DRAFT 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

March 1998

DATE DUE

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DEMCO 38-301

Custer National Forest
HC 49, Box 3420
Red Lodge, MT 59068

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

March 4, 1998

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

Dear Reader:

The Stillwater Mining Company (SMC) has 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) have released the draft Environmental Impact Statement (EIS) for the Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment. A copy of this document is being sent to you for your review. This EIS covers the proposed revision and revisions to the Stillwater Mine's air quality permit as well as the Forest Service's biological assessement and evaluation for the proposed action. We recommend you begin by reading the summary of the EIS and then proceeding to chapters in the EIS where the more detailed information can be found. Chapters 1 and 2 contain the bulk of the information including a summary of the impacts that are described in detail in Chapter 4. The appendices contain more technical information. More information regarding the content of each chapter can be found in the document Preface.

The public comment period will run for 60 days beginning March 20, 1998, and ending May 19, 1998. During that time you are welcome to submit written comments to the agencies at the addresses listed above. In addition to written comments, verbal comments will be recorded at the hearing to be held at the Absarokee Elementary School gym (the old high school) at 7 p.m. on Tuesday, April 28, 1998. An open house will be held at 6 p.m. before the hearing where you may ask technical and procedural questions of agency personnel.

The agencies are required to respond in the final EIS to all substantive comments on the draft EIS. The comment period mentioned above provides you, the public, with an opportunity to make an impact on the content of the document and, therefore, potentially affect the decision that will be made after the final EIS is released. We ask that your comments relate directly to the EIS, that you are as specific as possible, and that you cite the location(s) in the document on which you are commenting. While public opinions for or against the proposed action are of interest, they are often not useful for modifying an EIS and they seldom have any bearing on the criteria the agencies must use to make decisions regarding proposals.

If you have any questions, please contact the agency staff listed below:

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(406) 446-2103

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Sincerely,

Nancy T. Curriden

Nancy Curriden, Forest Supervisor
Custer National Forest

Sincerely,

Mark Simonich

Mark Simonich, Director
Montana Department of Environmental Quality

Draft Environmental Impact Statement

Stillwater Mine Revised Waste Management Plan and Hertzler Tailings Impoundment

March 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: Draft 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 Draft Environmental Impact Statement describes the land, people, and resources potentially affected by the proposed revision. 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 assessment 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 the proposed action and alternatives.

- *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.

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
DSL	Montana Department of State Lands
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
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
ppm	Parts per Million
PSD	Prevention of Significant Deterioration
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**).

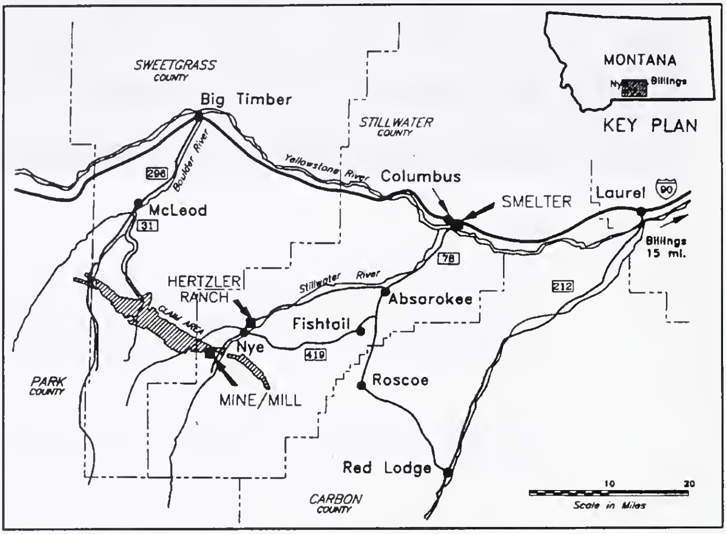

Figure S–1 Location of Stillwater Mine and Hertzler Ranch

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 and 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.

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, very few 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 feasibility. This screening focused 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. The reasons why these alternatives were not considered further are discussed below (starting on page **S – 16**).

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 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 Ranch

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 Stillwater 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–4** 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.

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 Stillwater Tailings Impoundment. This option had serious environmental concerns associated with it and, overall, it was one of the most expensive options to develop for the disposal of tailings and waste rock.

- Tailings Impoundment at Horseman Flats in conjunction with an East Stillwater Tailings Impoundment. Costs of transporting tailings up to this location were extremely high and the area contains several sources of domestic water supply.

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

- Tailings impoundment in the Nye Creek drainage. Implementation of this alternative would require SMC to pump tailings to an impoundment that would be about 0.5 mile higher than the mine. Few, if any, steel pipes can withstand a 2,000-foot or more head without bursting. 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.

- Dispose of tailings in the abandoned Benbow Mine. Implementation of this alternative was determined to be technically unfeasible. This alternative would have required pumping of 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 3,000 feet. Few steel pipelines can withstand a 2,000-foot or more head without bursting. Additionally, this alternative 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. Finally, insufficient space exists at the site to construct an impoundment of the size needed to dispose of the volume of tailings that this alternative would generate.

- Convert the tailings to paste and landfill or backfill. The use of paste technology would not substantially reduce the requirements for storage space, would not provide any substantive environmental benefits, would not provide any advantages for concurrent reclamation, and would substantially increase costs to install the paste handling technology.

- 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 275 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. Alterantive 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 132 new residents, including 31 new school students, 72 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. Alternative B would result in the construction of a second tailings impoundment at the Hertzler Ranch site, construction of four 7.8-mile long pipelines in a 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. The agencies would include mitigation for SMC to develop and implement a plan to ensure the surfaces of both the existing and proposed tailings impoundments would be kept wet to prevent blowing of tailings in the event that one or both facilities are shut down for any reason prior to mine closure and reclamation of the impoundment surfaces. Other mitigations include changes in the construction of the tailings embankment so the outer slopes can be completely reclaimed once they are built and changing the seed mix for the Hertzler LAD sites to a standard reclamation seed mix with more palatable species than the creeping meadow foxtail species proposed.

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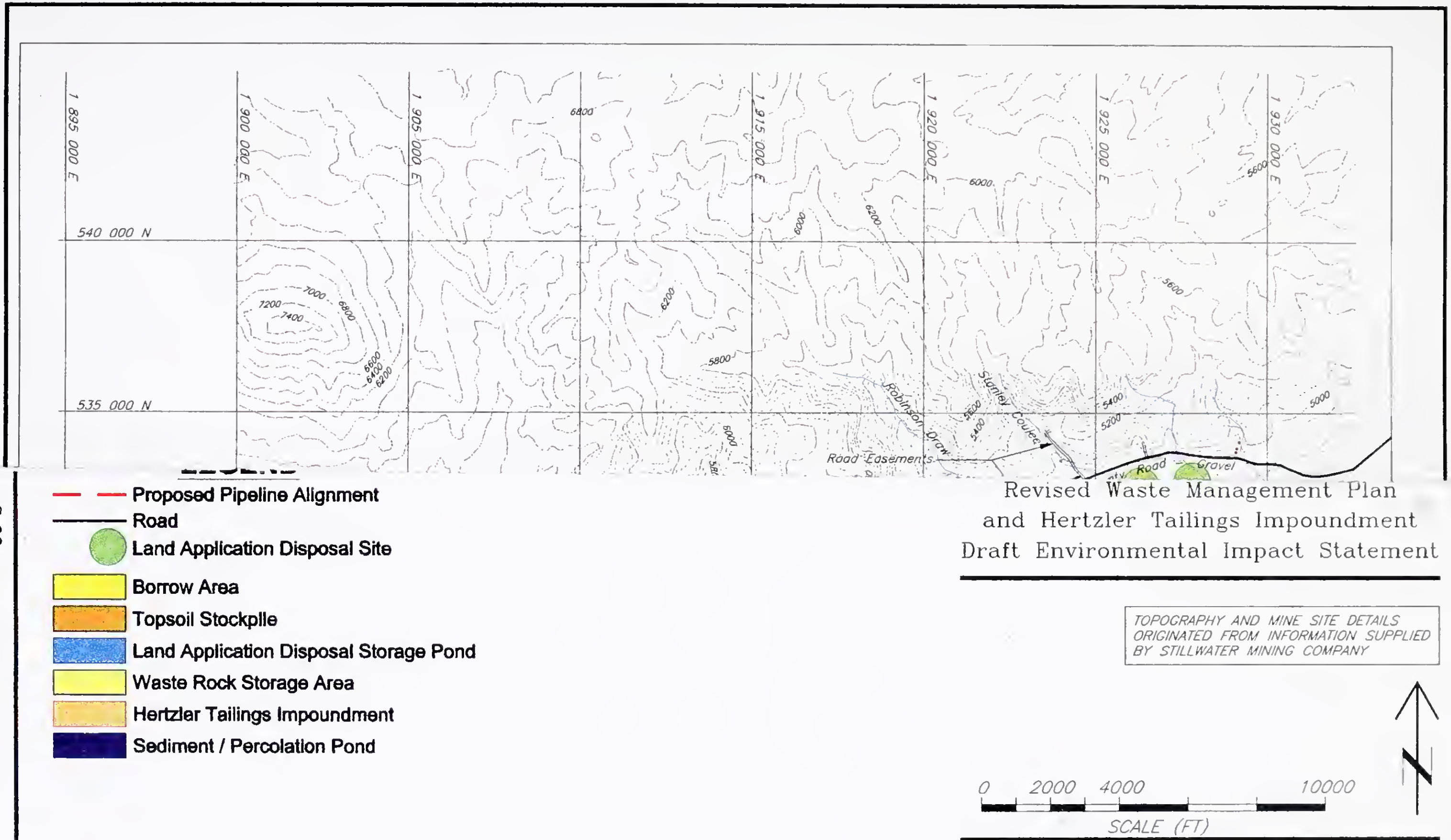
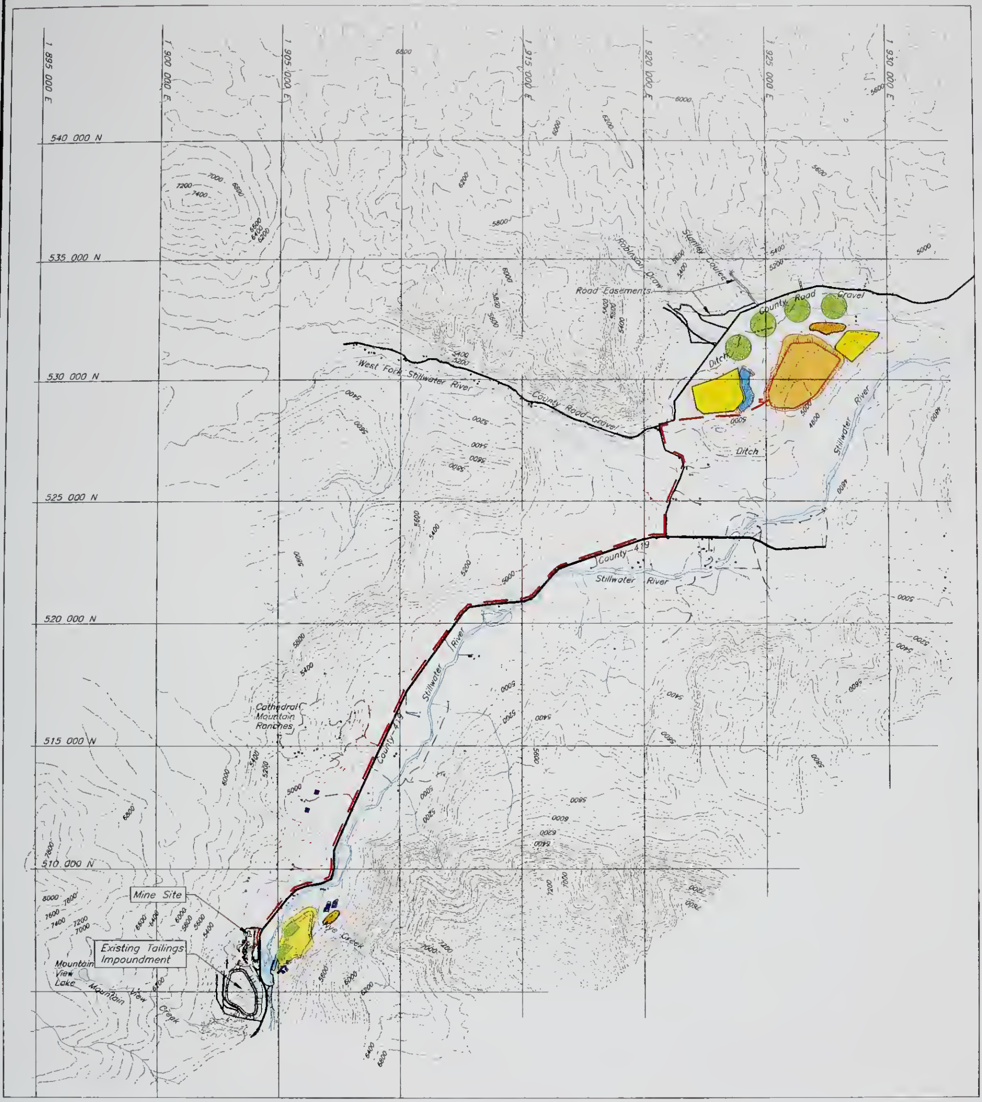


Revised Waste Management Plan
and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

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



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

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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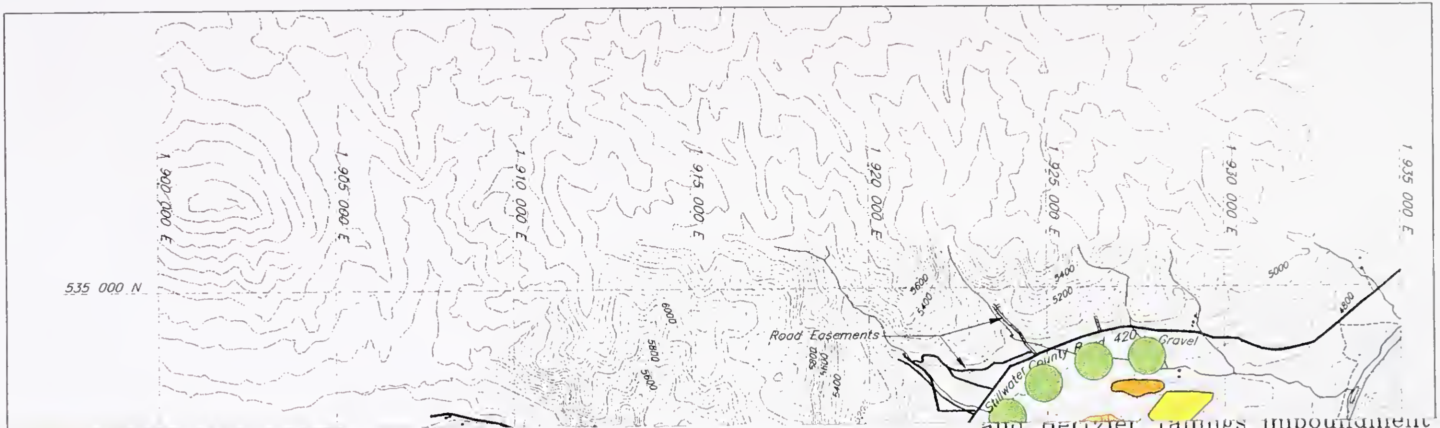
SCALE (FT)

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



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

Draft Environmental Impact Statement

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

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SCALE (FT)

Alternative C
Modified Centerline Expansion and Hertzler Ranch Site
Figure S-3

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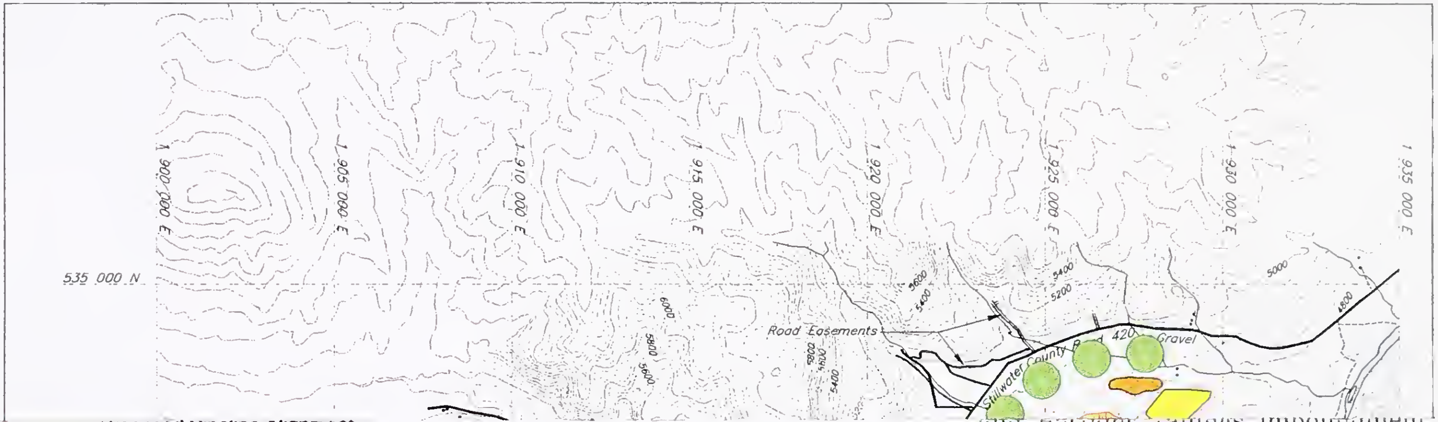

and Hertzler Tailings Impoundment
Draft Environmental Impact Statement

Proposed Pipeline Alignment
Road
Land Application Disposal Site
Borrow Area
Topsoil Stockpile
Land Application Disposal Storage Pond
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Sediment / Percolation Pond

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SCALE (FT)

Alternative C
Modified Centerline Expansion and Hertzler Ranch Site
Figure S-3

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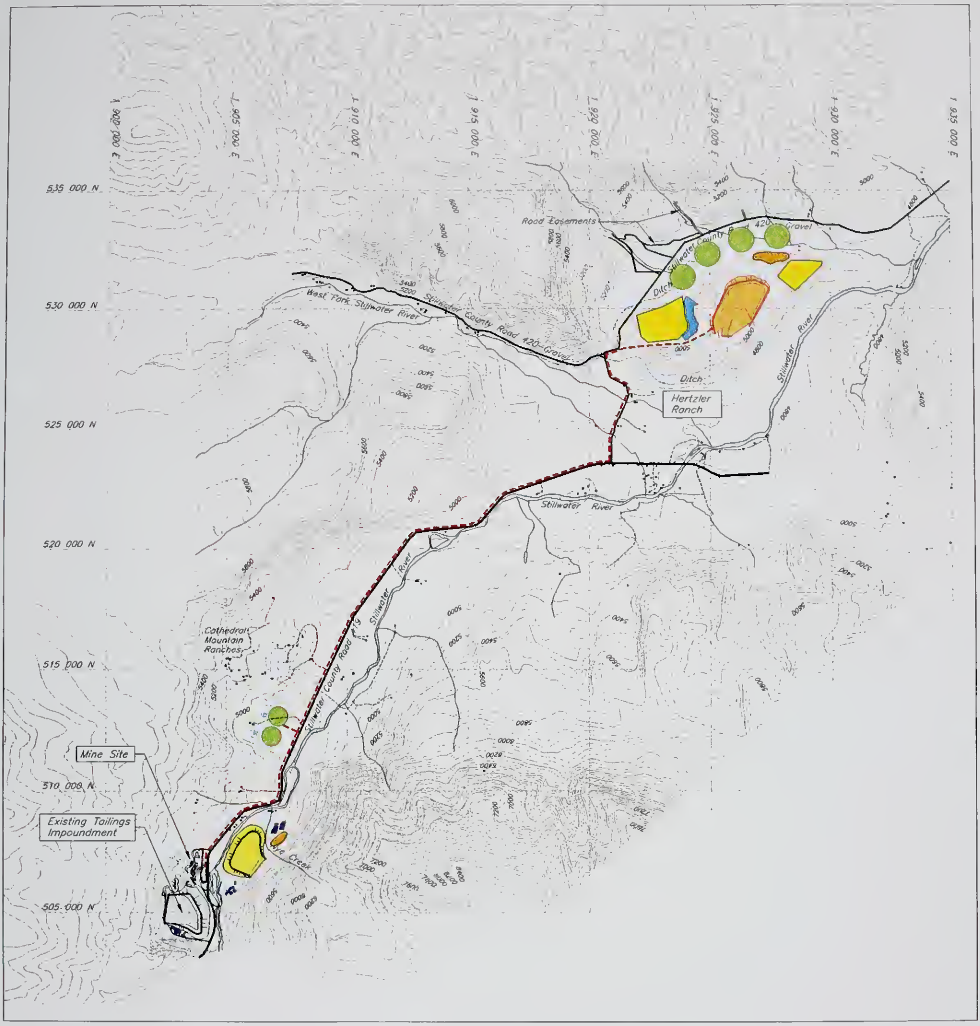

LEGEND

- Proposed Pipeline Alignment
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SCALE (FT)

Alternative C
Modified Centerline Expansion and Hertzler Ranch Site
Figure S-3

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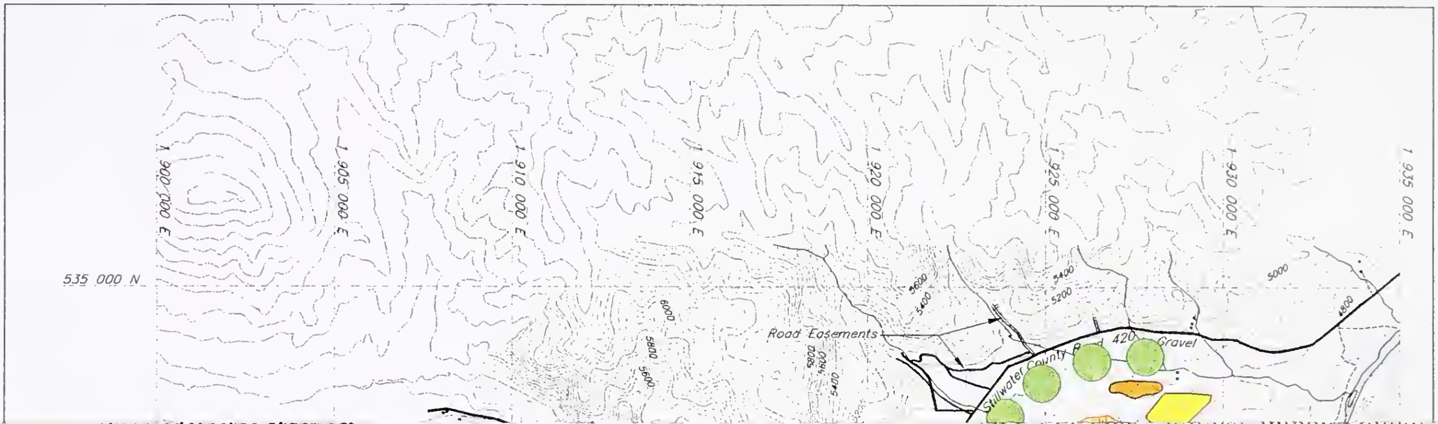

Proposed Pipeline Alignment
Road
Land Application Disposal Site
Borrow Area
Topsoil Stockpile
Land Application Disposal Storage Pond
Waste Rock Storage Area
Hertzler Tailings Impoundment
Sediment / Percolation Pond

and Hertzler Tailings Impoundment
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SCALE (FT)

Alternative C
Modified Centerline Expansion and Hertzler Ranch Site
Figure S-3

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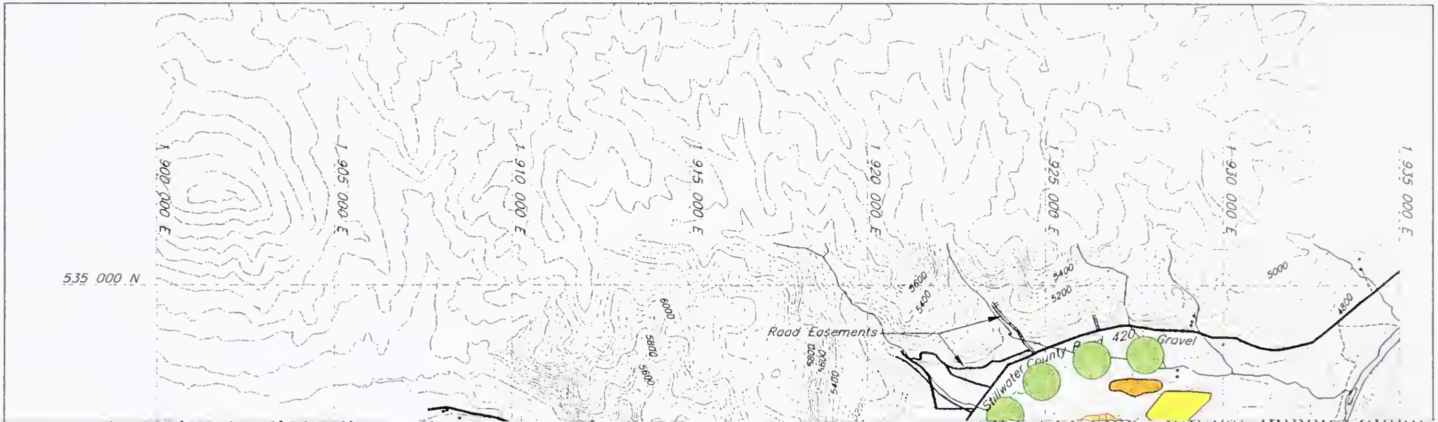

- Proposed Pipeline Alignment
- Road
- Land Application Disposal Site
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TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

0 2000 4000 10000
SCALE (FT)

N

Alternative C

Modified Centerline Expansion and Hertzler Ranch Site

Figure S-3

597ALTC.DWG

LEGEND

- Proposed Pipeline Alignment
- Road
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- Land Application Disposal Storage Pond
- Waste Rock Storage Area
- Tailings Impoundment

Stillwater Mine
Revised Waste Management Plan
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Draft Environmental Impact Statement

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

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SCALE (FT)

Alternative D
Modified Centerline Expansion and
East Stillwater Site
Figure S-4

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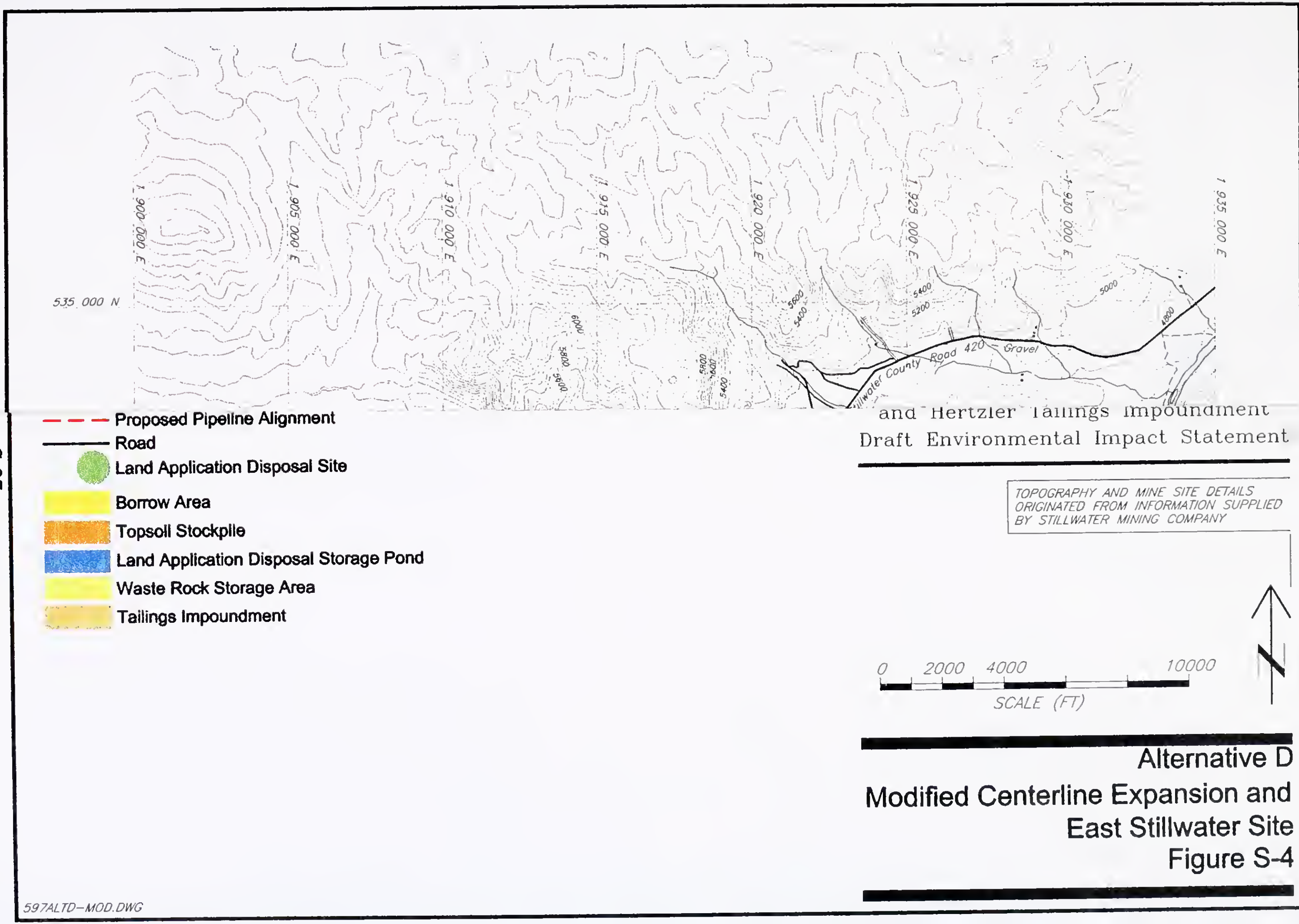

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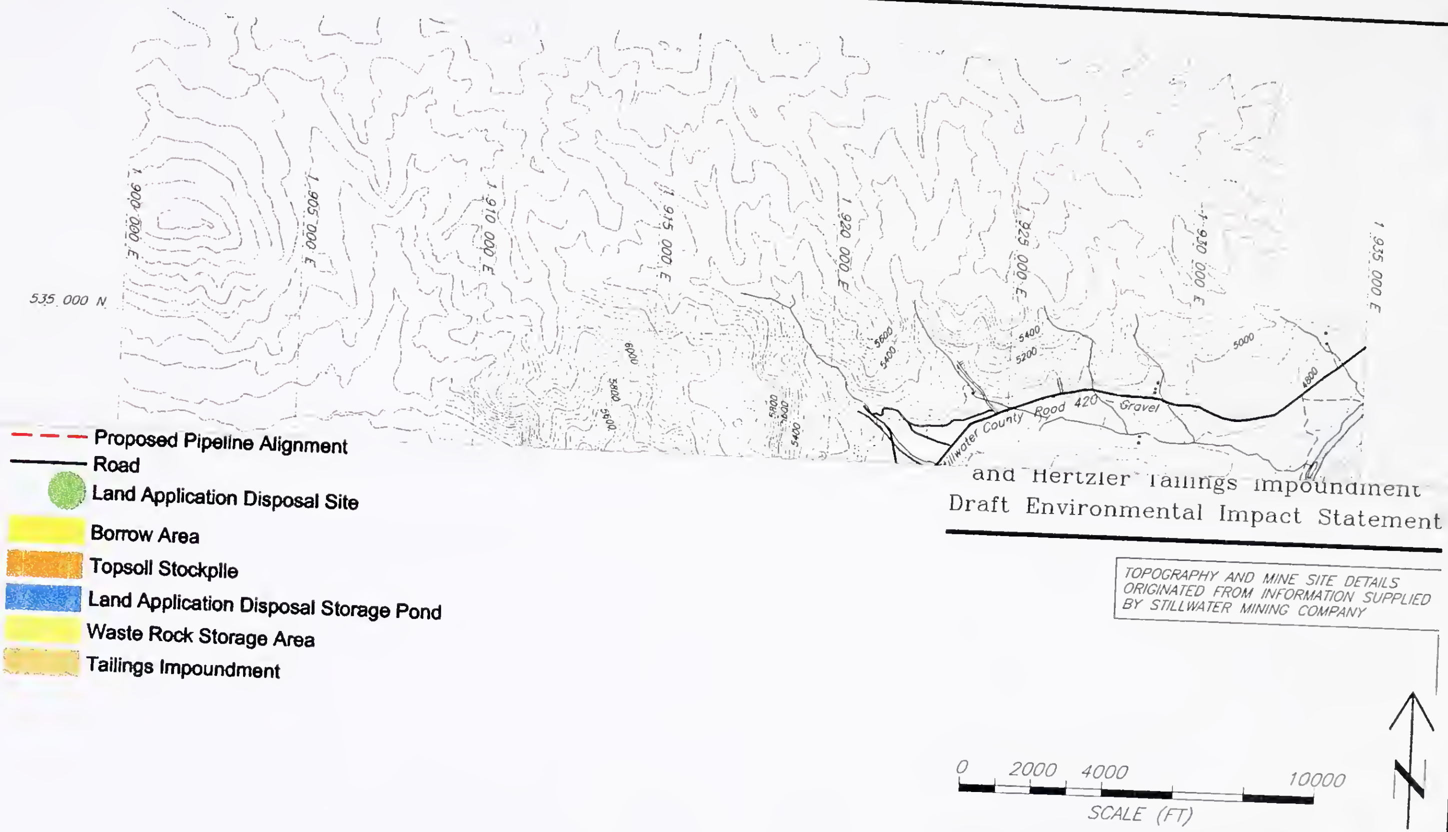
Alternative D
Modified Centerline Expansion and East Stillwater Site
Figure S-4



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

Alternative D
Modified Centerline Expansion and East Stillwater Site
Figure S-4

597ALTD–MOD.DWG

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	5,100
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)	628	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	148	148	60
New SMC disturbance (acres)	0	275	241	25
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	B — Proposed Action	C — Modified Expansion and Hertzler	D — Modified Expansion and East Side Impoundment
Physical Size	Acres	101	426	362	254
Water Resources	Groundwater Quantity	Aquifers are localized and highly variable. Overall mine discharges may reach 1,200 gpm.	Recharge at Stratton and Hertzler Ranch by LAD in summer. Overall mine discharges unchanged.	Same as B, but effects at Hertzler Ranch delayed.	Recharge only at Stratton Ranch. Overall mine discharges unchanged.
	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 11.3 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 11.3 lbs/day that would occur with waste rock facility.
	Tailings Pollutant From Pipeline Accident	Not applicable.	No long-term effects.	Slightly less risk 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	Same as B	Slightly better than B
	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.	No more than small, short-term increases during construction.	Same as B	About the same as B
	Heavy Metals	Some metals exceed standards. No change.	No change.	Same as B.	Same as B.
	Water Wells	No effect.	No effect.	Same as B.	Same as B.
	Pipeline Break	Not applicable.	Prevented by BMPs and monitoring.	Delayed construction. Shorter operating life than B.	Not applicable.
	Runoff From Waste Rock	No change.	Slight increase, but controlled by drainage-control structures.	Slightly less than B because some waste rock incorporated into expanding the existing tailings impoundment.	Less than B or C because waste rock incorporated into east side tailings impoundment and expansion of existing impoundment.
	Waters of the U.S.	None.	1.5 acres affected.	Same as B.	Less than 1 acre affected.

Table S–2 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
Wildlife	General Habitats Affected (acres)	No change from approved.	319	285 — affects at Hertzler delayed up to 10 years.	61
	Winter Range Affected (acres)	No change from approved	319 acres of mule deer winter range. No bighorn sheep habitat affected.	285 acres of mule deer winter range. 8 acres pf bighorn sheep habitat affected.	61 acres of mule deer winter range. 8 acres pf bighorn sheep habitat affected.
	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.	Same as B.
Social Economics	Population	No change (7,653 persons in the county).	250 new residents.	Same as B.	Same as B.
	Employment	No change (3,879 persons employed in the county).	30 new employees and 50 new contractors.	Same as B.	Same as B.
	Property Values	No change.	No change.	Same as B.	Same as B.
	New Students	No change (957 students).	36 new elementary and 13 new high school students.	Same as B.	Same as B.
Tailings Impoundment Stability	Exceed Safety Factor of 1.0	Yes	Yes	Yes	Yes
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.	Least of all actions.
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.	Same as B, but no lights at Hertzler Ranch.
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	Alternative: 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.	Same as B.
	Suitable Revegetation Plan	Yes	Yes	Same as B.	Same as B.
	Vegetation Disturbance (acres)				
	Currently-permitted disturb.	255	255	255	255
	Existing non-SMC disturb.[1]	0	148	148	60
	New SMC Disturbance	0	275	241[2]	25
	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

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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 disturbance would increase by 271 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 526 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 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. Proven and probable reserves of ore at the Stillwater Mine are estimated at approximately 10.5 million tons.

Currently, the Stillwater Mine can supply about five percent of World's annual demand for platinum group minerals, but only a portion of the U.S. demand. 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:

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.

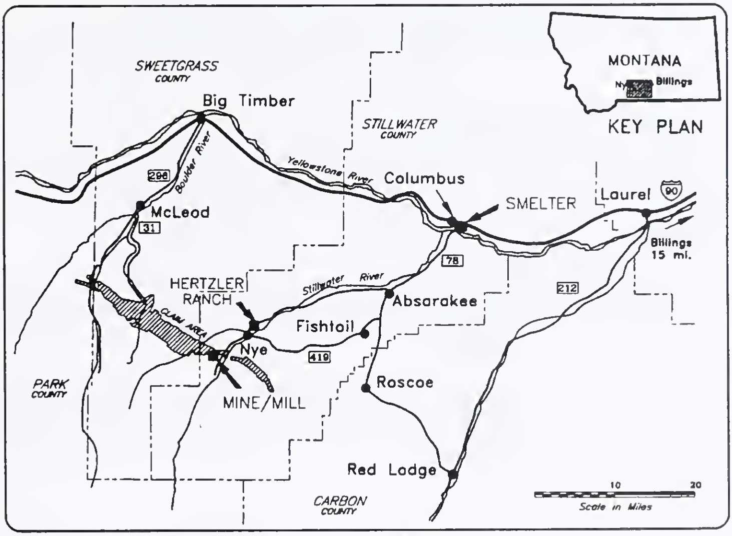

Figure 1–1 **Location of Stillwater Mine and Hertzler Ranch**

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 and stipulations of the approved amendment. The bond would include such costs as long-term maintenance of water treatment facilities, 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;
- 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.

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[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.*

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. Currently, this permit is being revised.

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 B**).

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. 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.
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	
Cultural Resource Clearance (National Historic Preservation Act)	To obtain joint approval by land-managing agencies and the State Historic Preservation Office before construction activities; 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.

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

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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 and 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.

2.2 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. 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 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.

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. 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.

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 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.

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 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.

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 tails. 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 tails have a low possibility of mobilizing metals and that many constituents are below the detection limits and all constituents of the tails 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. 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, very few 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 feasibility. This screening focused 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 (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	B	C	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 issues 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).

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.

2.4.1.3 Water Management and Disposal

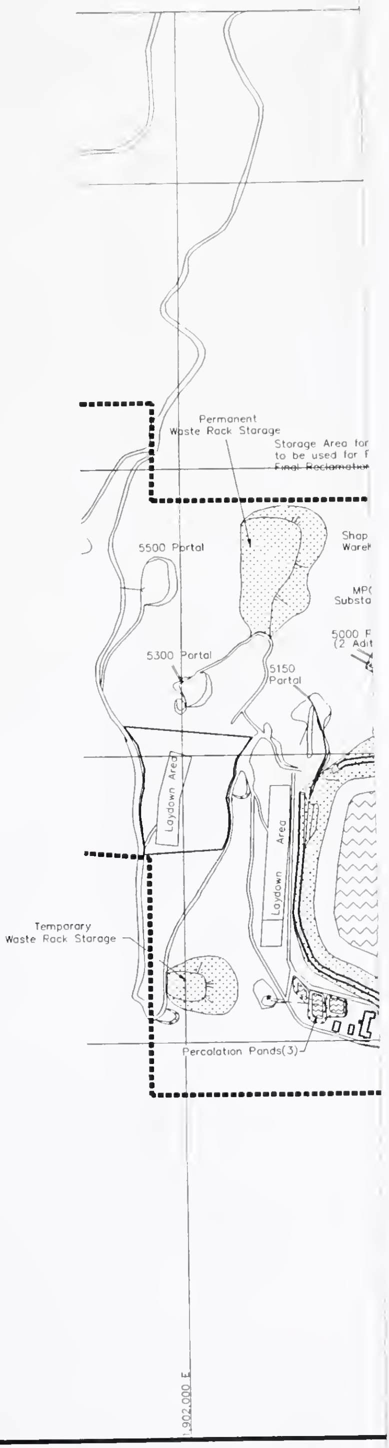
SMC handles two waste water streams at the Stillwater Mine. One stream is adit water, which is groundwater intercepted by the mine workings. The second stream is process and tailings water, which has been used in the milling and concentrating circuits and for slurrying tailings. Because the water in 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. 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 1,900 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 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 crop land; 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 crop land (hay fields) with clarified adit water.



LEGEND

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

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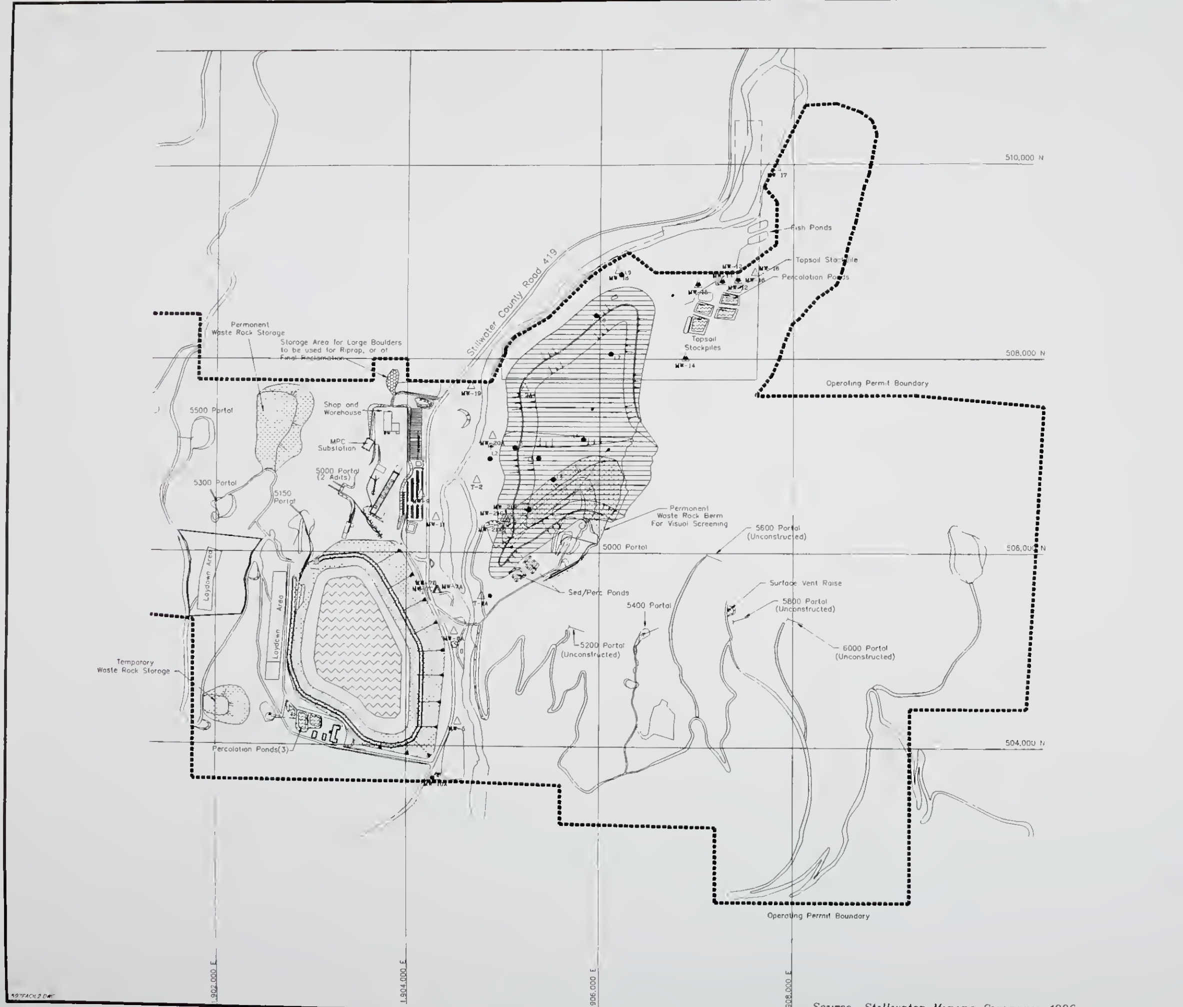
Waste Rock Storage Areas
Figure 2-1



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Waste Rock Storage Areas
Figure 2-1

Source: Stillwater Mining Company, 1996

SMC has applied for renewal of its MPDES permit. In its renewal, SMC proposes 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 of at least 70 percent, while maintaining concentrations of phosphate below 0.01 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 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 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.

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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 unchanged. As of December 1996, mineral development employment at the Stillwater Mine was 628 people. Thus, employment at the mine would continue to be 628 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.

Water Quality

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.

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 treatment facilities, 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 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.

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).

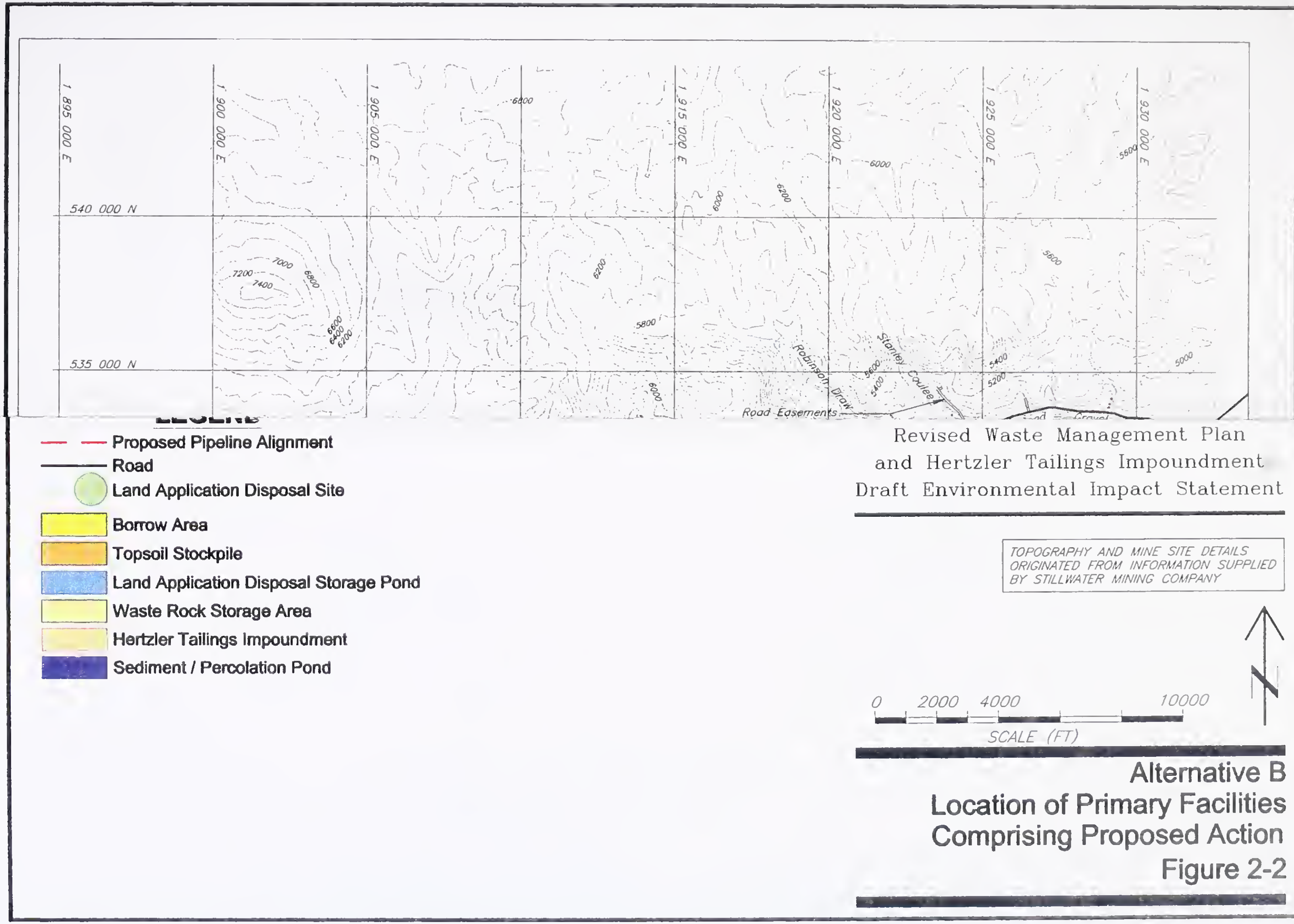
SMC proposes to expand the visual berm on the east side of the Stillwater River into an east side waste storage site to obtain the additional capacity it needs for waste rock (**Figure 2–3**). This expansion would increase the storage site's areal extent to about 80 acres from the current disturbance of 18 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. Additionally, SMC may elect to use the 4400 level (under the river) connection between the west and east mining areas to move 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).

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 rock 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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540 000 N
535 000 N
Robinson Draw
Stanley Coulee
Road Easements
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
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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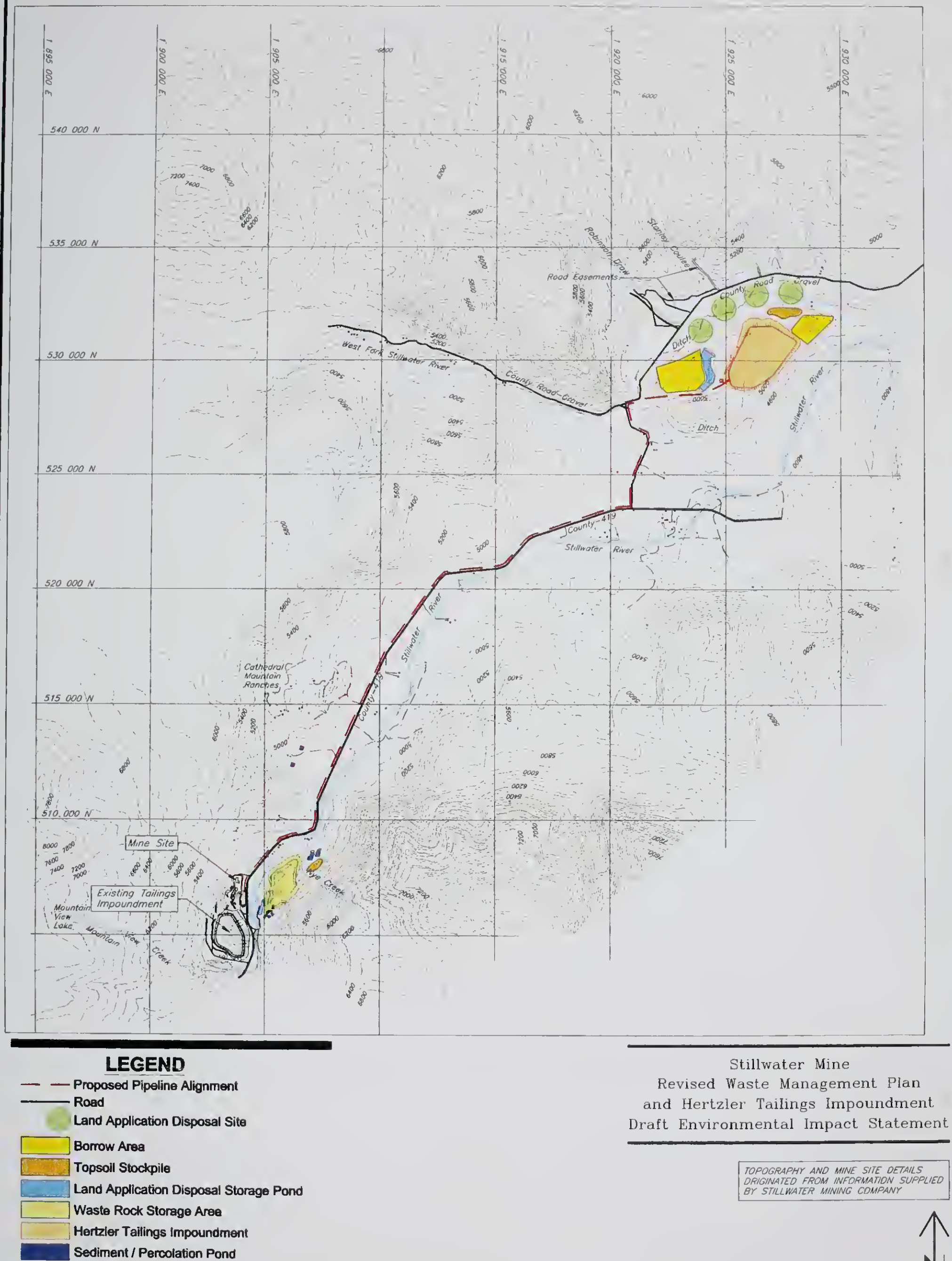
SCALE (FT)
Alternative B
Location of Primary Facilities
Comprising Proposed Action
Figure 2-2



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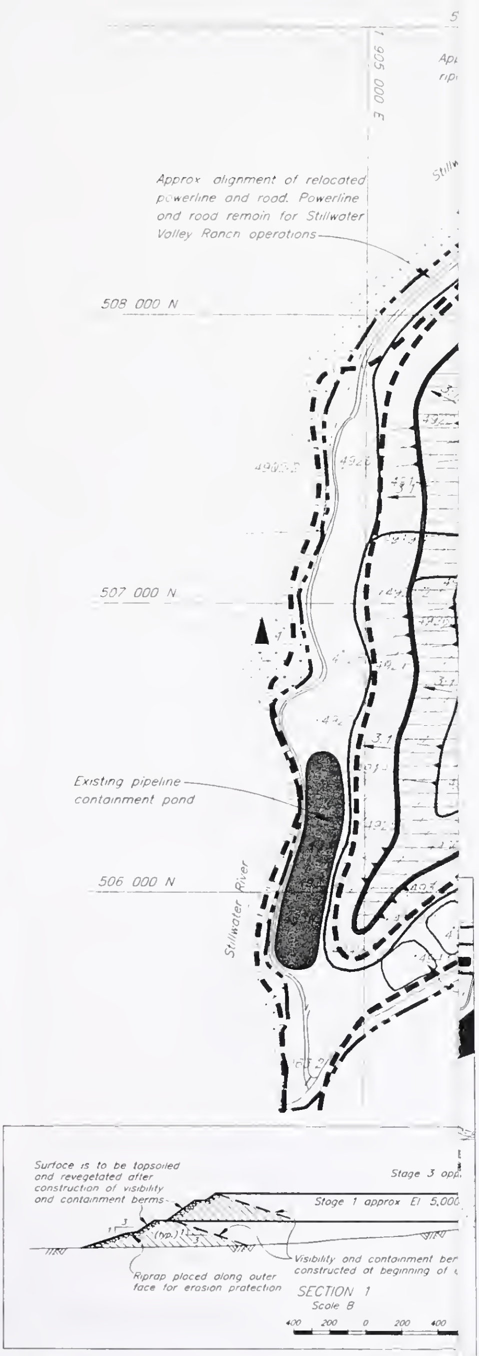
Alternative B
Location of Primary Facilities Comprising Proposed Action
Figure 2-2



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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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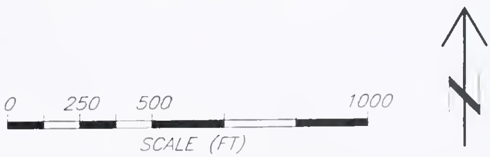
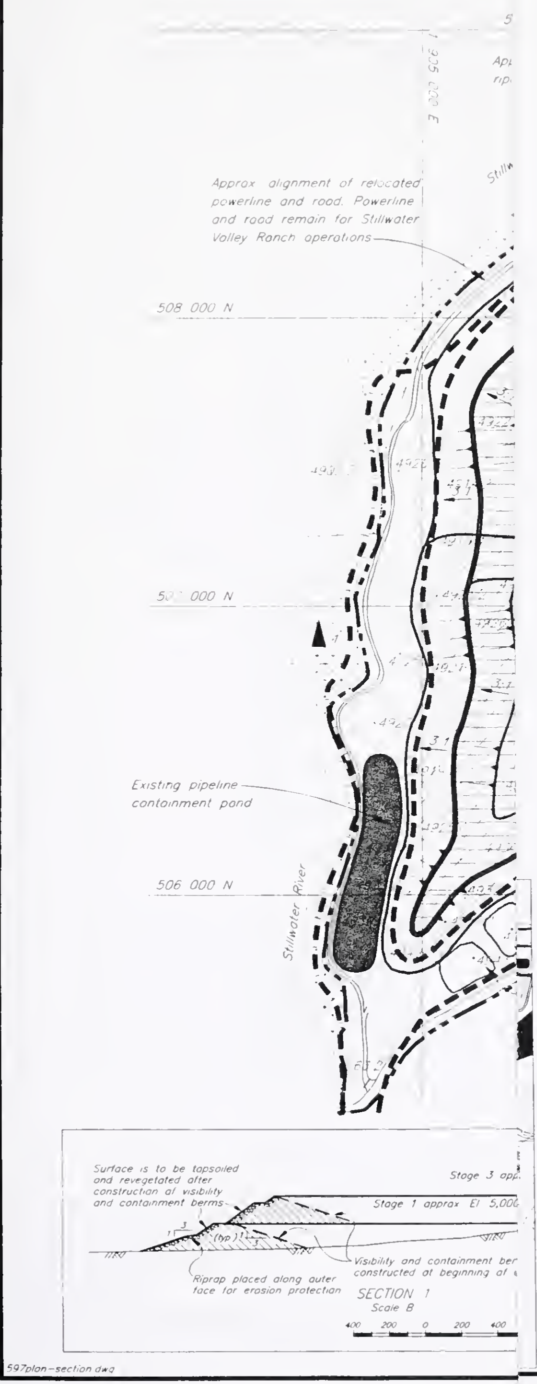


Plan and Section of East Side Waste Storage Site
Figure 2-3



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'.

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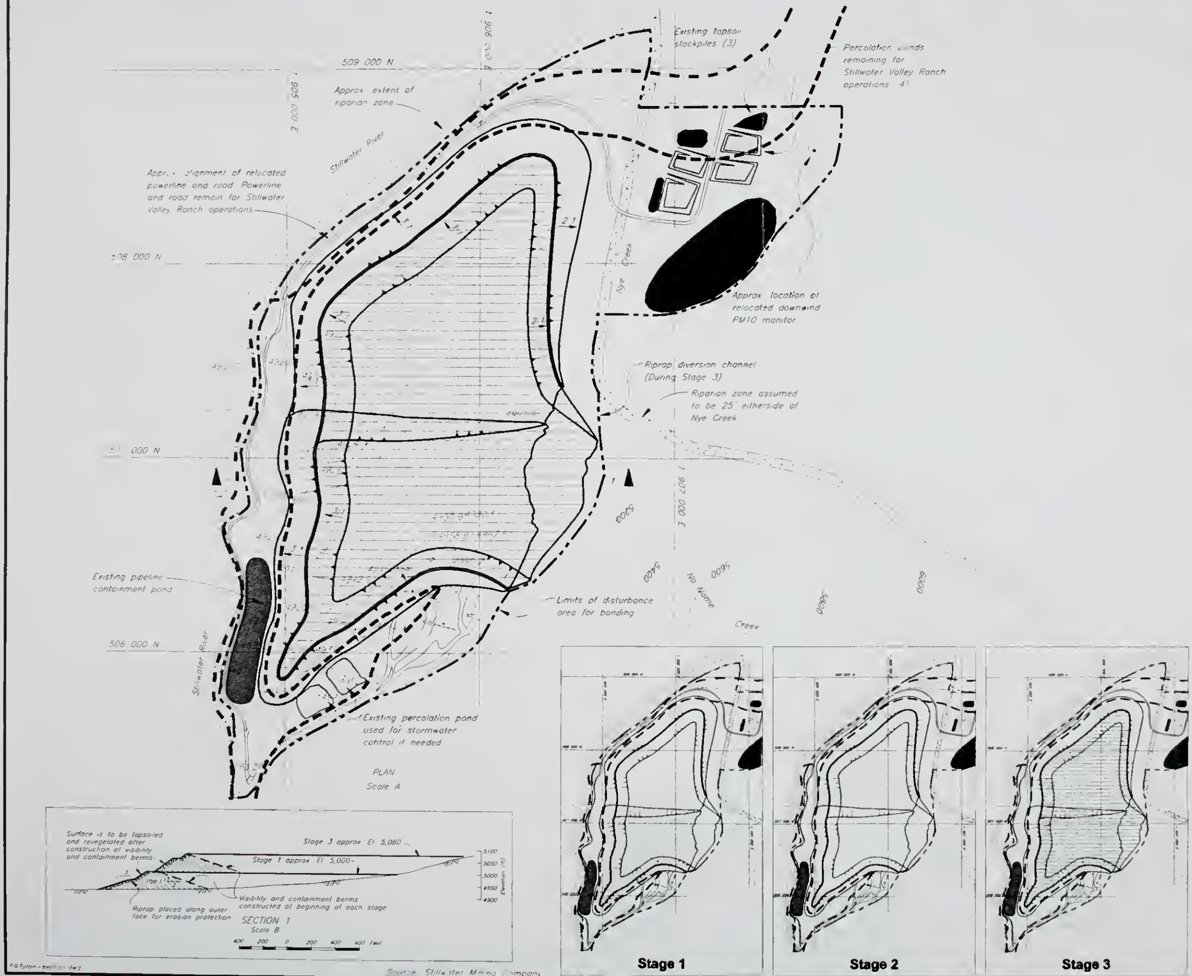
Plan and Section of East Side Waste Storage Site
Figure 2-3



LEGEND

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

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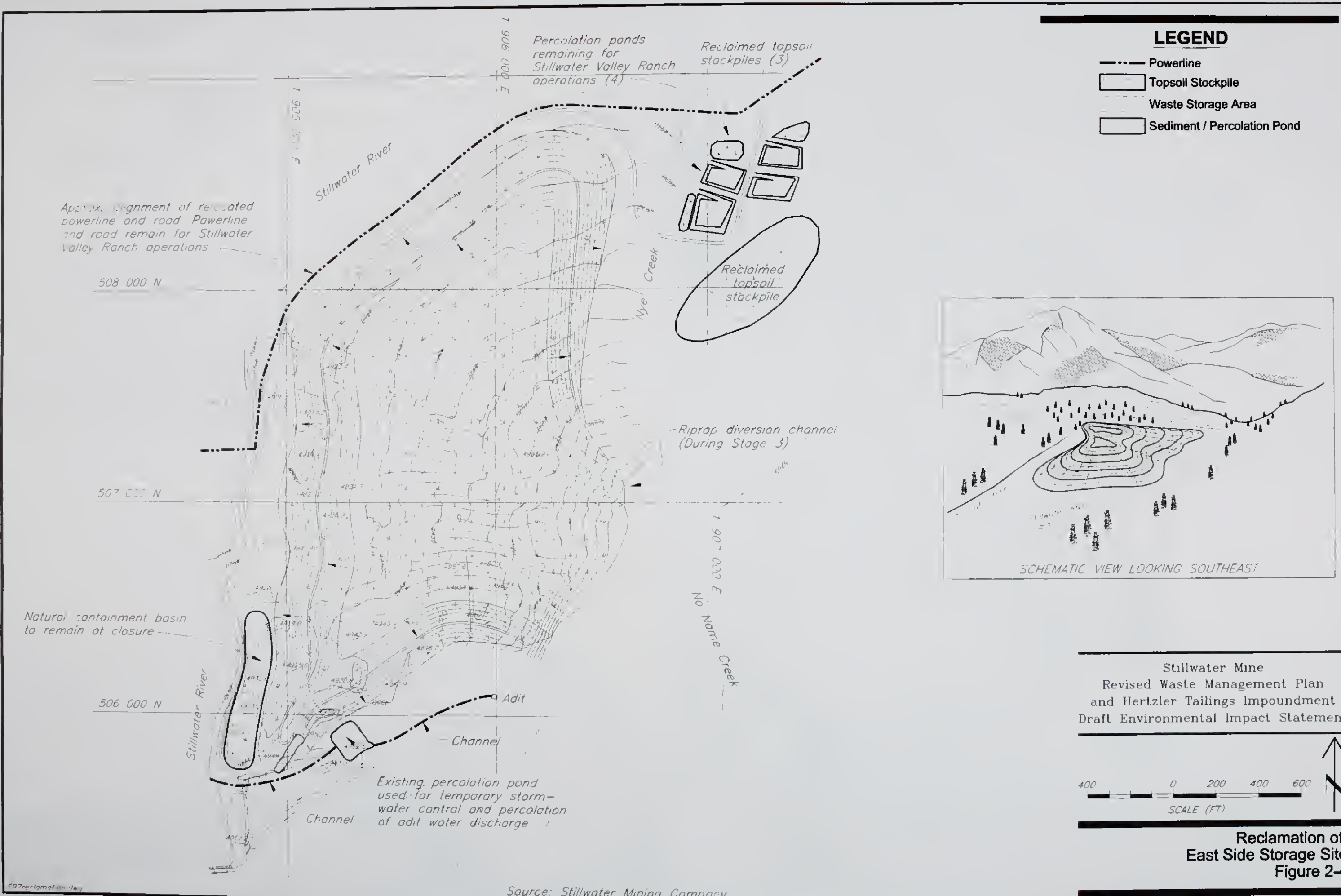
Plan and Section of
East Side Waste Storage Site
Figure 2-3



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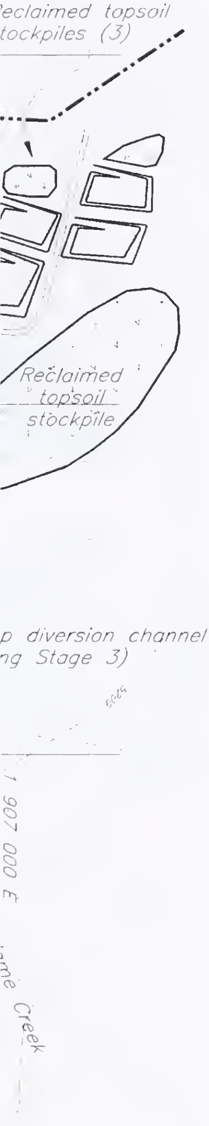
Reclamation of East Side Storage Site
Figure 2-4



LEGEND

- Powerline
- Topsoil Stockpile
- Waste Storage Area
- Sediment / Percolation Pond

SCHEMATIC VIEW LOOKING SOUTHEAST

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N

Reclamation of East Side Storage Site Figure 2-4

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.

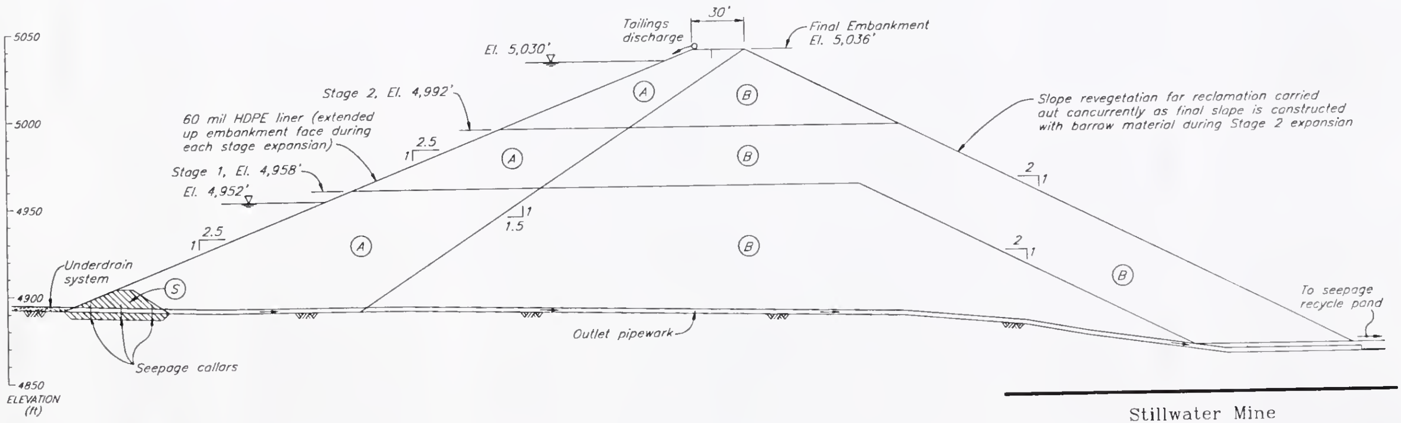
To provide the additional capacity for tailings needed for continued operation, SMC proposes to construct and operate a new impoundment at the former Hertzler Ranch. Tailings would be transported from the mine to this impoundment through two 8-inch high-density polyethylene-lined steel pipelines. Additionally, process water would be reclaimed from the impoundment and returned to the mill through a pipeline adjacent to the two tailings pipelines and the mine water pipeline.

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



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

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NOT TO SCALE

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

Source: Stillwater Mining Company, 1996.

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

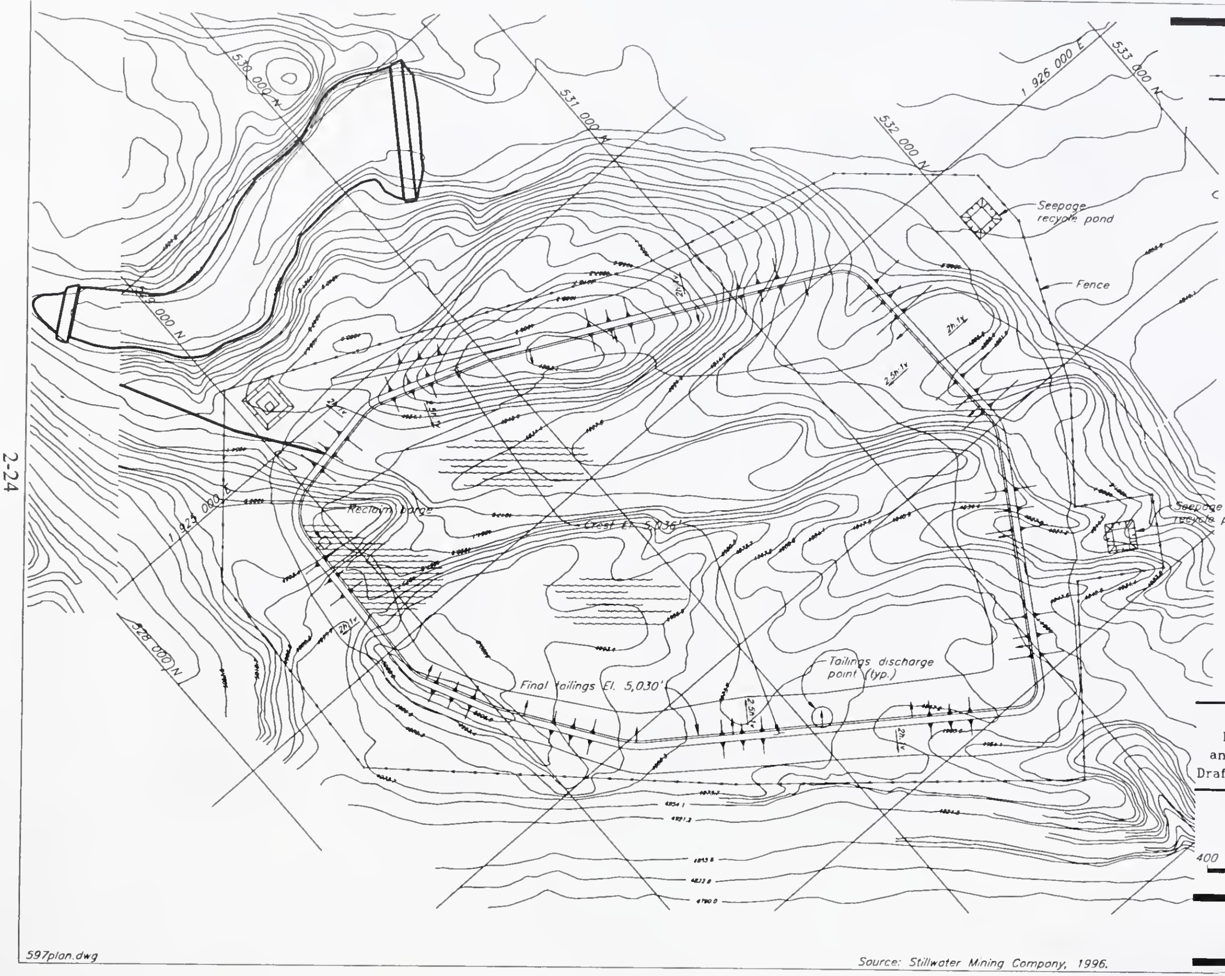
The impoundment also would be designed to incorporate technology to minimize seepage and promote drainage of the tailings. The impoundment would be lined with a 60-mil thick, high-density polyethylene (HDPE) liner to reduce the amount of seepage to groundwater beneath the impoundment. Finer glacial till, which is a clayey material with a naturally-low permeability of at least 1 x 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 underdrains constructed on top of the HDPE liner and recycle ponds. Underdrains would be built of corrugated polyethylene perforated pipe covered with filter media. 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



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Hertzler Impoundment Plan

Figure 2-6

Source: Stillwater Mining Company, 1996.

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.

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 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 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.

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 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 18 megawatts of power. 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 2000 tpd, production could peak as high as 5,000 tpd. An additional 4 megawatts would be required for each additional 1,000 tpd of ore production.

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. This agreement would constitute an amendment to SMC's Hard Rock Impact Plan for Stillwater County.

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. SMC's current Hard Rock Impact Plan for Stillwater County requires that the plan be amended should the workforce level exceed 15 percent of that projected in its 1988 plan amendment (this level is 525 employees). Projections suggest implementation of the proposed action alternative would increase employment at the mine from about 628 to about 700 workers. Forty to 45 percent of the additional workers are expected to be local residents. SMC's Hard Rock Impact Plan is currently being revised to address a total of 700 workers. 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 but may reduce the need for expanding the workforce as production at the mine increases.

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. 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. If the HDPE liner showed wear, it could be removed and replaced between any two vaults. Only a portion of the pipeline at each vault would need to be dug up for the replacement process.

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.

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 and CNF of any rupture and inform both agencies of conditions at the site of the rupture and cleanup efforts underway.

Water Quality

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 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 and stipulations contained in the approved and permitted amendment. The bond would include costs for long-term maintenance of water treatment facilities, such as percolation ponds and diversion ditches; demolition of buildings and other facilities; earth movement and soil replacement; seedbed preparation; and revegetation.

2.4.3 Alternative C — Modified Centerline Expansion and Hertzler Ranch

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 shorter 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 storage site (**Figure 2–3**). The east side waste rock storage site would be constructed and located as described under Alternative B — Proposed Action.

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.

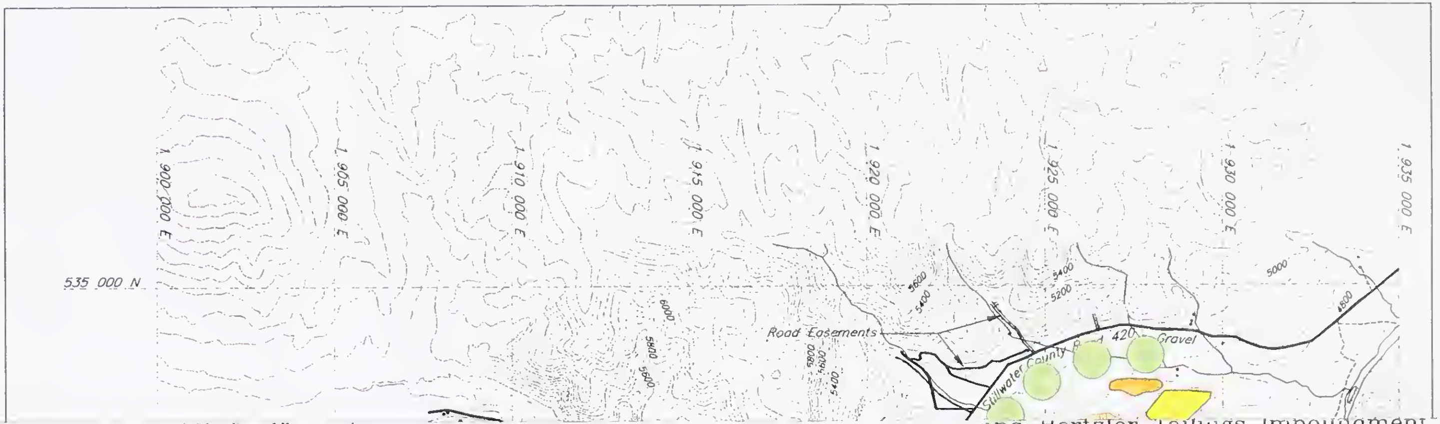
Existing Tailings Impoundment

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.



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

and Hertzler Tailings Impoundment
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TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

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SCALE (FT)

N

Alternative C
Modified Centerline Expansion and Hertzler Ranch Site
Figure 2-7

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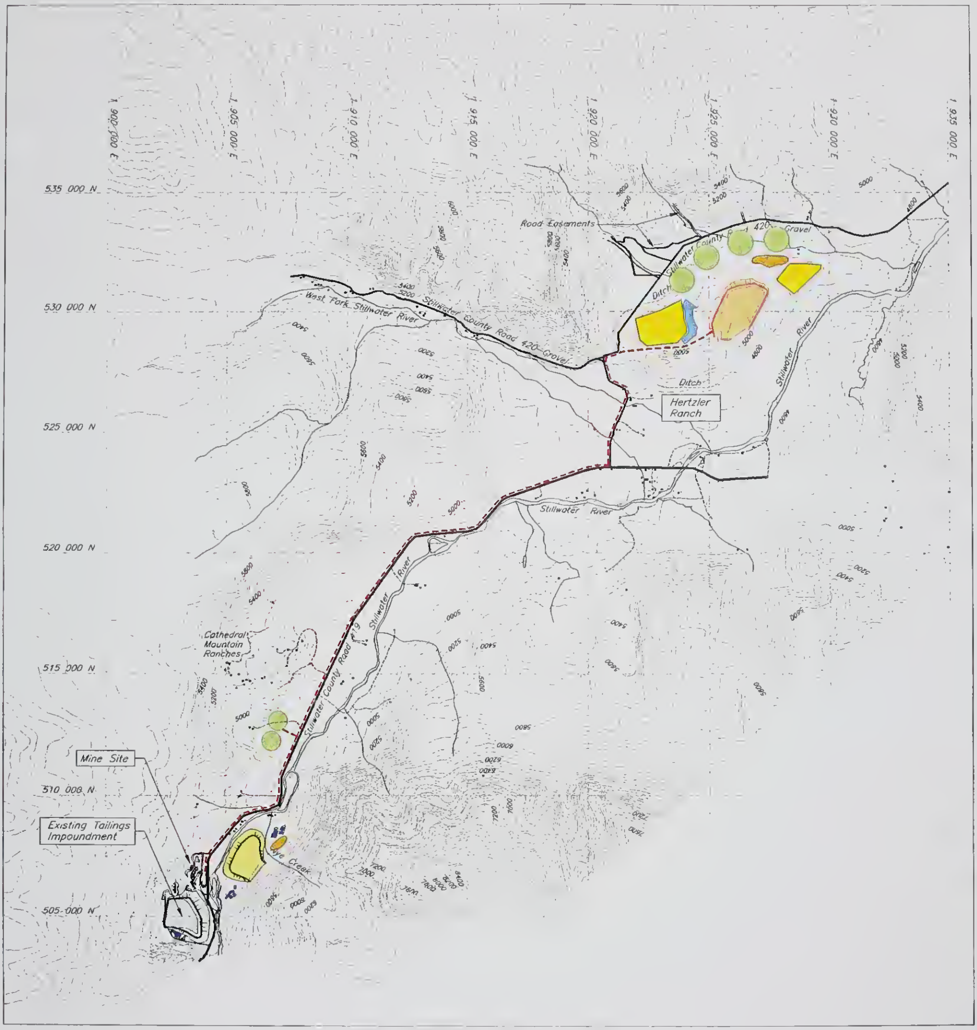

LEGEND

- 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

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SCALE (FT)

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Alternative C
Modified Centerline Expansion and Hertzler Ranch Site
Figure 2-7

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

B 0 50 100 150 200 ft.
A 0 200 400 600 800 1000 ft.
SCALE (FT)

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

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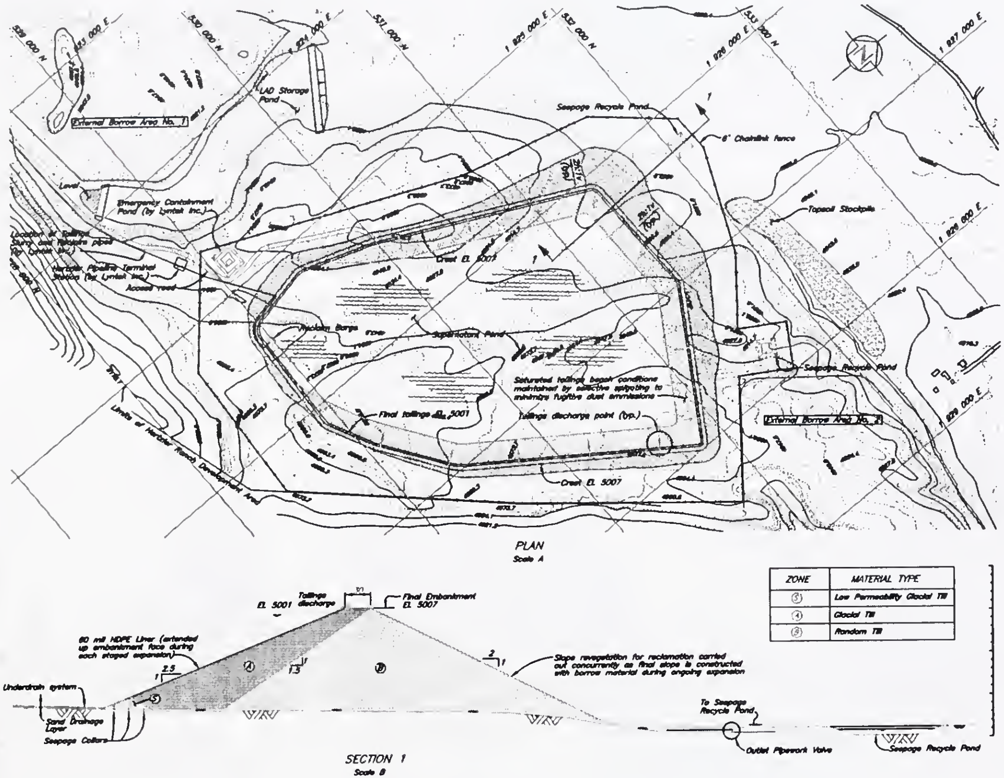
TOPOGRAPHY AND MINE SITE DETAILS ORIGINATED FROM INFORMATION SUPPLIED BY STILLWATER MINING COMPANY

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



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

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

Source: Knight & Piesold, 1996.

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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, 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 628 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. 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 and stipulations contained in the approved and permitted amendment. The bond would include costs for long-term maintenance of water treatment facilities, such as percolation ponds and diversion ditches; demolition of buildings and other facilities; earth movement and soil replacement; seeded preparation; and revegetation.

2.4.4 Alternative D — Modified Centerline Expansion and East Stillwater Site

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 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**).

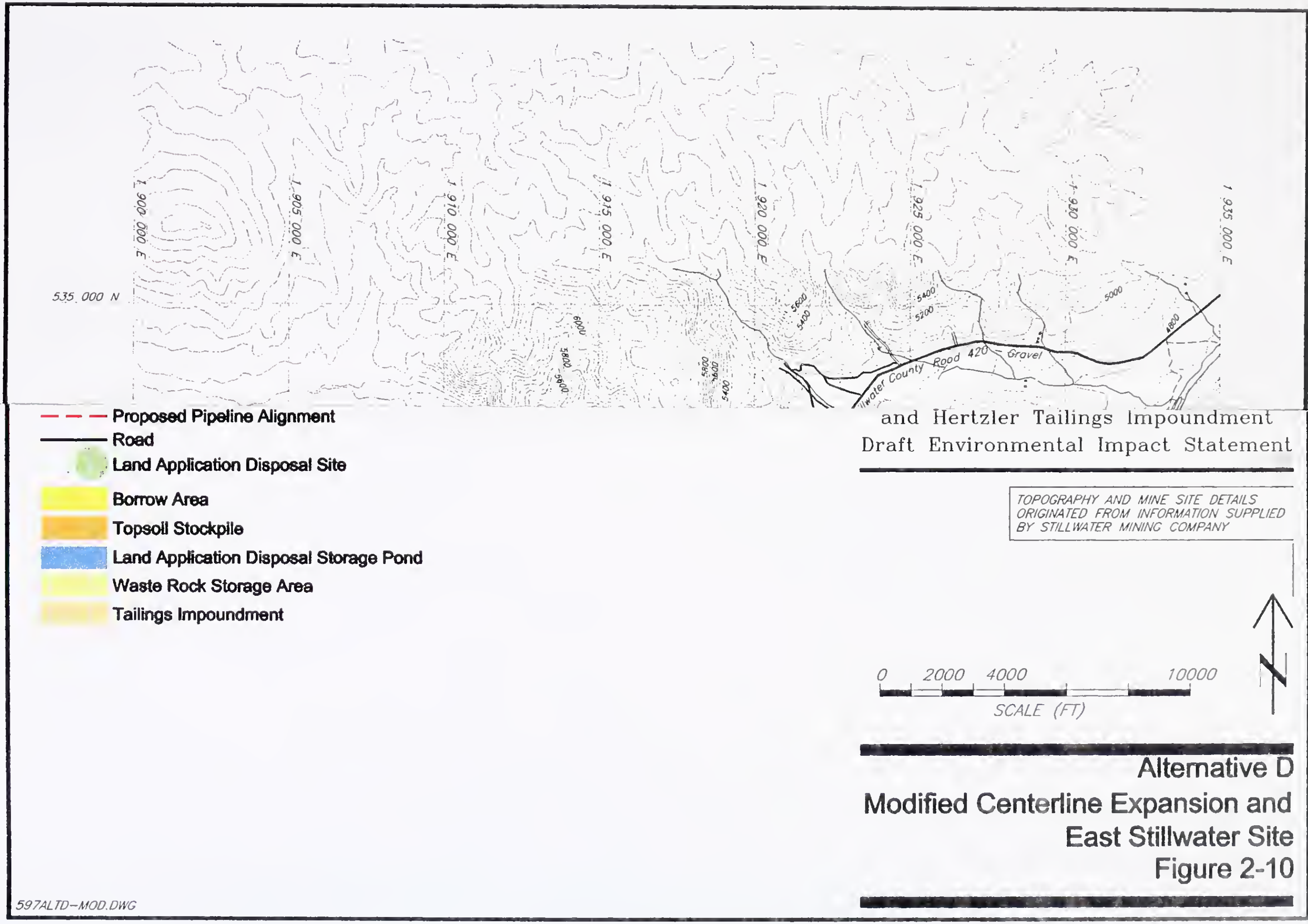
East Stillwater Impoundment

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 storage facility would cover. The impoundment would be constructed in three phases with the final crest elevation at 5,100 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. The rest of the construction would be similar to that described under the Proposed Action. The impoundment would be lined with a 100-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, 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 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.



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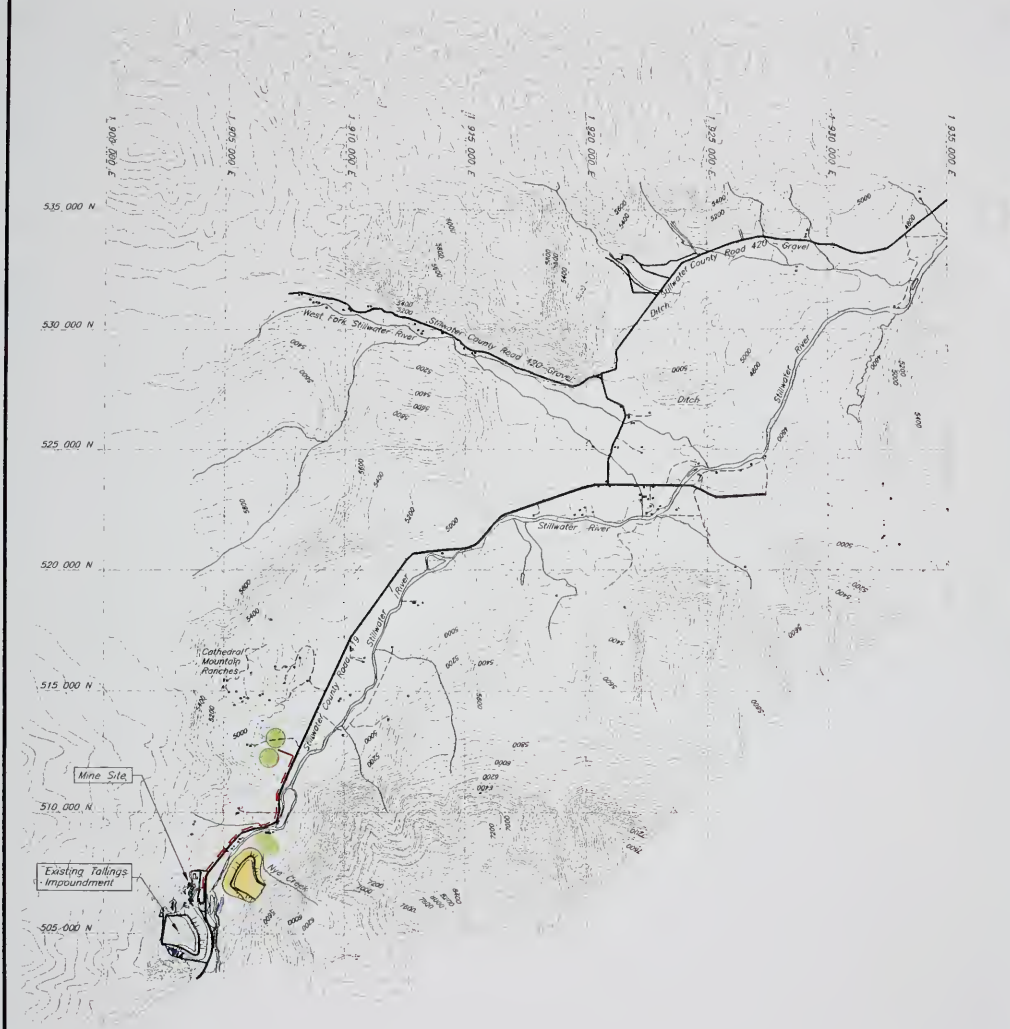
Alternative D
Modified Centerline Expansion and
East Stillwater Site
Figure 2-10



LEGEND

- Proposed Pipeline Alignment
- Road
- Land Application Disposal Site
- Borrow Area
- Topsoil Stockpile
- Land Application Disposal Storage Pond
- Waste Rock Storage Area
- Tailings Impoundment

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

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Alternative D
Modified Centerline Expansion and East Stillwater Site
Figure 2-10

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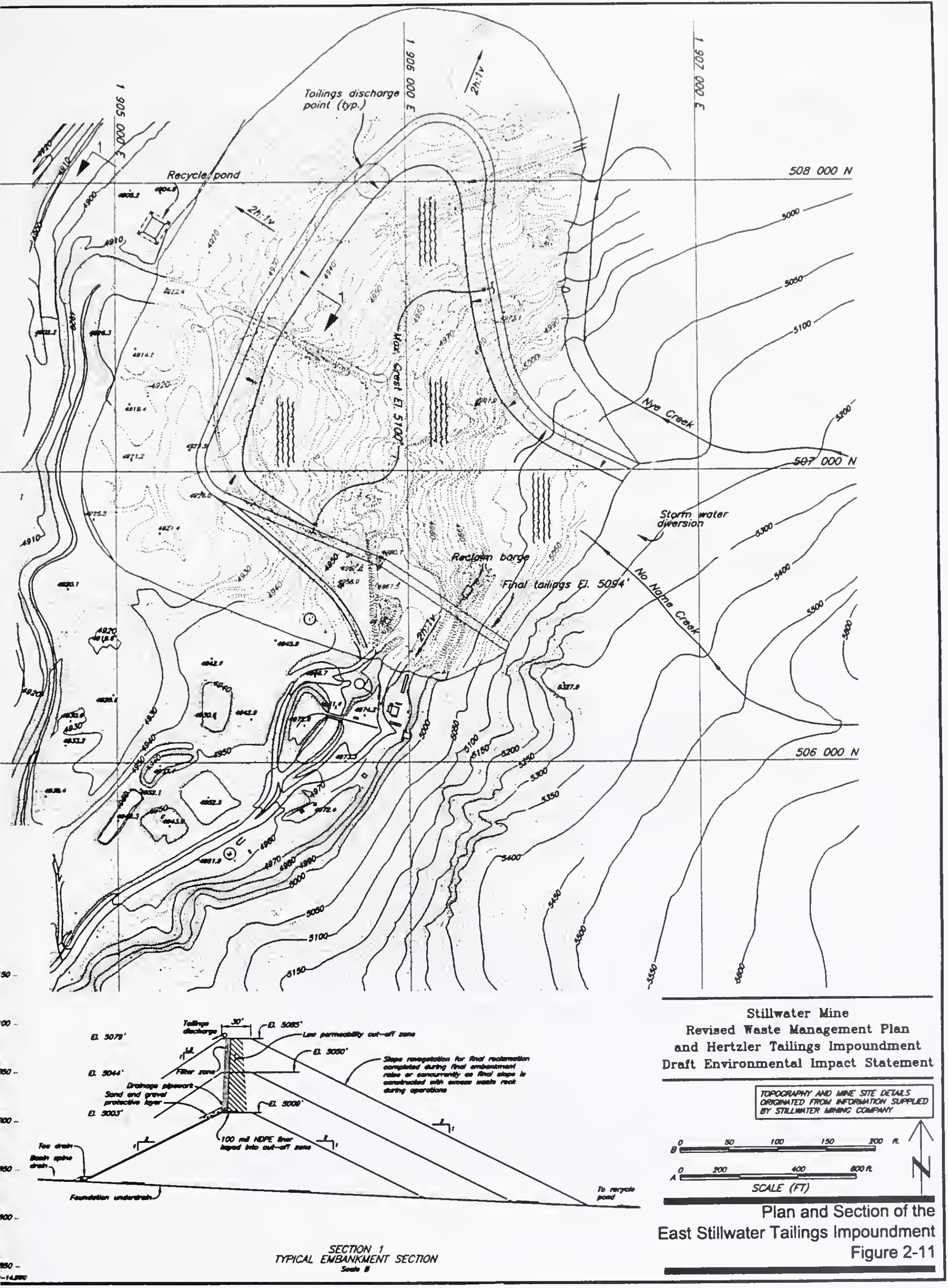
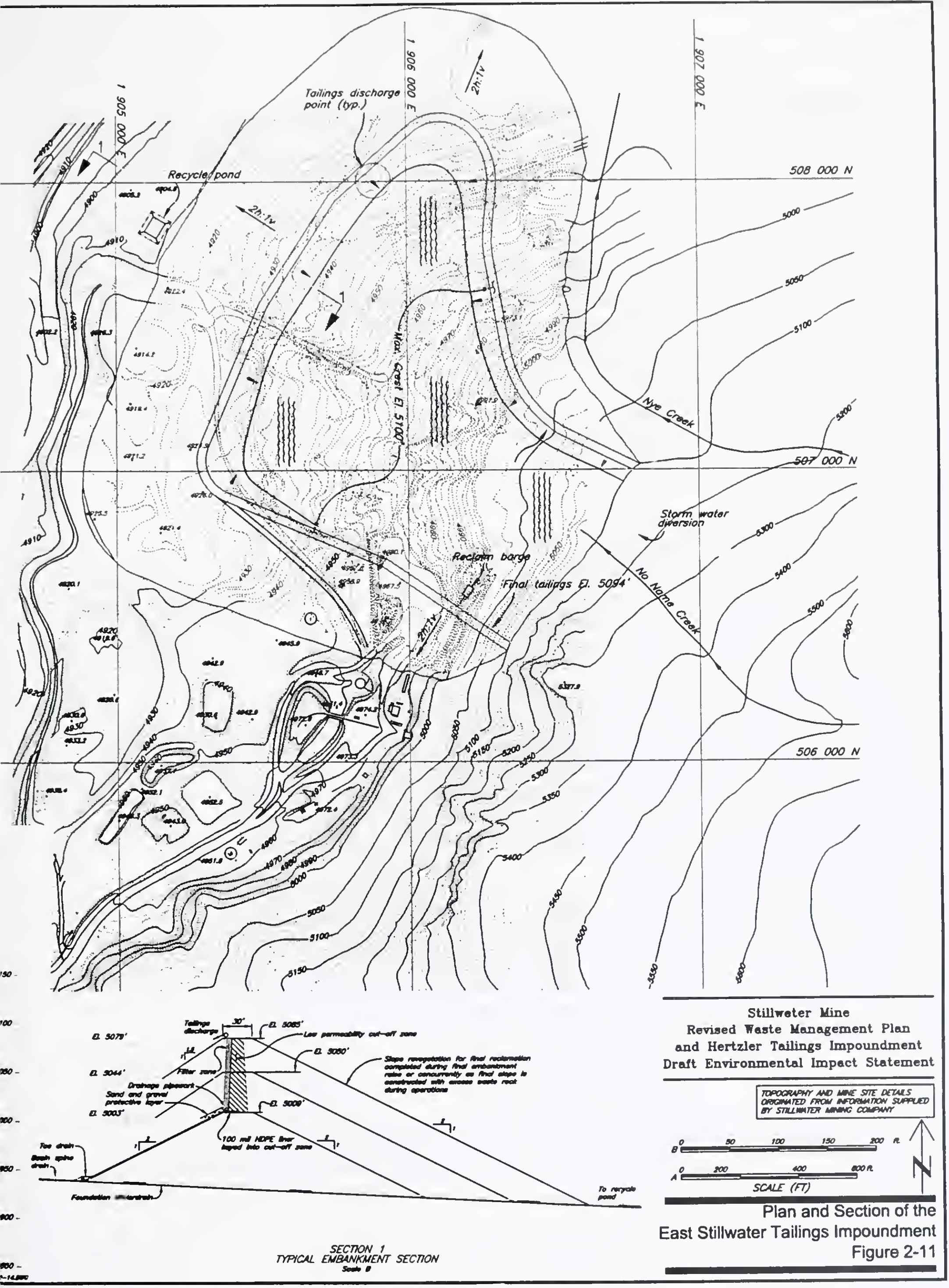


Plan and Section of the East Stillwater Tailings Impoundment
Figure 2-11



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Draft Environmental Impact Statement

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

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

Due to constraints in crossing the Stillwater River, the pipelines would be suspended across the river or attached to the bridge instead of 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

628 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. 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 treatment facilities, such as percolation ponds and diversion ditches; demolition of buildings and other facilities; earth movement and soil replacement; seeded preparation; and revegetation.

2.4.5 Agency Mitigations

Through the analysis of environmental consequences, DEQ and CNF identified three mitigation measures. These measures are:

- SMC shall develop and implement a plan to ensure the surfaces of both the existing and proposed tailings impoundments would be kept wet to prevent blowing of tailings in the event that one or both facilities are shut down for any reason prior to mine closure and reclamation of the impoundment surfaces.

- SMC shall construct the tailings embankments so the outer slopes can be completely reclaimed once they are built. For example, the embankment of stage 1 of the proposed Hertzler tailings impoundment would be constructed to the final toe location and would not be redisturbed for construction of stage 2.

- SMC shall develop the LAD sites at Hertzler Ranch using a standard reclamation seed mix with more palatable species than the creeping meadow foxtail species proposed.

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 described.

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, the economical costs to SMC would be very unreasonable (the cost/ton of tailings was one of the highest of alternatives considered). The primary reason for these increased costs is the requirement to pump tailings one mile to a site that is 400 feet above the Stillwater Mine's mill. Additionally, 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.
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:	Compared to the other alternatives available, the economical costs to SMC would be very unreasonable (the cost/ton of tailings was one of the highest of alternatives considered). The primary reason for these increased costs is the requirement to pump tailings five miles to a site that is 1,300 feet above the Stillwater Mine's mill. The high horsepower, positive displacement pumps this alternative requires 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. Additionally, 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.

2.5.2 1997 Alternatives Considered but Eliminated

Several new alternatives also were developed for consideration in the current MEPA/NEPA analysis. 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.
Reason Dropped:	Implementation of this alternative would require SMC to pump tailings to an impoundment that would be about 0.5 mile higher than the mine. Few, if any, steel pipes can withstand a 2,000-foot or more head without bursting. 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. Thus, this alternative was determined to be technically unfeasible.

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:	Implementation of this alternative was determined to be technically unfeasible. This alternative would have required pumping of 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 3,000 feet. Few steel pipelines can withstand a 2,000-foot or more head without bursting. Additionally, this alternative 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. Finally, insufficient space exists at the site to construct an impoundment of the size needed to dispose of the volume of tailings that this alternative would generate.

Alternative Considered: Paste Landfill

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. Depositing the paste as backfill in underground mining areas is another relatively new technology for disposing of tailings.

Reason Dropped: During June 1995, SMC conducted pilot tests at the Stillwater Mine to determine the efficiency and ability of dewatering Stillwater tailings. Both slimes and total mill tails were tested.

The results of the analysis on the 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. However, it would substantially increase SMC's costs to dispose of the tailings.

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 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.

Some tailings pastes allow concurrent reclamation of the impoundment, which minimizes the active area of land. Because SMC's tailings paste would 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.

SMC's costs to construct, operate, and maintain a paste disposal system would be substantial. The capital cost for an appropriate paste production plant would be at least $1 million. The pipeline system would have to be upgraded to a high pressure pipeline with positive displacement pumps, which is more costly and requires more maintenance. This pipeline system also has a higher risk for rupture. The use of a cement additive to increase the paste's strength for stability and reclamation would probably cost about $4.50 per ton of tailings.

Alternative Considered:	Paste Backfill
Reason Considered:	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 would eliminate all or much of the placement of tailings on the surface.
Reason Dropped:	Total tailings backfill is a relatively new technology. Total tailings backfill systems require state-of-the-art controls because only slight changes in moisture content cause wide variations in viscosity. Existing operations that use total tailings backfill do so in deep shaft mines that simplify the problems of pumping the material. Pumping of dewatered total tailings backfill would be difficult at the Stillwater Mine due to the long horizontal and vertical distances required to reach mining areas. This would require a major change in mine backfill methods and associated capital and operating costs would be excessive. Also, 100 percent of the tailings could not be backfilled into the mine due to the swell factor. A surface disposal facility would still be needed for placement of some of the tailings. The implementation of a total tailings backfill system would be unreasonably expensive. Additionally, uncertainty exists about whether total tailings backfill is technologically feasible at the Stillwater Mine.

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.
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 sufficient protection. The incremental decrease in seepage transfer to groundwater is insufficient to offset the substantial increase in costs to construct.

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* — Planning is underway for the modernization and increased capacity of Woodbine Campground. 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.

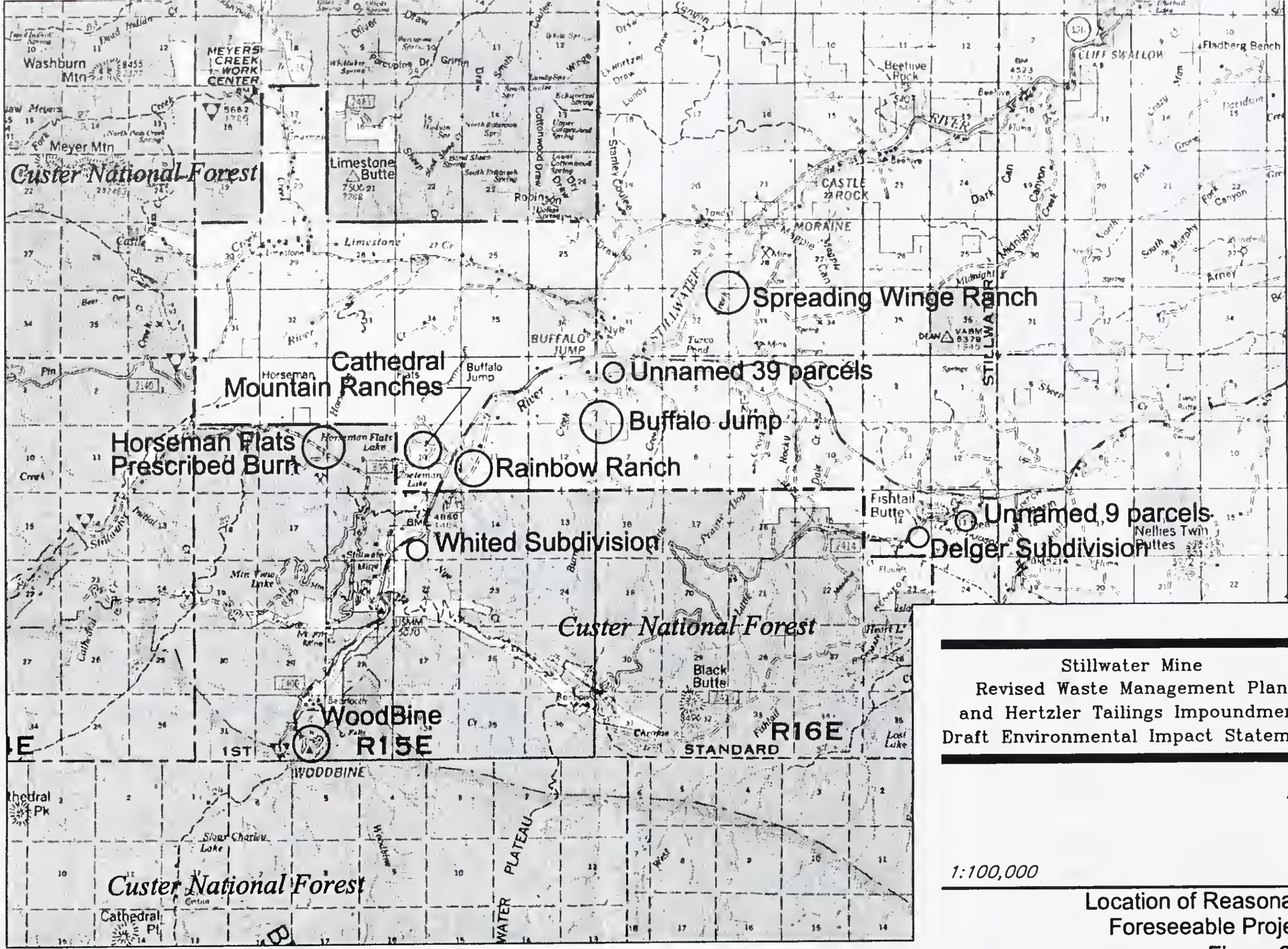
- *Horseman Flats Prescribed Burn* — The CNF is planning to conduct a prescribed burn of Forest Service system lands on Horseman Flat to increase the amount of forage available for wildlife. Currently, the CNF plans to conduct the burn in 1999.

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.



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Location of Reasonably
Foreseeable Projects
Figure 2-12

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- *Buffalo Jump*. Located one mile south-southeast of Nye, Montana, in Sections 1 and 12, T5S, R15E, and Sections 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.

- 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 an application 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. However, too many variables and unknowns exist to include this possible expansion into the cumulative impact analysis at this time and it will not be evaluated.

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. 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. The agencies would include mitigation for SMC to develop and implement a plan to ensure the surfaces of both the existing and proposed tailings impoundments would be kept wet to prevent blowing of tailings in the event that one or both facilities are shut down for any reason prior to mine closure and reclamation of the impoundment surfaces. Other mitigations include changes in the construction of the tailings embankment so the outer slopes can be completely reclaimed once they are built and changing the seed mix for the Hertzler LAD sites to a standard reclamation seed mix with more palatable species than the creeping meadow foxtail species proposed.

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	5,100
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)	628	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	148	148	60
New SMC disturbance (acres)	0	275	241	25
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
Physical Size	Acres	101	426	362	254
Water Resources	Groundwater Quantity	Aquifers are localized and highly variable. Overall mine discharges may reach 1,200 gpm.	Recharge at Stratton and Hertzler Ranch by LAD in summer. Overall mine discharges unchanged.	Same as B, but effects at Hertzler Ranch delayed.	Recharge only at Stratton Ranch. Overall mine discharges unchanged.
	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 11.3 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 11.3 lbs/day that would occur with waste rock facility.
	Tailings Pollutant From Pipeline Accident	Not applicable.	No long-term effects.	Slightly less risk 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	Same as B	Slightly better than B
	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.	No more than small, short-term increases during construction.	Same as B	About the same as B
	Heavy Metals	Some metals exceed standards. No change.	No change.	Same as B.	Same as B.
	Water Wells	No effect.	No effect.	Same as B.	Same as B.
	Pipeline Break	Not applicable.	Prevented by BMPs and monitoring.	Delayed construction. Shorter operating life than B.	Not applicable.
	Runoff From Waste Rock	No change.	Slight increase, but controlled by drainage-control structures.	Slightly less than B because some waste rock incorporated into expanding the existing tailings impoundment.	Less than B or C because waste rock incorporated into east side tailings impoundment and expansion of existing impoundment.
	Waters of the U.S.	None.	1.5 acres affected.	Same as B.	Less than 1 acre affected.

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.	319	285 — affects at Hertzler delayed up to 10 years.	61
	Winter Range Affected (acres)	No change from approved	319 acres of mule deer winter range. No bighorn sheep habitat affected.	285 acres of mule deer winter range. 8 acres pf bighorn sheep habitat affected.	61 acres of mule deer winter range. 8 acres pf bighorn sheep habitat affected.
	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.	Same as B.
Social Economics	Population	No change (7,653 persons in the county).	250 new residents.	Same as B.	Same as B.
	Employment	No change (3,879 persons employed in the county).	30 new employees and 50 new contractors.	Same as B.	Same as B.
	Property Values	No change.	No change.	Same as B.	Same as B.
	New Students	No change (957 students).	36 new elementary and 13 new high school students.	Same as B.	Same as B.
Tailings Impoundment Stability	Exceed Safety Factor of 1.0	Yes	Yes	Yes	Yes
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	Least of all actions.
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.	Same as B, but no lights at Hertzler Ranch.
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.	Same as B.
	Suitable Revegetation Plan	Yes	Yes	Same as B.	Same as B.
	Vegetation Disturbance (acres)				
	Currently-permitted disturb.	255	255	255	255
	Existing non-SMC disturb.[1]	0	148	148	60
	New SMC Disturbance	0	275	241[2]	25
	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

3.1	Water Resources	3 – 1
3.2	Wildlife	3 – 24
3.3	Fisheries	3 – 32
3.4	Air Quality	3 – 37
3.5	Socioeconomics	3 – 38
3.6	Tailings Impoundment Stability	3 – 47
3.7	Aesthetics	3 – 52
3.8	Transportation	3 – 57
3.9	Reclamation	3 – 59
3.10	Cultural Resources	3 – 64

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**.

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). High annual precipitation of 20 to 60 inches 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).

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.

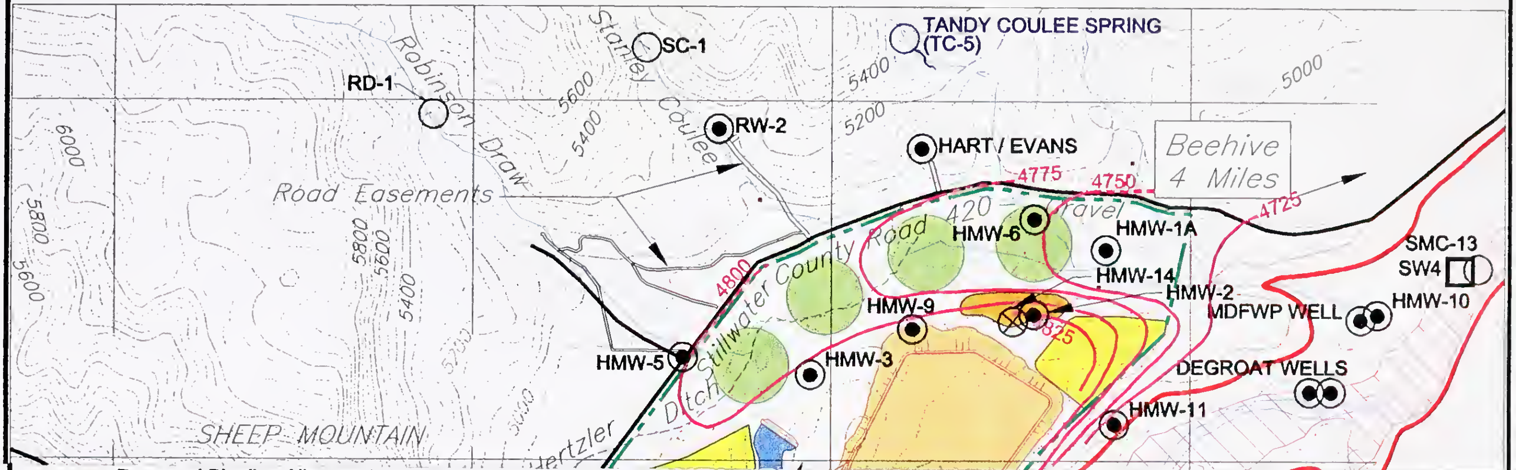
Nye Creek is a third order tributary located directly across the river from the SMC mine tailings impoundment and drains an area of about 3.7 square miles. Flows from June 1980 through June 1981 ranged from 0 to 0.60 cfs (CDM 1981). Flows acquired two to three times per year between May 1992 and December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

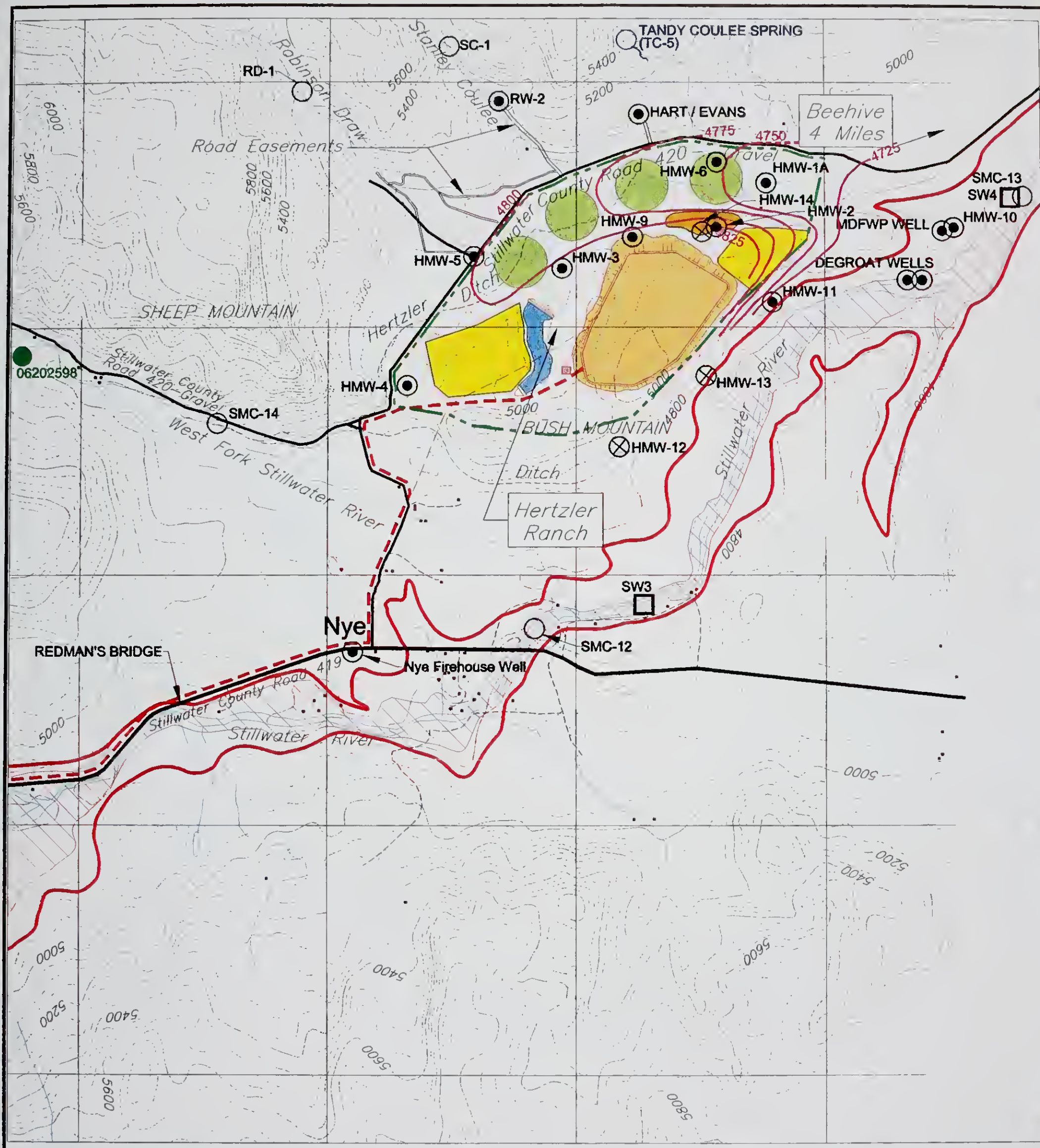
The Stillwater River lies one quarter of a mile east of Stratton Ranch. The river tends to loose water to the aquifer in this reach. A small perennial creek flows due east off the uplands above the ranch and disappears in alluvial fan material



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

WATER RESOURCES
Hertzler Area (Part 1)
Figure 3-1



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
- Limit of 100 Year Water Level
- Limit of PMF Water Level
- Water Table Elevation
- USGS Gage
- Surface Water Monitoring
- Spring
- Well
- Proposed Well
- Macroinvertebrate Sampling Site

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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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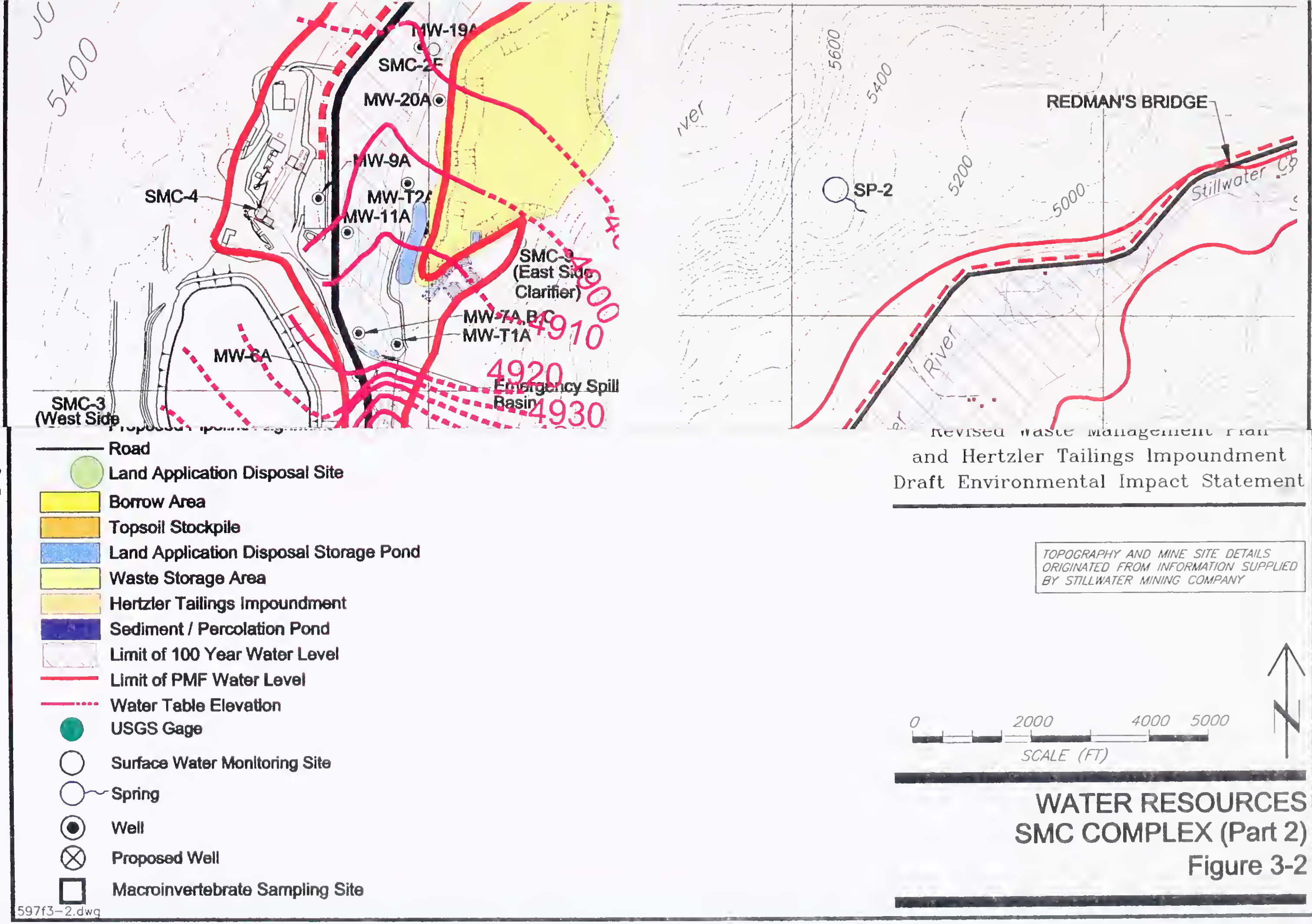
WATER RESOURCES
Hertzler Area (Part 1)
Figure 3-1



MW-19A
SMC-2E
MW-20A
MW-9A
MW-T2A
MW-11A
SMC-4
SMC-3 (East Side Clarifier)
MW-7A,B,C
MW-T1A
MW-6A
SMC-3 (West Side)
Emergency Spill Basin
4900
4910
4920
4930
5400
5600
5200
5000
SP-2
REDMAN'S BRIDGE
Stillwater
River
Road
Land Application Disposal Site
Borrow Area
Topsoil Stockpile
Land Application Disposal Storage Pond
Waste Storage Area
Hertzler Tailings Impoundment
Sediment / Percolation Pond
Limit of 100 Year Water Level
Limit of PMF Water Level
Water Table Elevation
USGS Gage
Surface Water Monitoring Site
Spring
Well
Proposed Well
Macroinvertebrate Sampling Site
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and Hertzler Tailings Impoundment
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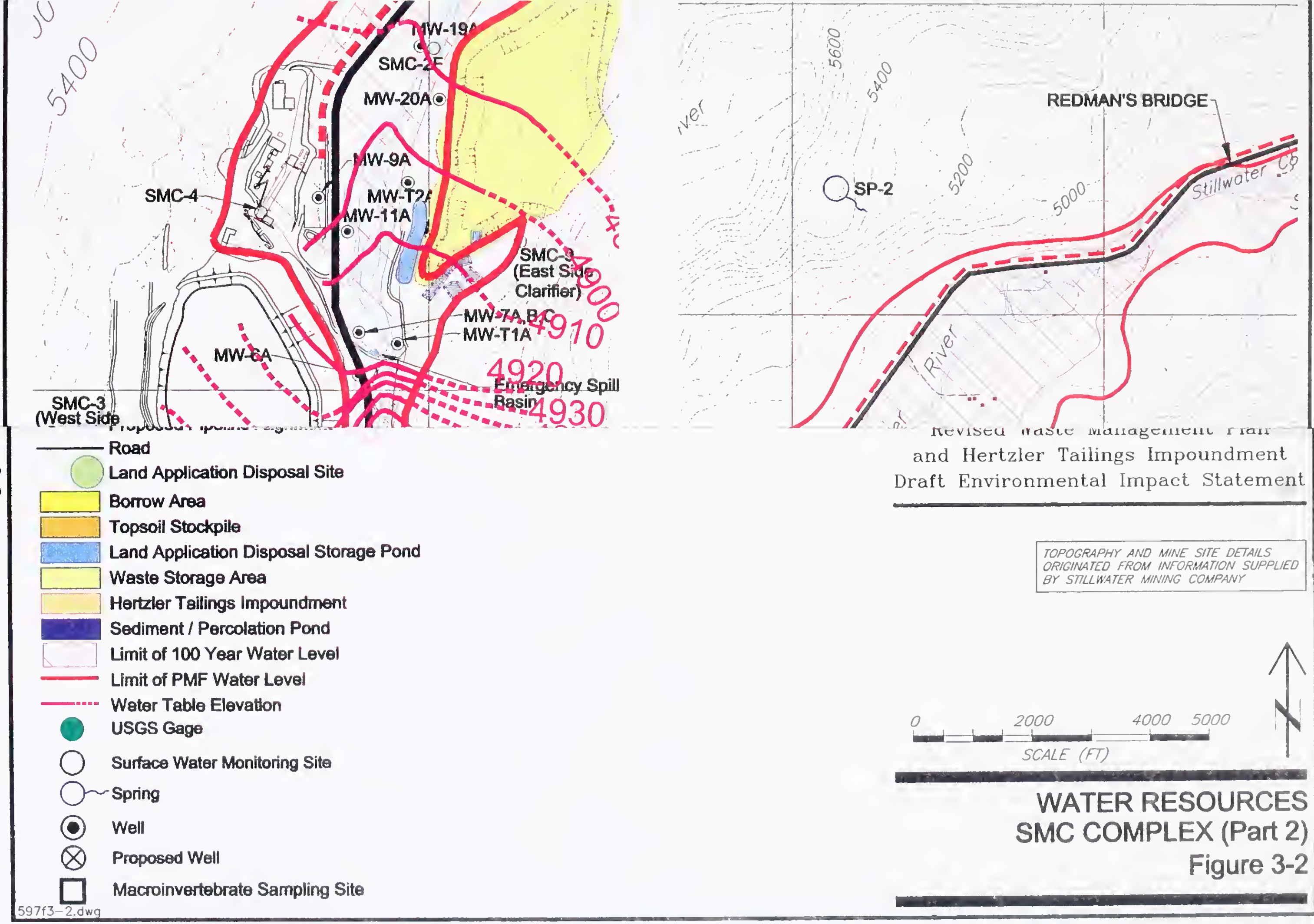
WATER RESOURCES
SMC COMPLEX (Part 2)
Figure 3-2



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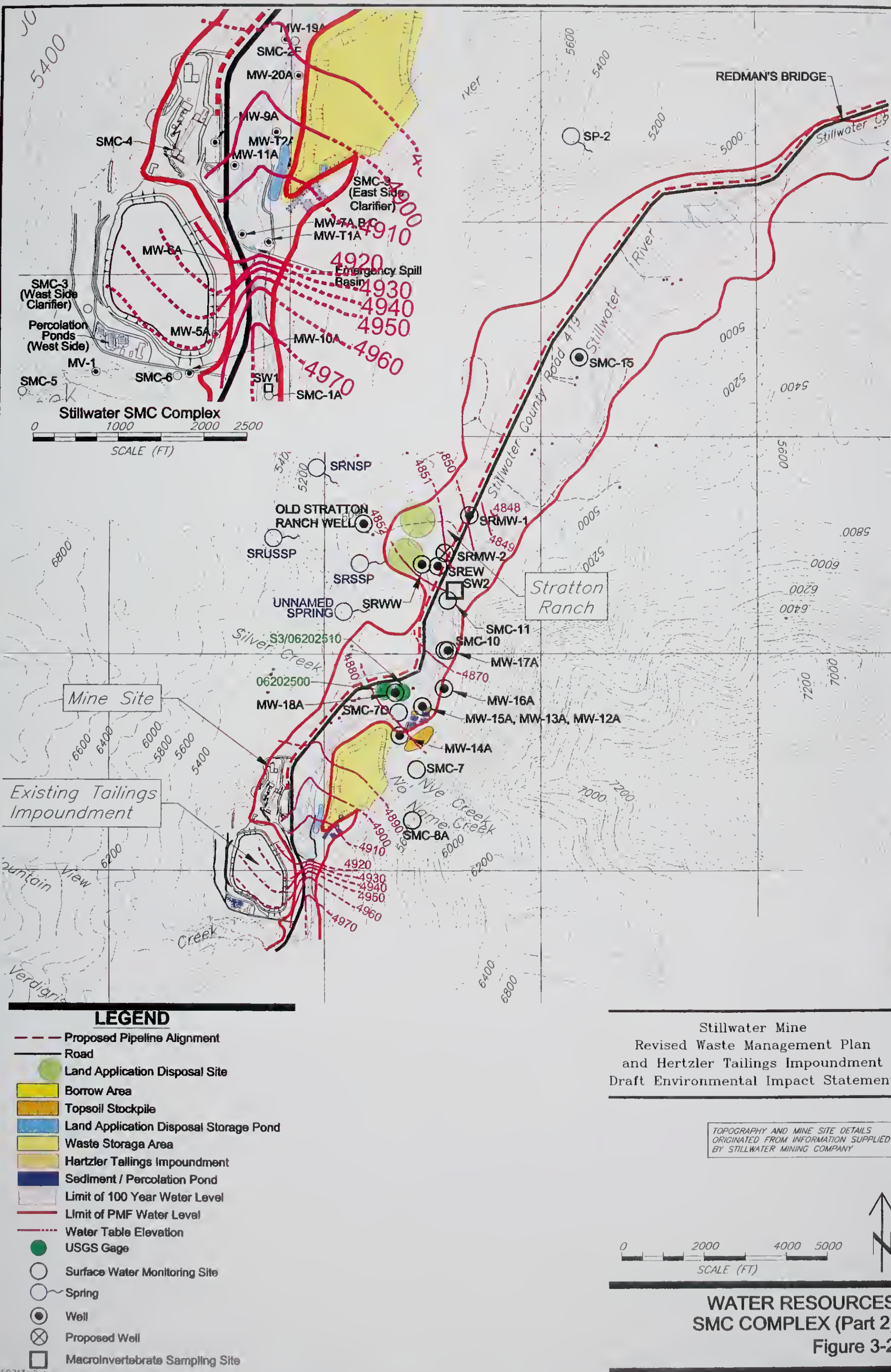
WATER RESOURCES
SMC COMPLEX (Part 2)
Figure 3-2



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WATER RESOURCES
SMC COMPLEX (Part 2)
Figure 3-2

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. 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.

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3.1.2 Surface Water Quality

3.1.2.1 Stillwater Mine Site

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**).

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, except during periods of high flow. 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).

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). For example, the maximum concentrations of cadmium, copper, lead, and zinc observed at the upstream site exceed the chronic aquatic standard (**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 are a result of the weathering of ultrabasic rocks of the Stillwater Complex and as a result of LAD application of adit water enriched in these constituents.

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	<1	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)

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). 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 standards set by the EPA for drinking and domestic water supplies (CDM 1981).

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 EPA drinking water standards; however, chromium levels have been shown to be somewhat elevated.

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. 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.

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

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.

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 0.08 to 0.25 mg/L at SMC–11 and 0.14–0.24 mg/L at SMC–15. 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.

Waters in the two small, poorly-developed coulees, Robinson Draw, Stanley Coulee, and Tandy Coulee occasionally exceed human health drinking water quality standards for fecal coliform and sulfates. Additionally, runoff from Robinson Draw, Stanley Coulee, and Tandy Coulee occasionally contains constituents (cadmium and iron) above Montana standards set for human health. 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 and rain 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, fractured aquifers result in initial mine 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).

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. Water from these bedrock sources probably contributes to the poor quality of water in Verdigris and Nye creeks.

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. 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 only rarely.

Table 3–3 Surface Water Discharge Water Quality

Parameters[1]	Adit Water Merged SMC-3 and SMC-9 Minimum	Maximum	Mean[2]	N[3]	Process Water SMC-4 Minimum	Maximum	Mean[2]	N[3]	Standards Aquatic 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	1390	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	0.002	<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	0.54	<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)

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 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 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.

Three alluvial wells were located in the area now covered by SMC's mine tailings impoundment. Water from these wells exceeded Montana's human health water quality standards for the following constituents: total dissolved solids, iron, lead, chromium, and selenium. Five other 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**).

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)

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)

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 (pending approval by DEQ) are within compliance of human health water quality standards and would not preclude the use of the groundwater for drinking water or other purposes.

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

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

	Upgradient LAD Sites Merge: MW-T1A, MW-14A				Downgradient LAD Sites MW-18A				Standards	
Parameter[1]	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 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. These sites show dissolved chromium exceeding the human health water quality standard, but all other parameters were within than the 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 to concentrations ranging from 1.93 to 2.34 mg/L and 1.97 to 3.1 mg/L, respectively. Hydrometrics (1996a) identifies 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 up to several hundred feet of unconsolidated glacial and alluvial deposits. Groundwater is available in the sedimentary units, but generally is not used where more reliable near-surface water in unconsolidated deposits exists. Overlying unconsolidated surficial deposits generally can produce greater quantities of groundwater and at more predictable depths than the bedrock strata.

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 through the basal coarse-grained deposits (primarily cleaned glacial outwash) 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).

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 springs that produce water from the alluvial aquifer in abandoned stream channels. The springs have reported flows ranging from 12.5 to 126 gpm. Water rights have been filed on five of the springs. All are located upgradient of proposed activities.

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.

The quality of groundwater in the unconsolidated deposits of the Hertzler Valley is poor to excellent, depending on what the water is used for. All six observation wells drilled in the area 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. 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. 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. 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.

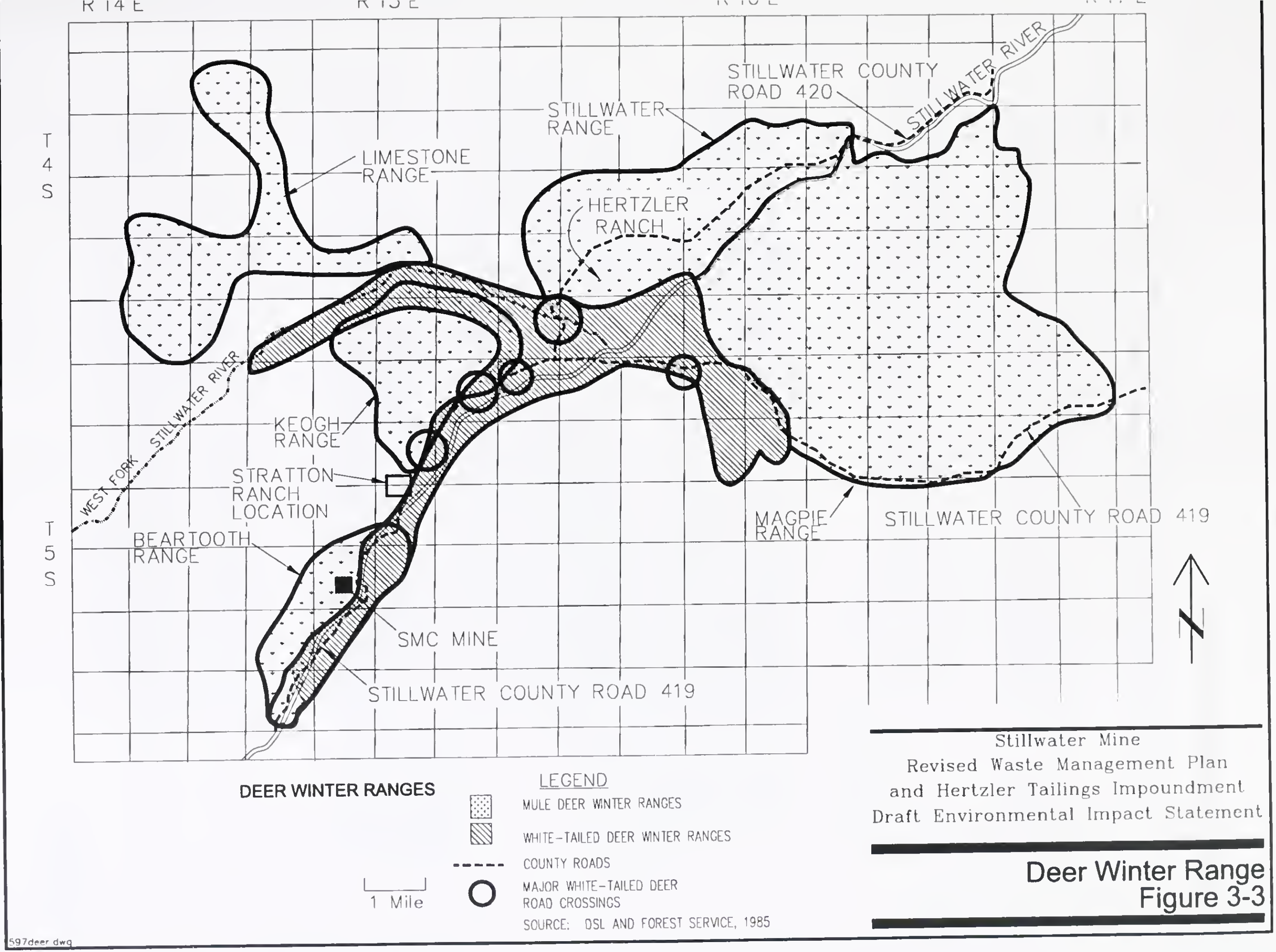
3.2.1.1.3 White-tailed Deer

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

Deer Winter Range
Figure 3-3

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. Resident grizzly bears in the project area are unlikely because the project area is not large enough to encompass the home range of an individual bear. 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.

An exception to these high quality conditions were found in three tributary streams (Verdigris Creek, Mountain View Creek, and Nye Creek). These streams had varying degrees of degraded aquatic habitat conditions. These conditions appeared to be caused by natural geologic sources and historic mining-related disturbances (e.g., wind-blown tailings).

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.

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.

3.1.1.2 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 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

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.

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.

3.1.1.3 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 B** 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 ($\mu g/m3$).
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

By 1996, the civilian labor force in Stillwater County consisted of 4,135 individuals. About 3,879 of these individuals were employed in the County. Another 256 persons, or 6.2 percent of the labor force, were unemployed. This rate increased from the 4.5 percent unemployment rate the County experienced the previous year. This rate also was higher than the annual statewide average unemployment of 5.3 percent (Montana Department of Labor 1997).

The distribution of employment for Stillwater County by industry for 1996 is shown in **Table 3–9**. 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 1997, employment at the Stillwater mine was 620 employees (Gilbert 1997, pers. comm.). This level of employment represents about a 35 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.

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.

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 3–11 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 User's Association is a cooperative that provides, for each purchasing property owner, potable water and treatment. 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. All solid waste collected is disposed of in 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 Billings Landfill and 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.**

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.

3.5.7.6 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.

3.5.7.7 Fire Protection

Four fire districts exist in the County. Absarokee, Broadview (encompasses parts of four counties), and Park City have active districts. The Columbus area district is inactive. 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.

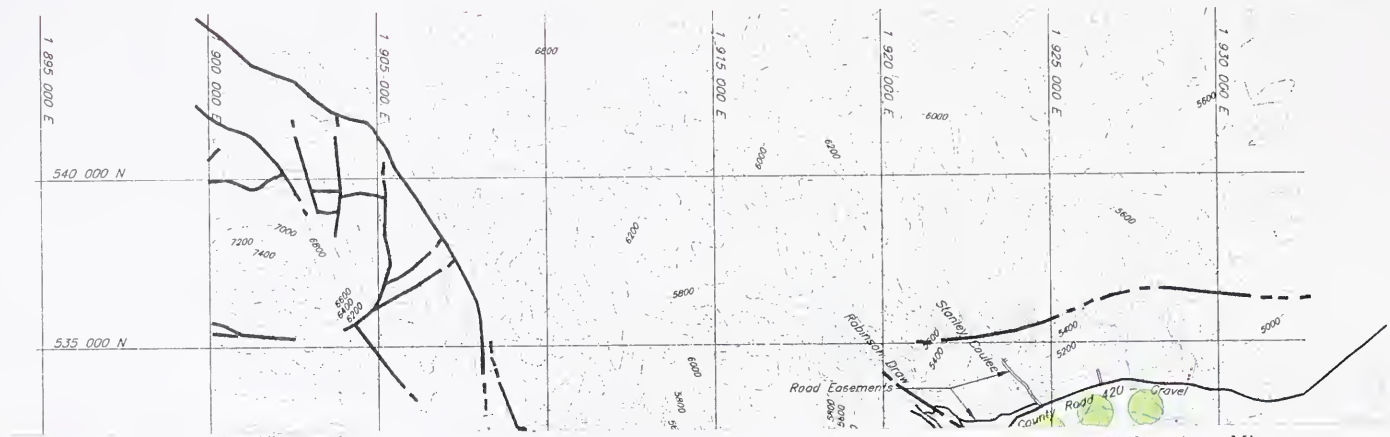
The 1959 Hebgen Lake earthquake, with its epicenter 30 miles to the west-southwest of the site, measured 7.1 on the Richter scale. Ground shaking at Nye caused a water main to break, foundations to crack, and initiated several rock falls. Earthquakes that are most likely to create future ground shaking in the Stillwater River valley will have their origin in the Hebgen Lake – Yellowstone Park area (CDM 1981).

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



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

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

0 2000 4000 10000
SCALE (FT)

Geologic Faults

Figure 3-4

597FAULTS.DWG

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
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  (Dashed where inferred; dotted where concealed)
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  (Sawteeth on upper plate)

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0 2000 4000 10000
SCALE (FT)

N

Geologic Faults

Figure 3-4

997FAULTS.DWG

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 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).

a third of the way across the Stillwater Valley along the southern edge of the ranch.

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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.

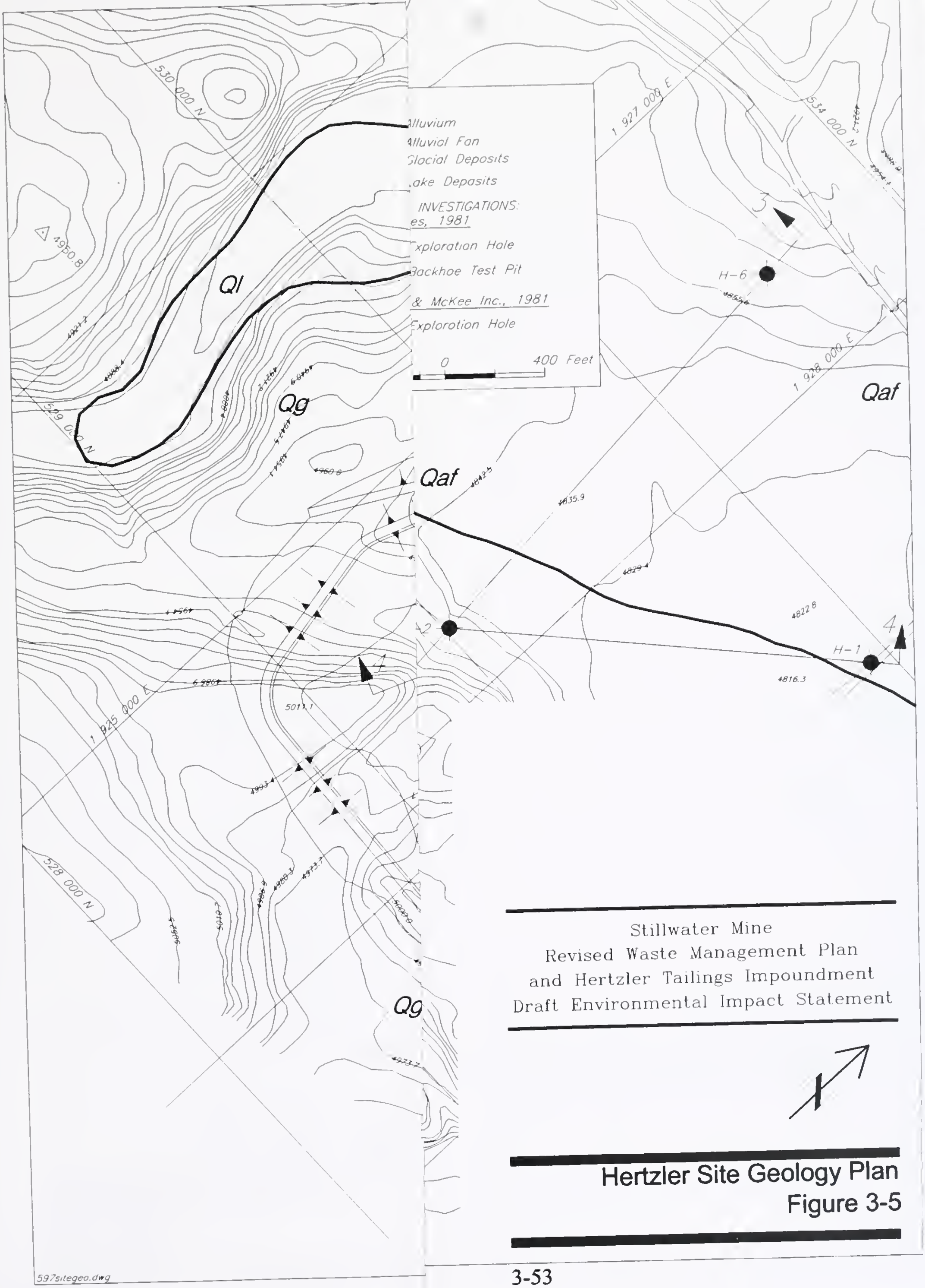
The VQO for lands in the CNF's Management Area E include Retention, Partial Retention, and Modification (Forest Service 1986a). The CNF's Forest Plan also states, "Short-term degradation will likely occur during mineral development that will not meet the assigned VQO of the area. Emphasis will be on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

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



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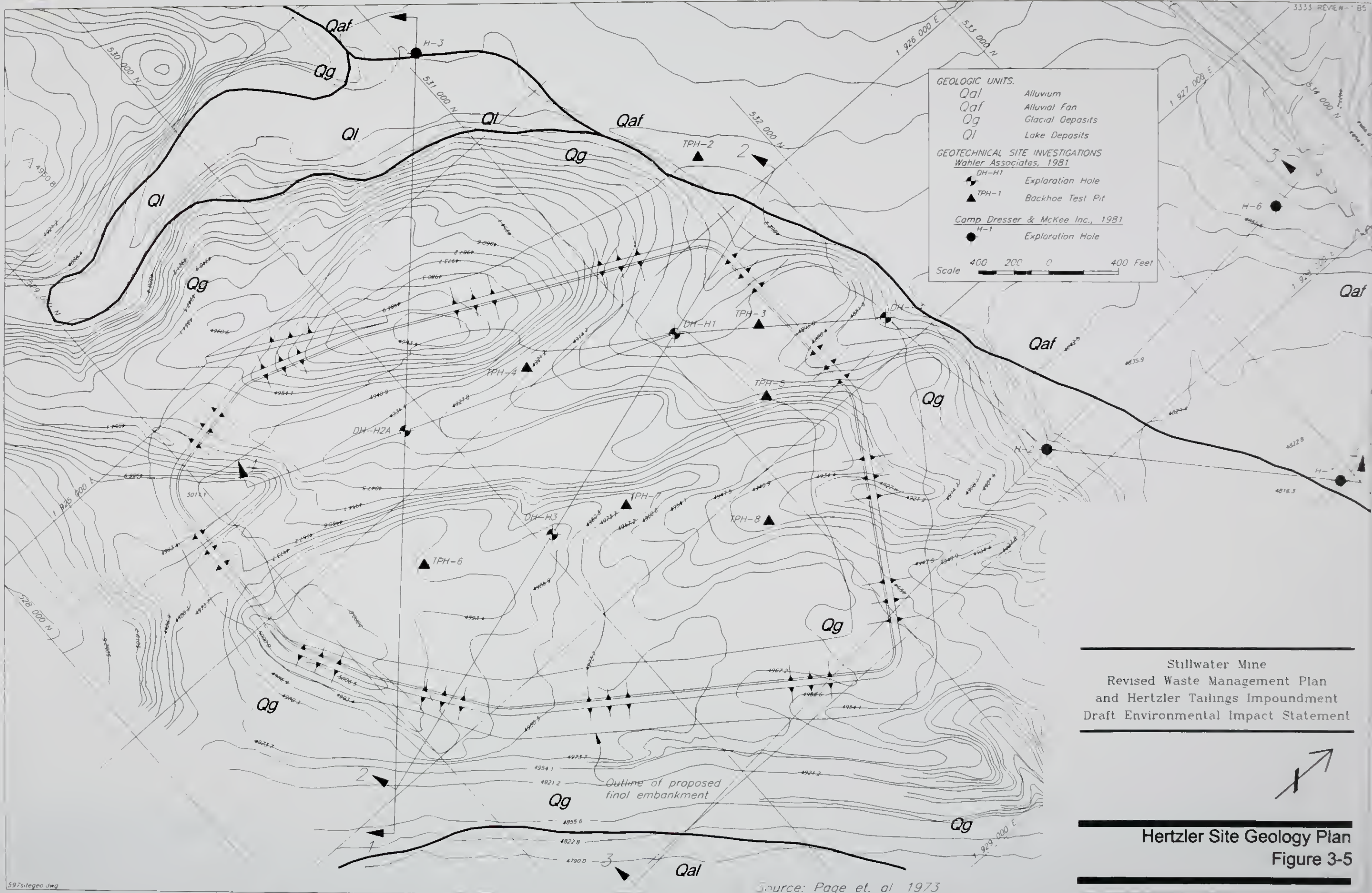
Hertzler Site Geology Plan
Figure 3-5



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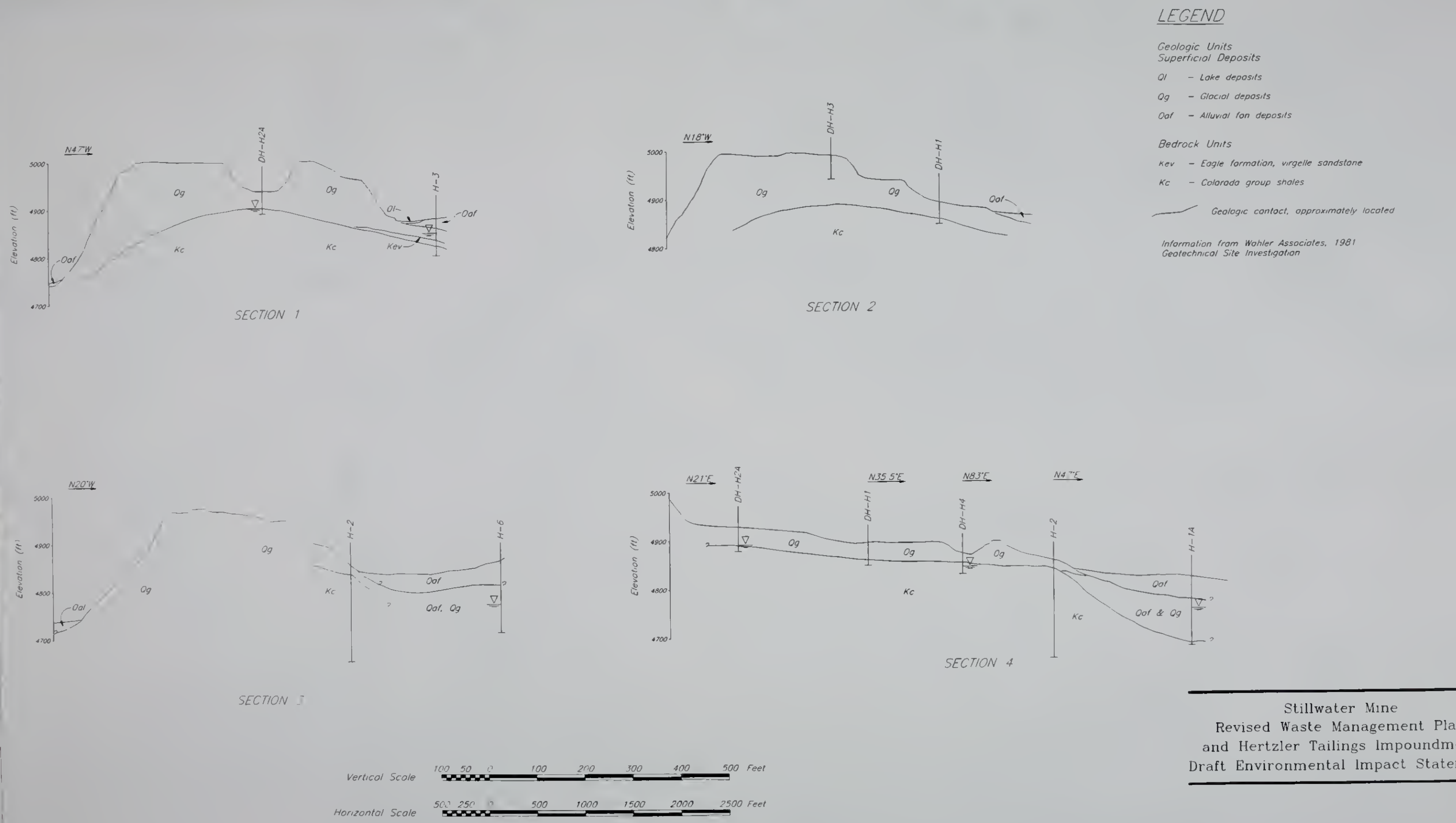
Hertzler Site Geology Plan
Figure 3-5



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Geological Cross-Sections for Hertzler Ranch
Figure 3-6

Source: Page etal. 1973

LEGEND

Geologic Units
Superficial Deposits

Ql – Lake deposits

Qg – Glacial deposits

Qaf – Alluvial fan deposits

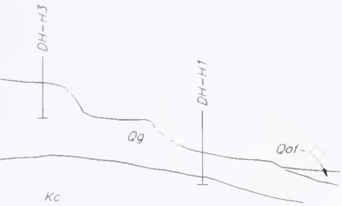
Bedrock Units

Kev – Eagle formation, virgelle sandstone

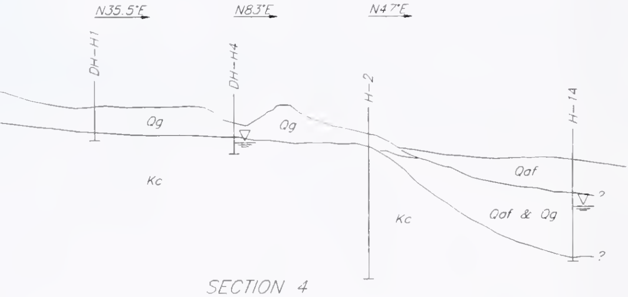
Kc – Colorado group shales

Geologic contact, approximately located

Information from Wahler Associates, 1981
Geotechnical Site Investigation



SECTION 2



SECTION 4

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Geological Cross-Sections for Hertzler Ranch
Figure 3-6

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, light-colored 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). Noise from beepers on vehicles operating at the mine can be noticeable to local residents living within 0.5 mile of the project site. However, SMC has fitted all 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 the condition because legal reviews have determined it lies outside the agencies' jurisdiction. 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 (22.5 miles, junction of Hwy 78 south of Absarokee to local road north of Nye)	595	818	803
Secondary 420 (6.9 miles, junction of Hwy 78 at Absarokee to local road 7 miles west)	402	427	442
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: Montana Department of Transportation 1997

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.

3.10.1.3 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. Additionally, about 26 percent of the ranch has been plowed.

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.

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).

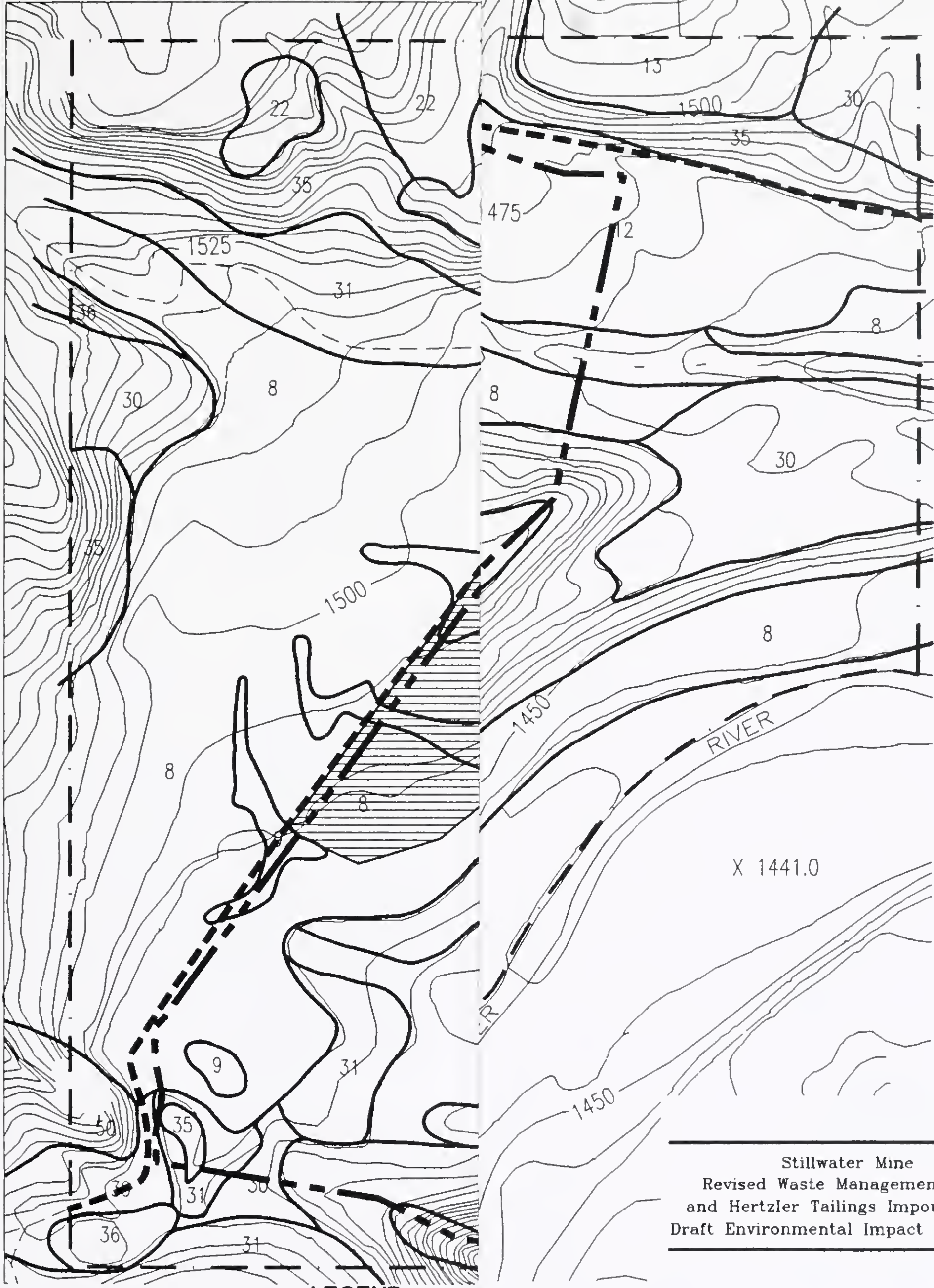
Table 3–15 Vegetation Categories and Types in the Stillwater Mine Project Area

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 (Westtech1996a). 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



LEGEND

1 = Lolo very gravely loam, 0 to 4% slopes, flooded
2 = Nesda gravely loam, 0 to 4% slopes, flooded
5 = Cryofluvents — Cryoaquolls complex, 0 to 4% slop
8 = Lolo cobby loam, 0 to 4% slopes
9 = Nesda gravely sandy loam, 0 to 4% slopes
11 = Turner clay loam, 0 to 4% slopes
12 = Turner clay loam, 4 to 8% slopes
13 = Turner stony clay loam, 4 to 15% slopes
22 = Absarokee — Sinnigam clay loams, 8 to 15% slo

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N

Distribution of Soils at Hertzler Ranch
Figure 3-7

LEGEND

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13 = Turner stony clay loam, 4 to 15% slopes
22 = Absorokee – Sinnigam clay looms, 8 to 15% slopes
24 = Work loam, 2 to 8% slopes
30 = Sebud stony loam, 4 to 25% slopes
31 = Sebud stony loam, 25 to 50% slopes
35 = Hilger – Costner – Rock outcrop complex, 25 to 60% slopes
36 = Winkler – Hilger – Rock outcrop association, steep slopes
50 = Rock outcrop – Costner association, steep slopes

= Stillwater County Road 420
= Permit Boundry
= Interseeded Pastureland

Source: DSL and Forest Service, 1985

0 2000 4000 6000
SCALE (FT)

597soils.dwg

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Draft Environmental Impact Statement

Distribution of Soils at Hertzler Ranch
Figure 3-7

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 noxious weeds, Stillwater County has found that sheep and goats will 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.

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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, page5–9 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.

3.12.2 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 and no potentially-significant resources had been reported in those locations. The Stratton Ranch LAD area, involving limited surface disturbance for two small percolation ponds and two LAD pivots, has not been covered by intensive surface inventory. A single undocumented site was recorded for the project area (24ST306), and the effect that the project might have on previously recorded sites was assessed.

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. The project areas included the proposed east side waste storage site, which is largely covered by existing mine tailings and waste dumps. The Stratton Ranch LAD area has not been surveyed intensively, as far as can be determined from available reports and maps. Surveys in nearby areas indicate this area has potential to contain historic homestead related sites and a lesser potential to contain significant prehistoric sites.

3.12.3 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.

3.12.4 Known Resources

Twenty-two cultural resources had been recorded within 100 meters of the proposed pipelines and tailings impoundment (**Table 3–16**). Five are considered eligible for the National Register of Historic Places (24ST50, 24ST54, 24ST69, 24ST306, and 24ST401). The Ekwortzel Ring site (24ST50) is close to the proposed tailings impoundment. The Guthrie Ring Site (24ST54) is crossed by the proposed pipeline corridor. The Ruppel site (24ST69) is within the survey area, but outside the areas of direct effect. The Rocky Pass Site (24ST306), consisting of stone features and traces of wagon roads, is crossed by the proposed pipeline corridor. The Keogh Bison Jump (24ST401) is a National Register site that is specifically mentioned in the Montana state preservation plan and in several regional syntheses of cultural chronology. Lahren (1997) also suggests the Keogh site may be the Long Ridge Kill Site of Crow Indian tradition.

Table 3–16 Known Cultural Resources near the Proposed Pipeline Corridor and Tailings Impoundment

Site #	Name	Site Type	Recorded by:	Testing or Re-evaluation:	Evaluation
24ST50	Ekwortzel	stone rings	WCRM 1981		eligible
24ST51		wagon road	WCRM 1981		not eligible
24ST52	Nye Burial	Burial/Cave	WCRM 1981		unknown
24ST53	Southworth	homestead	WCRM 1981		not eligible
24ST54	Guthrie	stone rings	WCRM 1981	Rosillon and McCormick 1991	eligible
24ST56		cairn	WCRM 1981		not eligible
24ST57		cairn	WCRM 1981		not eligible
24ST58	Nickel Camp	mine	WCRM 1981		not eligible
24ST60	Lake Camp	mining camp	WCRM 1981		not eligible
24ST61		cairn	WCRM 1981		not eligible
24ST62		powder house	WCRM 1981		not eligible
24ST63	Willis	homestead	WCRM 1981		not eligible
24ST66	Hertzler Mine	coal mine	WCRM 1981		not eligible
24ST67	Mouat	homestead	WCRM 1981	HRA 1984	not eligible
24ST68		cairn	WCRM 1981		not eligible
24ST69	Ruppel	stone rings	WCRM 1981		eligible
24ST70		mine	WCRM 1981		not eligible
24ST99		hunting blind	Ryan	Rosillon and McCormick 1991	unknown
24ST156	Mouat Mine	mining site	GCM 1988		not eligible
24ST218		claim marker	Rosillon and McCormick 1991		not eligible
24ST306	Rocky Pass	stone rings; rock lines	Lahren 1997		potentially eligible
24ST401	Keogh	Bison Jump	Malouf and Connor 1962	Lahren 1997	eligible

3.12.5 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 epidemics of the early 1800s, were numerous in the early historic period and, unlike many tribes, maintained a comparatively large population. Well-intentioned attempts of missionaries and government agents to "civilize" the Indians were less effective in eradicating traditions and cohesiveness among the Crow than among many tribes Many of the traits that are popularly associated with the Plains Equestrian cultures are typical of the historic Crow. Personal vision quests for guardian spirits are important in their world view and the Sun Dance has been an important element in their tribal interactions. The traditional Crow world view sees the world as an interactive whole infused with spiritual power and many features of the landscape or locations of traditional events are very tangible traditional cultural properties to the Crow people.

The Crow, like the Lakota and Assiniboine at the time of sustained American presence in the region, were a powerful and actively-expanding group who had gained control in the region as powerful middlemen from horticultural village ancestry. These were in no way marginal groups displaced by American expansion. Where prominent Lakota leaders like Red Cloud, Sitting Bull, and Crazy Horse confronted American encroachments with pride and defiance, Crow leaders, such as Plenty Coups, recognized American supremacy and attempted to negotiate advantageous treaties and settlements. Nonetheless, Crow territory was relentlessly reduced and the frustration and discontent of young warriors contributed to a brief uprising in 1887.

Chapter 4.0 — Environmental Consequences

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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.

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 which have been previously disturbed. 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, 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. Removal of the LAD sites would decrease the nitrates in the soils and groundwater immediately below the pivots. 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. Some water might leach nitrates into the adjacent alluvium over time.

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. 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. 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 87.46 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 5 percent soil porosity, and an estimated thickness of 150 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 11.3 lbs/day from the waste rock storage site. 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).

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 Stratton Ranch LAD sites would be supported directly by the pipeline. These circles would take adit water, which is at or slightly below the human health standard for nitrates, and irrigate two fields of Garrison creeping meadow foxtail grass, a high nitrogen uptake species.

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.

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 1996). LAD application rates of 600 gpm of adit water containing nitrate-nitrogen concentrations of 8 mg/L were modeled 500 feet downgradient from the LAD. These predictions indicated maximum concentrations of 7.3 mg/L. Actual nitrate concentrations are anticipated to be much lower due to vegetative uptake and evapotranspiration.

During 1996, the LAD system irrigated 41.5 acres with 1,024 acre-feet of the 11,750 acre-feet of water produced. 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 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.

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 2.5:1 (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 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 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 treat as much as 2,000 gpm of mine adit discharge water. 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.

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 7,500 feet east along the Hertzler Valley towards the Stillwater River before reaching the river.

Mixing projections (SMC 1996) 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 would be 0.789 mg/L. Nitrate concentrations in the Stillwater River following mixing during a 10-year, 7-day low flow would increase by 0.017 mg/L to 0.517 mg/L nitrate-nitrogen. Actual nitrate concentrations are anticipated to be much lower due to uptake by vegetation, evapotranspiration and higher flow in the Stillwater River.

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 impoundment may exhibit low to moderate rates of infiltration, depending on the water level and the resulting head. Adit water seepage would migrate north before entering the main eastern trend of the Hertzler Valley and moving 11,000 feet towards the Stillwater River slowly over time.

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. 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. 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 insulate the pipeline to prevent freezing using the same technology currently being used on Alaskan pipelines.

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 at a crossing of the West Fork of the Stillwater River, flow in the channel 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. A breach in the adit discharge line would release waters with a concentration of nitrate-nitrogen near 8 mg/L. These would be diluted rapidly downstream by stream volume. A breach in the recycled tailings water line also would release water with elevated concentrations of TDS.

4.1.1.3 Alternative C — Modified Expansion of Existing Tailings Impoundment and Hertzler Ranch 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 Expansion of Existing Tailings Impoundment and East Stillwater Site 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 5,100 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.

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 Alternative B. 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 similar impacts as 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 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. 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.

4.1.3 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 discharge to surface waters, SMC would sample and report the discharge as required by its approved stormwater MPDES Permit.

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**.

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 result in the direct loss of an estimated 319 acres of terrestrial wildlife habitats, until such habitats are reclaimed, in addition to the 255 acres of disturbance already permitted within the existing permit area. Approximately 68 acres of this additional loss would be associated with the proposed east side waste rock storage site near the existing Stillwater Mine. Another 250 acres would be associated with the development of facilities at the Hertzler Ranch Area.

All the 319 total acres disturbed under this alternative would be reclaimed following mine closure. The disturbance of these 319 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.

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. The LAD sites at Hertzler Ranch have been heavily grazed by domestic livestock and currently offer little value to wildlife. Additionally, SMC has been mining aggregate from the 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 could 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 likely 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 or indirect effect to Stillwater bighorn sheep herd (one of only 13 native herds left in Montana). Four 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.

Third, the increase in human activity associated with the construction of the east side waste rock storage site is not expected to indirectly affect bighorn sheep using winter range higher on the mountainsides above the site. Mining-related activities have been occurring in this area for several years and monitoring suggests the sheep occupying habitats within the Stillwater Mine's immediate environs have "habituated" to mine-related activities. Monitoring conducted in 1996 indicated they have retained this tolerance and some researchers (e.g., Van Dyke, et al. 1983) have determined bighorn sheep can become accustomed to vehicular traffic. In addition, the sheep occur primarily higher on the slopes above the east side waste storage site away from the disturbance.

Fourth, mitigation measures developed through the previous MEPA/NEPA analyses and implemented via their associated decision documents would continue to help minimize the Stillwater Mine's effects on bighorn sheep. Mitigation measures implemented by DEQ and CNF through the previous decision documents would continue to occur if this alternative is selected by the decision makers.

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 short 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 impact approximately 250 acres of wildlife habitat. These habitats would be lost to use by wildlife until they are reclaimed at the end of the Hertzler impoundment's useful life.

<u>Bighorn Sheep</u>. 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.

<u>Mule Deer</u>. 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 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 these 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*

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 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 Ranch Site

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, long-term habitat loss would total some 285 acres. Approximately 68 acres of this loss is 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.

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 associated 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 91 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 1 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 Stillwater Site

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 in the direct disturbance of an additional 61 acres of wildlife habitats. 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, but slightly less than those associated with Alternative B.

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 decade. 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. 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.

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 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 at about the beginning of 2004, reducing the work force by about 628 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. 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 (2004) 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 628 people would end in 2004 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 will 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 will likely have negligible effects on fish and other aquatic life in the Stillwater River.

4.3.1.3 Alternative C – Modified Centerline Expansion and Hertzler Ranch Site

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 Stillwater 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 will 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 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.

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), water as necessary (west side)	90 (east side), 50 (west side)	8.22
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.
Source: SMC 1996

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 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.

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)	352.98	26.49	303.73

Source: SMC 1996

4.4.1.3 Alternative C — Modified Centerline Expansion and Hertzler Ranch Site

Under this alternative, impacts would be similar to Alternative B. Because the Hertzler Ranch tailings impoundment would be 72 acres smaller, the fugitive 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 Stillwater Site

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 B**). 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). When one tailings impoundment was out of service for any reason, a possible mitigation measure would be for SMC to 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 30 additional permanent employees under any of the action alternatives. Projections suggest about 60 percent (18 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 23 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 30 in-migrating workers and their families, as well as persons seeking secondary employment, would increase the population of Stillwater County by about 250 persons.

Table 4–3 SMC's Population Effects

Parameter	12/31/96 Level	Projected Addition	Total
Total In-migrating Population	1,004	250	1,254
In-migrating Elementary Students	183	36	219
In-migrating High School Students	67	13	80

Source: Richard 1997

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.

Table 4–4 SMC Employment

Parameter	Dec. 1996 Level	Additional Employment	Total
Mineral Development Employment/Contractors	620	30 permanent employees plus 50 contractors	650 permanent employees plus 50 contractors
In-migrating Mineral Employment/Contractors	347	18 permanent employees plus 50 contractors	390 permanent employees plus 50 contractors
In-migrating Secondary Employment	24	1	31
Total In-migrating Employment	371	69	421 permanent employees plus 50 contractors

Source Richard 1997

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 1 in-migrating employee would be expected. In-migrating secondary employment is estimated at approximately 7 percent of in-migrating mineral employment (Richard 1997).

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 250 persons would in-migrate to Stillwater County as a result of this project and would result in the creation of about 70 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

Table 4–5 Distribution of Impact Employees and Population

	1988 Plan	Levels: 12-31-95 Report	SMC Mine Expansion from 1995	Projected Totals After Mine Expansion	Change from 1988 Plan Through Expansion	Percent of 1988 Plan	Projected Percent After Mine Expansion
Impact Employment	320	325	146	471	151	1	100
Columbus	31	68	32	100		10	21
Rural Stillwater County	100	43	3	46	-54	31	10
Absarokee	177	101	53	154	-23	55	33
Nye		38	51	89			19
Carbon County		26	7	33	33		7
Other	12	49		49	37	4	10
Impact Population	830	930	418	1,254	424	100	1
Columbus	80	194	92	286	206	10	0
Rural Stillwater County	260	123	9	132	-128	31	10
Absarokee	460	289	152	440	-20	55	35
Nye		109	53	162			13
Carbon County		74	20	94	94	4	8
Other	30	140		140	110		11

Source: SMC 1997

estimated population influx predicted under the proposed mine expansion. It is projected that about 25 percent of the in-migrating population would seek housing in the town of Columbus, and 75 percent in Absarokee.

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.

About 33 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.

Table 4–6 Distribution of SMC Elementary and High School Students

	Current Levels: 12-31-96 Report	Projected Additions with Mine Expansion	Projected Totals with Mine Expansion	Current Percent Impact Students	Projected percent Impact Students
Elementary Students	170	49	219	1	1
Columbus	48	18	66	0	30
Absarokee	77	20	97	1	44
Fish tail	4	3	7	0	3
Nye	6	0-2	4	0	2
Carbon County	6	5	11	0	5
Other	29	5	34	0	16
High School Students	82	2	80	100	100
Columbus	18	5	23	0	29
Absarokee	45	0	45	1	56
Carbon County	8	2	6	0	8
Other	12	6	6	0	8

Assumptions: The distribution of elementary and high school students reflects the distribution of mineral employees.

Source: SMC 1997

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 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 any significant detrimental effects on local property values. 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.

4.5.1.2.7 Community Services

As stated earlier, about 33 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 80 new 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) also is being used by SMC as it amends its Hard Rock Impact Plan. The Hard Rock Impact Plan and the EIS use the same basic information. The Hard Rock Impact Plan would have to be approved before implementation of the project.

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.

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.

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 Ranch Site

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. 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 Stillwater 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 site would be intermediate between the existing tailings impoundment site and the Hertzler Ranch site. 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

No additional mitigation measures are proposed. Designs of the alternative tailings impoundments would meet the minimum engineering requirements for stability. Also, sufficient monitoring of construction would occur to ensure the impoundments are constructed to design specifications.

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

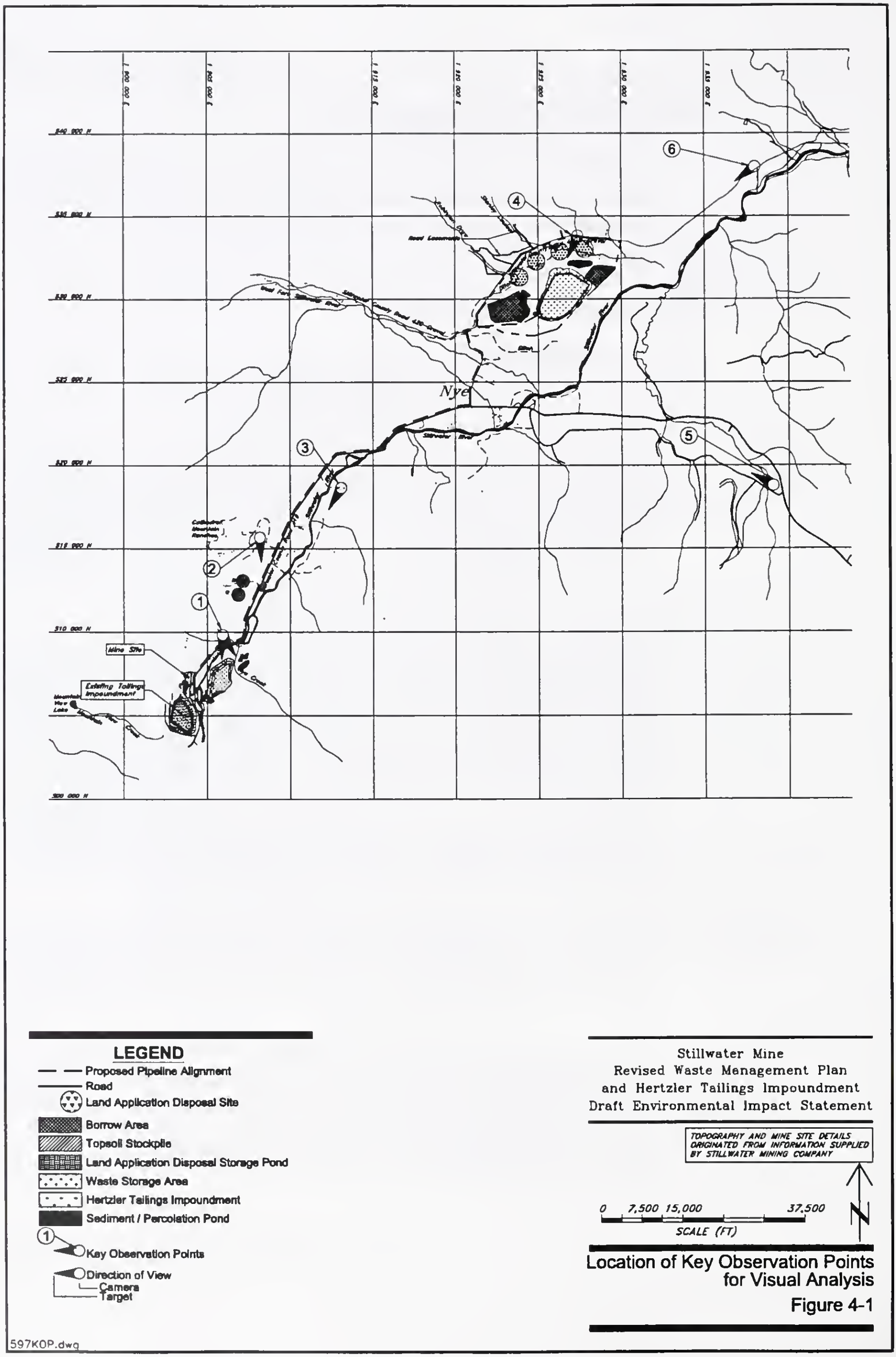
No additional impacts to visual resources would occur under this alternative beyond those previously disclosed and permitted. The existing condition of National Forest System lands in Management Area E and the Stillwater project area would be maintained under the current management direction as defined 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.



Location of Key Observation Points for Visual Analysis

Figure 4-1

597KOP.dwg

Stillwater Mine Site 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.

Pipeline Corridor The tailings pipelines would be buried in existing county road rights-of-way. 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

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 Ficility (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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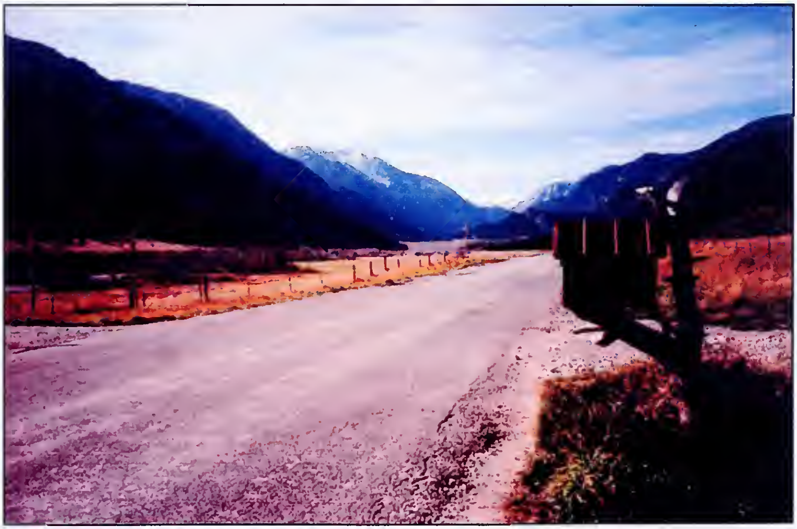
Existing Condition
Figure 4-4a View to the South from KOP 3 Located 1.2 miles South of Nye, Fall 1997.



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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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 Hertzler Ranch Proposed facilities (Alternative B) from KOP 4 After Reclamation, 2027. (Under Alternative C, Impoundment Would be Very Similar but 30 Feet Lower).

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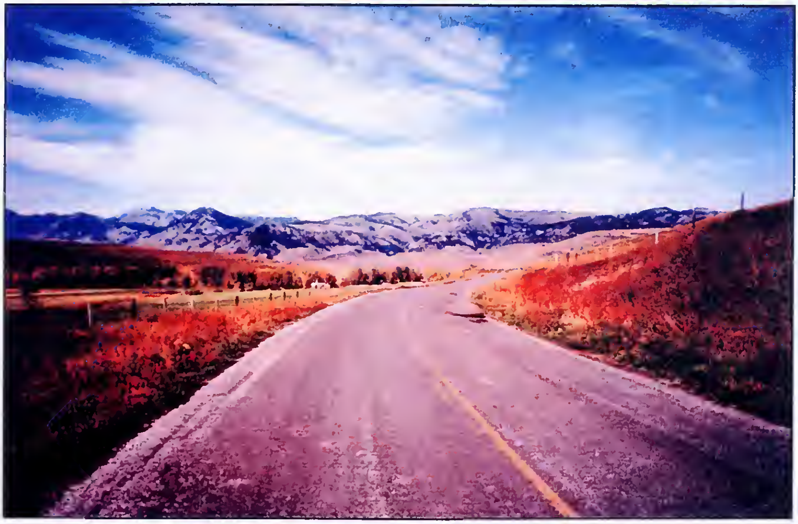
Existing Condition
Figure 4-6a View to the Northwest from KOP 5 Located 4 miles East of Nye, Fall 1997.



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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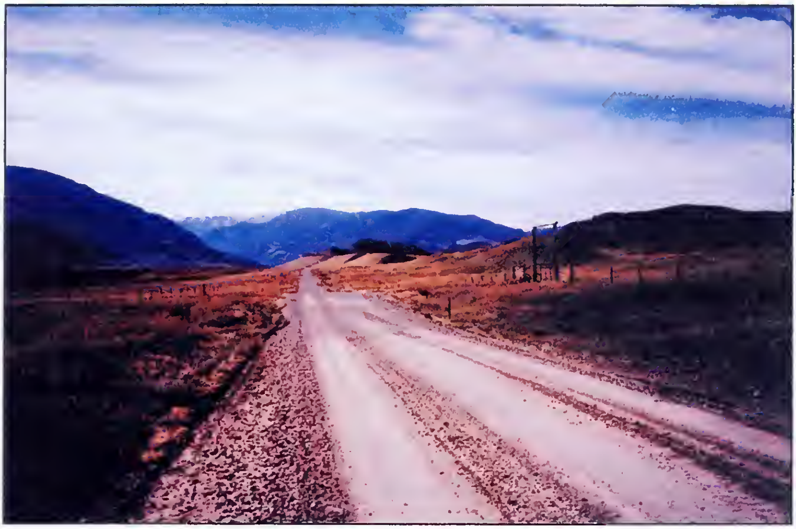

Figure 4-7a View to the Northwest from KOP 6 Located 0.3 miles South of Moraine Fishing Access, Fall 1997.

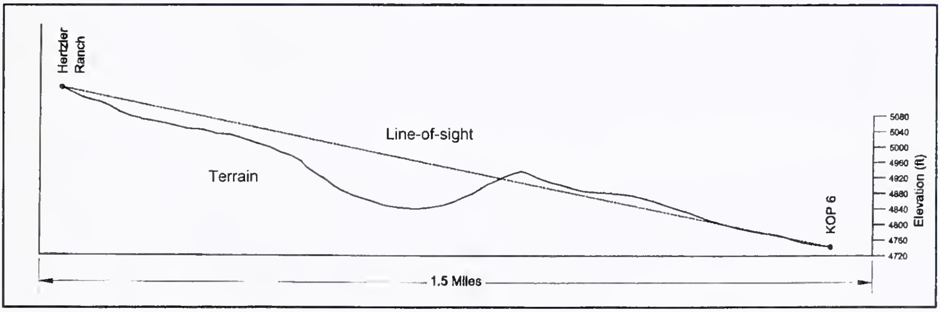

Figure 4-7b Cross Section of Terrain Between KOP 6 and Hertzler Ranch Showing Intervening Topography.

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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 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.

4.7.1.1.3 Alternative C — Modified Centerline Expansion and Hertzler Ranch Site

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 Stillwater 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 4.5.2.6** 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.

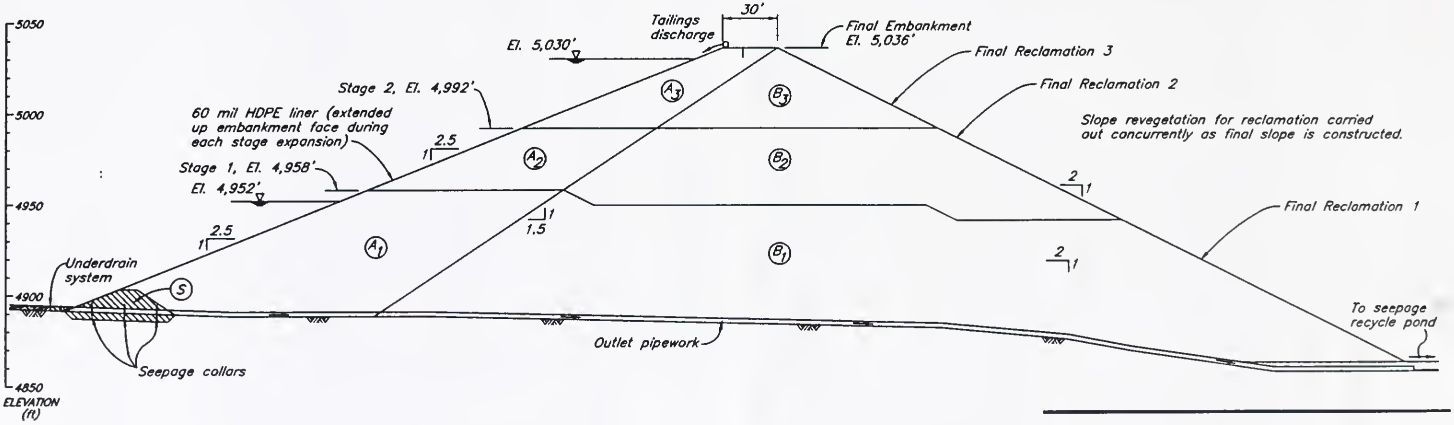
Modifications to the construction of the Hertzler tailings impoundment's embankment (**Figure 4–8**) would allow final reclamation of the outer slopes to occur soon after they were constructed and would limit redisturbance. This would minimize the visual impact during construction of the second lift.

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 construction of the pipelines and Hertzler Ranch tailings impoundment would not occur.



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 Impoundment Modified Cross Section of the Embankment
Figure 4-8

597cross-mod.dwg

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 Road 419. Noise from construction vehicles and equipment would be apparent to residents along Stillwater County Road 419 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 Ranch Site

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.

4.7.2.1.4 Alternative D — Modified Centerline Expansion and East Stillwater 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 Ranch Site

Lights and their potential impacts under this alternative would be the same as for Alternative B. The timing of these effects would be delayed because the Hertzler impoundment would not be constructed for a number of years.

4.7.3.1.4 Alternative D —Modified Centerline Expansion and East Stillwater Site

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.

4.7.3.1.5 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.

4.7.3.1.6 Mitigation Measures

If any action alternative is selected and implemented, SMC would apply mitigation it currently uses to minimize the amount of light visible off SMC's property. This mitigation 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.

There would be minor increases in traffic on Stillwater County Road 419 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 1996 employment level of 628, 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 27 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 Ranch Site

Under Alternative C, traffic impacts would be the same as under Alternative B.

4.8.1.4 Alternative D — Modified Centerline Expansion and East Stillwater Site

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 Impacts

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 would have to address possible mitigation measures for transportation impacts to Stillwater County roads.

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. 1997d) 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 145 acres have been previously disturbed at the mine site proper, and this proposal would disturb an additional 15 acres. 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 waste rock area. 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 15 acres might increase soil losses somewhat, but the increase would likely be undetectable in the Stillwater River.

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 275 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.

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			
Total Disturbance Area for Bonding	134		
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. (Note 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 (Note 3)	6	8	6,500
Misc. (Note 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.

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.

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			
Hertzler Ranch Disturbance Area for Bonding	502		
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

Soil salvage along the pipeline route would be restricted to approximately 12 inches depth on average. Soil stripping width along the entire pipeline route 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 Ranch and Alternative D — Modified Centerline Expansion and East Stillwater 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 23.5 acres of waste rock and 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 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 covered in the Stillwater Mine Expansion 2000 TPD EIS (DSL, DHES, and Forest Service 1992).

SMC currently has mitigation measures in place to minimize these sources. Reclamation to mitigate existing disturbances and restore 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.

Stillwater Mine Site Under the Proposed Action, the east side waste rock site would be expanded to cover 80 acres, 68 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 60 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.

Several new LAD sites and one LAD pond would be developed under this alternative, accounting for 122 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.

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 restore 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 Ranch Site

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. 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 Stillwater 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 reduction in native species diversity due to 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 permanent reduction in either the extent of native community or in the diversity of native species. Subsequently, the three action alternatives are not anticipated to contribute to any 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 eliminate 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 an interim 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 and revegetation) 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 are near or pass through four eligible sites (**Table 4–9**). Non eligible sites are discussed in Lahren 1997 and are not addressed here. No significant cultural resources exist at the east side waste storage site and none are known in the Stratton Ranch LAD area. In addition, the proposed east side waste storage site has had extensive previous surface disturbance and much of the area is currently mantled in mining wastes, spoils and tailings.

Table 4–9 Significant Cultural Resources and Areas of Concern in Project Area

Site #	Name	Site Type	Relation to Project	Evaluation	Effects
24ST50	Ekwortzel	stone rings	near tailings	Eligible	None
24ST54	Guthrie	stone rings	pipeline corridor	Not evaluated	Probably none, but additional work may be needed to confirm after final project design
24ST306	Rocky Pass	stone rings and alignments	near tailings	Eligible	None
24ST401	Keogh	bison jump	pipeline corridor	Eligible	None

The Ekwortzel Ring site (24ST50) was recorded by WCRM (1981) for the environmental baseline study as a prehistoric campsite, kill site, and stone ring site covering more than 300,000 square meters. Lahren (1997:9–2) indicates the cairns that were previously described as part of a bison kill feature were fencepost cairns and that the prehistoric portions of the site are southeast of the proposed tailings area, outside the areas of proposed impact.

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). Most of the site area is outside the proposed areas of disturbance and pipeline construction would be kept within previous disturbance.

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 four resources. The primary basis for this conclusion is that the pipelines would be constructed within the rights-of-way for Stillwater County roads 419 and 420. Also, no portions of these resources that contribute to the resources' eligibility occur within the projected extents of disturbance for the proposed Hertzler tailings impoundment.

4.10.1.3 Alternative C — Modified Centerline Expansion and Hertzler Ranch Site

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 Stillwater Site

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 four 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. Also, implementation of any of the alternatives would not contribute to an increase in visitation to the site areas or changes in air quality or local hydrology that would be likely to have indirect cumulative effects on these cultural resources.

4.10.3 Mitigation Measures

Because no significant direct, indirect, or cumulative effects would occur with the implementation of any of the alternatives, no additional mitigation measures are proposed.

4.11 Unavoidable Adverse Effects

The Proposed Action would disturb approximately 275 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 678 acres would be changed from the current vegetation community of native and introduced (agricultural) species to a different community after reclamation.

Wildlife Habitat — Approximately 319 acres would be affected in the long-term, but would be available for wildlife after mining ceases. Approximately 88 acres of winter range would be affected in the short-term.

Social and Economics — Approximately 132 new residents would be expected to enter the local communities, including 23 elementary and 8 high school students. This potential increase in the mine worker population is sufficient to trigger a modification to SMC's Hard Rock Impact Plan.

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 72 new jobs, 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 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.

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 draft 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 Draft 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
Pat Driscoll	Air Quality	B.S. Environmental Engineering 19 years of experience
Joe Gurrieri	Hydrology	B.A. Geography M.S. Geology 14 years of experience
Pat Plantenberg	Reclamation	B.S. Plant and Soil/Recreation Area Management M.S. Range Science/Land Rehabilitation 18 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 B.A. Geology 15 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

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Randy Schroeder	Principal-in-Charge	B.S. Natural Resource Management M.S. Environmental Science 22 years of experience
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Mike Bonar	Wildlife/Threatened or Endangered Species	B.S. Environmental Biology 8 years of experience
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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
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Lisa Welch	Land Use, Recreation	B.S. Earth Sciences 7 years of experience
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Name	Project Responsibility	Education
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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 Draft EIS

The following list identifies the agencies, organizations, and persons to whom the Draft 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
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.
Christensen, S. M.
Cluett, L.
Connor, H.
Coulter, J. E.
Degele, J.
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Doely, E.
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Egan, C.
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Fain, B.
Fisher, D. B.
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, L. and D.
Johnson, C.
Johnson, R. and B.
Johnson, S. and D.
Kamos, D.
Karnos, 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.
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.
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.
Trees, J.
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

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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.

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.

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 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.

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

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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 Ton 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 – Preliminary Determination of the Air Quality Permit Application

DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMITTING AND COMPLIANCE DIVISION
Air and Waste Management Bureau

MARC RACICOT, GOVERNOR

(406) 444-3490
FAX (406) 444-1499

STATE OF MONTANA

OFFICE: METCALF BUILDING
ADDRESS: 1520 E 6TH AVENUE

PO BOX 200901
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

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. ARM 17.8.110, Malfunctions. 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. ARM 17.8.111, Circumvention. 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. ARM 17.8.304, Visible Air Contaminants. No person may cause or authorize emissions to be discharged into the outdoor atmosphere from any source installed after November 23, 1968, that exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

2. ARM 17.8.308, Particulate Matter, Airborne. 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. ARM 17.8.309, Particulate Matter, Fuel Burning Equipment. 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 C – Biological Assessment

Biological Assessment 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

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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 Road 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 288 acres of 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 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. However, dead animals are removed from along the roads so little risk exists to bald eagles. 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.

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. Resident grizzly bears in the project area are unlikely because the project area is not large enough to encompass the home range of an individual bear. 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 if road-killed wildlife is 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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Western Technology and Engineering, Inc. 1996. Terrestrial Wildlife Reconnaissance: Stillwater Mining Company Hertzler Tailings Facility and Tailings Line — 1996. Western Technology and Engineering, Inc., Helena, Montana. 26 pages + appendices.

Appendix D — Biological Evaluation

Biological Evaluation for the Stillwater Mining Company's Revised Waste Management Plan

March 1998

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3/2/98

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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*, *Thalapsi 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.
Thalapsi 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.