice of intent to transfer is sent to the department. An air quality permit may be transferred from one person to another if written notice of intent to transfer, including names of the transferor and the transferee, is sent to the department.

F. ARM 17.8, Subchapter 8, Prevention of Significant Deterioration of Air Quality, including but not limited to:

ARM 17.8.801, Definitions. This facility is not a PSD source because this facility is not a listed source nor does the facility's potential to emit (excluding fugitive emissions) exceed 250 tons per year of any pollutant. Therefore, a PSD review is not required.

G. ARM 17.8., Subchapter 12, Operating Permit Program, including, but not limited to:

1. Title V of the Clean Air Act requires that all sources as defined in ARM 17.8.1204 obtain a Title V operating permit.

2. ARM 17.8.1204(3). The department may exempt a source from the requirement to obtain an operating permit by establishing federally enforceable permit conditions which limit the source's potential to emit to less than the applicable levels.

3. ARM.17.8.1207, Certification of Truth, Accuracy, and Completeness. The compliance certification submittal required by ARM 17.8.1204(3) must contain certification by a responsible official of truth, accuracy, and completeness. This certification and any other certification required under this subchapter shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

III. Existing Air Quality

Stillwater Mining operates a particulate sampling program around the mine area. Sampled PM-10 (particulate matter less than 10 microns) concentrations have been below applicable standards. The ambient 24-hour standard is 150 $\mu g/m^3$ which is not to be exceeded more than once per year and the ambient annual standard is 50 $\mu g/m^3$. Sampled PM-10 results are summarized in the table below for calendar years of 1995 and 1996.

Summary of the PM-10 Data for 1995 and 1996 Stillwater Mine, Nye, Montana					
Site	Sample Year	Maximum 24-hour ($\mu g/m^3$)	Second Highest 24-hour ($\mu g/m^3$)	Arithmetic Annual Mean ($\mu g/m^3$)	Number of Samples
1 (Upwind)	1995	26	22	8.1	76
1 (Upwind)	1996	33	29	8.1	91
2 (Downwind)	1995	28	26	9.5	76
2 (Downwind)	1996	39	35	9.8	91

IV. Emission Inventory

The following table lists the estimated PM-10 emissions from Stillwater Mining Company.

PM-10 Emissions - Worst Case Annual Period

Emission Unit/ Activity	Uncontrolled Emissions TPY	Control Measure	Percent Control Efficiency	Controlled Emissions TPY
Topsoil Stockpiles	0.26	revegetation (100%)	75	0.065
Disturbed Areas	15.78	revegetation (42%)	75	4.74
Coarse Ore Stockpile	0.02	none		0.02
Mine Ventilation Exhaust	52.56	none		52.56
Dumping Coarse Ore to Conveyor System	5.48	min. fall distance		5.48
Conveyor System Transfer Points	38.33	covered conveyors	90	3.83
Load, Dump Coarse Ore Into Mill Hopper Grizzly	5.48	min. fall distance		5.48
Haul Roads-Ore To Mill Hopper Grizzly	0.32	watering	50	0.16
Haul Roads-Ore From East Side	2.78	chem. stab	90	0.28
Load, Dump To Coarse Ore Stockpile	0.55	none		0.55
Haul Roads-Ore To Coarse Ore Pile From W. Side	0.053	watering	50	0.0265
Load, Dump Waste Rock On Tailings Embankment	13.09	min. fall distance		13.09
Haul Roads-Waste Rock To Tailings Embankment westside 4.02 TPY (controlled) eastside 1.61 TPY (controlled)	24.90	watering/chem. stab	50/90	5.63
Light Duty Vehicle Traffic On Unpaved Roads	20.31	chem. stab.	90	2.03
Diesel Exhaust From Surface Activities	4.61	none		4.61
Concentrate Dryer	2.19	baghouse	*	2.19
Hertzler Impoundment	7.57	none		7.57
East Side Waste Rock Pile	3.71	none		3.71
TOTAL	198.0			112.02

*Uncontrolled emissions for concentrate dryer are actually controlled emissions.

The following table lists the estimated gaseous emissions from Stillwater Mining Company.

Gaseous Emissions

Emission Unit/ Activity	Sulfur Oxides TPY	Carbon Monoxide TPY	Nitrogen Oxides TPY
Explosive Detonation *based on 4200 TPY of ANFO*	4.20	140.70	35.70
Diesel Equipment *based on 1,415,200 gal/yr diesel*	22.07	108.60	202.35
Concentrate Dryer *based on 463,950 gal/yr propane*	0.10	0.74	4.41
Unleaded Gasoline *based on 51,568 gal/yr*	0.14	102.96	4.79
TOTAL	26.51	353.0	247.25

V. BACT Determination

A Best Available Control Technology (BACT) determination is required for each new or altered source. The emission control measures shown in Section IV. have been determined to represent BACT.

The proposed Hertzler Tailings Impoundment and the east side waste rock disposal area are new sources at the facility; therefore, the department made a BACT determination for these facilities. For the Hertzler Tailings Impoundment, Stillwater Mining must maintain compliance with reasonable precautions and applicable opacity standards. If determined necessary at a later date, Stillwater Mining shall install a sprinkler system or provide equivalent mitigative measures to control wind-blown emissions from the tailings facility.

The east side waste rock disposal area is required to maintain compliance with reasonable precautions and applicable opacity standards. If determined necessary at a later date, Stillwater Mining shall apply water or provide equivalent mitigative measures to control wind-blown emissions from the disposal area.

The control options that have been selected as part of this review have controls and control costs similar to other recently permitted similar sources and are capable of achieving the appropriate emission standards.

VI. Air Quality Impact

During the department's review of the permit application, an Industrial Source Complex Short Term 3 (ISCST3) model was performed. The ISCST3 is a steady-state Gaussian plume model which can be used to access pollutant concentrations from an industrial source complex. The ISCST3 analysis demonstrated that Stillwater Mining will not cause or contribute to a violation of the National Ambient Air Quality Standards (NAAQS) for PM10. The department believes that this project will be conducted in compliance with all applicable ambient standards.

The highest annual concentration modeled was 28.526 $\mu g/m^3$ and the second highest 24-hour was 103.956 $\mu g/m^3$. When annual background concentrations of 8 $\mu g/m^3$ and 24-hour background concentrations of 30 $\mu g/m^3$ are added to the modeled concentrations, the total annual and second highest 24-hour are 36.526 $\mu g/m^3$ and 133.956 $\mu g/m^3$ respectively. The NAAQS for PM10 are 50 $\mu g/m^3$ for the annual concentration and 150 $\mu g/m^3$ for the 24-hour standard.

VII. Taking or Damaging Implication Analysis

As required by 2-10-101 through 105, MCA, the department has conducted a private property taking and damaging assessment and has determined there are no taking or damaging implications.

VIII. MEPA Compliance

The department, in conjunction with the U.S.D.A Forest Service, has prepared an Environmental Impact Statement (EIS) as required by Montana Environmental Policy Act (MEPA) for this project. The EIS is on file with the department and can be reviewed upon request.

Analysis Prepared by: Denise A. Kirkpatrick
Date: 1/02/98

Appendix F — Biological Assessment

Biological Assessment for the Stillwater Mining Company's Revised Waste Management Plan

March 1998

Prepared by:

Mike Bonar — 3/2/98
Date
Greystone Wildlife Biologist

David Cameron — 2 March 1998
Date
Greystone Senior Wildlife Biologist

Reviewed by:

Donald C. Sasse — 9 MARCH 1998
Don Sasse
Date
Custer National Forest Wildlife Biologist

Contents

Introduction

The Endangered Species Act (ESA) requires federal agencies to ensure their actions are not likely to jeopardize the continued existence of any species listed as threatened or endangered under the ESA. To meet this requirement, federal agencies considering approvals of projects must consult with the U.S. Fish and Wildlife Service (USFWS), which has the primary authority for implementing the ESA. Preparing a biological assessment (BA) is an integral part of this consultation process.

The USFWS identified four species for consideration in this BA (McMaster 1997, Christopherson 1997). They are the peregrine falcon (*Falco peregrinus*), bald eagle (*Haliaeetus leucocephalus*), black-footed ferret (*Mustela nigripes*), and grizzly bear (*Ursus horribilis*). The USFWS' list included no species of plants.

The specific goal of this assessment was to determine if the four species "are likely to be adversely affected" by the project. Information presented to support the determinations includes a description of the proposal, a synopsis for each species, and an assessment of the potential affects of the project on each species. The species synopses characterize the ecology, natural history, abundance, distribution, and behavior of the species as they relate to the project. The impact assessment looks at the potential direct, indirect, and cumulative effects of the project.

Methods

Information on the species covered by this assessment was acquired from three primary sources. First, resource management agencies were contacted for information. This information involved the species' status and use of habitat in the project area. Second, published literature was used to corroborate and supplement information provided by the agencies. Finally, unpublished literature was used to provide site-specific information. After all information was assembled, the ecology, habitats, and distribution of each species were compared to project features to determine potential effects.

Project Description

Stillwater Mining Company (SMC) has submitted an application to change its mine waste management operation for the Stillwater Mine (#00118) to Montana Department of Environmental Quality (DEQ) and the Custer National Forest (CNF). DEQ determined this application to be complete on January 28, 1997. The proposed project is five miles southwest of Nye, Montana in Stillwater County. The amendment application includes plans for constructing and operating a new tailings impoundment approximately 7 miles northeast of the mine and 2 miles northeast of Nye, installing a pipeline system along Stillwater County Roads 419 and 420 and reclaiming the resulting surface disturbance, and expanding the waste rock storage area on the east side of the Stillwater River at the mine site.

The proposed tailings impoundment would be on the former Hertzler Ranch, owned by SMC. The underground pipeline system would be located in the county road right-of-way and the waste rock repository would be located primarily on patented mining claims. Implementation of the amendment would require relocation of the Land Application and Disposal system (LAD), currently located on the east side of the Stillwater River where the proposed waste rock storage area would be built, to the Stratton Ranch (1.5 miles northeast of the mine along Stillwater County Road 420) and the former Hertzler Ranch. This proposed amendment would result in an additional 251 acres of direct disturbance and increase the total permit area by 1,112 acres to a total of 2,452 acres.

The agencies' preferred alternative that was considered in this BA is the Proposed Action. This alternative is fully described in Chapter 2 of the Draft Environmental Impact Statement.

Species Accounts

This section describes the vegetative community types present in the project area and the occurrence and current use of the project area by the four species under consideration. Additionally, it presents the results of the impact assessment conducted for each species.

Vegetative Community Types

A variety of vegetative community types occur in the project area. However, the specific types present and their distribution vary with location. Vegetation types within the portion of the Stillwater Mine's current permit boundary east of the Stillwater River are a mixture of open forests with either a meadow or rocky understory. Open forest-rocky understory, ravine aspen-chokecherry, lodgepole pine, rocky grassland, and disturbed. Within the 80-acre footprint of the proposed east side waste storage site, about one third is rocky grassland. The remaining 60 acres is revegetated chrome tailings.

The 1,112 acres of rolling landscape comprising the Hertzler Ranch site are dominated by the stony grassland vegetation type. This vegetation type has been replaced by a band of cultivated hayland in the northern portion of the ranch, which stretches from east to west. The hayland is flood-irrigated by a historic ditch that travels along the northern permit boundary. Cultivated hayland accounts for 26 percent of the total area encompassed by the Hertzler Ranch site.

Several vegetation types account for the remaining nine percent of the area. Sagebrush shrubland and skunkbrush shrubland types account for 5 percent and 2 percent, respectively, and are restricted to the northwestern and southeastern aspects defined by slope shoulders, toes of slopes, and swales. About six acres of drainage bottomlands are present. Disturbed areas other than the cultivated haylands account for 1 percent of the Hertzler Ranch site's total acreage.

Most of the lands crossed by the proposed pipeline route presently support the rocky grassland vegetation type. However, several small segments also cross riparian woodland, cultivated hayland, drainage bottomland, skunkbrush shrubland, ravine aspen-chokecherry, and open forest with meadow understory.

Species Accounts

Bald Eagle (Threatened Designation)

Distribution and Current Use of the Project Area

Two general habits of bald eagles are of primary concern with this species: nesting and wintering. Breeding bald eagles typically build stick nests in the tops of coniferous or deciduous trees along streams, rivers or lakes. They also may select cliffs or ledges as nest substrates (Call 1978). Selection of nest trees appears to depend, in part, on the availability of food early in the nesting season (Swenson et al. 1986).

Primary wintering areas are typically associated with concentrations of food sources along major rivers that remain unfrozen where fish and waterfowl are available and near ungulate winter ranges (Montana Bald Eagle Working Group 1990). Wintering bald eagles are known to roost near concentrations of domestic sheep and big game in forests with large, open conifers and snags often protected by winds by ridges (Anderson and Paterson 1988).

Bald eagles occur along the Stillwater River as fall (October–December) and spring (February–March) migrants. However, sporadic winter occurrence has also been recorded (Flath 1989). This pattern of occurrence coincides with general trends observed in other mountain valleys of Montana. Although habitats appropriate for concentration areas occur along the length of the Stillwater River, no concentration areas have been identified (DSL and Forest Service 1989). Finally, although suitable habitats are present in the area, only a single occurrence of bald eagles nesting in the Stillwater River drainage has been documented. This nest is well outside the project area.

Effects

Implementation of the proposed action is not likely to adversely affect the bald eagle. Bald eagle do not occur in or near the project area. Bald eagles wintering along the Stillwater River would essentially be unaffected by the proposed action. A few bald eagles are present along stretches of open water along the river and are limited primarily by the availability of prey (e.g., waterfowl and fish). Wildlife killed by vehicles along Stillwater County Road 419, particularly big game, could attract bald eagles. Eagles feeding on carrion would therefore be more vulnerable to injury or death from increased vehicular traffic because of the SMC mine expansion. The death of a single bald eagle would constitute a significant impact. However, potential mortality to eagles could be reduced by removing road-killed deer and other wildlife from road rights-of-way and disposing of them where there would be little risk to eagles attracted to them and SMC currently has a road-kill removal program.

Peregrine Falcon (Threatened Designation)

Distribution and Current Use of the Project Area

Nesting habitats of the peregrine falcon usually involve cliff faces 200 to 300 feet high, but cliffs as high as 2,100 feet have been used. Most known nest sites are below 9,500 feet in elevation, but nests located as high as 10,500 feet have been documented (USFWS 1984). An available prey base of shorebirds, waterfowl or small- to medium-sized terrestrial birds usually occurs within ten miles of a nest site. Wetlands and riparian zones, as well as open meadows, parklands, croplands, lakes and gorges are potential habitats in which prey bird species are found and easily hunted by peregrines. Nesting peregrines may, however, hunt up to 17 miles from their nest to locate prey (USFWS 1984).

Bird populations on the project area appear to be sufficiently abundant and diverse to support peregrines and some of the cliffs located in the central and southern portions of the Stillwater Valley are high enough to provide suitable nesting habitats. In spite of the presence of what appears to be suitable habitats, no recent observations of peregrines in or near the project area have been documented. However, a historic nest site occurs in the valley near Nye, Montana. This site is on a cliff complex overlooking the West Fork of the Stillwater River and provides excellent foraging habitats. The last confirmed occupancy of this nest occurred in 1976.

Effects

Implementation of the proposed action is unlikely to adverse affect the peregrine falcon. Although peregrines have historically nested in and near the project area, there have been no recent records of nesting activity near the project area. Further, there is no evidence that indicates that the project area is used by the peregrine falcon, except on an occasional migratory basis. Therefore, implementation of the proposed action is not likely to adversely affect the species.

Black-footed Ferret (Endangered Designation)

Distribution and Current Use of the Project Area

White-tailed prairie dog colonies are essential habitat for the black-footed ferret, which depends on prairie dogs for food and uses the prairie dogs' burrows for shelter and raising their young (Hillman and Clark 1980, Fagerstone 1987). Because ferrets are nocturnal and spend much of their time underground, their presence in an area is difficult to ascertain, but their original distribution in North America closely corresponded to the distribution of the white-tailed prairie dog (Hall and Kelson 1959, Fagerstone 1987).

Although prairie dog colonies are present in the Stillwater River valley (McMaster 1989), many of the individual towns by themselves may be too small to support black-footed ferrets. Furthermore, no known colonies exist near any of the proposed facilities. Therefore, the black-footed ferret is unlikely to be present within or near the project area.

Effects

No prairie dogs or prairie dog colonies are known to occur within the project area. In addition, no black-footed ferret sightings within or proximal to the project area have been reported by the Montana Department of Fish, Wildlife, and Parks (MDFWP) or the records of the USFWS. For these reasons, the implementation of the preferred alternative is not likely to adversely affect the species.

Grizzly Bear (Threatened Designation)

Distribution and Current Use of the Project Area

The grizzly bear is present in the Absaroka-Beartooth Mountains and may enter the project area on occasion. Wildlife monitoring activities conducted for the Stillwater Mine have not produced or located any confirmed reports of grizzlies in the project area. However, this was not unexpected. Also, the project area does not contain any denning habitats or other sites that might be considered critical to grizzly bears (Western Technology and Engineering, Inc. 1996). Thus, any grizzly bears that might occur within the project area would be transitory.

Effects

Implementation of the proposed action is unlikely to adverse affect the grizzly bear. Although grizzlies may have historically occurred near the project area, there have been no recent records of activity near the project area. In addition, no habitats that may be considered critical to grizzly occurs within the project area. Furthermore, there is no evidence that indicates the project area is used by grizzlies, and any bear use of the area would be transitory. Therefore, implementation of the proposed action is not likely to adversely affect the species.

Summary

Direct, indirect, and cumulative Impacts to the peregrine falcon and the bald eagle are not expected to occur as a result of the proposed project. This is based on the fact that no nests for either species are known to occur within the project area. Although wintering bald eagles do occur in the area, they are not anticipated to be impacted because road-killed wildlife are removed from the road rights-of-ways. Based on both the lack of potentially-suitable habitat and documented occurrences within the project area, the direct, indirect, and cumulative impacts of the preferred alternative are "not likely to adversely affect" the black-footed ferret, and grizzly bear. The determination of effects for the preferred alternative for all previously-discussed threatened and endangered species and their habitats is "not likely to adversely affect."

Consultation With Others

Persons consulted for this Biological Assessment include the following:

- K. McMaster. Field Supervisor, U.S. Fish and Wildlife Service, Helena, Montana.
- D. Sasse. Wildlife Biologist. Custer National Forest, Supervisor's Office, Billings, Montana.
- S. Stewart. Wildlife Biologist. Montana Department of Fish, Wildlife, and Parks, Red Lodge, Montana.

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Appendix G — Biological Evaluation

Biological Evaluation
for the
Stillwater Mining Company's
Revised Waste Management Plan

March 1998

Prepared by:

3/2/98

Mike Bonar — Date

Greystone Wildlife Biologist

2 March 1998

David Cameron — Date

Greystone Senior Wildlife Biologist

Reviewed by:

Donald C. Sasse

9 MARCH 1998

Don Sasse — Date

Custer National Forest Wildlife Biologist

Contents

Introduction

The USDA Forest Service must consider possible effects of the proposed project on species listed as sensitive species by the Regional Forester. Fourteen of these sensitive species may occur within the Custer National Forest (CNF). They include eight species of wildlife and six species of plants. The sensitive species of wildlife include the harlequin duck (*Histrionicus histrionicus*), flammulated owl (*Otus flammueolus*), boreal owl (*Aegolius funerues*), black-backed woodpecker (*Picoides arcticus*), Townsend's big-eared bat (*Plecotus townsendii*), pallid bat (*Antrozous pallidus*), spotted bat (*Euderma maculatum*), and lynx (*Felis lynx*). The six species of plants are the *Gentianopsis simplex*, *Kobresia macrocarpa*, *Salix barrattiana*, *Selaginella watsonii*, *Thlapsi parviflorum*, and *Shoshonea pulvinata*.

The specific goal of this Biological Evaluation (BE) was to determine if the 14 species are likely to be affected by the project. Information presented to support the determinations includes a description of the proposal, a synopsis for each species, and an assessment of the potential effects of the project on each species. The synopses characterize the ecology, natural history, abundance, distribution, and behavior of the species as they relate to the project. The impact assessment looks at the potential direct, indirect, and cumulative effects of the project.

Methods

Information on the species covered by this assessment was acquired from three primary sources. First, published literature was used to determine the species' status and use of habitats in the project area. Several EISs have been prepared for the Stillwater Mine. They include the EIS prepared for the original operating permit/plan of operations and EISs prepared in support of amendments to that permit/plan of operations. This BE is specifically tiered to the following environmental documents:

- Final Environmental Impact Statement, Stillwater Project, Stillwater County, Montana. Prepared by the Montana Department of State Lands and USDA Forest Service, Custer National Forest in 1985.

- Preliminary Environmental Review/Environmental Assessment (PER/EA), Stillwater Project East Side Adit Development. Prepared by the Montana Department of State Lands and USDA Forest Service, Custer National Forest in 1989.

- Final Environmental Impact Statement, Stillwater Mine Expansion 2000 TPD, Application to Amend Plan of Operations and Permit No. 00118. Prepared by the Montana Department of State Lands, Montana Department of Health and Environmental Services, and USDA Forest Service in 1992.

- Final Environmental Impact Statement for the Stillwater Mining Company Underground Valley Crossing and Mine Plan. Application to Amend Plan of Operations, Permit No. 00118. Prepared by the Montana Department of Environmental Quality in 1996.

Second, resource management agencies were contacted for additional information to corroborate and supplement information in the documents identified above. Finally, unpublished literature was used to provide site-specific information. After all information was assembled, the ecology, habitats, and distribution of each species were compared to project features to determine potential effects.

Project Description

The four alternatives considered in detail for this BE are described fully in Chapter 2 of the Draft Environmental Impact Statement (EIS). Because these descriptions are relatively long and this BE is an appendix to the Draft EIS, they are not repeated here. Readers are referred to the Draft EIS to review the descriptions of the alternatives considered.

Evaluation Results

This section describes the vegetative community types present in the project area and the occurrence and current use of the project area by the four species under consideration. Additionally, it presents the results of the impact assessment conducted for each species.

Vegetative Community Types

A variety of vegetative community types occur in the project area. However, the specific types present and their distribution vary with location. Vegetation types within the portion of the Stillwater Mine's current permit boundary east of the Stillwater River are a mixture of open forests with either a meadow or rocky understory. Open forest-rocky understory, ravine aspen-chokecherry, lodgepole pine, rocky grassland, and disturbed. Within the 80-acre footprint of the proposed east side waste storage site, about one third is rocky grassland. The remaining 60 acres is revegetated chrome tailings.

The 1,112 acres of rolling landscape comprising the Hertzler Ranch site are dominated by the stony grassland vegetation type. This vegetation type has been replaced by a band of cultivated hayland in the northern portion of the ranch, which stretches from east to west. The hayland is flood-irrigated by a historic ditch that travels along the northern permit boundary. Cultivated hayland accounts for 26 percent of the total area encompassed by the Hertzler Ranch site.

Several vegetation types account for the remaining nine percent of the area. Sagebrush shrubland and skunkbrush shrubland types account for 5 percent and 2 percent, respectively, and are restricted to the northwestern and southeastern aspects defined by slope shoulders, toes of slopes, and swales. About six acres of drainage bottomlands are present. Disturbed areas other than the cultivated haylands account for 1 percent of the Hertzler Ranch site's total acreage.

Most of the lands crossed by the proposed pipeline route presently support the rocky grassland vegetation type. However, several small segments also cross riparian woodland, cultivated hayland, drainage bottomland, skunkbrush shrubland, ravine aspen-chokecherry, and open forest with meadow understory.

Sensitive Species

Table 1 identifies the sensitive species potentially occurring within the project area. In addition, it provides a description of their habitat requirements and potential for occurrence within the project area.

Table 1 Summary of Evaluation of Sensitive Species

Species	Habitat Requirements	Potential for Occurrence and Rational for Determination
Harlequin duck	This species occurs on second to fifth order streams that have swift clean water with a cobble to bedrock substrate.	Moderate, Stillwater River may provide suitable habitats; however, existing impacts (fishing and mining) reduce suitability.
Flammulated owl	Flammulated owls are associated with mature ponderosa pine and Douglas-fir stands with low stand densities and open canopies.	Low, lack of suitable habitats.
Boreal owl	Boreal owls typically nest in mixed conifer, aspen, Douglas-fir, and spruce-fir forests.	Low, lack of suitable habitats within the project area.
Black-backed woodpecker	The black-backed woodpecker typically occurs in concentrations of dead and dying trees and logs these areas may be associated with burned forests. Englemann spruce, lodgepole pine, Douglas-fir, ponderosa pine, and western larch provide suitable nesting habitat for this species.	Low, lack of suitable habitats within the project area.
Townsend's big-eared bat	This bat species typically uses a wide variety of habitats ranging from pinyon-juniper forests to high elevation forests. Roost sites may include caves, buildings, and mine adits.	Moderate, although this species may forage in the area, the lack of roost sites limits the potential for this species to occur within the project area.
Pallid bat	This species is typically found in shrub-steppe, desert scrub, and ponderosa pine habitats with rocky outcrops.	Moderate, although this species may forage in the area, the lack of roost sites limits the potential for this species to occur within the project area.
Spotted bat	The spotted bat is associated with arid, desert terrain and high sedimentary cliffs.	Moderate, although this species may forage in the area, the lack of roost sites limits the potential for this species to occur within the project area.
Lynx	Lynx are associated with large tracts of boreal forests that contain open areas such as bogs and rock outcrops.	Low, based on a lack of suitable habitats within the project area.
Gentianopsis simplex	This species typically occurs in boggy areas.	Low, based on a lack of suitable habitats within the project area.

Table 1 Summary of Evaluation of Sensitive Species

Species	Habitat Requirements	Potential for Occurrence and Rational for Determination
Kobresia macrocarpa	This species is associated with alpine boggy habitats.	Low, based on a lack of alpine habitats within the project area
Salix barrattiana	This alpine species occurs on gravelly slopes overlain with a peat layer that is moist or saturated.	Low, based on a lack of alpine habitats within the project area
Selaginella watsonii	This alpine species is associated with gravelly subalpine to grass/forb dominated sites.	Low, based on a lack of alpine habitats within the project area
Shoshonea pulvinata	This species is associated with narrow ridgetops with calcareous , rocky soils.	Low, based on a lack of suitable habitats within the project area.
Thlapsi parviflorum	This species also occurs in alpine habitats with dry to moist granitic soils.	Low, based on a lack of alpine habitats within the project area

Summary

Information presented in Table 1 was compared with all the action alternatives to determine the potential for adverse impacts from the project on sensitive species. Based on this information and other NEPA documents prepared for the Stillwater Mine project it was determined that none of the alternatives would have significant impacts on any sensitive species. The determination of effects for all previously-discussed sensitive species (**Table 1**) for all action alternatives considered in detail is "may impact individuals, but is not likely to cause a trend to federal listing or loss of viability."

Consultation With Others

Persons consulted for this Biological Evaluation include the following:

- K. McMaster. Field Supervisor, U.S. Fish and Wildlife Service, Helena, Montana.
- D. Sasse. Wildlife Biologist. Custer National Forest, Supervisor's Office, Billings, Montana.
- S. Stewart. Wildlife Biologist. Montana Department of Fish, Wildlife, and Parks, Red Lodge, Montana.

Appendix H — Alternatives Eliminated from Detailed Consideration Background Report

Alternatives Eliminated from Detailed Consideration Background Report

Several potential alternatives were considered for this analysis, but were dropped from detailed study for various reasons. These alternatives, and the reasons they were excluded from further consideration, are presented and discussed in this report.

When reviewing the alternatives presented in this section, the reader must keep in mind the MEPA/NEPA process requires that alternatives evaluated in detail be implementable (i.e., something that could be developed if approved). Moreover, economic feasibility in part defines whether or not something could go forward or is reasonable. The intent that economic feasibility is to be included in the determination of the reasonableness of alternatives is expressed in CEQ's memorandum on the 40 Most Asked Questions about NEPA. In part, CEQ's answers to these questions state *"reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense..."* (CEQ 1981). In response to this direction, DEQ and CNF considered economic feasibility or cost in their determination of the reasonableness of the alternatives developed for this MEPA/NEPA analysis.

Analysis and Results

Two firms examined the technical and cost considerations for the alternatives that were ultimately dropped from detailed evaluation. Pincock Allen and Holt (PAH). examined the non-paste options and Knight Piésold, Ltd. (KP) examined the paste options. Both companies used standard methods reviewed and approved by DEQ for evaluating tailings disposal options.

Pincock Allen and Holt's Assumptions and Summary of Analysis

Recently, KP developed a series of tailings disposal options for the Stillwater Mine because future operations would require additional storage capacity beyond that available in the current tailings impoundment. This work was presented in a consultants report to Stillwater Mining Company, dated February 5, 1996, titled " Evaluation of Tailings Disposal Alternatives." KP evaluated ten alternatives that considered expansion of the existing tailings facility, construction of new facilities at three different sites, and options for either slurry or dry stacked deposition.

Two of the alternatives considered by PAH included development of an initial impoundment at the site designated by KP as East Stillwater (Option 3 in KP's report). This was estimated by KP to have a capacity of 4.94 million tons of tailings which at a mine production rate of 2000 tons per day would have a design life of about 17 years, considering approximately 58 percent of the tailings are used as mine backfill. At the time the East Stillwater facility nears capacity, a second impoundment would be required for subsequent production. The two siting options considered for the second impoundment are at either the Beartooth Ranch Site or at the Horseman Flats Site.

The third alternative considered by PAH consisted of a tailings slurry impoundment located within the Nye Creek drainage, east of the existing Stillwater mill facility. The attached site plan presents the location and approximate configuration of impoundments at the four sites. The East Stillwater and Beartooth Ranch alternative is referred to herein as Option 3A while the East Stillwater and Horseman Flats alternative is referred to as Option 3B.

In order for these evaluations to be comparative with the previous siting alternative study, the base assumptions previously used by KP were followed. A mine production rate of 2,000 tons per day beginning in Year 2000 and extending for a period of 20 years was considered. Approximately 840 tons per day would report to the tailings impoundment with the remainder being either flotation concentrate or sand tailings which is sent back underground as mine fill. Under this scenario, a total of approximately 6.13 million tons of tailings will require surface disposal. For the slurry disposal options, an average stored tailings dry density of 70 pounds per cubic foot was assumed. Staged expansions of the impoundments would be made using downstream construction configuration raises with minimum freeboard requirements of six feet between crest elevation and tailings. The impoundments are to be fully lined with High Density Polyethylene (HDPE) geomembrane liner. Decant of process water from the impoundment is to be with barge mounted pumps.

Under Option 3A and 3B, the East Stillwater embankment would be constructed of combined borrowed earthfill and waste rock. The site location for the second impoundment at either Beartooth or Horseman Flats will preclude economic haulage of waste rock and construction of the impoundments will be with borrowed fill. Similarly, the impoundment dam at the Nye Creek site would be constructed of locally available fill materials. Unit costs for fill materials used by KP in the previous study were incorporated in the current analysis

For Options 3A and 3B, waste rock generated after construction of the East Stillwater impoundment will require disposal in an alternative site, likely at the east side waste rock storage area, located across the Stillwater River from the mine site. Since the Nye Creek site alternative will not incorporate any waste rock in construction, all waste rock will require disposal at alternative sites. Over the twenty year life, approximately 4.5 million tons of waste rock will require disposal at other locations. Waste rock disposal costs of $1.50 per ton were included in the economic analysis for all waste rock not included in the dam construction.

PAH has used the same base assumptions that were established by Knight Piésold in the 1996 evaluation to develop costs for the three additional options. Discussions of these options follow.

Option 3A East Stillwater and Beartooth Sites

This option is similar to KP's Option 3 in that the tailings slurry will first be pumped to a new tailings facility constructed at the East Stillwater location. After East Stillwater is filled to its ultimate capacity of 4.94 million tons of tailings, the future tailings will be pumped to a new facility constructed at the Beartooth Site which is about 1.5 miles upstream and 200 feet higher than the existing mill site. Access to the site for operational maintenance would be by existing roads, with minimal improvement required. Water from the impoundments will be collected and recycled to the mill facility. Seepage collection piping and ponds with recycle pumps will be installed below the impoundments. The East Stillwater site impoundment will use all of the waste rock in embankment construction over the life of the facility, however, additional storage capacity for waste rock disposal is required once the tailings are pumped to the Beartooth Site. The East Stillwater Site will be reclaimed after tailings deposition and consolidation is complete.

In consideration of the Beartooth site, PAH would note that the site has several disadvantages that lead to a higher environmental risk level. First, the site is located within the floodplain of the Stillwater River, which will necessitate floodproofing the embankment dam to minimize erosion during flood events and possibly relocation of the main channel of the river. The floodplain soil deposits underlying the site likely contains softer, less stable soil layers, resulting in a reduced stability of an embankment constructed on these deposits. The very close proximity of the Stillwater River and the shallow groundwater lead to an increased risk of water quality impacts from any seepage or other discharge from the site. Relocation of the existing county road will be required, likely to the east side of the river. The site will have a high visual impact.

Option 3B East Stillwater and Horseman Flats Sites

This option is similar to KP's Option 3 in that the tailings slurry will first be pumped to a new tailings facility constructed at the East Stillwater location. After East Stillwater is filled to its ultimate capacity of 4.94 million tons of tailings, the future tailings will be pumped to a new facility constructed at the

Beartooth Site which is about 1.5 miles upstream and 200 feet higher than the existing mill site. Access to the site for operational maintenance would be by existing roads, with minimal improvement required. Water from the impoundments will be collected and recycled to the mill facility. Seepage collection piping and ponds with recycle pumps will be installed below the impoundments. The East Stillwater site impoundment will use all of the waste rock in embankment construction over the life of the facility, however, additional storage capacity for waste rock disposal is required once the tailings are pumped to the Beartooth Site. The East Stillwater Site will be reclaimed after tailings deposition and consolidation is complete.

In consideration of the Beartooth site, PAH would note that the site has several disadvantages that lead to a higher environmental risk level. First, the site is located within the floodplain of the Stillwater River, which will necessitate floodproofing the embankment dam to minimize erosion during flood events and possibly relocation of the main channel of the river. The floodplain soil deposits underlying the site likely contains softer, less stable soil layers, resulting in a reduced stability of an embankment constructed on these deposits. The very close proximity of the Stillwater River and the shallow groundwater lead to an increased risk of water quality impacts from any seepage or other discharge from the site. Relocation of the existing county road will be required, likely to the east side of the river. The site will have a high visual impact.

Nye Creek Slurry Impoundment Option

The Nye Creek site is located approximately 1 mile east of the mill facility and is approximately 1600 feet higher than the mill site. There is sufficient capacity within the drainage to impound in excess of the 6.13 million tons of tailings, however a dam that is over 160 feet high would be required. Access to the site will require major upgrade of existing four-wheel drive trails. Several pumping schemes are conceptually viable, however from considerations of surface disturbance, operational reliability, and overall efficiency; the economic analysis considered that tailings will be pumped by high horsepower, positive displacement pumps located at the existing mill facility. The tailings would be conveyed through a HDPE lined, steel pipe with secondary containment. The high pumping pressures and resulting pipe friction and abrasion will require a high level of pipeline maintenance. Accordingly, this pipeline would need to be at the surface to allow monitoring and maintenance access. A pipeline bridge across the Stillwater River would be required. Water from seepage and the impoundments will be collected and recycled to the mill facility. Alternative waste rock disposal will be required for all rock generated as no waste rock can economically be incorporated in dam construction.

There are several issues with the Nye Creek site that will present both operational difficulties and environmental risks. The accessibility to the site during winter will be restricted and any closure of the access road will prohibit operational access to the tailings impoundment and water reclaim system. To develop the required impoundment capacity, the required dam will be almost twice as high as required at either the Beartooth or Horseman Flats sites. This increases the risk of failure and the consequences of a failure. The potential for accidental discharge of tailings from the tailings transport pipeline is very likely over the operational life of the facility. Due to the tailings pipeline being above grade and extending up the valley slope, there will be a high visual impact. Development of the tailings impoundment will require diversion of the Nye Creek drainage, which considering the steep topography of the drainage basin will be very disruptive to normal stream flows. The proximity of the Stillwater River increases the risk of any release of tailings or discharge of water causing a water quality impact. This would include both releases from the impoundment and accidental releases due to failure of pipelines leading to and from the impoundment.

Cost Estimates

PAH developed capital and operating costs for the three options described above and determined the Net Present Values (NPV) at 10% discount rates and costs per ton of tailings as presented in **Table H–1**. Costs for construction and operation of the East Stillwater impoundment are as presented by KP under Option 3 - Slurry Disposal at East Stillwater. PAH has estimated capital and operating costs for impoundments at the Beartooth, Horseman Flats and Nye Creek sites. Construction material quantities were estimated from conceptual impoundment designs developed using available U.S. Geologic Survey topographic mapping. Unit costs for construction of these alternatives generally followed those used by KP to provide a uniform basis for comparison of alternatives. The primary departures from KP's cost assumptions were related to the construction and operation of the high pressure tailings transport pipelines required for use of either the Horseman Flats site or the Nye Creek site.

For comparison, **Table H–1** also presents the resulting NPV's for the Alternatives B, C and D that are addressed in the draft Environmental Impact Statement. These alternative are:

- Alternative B - Hertzler Ranch Slurry Impoundment. Under this alternative tailings would be deposited in an impoundment at the Hertzler Ranch site and waste rock would be deposited in the east side waste rock storage site.

Table H–1 Summary of Costs for Tailings Disposal Alternatives

Tailings Disposal Alternatives	Net Present Value (NPV) @ 10% discount	Cost/ton of Tailings ($US/ton)	Cost/ton Relative to Alt. B
EIS Alternatives			
Alt. B - Hertzler (preferred alternative)	$20,020,000	$3.27	-
Alt. C. Mod. Centerline & Hertzler	$20,168,000	$3.29	0.7%
Alt. D. Mod. Centerline & E. Stillwater	$20,749,000	$3.38	3.6%
Alternates Considered and Dismissed			
Option 3A - E. Stillwater & Beartooth	$23,778,000	$3.88	18.8%
Option 3B - E. Stillwater & Horseman Flats	$24,137,000	$3.94	20.6%
Nye Creek	$25,050,000	$4.09	25.1%

- Alternative C - Modified Centerline Expansion and Hertzler Ranch. Under this alternative, the existing tailings dam would be expanded to full capacity to store an additional 4.85 million tons of tailings. Additional tailings disposal capacity would then be developed at the Hertzler Ranch site as addressed in Alternative B. Waste rock would be used to construct the raises to the existing dam. At the time the dam is brought to full height, the additional waste rock would be deposited in the east side storage site.

- Alternative D - Modified Centerline Expansion and East Stillwater Site. Under this alternative, the existing tailings dam would be expanded to full capacity to store an additional 4.85 million tons of tailings. Additional tailings disposal capacity would then be developed at the East Stillwater site as addressed in Option 3A and 3B considered herein. Waste rock would be used to construct the raises to the existing dam and to build the East Stillwater dam embankment. Any additional waste rock would be deposited in the east side storage site.

The NPV values for Alternative B were obtained directly from the 1996 KP siting study report. PAH developed an estimate of the NPV for Alternatives C and D which provided for a combined capacity of tailings of 6.13 million tons to be comparable with KP's Alternative B costs. This estimate considered the full capital and operating costs presented by KP for raising the existing tailings dam by the Modified Centerline Expansion approach. KP's capital and operating costs for construction of the East Stillwater and the Hertzler impoundments were reduced appropriately to account for just the portion of the impoundments required to develop a comparable 6.13 million tons of total tailings capacity.

PAH would note that the cost estimates presented in **Table H–1** are based on developing a total of 6.13 million tons of additional tailings disposal capacity to allow comparison with KP's costing efforts for the initial siting study. Since the initial costs for development of the tailings impoundments include the tailings pipeline construction, lining of the impoundment, construction of seepage collection and containment ponds, powerlines, access roads, etc.; these costs are relatively independent of the total capacity of the impoundment. Future raises of the dam to increase capacity are relatively moderate as compared to these initial costs. As a result, while the total costs presented for each alternative are not representative of the costs to develop the currently planned 15 million tons of tailings, the relative cost basis is considered representative. Alternatives which require development of two sites (Options 3A and 3B and Alternatives C and D) have significantly higher capital costs due to the duplication of sunk costs for basic development of infrastructure (tailings transport and water reclaim systems, power and access) as compared to single sites (Hertzler and Nye Creek) that will require this development only once.

Knight Piésold's Assumptions and Summary of Analysis

Two types of tailings were considered. They are fine tailings and whole tailings. The fine tailings would consist predominantly of silt (> 80 percent) with some clay and a minor trace of sand. Over 70 percent by weight of the tailings is finer than 20 microns. Typically, a fine tailings paste will have a solids content of approximately 60 to 70 percent by weight. Assuming a tailings paste with an initial solids content of 70 percent is achieved (water content of 30 percent by weight) the corresponding dry density is approximately 78 pcf. Allowing for some consolidation of the tailings paste prior to closure, an average density of 80 pcf may be achieved and can be used to estimate impoundment storage requirements.

Approximately 30 percent of the whole tailings is finer than 20 microns. Typically. a tailings paste produced from these tailings will have a solids content of approximately 70 to 80 percent by weight. Assuming a tailings paste with an initial solids content of 80 percent is achieved (water content of 20 percent by weight) the corresponding dry density is approximately 100 pcf

Additional assumptions included:

- The available storage capacity at the existing tailings impoundment would still be used for slurried tailings disposal.

- If whole tailings paste backfill is implemented, about 32 percent of the whole tailings would report to the surface for disposal and the remaining 68 percent would be used as paste backfill.

- The operating cost for tailings paste production (dewatering) and delivery to the tailings impoundment is estimated to be approximately $2/ton of solids. This includes the additional cost to operate a high pressure pipeline delivery system from the. paste production plant to the tailings impoundment, and increased maintenance demand for the pipeline and positive displacement pump system. It is assumed that the paste plant is located adjacent to the tailings impoundment.

- The fine tailings paste would be placed in a saturated condition with low strength and poor trafficability. To allow concurrent reclamation operations to proceed it is likely that the paste would require the addition of at least one percent of cement by dry weight of solids. This would result in an additional cost of approximately $1.5/ton of tailings solids. Alternatively, the fine tailings paste would require additional dewatering to achieve a satisfactory material at a cost of at least $1/ton.

- To provide a landfill type of impoundment for the tailings paste, perimeter berms would be required to provide containment, due to site constraints and the low strength of the paste. These would need to be constructed from local borrow materials or cement-amended paste. Cement-amended paste for structural support would likely require at least three percent cement, resulting in a cost of about $4.5/ton of tailings solids. This would likely be required for approximately 10 percent of the total stored tailings.

- All of these costs are additional above those required for slurried tailings Alternatives B, C and D described in the EIS document.

Alternative B

Fine tailings paste

It is assumed that the available storage capacity of 1.7 million cubic yards (1.6 million tons of dry tailings at an average density of 70 pcf) at the existing tailings impoundment would still be used for slurried tailings disposal. The remaining 15 million tons of tailings would be pumped as a slurry to the Hertzler Ranch site and dewatered to form a paste for disposal within the proposed Hertzler impoundment. The paste production plant would be located adjacent to the Hertzler tailings impoundment.

For fine tailings paste disposal within the proposed Hertzler impoundment, storage capacity of approximately 13.9 million cubic yards would be required for storage of 15 million tons of tailings solids at an average dry density of 80 pcf. A final embankment elevation of 5,025 feet would be required. By comparison, a final embankment elevation of 5,036 feet is required for slurried tailings disposal with an average dry density of 70 pcf. An ultimate impoundment area of approximately 150 acres would be required for tailings paste disposal, compared to a total area of about 163 acres for slurried tailings disposal.

Whole tailings paste
If whole tailings paste backfill were implemented it is assumed that approximately 32 percent of the whole tailings would report to the surface for disposal and the remaining 68 percent used as paste backfill (information provided by Alan Buell). Therefore, impoundment capacity for approximately 9.3 million cubic yards would be required for storage of 12.6 million tons of tailings solids at an average dry density of 100 pcf. (We have estimated this assuming that the 15 million tons of tailings reporting to Hertzler plus the 1.6 million tons reporting to the existing tailings impoundment account for 42 percent of the total tailings production.)

For whole tailings paste disposal at the proposed Hertzler impoundment a final elevation of approximately 4,996 feet would be required with an ultimate impoundment area of approximately 150 acres. To facilitate the production of whole tailings paste for underground backfill, the paste production facility would be located at the existing plant site. This would require that the remaining paste for surface disposal be transported to the Hertzler site. Depending on handleability, the paste may be transported to the Hertzler Ranch by a conveyor system or by trucking. A conveyor system of over 7 miles from the mine site to the Hertzler Ranch would be prohibitively expensive and have a large environmental impact. Similarly, trucking the paste material to the Hertzler Ranch site would significantly increase traffic volumes and noise levels. Pipeline transport of the whole tailings paste is not economically or technically feasible. Pipe transport would require re-slurrying the paste for delivery to the Hertzler site followed by dewatering to reestablish a paste for disposal.

Alternative C

Fine tailings paste
It is assumed that the available storage capacity of 1.7 million cubic yards (1.6 million tons of dry tailings at an average density of 70 pcf) at the existing tailings impoundment would still be used for slurried tailings disposal. For fine tailings paste disposal within the proposed Hertzler impoundment, storage capacity of approximately 9.4 million cubic yards would be required for storage of the 10.15 million tons of tailings solids at an average dry density of 80 pcf. A final embankment elevation of approximately 4,998 feet would be required. The

ultimate impoundment area would only be slightly smaller than the 150 acres required for disposal of 15 million tons (13 million cubic yards) of fine tailings paste. Therefore, it would be beneficial to store all of the 15 million tons of fine tailings paste at the Hertzler impoundment *as for Alternative B). This would remove the requirement for expansion of the existing tailings impoundment with associated increases in disturbed area, visual impact and increased costs.

Whole tailings paste
Same as for Alternative B. Assumes that no whole tailings paste would be stored in the existing impoundment.

Alternative D

Fine tailings paste
It is assumed that the available storage capacity of 1.7 million cubic yards (1.6 million tons of dry tailings at an average density of 70 pcf) at the existing tailings impoundment would still be used for slurried tailings disposal.

For fine tailings paste disposal within the East Stillwater impoundment a final elevation of approximately 5,120 feet would be required for a storage capacity of 13.9 million cubic yards (15 million tons at a dry density of 80 pcf). The layout of the ultimate impoundment area would need to be similar to the proposed East Side waste rock facility, but would cover a slightly larger area (>80 acres). With a final height of over 150 feet the static and seismic stability of the tailings paste would be a concern. The fine tailings paste is likely to remain saturated and therefore susceptible to liquefaction during earthquake shaking.

Whole tailings paste
For whole tailings paste disposal at the East Stillwater impoundment a final elevation of approximately 5,060 feet would be required with an ultimate impoundment area of approximately 80 acres. The layout of the ultimate impoundment area would need to be similar to the proposed East Side waste rock facility.

To facilitate the production of whole tailings paste for underground backfill, the paste production facility would be located at the existing plant site. This would require that the remaining paste for surface disposal be transported to the East Stillwater site. As described for Alternative B, the paste may be transported to the Hertzler Ranch by a conveyor system or by trucking if the handleablility of the whole tailings paste allowed. A conveyor system from the mine site to the East Stillwater impoundment would need to cross the Stillwater River. This is likely to be prohibitively expensive and have a large environmental impact. Similarly, trucking the paste material to the East Stillwater site would increase traffic volumes and noise levels. Pipeline transport of the whole tailings paste would require the use of positive-displacement pumps which operate at high pressures. The costs associated with a paste delivery system, including pipeline construction, pumps and maintenance requirements are high compared to a slurried tailings pipeline.

Both the Hertzler Ranch and East Stillwater sites experience strong winds. Potential problems with the placement of paste tailings include dusting of partially saturated tailings on the impoundment surface and the associated visual impacts. Unlike a slurried tailings impoundment, the lack of a supernatant water pond on the tailings paste surface makes it difficult to control fugitive dust emissions created by strong winds.