States Department of the Interior
of Land Management
Lewistown District Office

State of Montana
Department of Environmental Quality
Hard Rock Bureau

August 1995

Executive Summary
Draft Environmental Impact Statement
Zortman and Landusky Mines
Reclamation Plan Modifications and Mine Life Extensions

Historic Ruby Mill near the town of Zortman

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based on the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation; rangelands; timber; minerals; watershed; fish and wildlife; wilderness; air; and scenic, scientific, and cultural values.

BLM/MT/PL-95/014+1990

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August 1995

Dear Reader:

Enclosed for your review and comment is the executive summary for the Draft Environmental Impact Statement (DEIS) for the expansion of the Zortman and Landusky mines in north central Montana, and modified reclamation measures at both mines. Copies of the DEIS are available from the Bureau of Land Management, Phillips Resource Area, 501 South 2nd Street East, Malta, Montana 59538 (406-654-1240) and Lewistown District Office, P.O. Box 1160, Lewistown, Montana 59457-1160 (406-538-7461), or the Montana Department of Environmental Quality, Hard Rock Bureau, P.O. Box 201601, Helena, Montana 50620-1601 (406-444-2074).

The DEIS presents a preferred alternative (Alternative 7) and six other alternatives including the company proposed action. The preferred alternative is the agencies' attempt to reduce or avoid the potential environmental impacts of the proposed action. The DEIS discloses the environmental consequences associated with each alternative.

You are invited to make written or oral comments on the DEIS. We are particularly interested in comments that address one or more of the following: (1) needs for clarification; (2) new information that would have a bearing on the analysis; (3) a possible new alternative not within the range of alternatives presented here; and (4) possible errors in the analysis. Specific comments will be most useful.

We have scheduled four open houses/meetings to discuss this DEIS. They will be: September 18, at the Medicine Bear Lodge in Lodgepole; September 19, at the John Capture Center in Hays; September 20, in the Guard Armory in Malta; and September 21, in the Community Hall in Landusky. All of these open houses/meetings will begin at 5:00 p.m. with an open house to answer questions followed at 7:30 p.m. by a meeting to accept comments. These meetings will also be the forum for the U.S. Corps of Engineers to collect public comments on Zortman Mining, Inc. 404 permit application for the Zortman and Landusky mine expansions.

For consideration, your written comments should be received by close of business on October 17, 1995. Please include your name and complete mailing address on all written comments, including any copies of testimony that you make available to us.

Written comments should be addressed to David L. Mari, District Manager, Bureau of Land Management, Lewistown District Office, P.O. Box 1160, Lewistown, Montana 59457-1160.

Mark A. Simonich, Director
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Phillips Resource Area

Draft
Environmental Impact Statement

Zortman and Landusky Mines
Reclamation Plan Modifications and Mine Life Extensions
Phillips County, Montana

August 1995

Lead Agencies: United States Department of the Interior, Bureau of Land Management, Lewistown District and State of Montana, Department of Environmental Quality, Hard Rock Bureau.

Cooperating Agencies: United States Environmental Protection Agency, United States Army Corps of Engineers, and State of Montana, Department of Environmental Quality, Water Quality Division.

Contacts for Further Information: Jim Robinson, Team Leader, Department of Environmental Quality, Hard Rock Bureau, P.O. Box 201601, Helena, Montana 59620-1601 (406/444-2074) and Scott Haight, Team Leader, Bureau of Land Management, Lewistown District Office, P.O. Box 1160, Lewistown, Montana 59457 (406/538-7461).

Abstract: This Draft EIS analyzes impacts associated with expansion of mining and modification of reclamation plans at the Zortman and Landusky mines in north-central Montana. The DEIS analyzes seven alternatives, including the No Action Alternative and the Company Proposed Action. Significant issues include: acid rock drainage, reclamation success, impacts to Native American traditional cultural and historic resources, and economics. A preferred alternative has been identified (Alternative 7) which addresses these, and other issues. This alternative would provide for expansion of mining and modified reclamation plans using mitigating measures developed by the lead agencies to avoid or reduce environmental impacts.

Other Environmental Review: This Draft EIS will also serve as the environmental review document for a permit issued by the U.S. Army Corp of Engineers under Section 404 of the Clean Water Act.

Comments: Comments should be received by close of business on October 17, 1995, and addressed to David L. Mari, District Manager, Bureau of Land Management, Lewistown District Office, P.O. Box 1160, Lewistown, Montana 59457-1160.

INTRODUCTION

This Draft Environmental Impact Statement (EIS), prepared by the Montana Department of Environmental Quality (DEQ) and the U.S. Department of the Interior, Bureau of Land Management (BLM), describes the evaluation of a proposal by Zortman Mining, Inc. (ZMI) to continue and expand mining operations at both the Zortman and Landusky mines in Phillips County, Montana. This summary of the Draft EIS contains a description of the proposed action and other alternatives; identifies the agencies' preferred alternative; summarizes existing environmental conditions in the study area; and discloses the major impacts and issues associated with the various alternatives. If more detail is desired regarding all or certain aspects of these topics, the relevant sections of the Draft EIS should be reviewed in whole.

PROJECT DESCRIPTION, PURPOSE, AND NEED

Project Description

On May 11, 1992, ZMI filed an application with the Lewistown District BLM and the Montana DSL (part of the DEQ as of July 1, 1995) to expand mining operations at the Zortman Mine in the Little Rocky Mountains, Montana. The proposal includes: expansion of existing mine pits to access sulfide ore; a 150-acre, 60-million ton waste rock disposal area; crushing facilities; a 2 ½-mile conveyor system; a 200-acre, 80-million ton leach pad; a new processing plant and ponds; a limestone quarry; and other associated facilities. Total disturbance would increase from the existing 401 acres to about 1,292 acres. The operation is located on private and BLM-managed land. Issues of special note include Native American religious concerns, acid rock drainage, reclamation, and socioeconomics. In a March 9, 1994, Decision Record, the BLM and DEQ included the analysis of acid rock drainage corrective measures for the nearby Landusky Mine within the scope of the Environmental Impact Statement for the Zortman Mine expansion, since acid rock drainage has been a problem at both mines. The Draft EIS addresses additional mining at the Landusky and Zortman mines, plus modified reclamation plans for both facilities.

Purpose and Need

The purpose of the modified reclamation plans and proposed mine expansions is to address two different types of needs. The first is the need to correct inadequacies in the existing reclamation plans. It has become apparent that the current approved reclamation plans are not adequate to limit or prevent the development of acid rock drainage from the present mine facilities. In early 1993, the agencies informed ZMI that the reclamation plans had to be modified to mitigate existing acid rock drainage and to ensure successful surface reclamation. ZMI has submitted proposed modifications to the current reclamation plans. These are described under Alternatives 2 and 4.

The second purpose is to consider ZMI's need to develop their mineral property rights. These rights have been secured on federal land under the Mining Law, or are privately owned where the land has been patented. ZMI's proposal for additional mining and reclamation is presented in Alternative 4.

There is considerable interdependence between mine expansion activities and corrective measures to address the inadequacies of the existing reclamation plans. To consider these in a comprehensive fashion, the scope of the EIS includes alternatives that address both these needs. The EIS addresses impacts from past, present, and reasonably foreseeable future activities at the Zortman and Landusky mines. Baseline for this analysis is circa 1979 which marks the beginning of modern, large-scale mining in the Little Rocky Mountains. Earlier baseline is used when discussing specific historic mining disturbances such as the Ruby Gulch tailing.

The EIS Process

The environmental analysis of ZMI's applications for a mine permit modification for the Zortman and Landusky mines is being conducted under requirements of the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA) and the administrative rules and regulations implementing both these acts. An EIS is required because federal and state agency consideration of the proposed permit modifications constitutes federal and state actions which may significantly affect the quality of the human environment under NEPA and MEPA. The BLM and the DEQ are the joint lead agencies responsible for the preparation of the EIS and for issuing a final decision on the mine permit applications. However, a number of other agencies provide input to the EIS analysis. The

U.S. Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers (COE), and the Montana Water Quality Division (WQD) of the DEQ are cooperating agencies, and several other agencies are providing comments.

The EIS process includes the following steps:

1. Public and agency "scoping" during which issues and concerns are identified early in the process;
2. Alternatives development;
3. Data collection;
4. Impact analysis;
5. Completion of a Draft EIS;
6. Public review and comment period;
7. Completion of a final EIS; and
8. Completion of a Record of Decision (Final Decision)

At the end of the process, it is the responsibility of the BLM and DEQ as the lead agencies to consider the proposed action and alternatives presented in the EIS and issue a decision on the permit and approvals required for both the Zortman and Landusky Mine expansion projects. The agencies may approve the application as submitted, or they may approve a modified application and/or approve the application with stipulations. Any of these options may require ZMI to adopt measures to mitigate environmental impacts. The final decision would be presented in a document known as the Record of Decision.

Major Issues

Significant areas of concern or controversy were identified through public scoping and review by agency specialists. Public scoping meetings have been held at various locations in the study area to solicit public comment. Based on scoping and agency review, four primary issues were identified that reflect concerns or conflicts which could be partially or totally resolved through the EIS process. These issues are:

- Water Quality (Groundwater and Surface Water)
- Reclamation Plans and Procedures
- Cultural Resource Impacts
- Socioeconomics

These four issues are by no means the complete list of environmental concerns identified during project review and public scoping or used to develop alternatives. However, they do represent the issues that, because of the potential magnitude, duration, or significance of their effect on the environment, have played the greatest role in the development of alternatives. The following discussion provides a brief summary of these issues.

Water Quality. The public and the agencies have expressed concern that existing and/or historic mining operations have impacted and are continuing to impact water quality, and therefore aquatic habitat, in the area. Releases of acidic and metal-bearing waters from the mines have resulted in the loss of aquatic habitat and have adversely impacted the streams and groundwater in the area. Cyanide and metals are mentioned most often as analytes of concern.

Of particular interest is acid rock drainage and its effects on both surface and groundwater. Concern has been expressed that some of the existing mine, heap leach, and waste rock facilities have acidified and are releasing dissolved metals to ground and surface waters. The proposed mine expansion would develop sulfide ore and waste to an extent not contemplated previously for the Zortman and Landusky mines. Concerns have been raised regarding both mitigation of existing impacts and possible additional adverse water quality impacts mine expansion.

Other water quality issues include the potential leakage of heap leach process solution from storage ponds, contamination of water in pits and release of that water to surface drainages and groundwater, and the scope and adequacy of the water quality monitoring program.

Reclamation Plans and Procedures. Some reclamation at the mines has proved to be inadequate and/or ineffective. For instance, acid rock drainage emanating from some heap leach facilities and waste rock dumps may be due to incomplete reclamation procedures, or a failure to use appropriate materials to prevent water infiltration into the acid-producing materials. ZMI has proposed various rock characterization methods, materials handling procedures, and engineering practices to enhance the potential for successful reclamation. The agencies have also developed alternatives which incorporate engineering and reclamation modifications and mitigations as further protection. The scope and adequacy of reclamation monitoring has also been raised as an issue.

Cultural Resource Impacts. Areas within the Little Rocky Mountains, and specific sites near the Zortman and Landusky mines, are culturally and historically important to various North American Indian peoples. Many public comments received by the agencies during the scoping meetings for this Draft EIS and previous mine permitting actions have expressed concerns about impacts to cultural resources resulting from mine

actions. In response, the agencies have included an analysis of impacts to cultural resources and the use of these resources as a result of mine noise, air quality and water resources degradation, and modification of the visual perspective from certain locations of traditional cultural practices and importance.

Socioeconomics. The Zortman and Landusky mines have employed a large number of workers during the years 1979 through 1994. This employment represents a significant percentage of the total workforce in the surrounding region. A concern to many people is the socioeconomic impact mine closure would have upon mine workers and the area economic base.

PROPOSED ACTION AND ALTERNATIVES

Development of Alternatives

The issues identified through agency review and public scoping efforts were used to formulate reasonable alternative actions pertaining to the proposed Zortman-Landusky mine expansion. These alternatives were then evaluated based on engineering, environmental, and economic factors. The engineering evaluation included technical implementability and effectiveness, while the environmental evaluation considered potential impacts on air, water, and soil, with consideration of subsequent impacts to cultural resources, vegetation, wildlife, and human health. Cost was only considered as a factor in the elimination of an alternative where it would likely result in an uneconomic mine project, thus equating to the No Action Alternative. The following describes in more detail the considerations evaluated by the agencies in developing project alternatives.

Several alternatives were developed regarding the location of two major facility components of the proposed action: 1) the waste rock storage facility site and 2) the location for the ore heap leaching facility. At Zortman, seven alternatives to the proposed Carter Gulch waste rock storage site were evaluated. Three of these - the Ruby Flats site, partial backfill of the mine pits, and placement of waste rock on top of and adjacent to existing disturbances - were retained as viable waste rock storage alternatives for detailed evaluation. At Landusky, the proposed waste rock storage alternative (Gold Bug site or backfilling in other pits) was considered the only reasonable alternative. Regarding heap leach locations at Zortman, five alternatives to the proposed Goslin Flats location were considered, but only Alder Gulch remains as a viable alternative heap leach site for detailed evaluation. At Landusky, alternatives to the expansion of the existing pad were considered but eliminated.

In addition to the two major facility components discussed above, several items were considered for incorporation into an agency-modified alternative. These included: 1) mining methods, 2) reclamation, 3) ore transport, 4) beneficiation technology, 5) conveyor route, 6) process solution storage, 7) leach pad type, 8) processing, 9) waste rock transport, and 10) water control. Alternative actions were then developed by considering and evaluating:

- Company proposed action;
- Agency comments to the company proposed action, generated during completeness reviews;
- Public comments about the proposed extension projects, solicited during scoping meetings;
- Experiences at other mining projects;
- Technical literature and the relevant scientific database; and
- Past and present environmental concerns at the Zortman and Landusky mines.

Following review of engineering, environmental, and economic feasibility, seven alternatives were retained for detailed analysis. These include the company-proposed action, the no-action alternative, and 5 other agency alternatives. Actions which were eliminated from further evaluation were considered to be unacceptable in terms of engineering feasibility or environmental protection. In addition, certain actions such as complete backfilling of the mine pits were eliminated from consideration because they are not economically feasible.

Summary Description of Alternatives

The seven alternatives (including the proposed action) are listed and described below. For ease of reading, these are arranged from the simplest (No Action) to the most complex (Expanded Mining with Imposed Mitigation), as follows:

Alternative 1: No Action (continue permitted operations and reclamation)

Alternative 2: Mine Expansions Not Approved and Company Proposed Reclamation

Alternative 3: Mine Expansions Not Approved and Agency Mitigated Reclamation

Alternative 4: Company Proposed Expansion and Reclamation (Company Proposed Action or CPA)

Alternative 5: Agency Mitigated Expansion and Reclamation with Leach Pad Located in Upper Alder Gulch rather than on Goslin Flats

Alternative 6: Agency Mitigated Expansion and Reclamation with Waste Rock Repository Located on Ruby Flats rather than in Carter Gulch

Alternative 7: Agency Mitigated Expansion and Reclamation with Waste Rock Repository Located on Existing Mine Facilities rather than in Carter Gulch

Alternative 1 - No Action (continue permitted operations and reclamation). At the **Zortman Mine**, mine expansion plans would not be approved. Leaching and reclamation would continue as permitted. At the **Landusky Mine**, expansion plans would not be approved and the permitted ore reserves would be mined out by the beginning of 1996.

Alternative 2 - Mine Expansions Not Approved and Company Proposed Reclamation. ZMI would continue already permitted activities at both the Zortman and Landusky mines. Mine expansion plans would not be approved. The existing reclamation plans for the mines would be revised as proposed by ZMI to mitigate the existing acid rock drainage problems. Company proposed revisions include low permeability capping of unreclaimed heaps and waste rock dumps, redesign of diversion structures, water treatment contingencies, and enhanced monitoring for evaluating reclamation effectiveness.

Zortman Mine - Existing mine facilities would be tested to determine their acid generation potential. Those facilities that could generate acid rock drainage would be reclaimed with a 6-inch compacted clay infiltration barrier between the mine waste unit and the topsoil. Clay material for reclamation would be mined from the Seaford clay pit approximately 9 miles south of Zortman.

Landusky Mine - The existing Landusky Mine disturbances would be reclaimed using enhanced reclamation measures proposed by ZMI. The existing interim reclamation covers on the Mill Gulch and Gold Bug waste rock repositories would become the final covers. The other mine waste units would be tested to determine their acid generation potential. Those facilities that could generate acid rock drainage would be reclaimed with a 6-inch compacted clay infiltration barrier between the mine waste unit and the topsoil. Clay material for reclamation would be mined from the Williams clay pit approximately 3 miles southwest of Landusky.

Alternative 3 - Mine Expansions Not Approved and Agency Mitigated Reclamation. This is similar to Alternative 2 described above, but with additional agency-imposed requirements on ZMI's proposed plans to ensure reclamation success. These mitigating measures would include, but not necessarily be limited to:

Zortman Mine - Low permeability capping on all mine facilities not just those that test positive for acid generating potential; slope reduction to 3H:1V on most mine waste units; increasing the clay cap thickness to 12-inches; adding a 3-feet thick non-acid generating capillary break between the clay layer and the cover soil; development of a limestone quarry in the Beaver Creek area to be used for reclamation materials; removing the existing Alder Gulch waste rock dump and using it for mine pit backfilling; removing the OK and Ruby waste rock dump/stockpile and placing them in the mine pit as backfill; removing the 85/86 leach pad and retaining dike and using it as mine pit backfill; grading and capping of the mine pits floors to achieve a free-draining surface that discharges into Ruby Gulch; and enhancement of capture-pumpback-treatment facilities to function through runoff/seepage from a 100-year, 24 hour storm event.

Landusky Mine - Low permeability capping on all mine facilities; slope reduction to 3H:1V on most mine waste units; increasing the clay cap thickness to 12-inches; adding a 3-feet thick non-acid generating capillary break between the clay layer and the cover soil; development of a limestone quarry in the King Creek area to be used for reclamation materials; excavation of a drainage notch to route surface runoff from the reclaimed Landusky Mine pit floors into Montana Gulch instead of infiltrating through the pit floor and daylighting at the toe of the Montana Gulch waste rock dump.

Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action or CPA). ZMI would continue already permitted activities at both the Zortman and Landusky mines. This is ZMI's proposed Zortman Mine Expansion Plan contained in the application documents initially submitted to BLM and DSL on May 11, 1992 and revised through the completeness process until September of 1994. It also includes the smaller proposed expansion of the Landusky Mine detailed in the ZMI document of September, 1994. Enhanced reclamation measures for both operations are included in the proposals. These

are collectively known as the Company Proposed Actions (CPA).

Zortman Mine - Approximately 877 additional acres would be disturbed. Major disturbances would be from construction of the leach pad, the waste rock repository, crusher, conveyor system, and processing facilities. Mining activities would expand and deepen the current pit areas. The proposed limestone quarry, shale pit expansion, Goslin Flats leach pad, Landusky powerline extension, and the conveyor would be outside the current mine permit boundaries.

ZMI proposes to mine and process oxide and non-oxide ore reserves. The proposed expansion would include mining 80-million tons of ore and 60-million tons of waste rock at the rate of 60,000-80,000 tons per day, 350 days per year for 5 to 8 years. The operation would enlarge the existing pits, combine run-of-mine oxide and crushed non-oxide ore, and transport the ore via a 12,000-foot overland conveyor to a cyanide heap leach facility located at Goslin Flats. Cyanide solution would be applied to the ore heap and the precious metal-enriched solution would be captured within the leach pad, and processed at an adjacent recovery facility. Precious metals from the recovery process would be smelted to a dore' bullion product on site.

Support facilities for mining and processing would include existing offices, shops, labs, warehouse, and explosive storage facilities. A new land application disposal area would be on Goslin Flats adjacent to the leach pad. Electrical power would be delivered to the operation along existing powerline corridors owned and operated by Big Flat Electric. To utilize available power supply from the Landusky Mine, a buried powerline is proposed to be constructed between the Zortman and Landusky mines.

One million tons of limestone is proposed to be mined from a quarry in upper Beaver Creek to support drainage construction and mine waste unit reclamation. Shale would be mined from the Seaford clay pit for leach pad liner and reclamation cap construction.

In addition to expanding operations at the Zortman Mine, ZMI also proposes to change the present reclamation plan for existing facilities. ZMI proposes to enhance surface reclamation of all existing leach pads, containment dikes, and waste rock dumps to restrict infiltration of precipitation into these facilities, thereby preventing or limiting acid rock drainage. All existing facilities would be resloped to 3H:1V where topography allows. Where testing indicates acid generating materials are present, the surface would be reclaimed by placement of two compacted 6-inch clay layers, overlain with 36-inches of non-acid generating rock, followed by 8-inches of topsoil with surface revegetation. Where surface slopes are less than 5 percent, a PVC liner with a geotextile would be placed immediately above the clay liner.

ZMI also proposes to remove the existing Alder Gulch waste rock dump (an acid rock drainage source) before the area is covered by the proposed new Carter Gulch waste rock facility and transport it to Goslin Flats. Some of the spent ore from the 85/86 leach pad would be used to backfill the mine pits at the end of mining to achieve a free-draining pit floor configuration.

All seepage capture and pumpback systems would be sized to accommodate the seepage resulting from a 100-year, 24-hour storm event. A water treatment plant with a 2,000 gpm capacity would be used to improve the quality of effluent from the mine facilities. Active water treatment would be phased out as source controls proved effective. Passive methods such as wetlands and limestone drains would be used in the long term.

Landusky Mine - Permitted ore reserves would be mined out by the beginning of 1996. ZMI has proposed mining an additional 7.6 million tons of ore and 7 million tons of waste rock beyond that already permitted. This would extend the mine life by less than one year. Four million tons of the waste rock would be scheduled as backfill in the Gold Bug waste rock facility. The remaining waste rock would be stored in the mine pits for use in reclamation.

The 7.6 million tons of additional ore is proposed to be placed on the existing 87/91 leach pad extension. The ore would be stacked on top of the existing ore increasing the heap height by 50 feet. This would require no increase in surface disturbance.

Besides additional mining, ZMI proposes to enhance the existing reclamation plans for the Landusky Mine to address acid rock drainage concerns. ZMI proposes to enhance surface reclamation of all unreclaimed leach pads, containment dikes, and waste rock piles to restrict infiltration of precipitation into these facilities thereby preventing or limiting acid rock drainage. All existing facilities would be resloped to 3H:1V where topography allows. Where testing indicates acid generating materials are present, the surface would be reclaimed by placement of two compacted 6-inch clay layers, overlain with 36-inches of non-acid generating rock, followed by 8-inches of topsoil with surface revegetation. Where surface slopes are less than 5 percent, a PVC liner with a geotextile would be placed immediately above the clay

liner. The existing interim reclamation covers on the Mill Gulch and Gold Bug waste rock repositories would become the final reclamation covers.

The existing acid rock drainage seepage and pumpback systems in Mill Gulch and Rock Creek would be sized to accommodate runoff/seepage from a 6-inch, 24-hour storm event. A water treatment plant with a 2,000 gpm capacity would be constructed in the Montana Gulch area to improve the quality of effluent from the mine facilities if the need arises. Active water treatment would be phased out as source controls took effect. Passive methods such as wetlands and limestone drains would be used in the long term.

ZMI would mine approximately 50,000 tons of limestone from a 10-acre quarry to be developed on private land in the King Creek area. This material would be used to construct drains and diversions to aid in reclamation and maintenance of water quality.

Alternative 5 - Agency Mitigated Expansion and Reclamation with Leach Pad Located in Upper Alder Gulch rather than on Goslin Flats. This alternative is similar to the CPA (Alternative 4) for both mine expansion and modification of reclamation plans, but with agency mitigation added to reduce or avoid potential environmental impacts.

Zortman Mine - The major change is that the Goslin Flats leach pad would be constructed in Upper Alder Gulch just west of the proposed waste rock dump. The conveyor system would not be constructed. . Truck haulage would be used to transport both ore and waste rock from the mine to their respective facilities.

The agencies would also require changes in ZMI's proposed plans to ensure reclamation success. These mitigating measures would be similar to Alternative 3.

Landusky Mine - No change in mining operations from that proposed in Alternative 4.

Modification to the reclamation plan would be similar to Alternative 3. The post-reclamation pit drainage would include cutting a drainage channel or notch out of the pit wall so that all surface water runoff from the pit floor would drain into King Creek. A drainage diversion would be constructed along the pit highwall so that highwall runoff would discharge into Montana Gulch.

Alternative 6 - Agency Mitigated Expansion and Reclamation with Waste Rock Repository Located on Ruby Flats rather than in Carter Gulch. This alternative is the same as the CPA (Alternative 4) for both mine expansion and modification of reclamation plans, but with agency mitigation added to reduce or avoid potential environmental impacts.

Zortman Mine - The major modification is that the Alder Gulch waste rock repository would not be constructed. Instead waste rock would be disposed of at a repository site on Ruby Flats east of the proposed leach pad. The waste rock would be transported from the mine site by the conveyor to an off-load area near the leach pad. It would then be transported by truck to Ruby Flats waste rock repository for disposal. This waste rock facility would be reclaimed similar to the leach pad.

The agencies would also require changes in ZMI's proposed plans to ensure reclamation success. These mitigation measures would be similar to those in Alternative 3.

Landusky Mine - No change in mining operations from that proposed in Alternative 4.

Modification to the reclamation plan would be similar to those in Alternative 3. The post-reclamation pit drainage would involve cutting a drainage notch or channel out of the pit wall so that all surface water runoff from the pit floor would drain into Montana Gulch. Spent ore from the 85/86 leach pad and dike would be excavated from Montana Gulch and used to backfill the mine pits. This would raise the backfilled pit floor elevation, thus decreasing the size of the drainage notch needed to achieve a free-draining surface, and it would remove potentially acid generating material from close proximity with the Montana Gulch drainage.

Alternative 7 - Agency Mitigated Expansion and Reclamation with Waste Rock Repository Located on Existing Mine Facilities rather than in Carter Gulch. This alternative is similar to the CPA (Alternative 4) for both mine expansion and modification of reclamation plans, but with agency mitigation added to reduce or avoid potential environmental impacts.

Zortman Mine - The major modification is that the company proposed Carter Gulch waste rock repository would not be constructed. Instead, waste rock would be disposed on top of and adjacent to existing disturbances at the Zortman Mine. This would mean placement of waste rock over some of the existing leach pads and retaining dikes. The waste rock repository would be constructed at a 3H:1V slope and concurrently reclaimed as it was built upward from the lower slopes. The existing Alder Gulch waste rock dump would be

removed and placed on the new leach pad at Goslin Flats.

The agencies would also require changes in ZMI's proposed plans to ensure reclamation success. These mitigation measures would focus on constructing reclamation cover using a water balance approach rather than a barrier approach. Thicker cover soil with a capillary break would be required. Compacted clay would not be used in the reclamation covers.

Landusky Mine - This would be the same as described for the Landusky Mine under Alternative 5 for the post-reclamation drainage. The water balance reclamation cover would be used for unreclaimed facilities and those requiring re-reclamation.

Comparison of Alternatives. Tables ES-1 and ES-2 are provided to facilitate a comparison of the seven alternatives described above. The tables compare the differences in the various project components (type, location, extent, method, etc.) among the seven alternatives. A comparison of impacts among alternatives is provided later in the summary.

Summary of Agencies' Mitigations

During the development and evaluation of project alternatives the agencies identified a number of mitigations designed to eliminate or substantively reduce environmental impacts. Many of these mitigations are integral parts of one or more alternatives. No mitigations are applied to Alternative 1 since it represents no action and no modification to existing permit conditions. In addition, no specific mitigations have been developed for Alternatives 2 or 4 since they were proposed by ZMI.

The following is a list of mitigations which the agencies have incorporated into one or more agency-developed alternatives. The numbers in parentheses following each mitigation refer to the alternatives containing the mitigation, although each alternative should be read and considered for the context in which a particular mitigation is applied.

Mitigations Common to Both Mines

- All mine expansion and reclamation activities would be conducted in accordance with the Water Quality Improvement Plan. (all alternatives)

- All mine expansion and reclamation activities would be conducted in accordance with the signed Memorandum of Agreement developed under Section 106 of the National Historic Preservation Act (see Appendix E). (4, 5, 6, 7)

- ZMI's proposed Reclamation Cover C would be modified to include 6 inches of compacted clay (as opposed to 3 inches of compacted clay) between the bottom substrate and the PVC liner. The PVC liner thickness would be increased to 30 mil. For the purpose of discussion in this and future alternatives, this cover is known as "Modified Reclamation Cover C." (3, 5, 6)

- With the exception of leach pad dikes, existing and expanded facilities would be reclaimed to a 3H:1V slope with constructed benches every 200 feet of slope length. In order to achieve the slope reductions while minimizing additional land disturbance, some material may have to be off-loaded from existing facilities and backfilled into the pit. (3, 5, 6)

- With the exception of leach pad dikes, existing and expanded facilities would be reclaimed to a 3H:1V slope with constructed benches every 50 vertical feet. (7)

- In order to classify as "Non-Acid Generating" and be used without restriction in construction and reclamation, waste rock or other material (3, 5, 6, 7):

  1) Cannot be composed of igneous breccia, felsic gneiss, monzonite, quartzite, or trachyte lithologies;

  2) Amphibolite, mafic gneiss, shale, dolomite or limestone must have a total sulfur content less than 0.8%, and a paste pH of 6.0 or greater;

  3) If syenite, must have a total sulfur content less than or equal to 0.2%, a paste pH of 6.5 or greater, and a NNP greater than or equal to 0 with an NP:AP ratio greater than or equal to 1;

  4) Must meet the criteria above as demonstrated by sampling and analyzing lithologies from every blasthole providing non-acid generating material.

- The water-balance reclamation covers would be used to reclaim mine facilities. The performance criterion for the reclamation covers would be to limit infiltration to not more than 5 percent of precipitation. (7)

- Additional material used for capillary break/drainage layers in reclamation covers may be

obtained from an area limestone source or non-acid generating waste rock. (3, 5, 6, 7)

- Reclamation viability would be monitored by ZMI until the agencies have approved final closure and released the mine reclamation bond. Vegetative cover must achieve 90 percent of that in adjacent natural communities of similar composition and location. (3, 5, 6, 7)

- ZMI would be required to conduct a study after mine closure of the potential to use the pit highwalls as peregrine falcon hack sites. (7)

- The reclamation requirements of this EIS and the Water Quality Compliance Plan would be used as a basis for determining reclamation success and directing any further corrective measures. (3, 5, 6, 7)

- Prior to liner perforation, ZMI would undertake an expanded and more rigorous analysis of heap detoxification, to include additional sampling and monitoring requirements, water level measurements monthly, and agency notification. (3, 5, 6, 7)

- An expanded reclamation quality control program would be implemented to include such items as particle size restrictions for clay, used in reclamation clay installation procedures, foundation preparation, testing of placed materials, inspection requirements, and construction reporting. (3, 5, 6)

- All drainage and diversion ditches would have to be able to pass the peak flow from a 100-year storm event with 1 foot of freeboard. (3, 5, 6, 7)

- Seepage water capture and treatment systems must be sized for a 100-year, 24-hour storm event. (3, 5, 6, 7)

- Trees would be used in revegetation only to mitigate visual impacts. Crested wheatgrass would not be allowed in the revegetation mixture. (3, 5, 6, 7)

- Long-term soil loss rates could not exceed 2 tons per acre per year. (3, 5, 6, 7)

- For reclamation material haul trips utilizing convoys that are routed through the communities of Zortman or Landusky, pilot cars would escort the convoys over the entire length of the haul routes and the speed of the convoys would be reduced to 15 mph. (3, 5, 6, 7)

- Performance of an Environmental Audit on an annual basis would be carried out at both mines to assure that spill containment systems work properly, that leak detection systems are in proper working order, and that spill prevention and response planning can be realistically implemented through review of company training programs and inspection of emergency response equipment. (5, 6, 7)

- At the end of mine life, a comprehensive Environmental Site Assessment would be carried out that covers the entire Zortman and Landusky mine permit areas. This site assessment would include inspection of all locations where hazardous materials were stored and used and would identify evidence of spills or accidental releases that may have contaminated soil and groundwater. This site assessment would include soil and groundwater sampling should evidence of contamination be identified. (3, 5, 6, 7)

<u>Zortman Mine Mitigations</u>

- The 80-million ton capacity heap leaching facility would be constructed in Upper Alder Gulch as a valley fill leach pad, rather than at Goslin Flats. (5)

- The ore crushing facility would be sited in the vicinity of the pit complex. (5)

- Crushed ore would be transported to the heap leach pad by truck (rather than by conveyor system). (5)

- The 60-million tons of waste rock would be placed in a repository constructed on the Ruby Flats, just east of the Goslin Flats heap leach pad. (6)

- The waste rock repository would be lined on the bottom with a solution detection and collection system to reduce the potential for contamination of area water resources. (6)

- Rerouting of Phillips County Seven Mile Road around the Ruby Flats waste rock repository. (6)

- The Thermopolis shale could not be used without restriction in construction or reclamation purposes. Under-drains for the leach pad would have to be constructed using the native calcareous subsoil material or unmineralized limestones or carbonates from other sources. (6, 7)

- The waste rock repository would be constructed mostly on existing facilities around the Zortman pit complex, rather than in Carter Gulch. (7)

- More rigorous construction quality control procedures would be applied to the leach pad construction. (5, 6, 7)

- With the exception of the 89 leach pad dike, all facilities not used as pit backfill are assumed to be potentially acid generating and require re-reclamation. Cover soil on the facilities would be removed, stockpiled, and reused. The 89 leach pad dike would be tested and re-reclaimed if it exceeds the test criteria. (3, 5, 6, 7)

- The existing Alder Gulch waste rock dump would be used to backfill the pit complex. The cover soil would be re-salvaged and the waste rock footprint reclaimed using this material. (3)

- After detoxification, portions of the 85/86 leach pad and dike would be removed to create a free draining surface and placed in the pit as backfill material prior to pit floor reclamation. (3, 5, 6, 7)

- The OK waste rock dump would be removed and used to backfill the pit complex or used as reclamation material. Cover soil would be re-salvaged and the waste rock footprint reclaimed. (3, 5, 6, 7)

- The tailing in Ruby Gulch above the town of Zortman would be removed from the drainage and placed in the pit complex. The drainage would be restored as mitigation for existing disturbance to waters of the United States by other Zortman and Landusky mines facilities. (3, 5, 6, 7)

- The sulfide storage area would also be removed and used as backfill in the pit complex. (3, 5, 6, 7)

- Additional backfill in the pits would be graded so that runoff freely drains, without impoundment in the pit, into the Ruby Gulch drainage. (3, 5, 6, 7)

- A borrow pit would be developed on Ruby Flats, if needed, to provide subsoil for use in construction and reclamation activities, and to stockpile reclamation materials removed from Goslin Flats during leach pad construction. (7)

- An alternate water source for bats (or other wildlife) would be constructed in Goslin Gulch between Azure Cave and the leach pad site to mitigate potential loss of wildlife drinking water on Goslin Flats. (6, 7)

Landusky Mine Mitigations

- The 91 leach pad dike would be re-reclaimed. Other facilities, not used as pit backfill would be tested for sulfur content and re-reclaimed if the test criteria are exceeded. Cover soil on the facilities would be removed, stockpiled, and reused. (3, 5, 6, 7)

- With the exception of leach pad dikes, the Gold Bug repository and the Mill Gulch waste rock dump, existing facilities would be reclaimed to a 3H:1V slope with constructed benches every 200 feet of slope length. In order to achieve the slope reductions while minimizing additional land disturbance, some material may have to be off-loaded from existing facilities. (3, 5, 6)

- The pits would be backfilled to a minimum elevation of 4,900 ft (at the midpoint of the drainage ditch) to create a surface which will freely drain into Montana Gulch. Approximately 13 million tons of backfill would be required to reach this level. Material used in backfill would come from existing waste rock dumps and leach pads. (3, 6)

- Prevent runoff from the Queen Rose/Suprise and August/Little Ben pit areas from flowing into the August tunnel by constructing a drainage notch between the August/Little Ben pit and Montana Gulch, and directing surface water to Montana Gulch immediately below the waste rock dump. (3, 6)

- Rock fill would be removed and used as backfill to raise the pit floor to a minimum elevation of 4,850 feet (at the midpoint of the drainage) to create a surface which would freely drain into King Creek. Sources of pit backfill to reach the 4,850 foot level would include the Montana Gulch waste rock dump and the 85/86 heap leach pad. (5, 7)

- Portions of the 85/86 leach pad and dike would be removed in order to unblock the western tributary of Montana Gulch and create a free draining surface. (5, 7)

- Highwall runoff would be diverted from the mine pits into Montana Gulch and treated if necessary. (5, 6, 7)

- Contingency water capture systems and settling ponds would be installed in upper King Creek to treat surface water runoff from the backfilled pit floors. (5, 7)

- Removal of the 85/86 leach pad from Montana Gulch and part of the Montana Gulch waste rock dump, and placement of this material in the pit as backfill. (6)

AGENCIES' PREFERRED ALTERNATIVE

Identification of a preferred alternative is required in a Draft EIS to allow the public to review the agencies' preference. The preferred alternative may be changed in the Final EIS based upon comments received on this draft. Rationale for the selection of a preferred alternative will be provided in the Record of Decision.

Alternative 7 has been identified as the agencies' (BLM and DEQ) preferred alternative. Alternative 7 satisfies the purpose and needs described in Chapter 1.

Of the seven alternatives in this Draft EIS, a mine expansion alternative has been identified to meet the need of providing for ZMI to develop their precious metal deposits at the Zortman and Landusky mines and reclaim both mine facilities. Of the various possible waste rock and leach pad facility locations for mine expansion at the Zortman Mine, Alternative 7 is preferred.

Preferred reclamation measures are described under Alternative 7. The water "balance" approach to reclamation covers is preferred over the "barrier" type construction, for both existing and new facilities. These measures, together with the other mitigations detailed in Alternative 7, would be used to address existing environmental problems and prevent unnecessary or undue degradation.

AFFECTED ENVIRONMENT

The proposed project is located in the Little Rocky Mountains of north-central Montana, near the southern boundary of the Fort Belknap Indian Reservation in the southwest corner of Phillips County. Nearby towns include Hays and Lodgepole (in the southern portion of the Reservation), Landusky (approximately 0.5 miles south of the Landusky Mine), and Zortman (about 1 mile south of the Zortman Mine).

The study area is characterized by rolling prairie dissected by streams and interrupted by "island mountains" that rise out of the relatively flat plains like islands in the ocean. Elevations range from approximately 2,300 feet above sea level at Fort Peck Lake east of the Little Rocky Mountains, to 5,700 feet above sea level at Old Scraggy Peak, located approximately 1.5 miles east of the Zortman Mine. Topography within the mountains is rugged, with high outcrops and steep v-shaped valleys. Mineral resources are abundant, and historic mining has occurred over the past century. Soil resources include young and relatively undeveloped soil in the mountain areas, and more developed soil in the plains areas, which are potential major sources of reclamation cover soil and subsoil.

Portions of the project area that have not been mined are mostly forested. Primary community types present include lodgepole pine forest, ponderosa pine forest, Douglas fir forest, deciduous tree forest, grassland, shrubland, and outcrop/scree communities. Small wetlands occur along the lower drainages. The area supports a wide variety of plants, and the Little Rocky Mountains are a source of plant materials for ethnobotanical uses. No plants listed as federally threatened or endangered or as of special interest or concern by the State of Montana are known to occur within the study area. A wide variety of wildlife species can also be found. Well-known species include big game animals, upland game birds, raptors, and bats. Eighteen species of special concern at either the federal and/or state level may potentially occur in the region.

The headwaters of several streams are located in the study area; most streams are ephemeral or intermittent in nature. These drainages and the subsurface aquifers in the area have been or can be affected by acid rock drainage associated with mining activities in this highly mineralized area. Surface water and groundwater have exhibited elevated chemical concentrations on specific occasions downstream as far as Zortman and Landusky since 1979. Water treatment systems are currently operating in all of the affected drainages, and significant improvement in downstream water quality has been observed.

The economy of the area is based primarily on the use of natural resources, which includes agricultural, mining, and outdoor recreation. Agriculture is the predominant land use in the study area. Public lands provide both developed and dispersed recreation opportunities. Fort Belknap Indian Reservation also provides some recreational facilities including Pow Wow grounds. A number of Native Americans have used the Little Rocky Mountains for subsistence, social, and religious activities, and the Little Rocky Mountains are considered eligible for listing on the National Register of Historic Places as a Traditional Cultural Property. The Alder Gulch Historic District, which contains historic mining remains, is also considered eligible for the National Register.

Other areas are recognized as Areas of Critical Environmental Concern (ACEC). These include Azure Cave and prairie dog towns 20 miles east of the Little Rocky Mountains. Three other areas nominated for ACEC consideration include Little Rocky Mountains, Saddle Butte, and Old Scraggy Peak.

Air resources in the project area are generally of good quality. Ambient noise levels reflect mining operations and have been measured throughout the study area.

ENVIRONMENTAL CONSEQUENCES

The seven alternatives described above were evaluated for their potential impact on various environmental, social, and cultural resources. A detailed discussion of these impacts, or environmental consequences, is contained in Chapter 4 of the Draft EIS. The following discussion highlights the EIS material, with emphasis on the most significant impacts, especially impacts associated with the four primary issues of concern previously discussed: water quality, reclamation and its associated impacts, cultural resources, and socieconomics.

In addition to the narrative, Table ES-3 is provided as an impact summary matrix. The table contains both quantitative information and/or relative impact rankings for each resource and for primary issues of concern under the resources. Table ES-3 also documents where no significant impact is expected for some issues of concern, such as special status species. The rankings shown in Table ES-3 are based on professional and technical judgement in view of this particular project, its setting and context, other projects the EIS Team has reviewed, and the effects of this project in both a site-specific and regional sense. More information is available in Chapter 4 of the Draft EIS regarding methods and criteria used to assess impacts for each resource.

Alternative 1

This is the "No Action" alternative which involves no mine expansion, continuation of permitted operations, and implementation of existing reclamation plans. Potential negative impacts to *water quality* would be very high under this alternative since no enhancement of reclamation measures would occur to limit acid rock drainage (ARD) problems. Reclamation of spent ore piles, waste rock heaps, and pit floors is expected to result in poor vegetation cover and continued high rate of infiltration through the facilities. Closure of the mine under these conditions is expected to result in long-term generation of significant volumes of acid rock drainage.

The reclamation would also result in more severe impacts to on-site *soil resources*, since using the eight-inch minimum cover over waste rock and native rock would not provide sufficient soil thickness for support of a viable vegetative cover. Also, the soil layer would be subject to acidification from the acid-generating rock substrate. Continued and accelerated erosion on the 2.5H:1V slopes would result in high negative impacts.

Because of the expected water and soil impacts associated with the limited reclamation under Alternative 1, secondary adverse impacts would also be expected on *vegetation* and *wildlife* resources. Under the Alternative 1 scenario, revegetation success is estimated at only 25 percent due to soil erosion and acid rock drainage impacts. The failure of long-term reclamation would result in high negative cumulative impacts on both vegetation and wildlife. Residual water quality impacts on macroinvertebrate populations and habitat would be moderately negative. However, since new mining is limited, Alternative 1 does result in fewer acres of new surface disturbance and no further direct impacts on biological resources.

All of the alternatives represent relatively high and negative impacts to Native American *cultural resources*, defined as the Little Rocky Mountains Traditional Cultural Property (TCP) Historic District, individual cultural properties within the boundaries of the District, and Native American values. However, Alternative 1 is considered to have moderate impacts overall on the cultural resources of the area. This is because there would be no impact to historic or prehistoric resources under Alternative 1, and the completion of existing operations without expansion and with reclamation would result in some improvement to the visual quality of the area and would limit additional disturbance to Native American cultural resources. Along with Alternative 2, this alternative is ranked second most favorable on Table ES-3.

Socioeconomic impacts are significant under Alternative 1, since this alternative results in mine closure and the associated impacts on local employment and economy. Phillips County and the communities of Malta and Zortman would sustain almost immediate significant negative impacts to economic and fiscal conditions, community resources, and social well-being because of sharply reduced employment and spending by ZMI and the reduction or loss of income and the potential out-migration of laid-off workers and their households. County government and schools would lose tax revenue

directly and indirectly generated by ZMI and potentially would not be able to reduce service costs in proportion to the reduction in revenue. Material and service providers elsewhere in Montana, especially in Billings and Helena, would lose significant revenue. Property values potentially would decline in Phillips County, especially in the communities of Zortman and Malta. Finally, there may be an increase in what local consumers throughout the study area would pay for power from the Big Flat Electric Cooperative as they adjust to lost revenue from the mine closure.

In Phillips County, and especially in the communities of Malta and Zortman, social impacts would include a weakening of local social structures and a potential weakening of local facilities, services, schools, and businesses due to the reduced economic well-being and potential out-migration of laid-off workers and their households.

The impact of mine closure on attitudes toward the quality of life on Fort Belknap Indian Reservation would be significant and positive, because reclamation would eliminate many of the mines' impacts upon social and cultural activities, contemporary and heritage cultural sites, and life-styles dependent on the Little Rocky Mountains. This would occur despite lingering concern about water quality and quantity in drainages affecting the reservation and job losses by Native Americans now employed by ZMI. About 18 percent of the mines' work force is comprised of Native Americans.

Regarding *recreation and land use*, impacts are expected to be negative and moderate for developed and dispersed recreation and negative and relatively high for land use overall. This is because no mine expansion would end any foreseeable mining activities in the Little Rocky Mountains which would effectively end a BLM-approved land use in the area. Residual visual impacts, caused by the irreversible change in topography present after reclamation, would remain and have a permanent and moderate negative effect on the aesthetic quality of the landscape, which effects the recreational setting.

Alternative 1 would limit new visible ground disturbance by not allowing expansion activities at the Zortman or Landusky mines. Existing disturbance, particularly the mine pit highwalls, would cause significant long-term impacts to scenic quality of the affected lands. Potentially poor reclamation success would cause long-term *visual impacts* on most disturbed lands. VRM Class II objectives would not be met.

Transportation impacts are all considered low for Alternative 1. There would be no convoys of trucks associated with this alternative. This alternative would limit public access to the Little Rocky Mountains, as do all alternatives, which could be considered a high negative impact. However, the duration of this limitation under Alternative 1 is less than the expected duration under alternatives that involve mine expansion.

Because expansion of the mines would not be approved, impacts to *geologic resources* are limited. No additional gold or silver would be produced from these mines without additional regulatory review. No additional topographic modifications or disturbances to clay pits or limestone quarries would occur as a result of mining.

Mine activities would result in significant cumulative *noise* impacts at the towns of Zortman and Landusky. Direct and cumulative impacts to *air quality* from reclamation activities would not be significant. Impacts to air and noise for Alternative 1 are the lowest projected for any alternative because of limited reclamation activities and earlier closure of mine operations. Impacts relating to *hazardous materials* would be low and negative for this alternative and any of the non-expansion alternatives, since there would be less likelihood for exposure or incidents to occur without expansion and extended mine life.

Finally, no *ACEC* would experience significant impacts; the impact on the ACEC nominations would be less than for any of the other alternatives involving mine expansion.

Alternative 2

Alternative 2 is essentially the same as Alternative 1, but with ZMI-proposed modified reclamation plans replacing the existing reclamation plans. Because of the additional reclamation measures, this alternative would have a less negative impact to those resources that are dependent on the extent and success of reclamation, but would still have significant impacts because of the limitations of the proposed modified plans. Impacts to *surface and groundwater quality* would still be considered negative and high. The low permeability clay layer proposed for the modified reclamation would likely become desiccated after a short time due to temperature changes and dehydration. Therefore, this alternative is expected to result in acid rock drainage requiring long-term capture and treatment, as was discussed for Alternative 1.

The limited reclamation would result in similar adverse impacts to *soil resources* as discussed for Alternative 1, i.e., high soil erosion and soil productivity impacts. Similar impacts for *vegetation* and *wildlife* would also

remain, since the proposed reclamation plan is expected to increase the success of revegetation by only ten percent over that predicted for Alternative 1. Cumulative impacts on vegetation are considered high negative. For wildlife, similar residual impacts to aquatic macroinvertebrates and habitat are expected, and the failure of the long-term effectiveness of reclamation is expected to result in a moderately negative impact on wildlife habitat.

Impacts to *cultural resources* are also considered similar to those predicted for Alternative 1, i.e., moderately negative impacts. Again, this alternative represents a relatively high impact to Native American cultural resources, because of existing disturbance, but reclamation and mine closure would improve the existing situation somewhat and would result in no further impact to historic, prehistoric, or Native American resources. This alternative, along with Alternative 1, is ranked as second most favorable in Table ES-3.

The economic and social impacts of Alternative 2 would be essentially the same as those of Alternative 1. In the long term, the quality of life, as perceived by all groups within the study area, may improve somewhat because of the greater probability of reclamation success.

Similarly, *recreation and land use* impacts are expected to be similar to those predicted for Alternative 1, with the main difference being the increased effectiveness of reclamation. However, mine expansion would effectively end a BLM-approved land use in the area, resulting in a negative impact. Also, the residual visual impacts that are expected due to the limited success of the reclamation would have a moderately negative impact on the quality of the landscape, affecting the recreational setting.

Alternative 2 would limit new visible ground disturbance by not allowing mine expansion activities at the Zortman or Landusky mines. Existing disturbance, particularly the mine pit highwalls, would cause significant long-term impacts to scenic quality of the affected lands. Potentially limited reclamation success would cause long-term *visual impacts* on most disturbed lands. VRM Class II objectives would not be met.

The main difference in *transportation* impacts from Alternative 1 would be the predicted medium negative impact associated with the number of truck trips through Zortman and Landusky, due to the concentrated periods of intense reclamation material hauling through these communities. For Alternative 2, it is predicted that there would be 300 truck trips through each of the towns per day for a duration anywhere from 12 to 27 days in the peak year.

No additional gold or silver would be produced, but there would be some limited impact to *geologic resources*. Nine acres of additional disturbance to mine clay would occur at the Seaford and Williams pits. No disturbance at limestone quarries would occur.

Reclamation activities would result in significant *noise* impacts at the towns of Zortman and Landusky. Direct impacts to *air quality* from reclamation activities would generally not be significant. Cumulative fugitive emissions from haul truck traffic in Zortman could exceed the 24-Hour PM_{10} standard, resulting in a significant impact. Impacts relating to *hazardous materials* would be low and negative for this alternative and any of the non-expansion alternatives since there would be less likelihood for exposure or incidents to occur without expansion and extended mine life.

Impacts to *ACEC* would generally be similar to those predicted for Alternative 1.

Alternative 3

Alternative 3 also involves no mine expansion. It adds agency mitigation to the ZMI proposed modified reclamation plans. Therefore, any resources dependent on the success of reclamation would be positively affected under Alternative 3. This is particularly important for predicted impacts on *water quality* for which low to moderate positive impacts are expected. The composite reclamation covers would limit the infiltration of water through reclaimed facilities, and the resultant discharge volumes would decrease significantly. In addition to the enhanced reclamation activities, several existing sources of acid rock drainage would be removed and placed in the pit as backfill. Negative impacts associated with the implementation of Alternative 3 include development of quarries required as a source for NAG capillary break and clay although water quality impacts associated with these developments are expected to be short term only.

Given the enhanced reclamation proposed under Alternative 3, adverse impacts to *soil resources*, *vegetation*, and *wildlife* are expected to lessen compared to Alternatives 1 and 2. This results in a moderate negative ranking for soil, a moderate negative ranking for vegetation, and a negative low impact ranking for wildlife. Soil productivity would still be somewhat limited since the placement of only eight inches of cover soil to serve as the growth medium may limit the establishment of an effective vegetative cover. There

would also be additional acres of disturbance under Alternative 3. However, the predicted revegetation success increases to 95 percent. This would result in low negative impacts on wildlife populations, including aquatic macroinvertebrate populations and habitat.

Alternative 3 has the least impact to *cultural resources* of all alternatives considered with an overall low negative impact ranking. Alternative 3 does represent a high and negative impact to the cultural resources of the area because of the existing disturbance. However, as with Alternatives 1 and 2, there would be no additional impact to historic or prehistoric resources. Due to the improved reclamation measures and no mine expansion, a lower impact level would be predicted. This alternative is ranked number 1 (least impacting) on Table ES-3.

The *socioeconomic* impacts of Alternative 3 would be essentially the same as those of Alternative 1. In the long term, the quality of life of all groups in the study may improve somewhat more, as compared to other non-expansion alternatives, because of further improvements in the probability of success in reclamation and the correction of the existing water quality problems.

Alternative 3 results in the least negative *land use and recreation* impacts, because of the predicted success of the proposed reclamation. It does have the same impact on land use as Alternatives 1 and 2 regarding the denial of mine expansion; however, the increased potential for successful reclamation improves the possibility for productive future land uses and recreational activities.

Alternative 3 would limit new visible ground disturbance by not allowing mine expansion activities at the Zortman or Landusky mines. Existing disturbance, particularly the mine pit highwalls, would cause significant long-term *visual impacts* to scenic quality of the affected lands. The improved reclamation plan associated with this alternative would reduce existing visual contrasts. VRM Class II objectives would not be met from close in viewpoints (0-5 mi.), and from those viewpoints with views of the mine pit highwalls. VRM Class II objectives would be met from the more distant viewpoints (>5 mi.) without clear views of the mine pit highwalls.

Transportation impacts of Alternative 3 are similar to those of Alternative 2. Although increases in traffic volume would be minor and cause low negative impacts to the transportation network in general, there would be concentrated periods of intense reclamation hauling through the local communities of Zortman and Landusky which would result in medium negative impacts on the residents of those communities. For Alternative 3, approximately 300 truck trips through the towns per day would occur for a duration of 14 to 35 days in the peak year.

No additional gold or silver would be produced. However, this alternative has the greatest impact on *geologic resources* of any of the mine expansion denial alternatives. About 12.5 acres of additional disturbance to mine clay would occur. About 32 acres of new and additional disturbance to mine limestone would occur at the LS-1 and King Creek quarries.

Reclamation activities would result in significant *noise* impacts at Zortman and Landusky. Direct impacts to *air quality* from reclamation activities would generally not be significant. Cumulative fugitive emissions in Zortman could exceed the 24-Hour PM_{10} standard, resulting in a significant impact. Impacts relating to *hazardous materials* would be low and negative for this alternative and any of the non-expansion alternatives since there would be less likelihood for exposure or incidents to occur without expansion and extended mine life.

Alternative 3 is predicted to have the same impacts as Alternatives 1 and 2 on *ACEC*.

Alternative 4

Alternative 4 is the Company Proposed Action, which involves expansion of mining activities at both the Zortman and Landusky mines, plus enhanced reclamation measures for both operations. Reclamation involves some, but not all, of the same modifications proposed under Alternative 3. *Water quality* impacts are predicted to be moderately negative under the Alternative 4 scenario. There is additional land and water resource disturbance related to the mine expansion. The construction of a heap leach pad and waste rock repository in relatively impacted drainage areas is a factor. The construction of the waste rock repository in Carter Gulch on steep terrain makes effective source control and water quality management difficult. These negative impacts are somewhat balanced by the additional reclamation proposed. Although the additional exposure of more potentially acid-generating rock could result in negative impacts, the additional reclamation is expected to limit long-term acid rock drainage.

The reclamation measures proposed under Alternative 4 are expected to result in impacts to *soil resources* similar to those predicted for Alternatives 2 and 3, with

moderate negative impacts overall for both erosion and soil productivity. However, the overall acres of soil disturbance increase by about 900 acres because of the proposed expansion. The 2.5H:1V side slopes of Goslin Flats heap leach pad create a moderate erosion hazard. The increased disturbance and vegetation clearing, associated with this alternative. This alternative would result in a cumulative loss of 1,387 acres of forest and 10 acres of riparian vegetation, plus 1.06 acres of wetland. The reclamation plan is expected to be as successful as that proposed for Alternative 3; a 95 percent revegetation rate is predicted. Overall cumulative impacts to *vegetation* are considered moderate negative. Residual water quality impacts on macroinvertebrates are expected to be moderate negative, and the overall *wildlife* impact rating would be moderate negative. This overall ranking for wildlife is based on the conveyor's impact on wildlife movement, the loss of forest habitat, and the increased sedimentation in Alder Gulch, coupled with the expected 95 percent reclamation effectiveness.

Cultural resources impacts for this alternative (and any of the alternatives involving mine expansion) are considered high and negative. This is because the continued operation, expansion, and new activities and facilities would result in substantial impact to the Little Rocky Mountains Traditional Cultural Property and associated Native American values. Also, impacts to both prehistoric archaeological and historic sites would occur under this alternative. A positive effect would be the increase in knowledge concerning Native American and historic mining activity in the Little Rocky Mountains due to impact mitigation. This alternative, along with Alternatives 6 and 7, is ranked number 4 (least favorable) in Table ES-3.

Alternative 4 would sustain the direct and indirect economic activity attributable to ZMI's operations for approximately seven additional years. In socioeconomic terms, the level of activity at the Zortman and Landusky mines during the period of extended mineral activity would be similar to that of the past. Therefore, the socioeconomic effect would be to sustain current economic and fiscal, community resource, and social conditions now experienced within the study area. The primary effect would be within Phillips County. Residents of the study area, especially in Phillips County and the communities of Zortman and Malta, would be satisfied by continued ZMI activity, because it would sustain current economic activities and levels of social well-being. Although some Native Americans of the Fort Belknap Indian Reservation may share this view, reservation residents generally would see the continued interference with social and cultural activities, contemporary and heritage cultural sites, and life-styles dependent on the Little Rocky Mountains as a negative impact related to continued mine activities.

Closure and reclamation would be delayed by about seven years but would eventually occur under Alternative 4. The socioeconomic impacts of closure under Alternative 4 would be similar to those described for Alternative 1 and other alternatives. This would be true for both the community at large within the study area, which would experience negative impacts overall, and for the Native American community of the Fort Belknap Indian Reservation, which would view closing as improving the quality of life and social well-being, despite some job losses. The main difference is that for Alternative 4, the impacts would occur later. This may change the relative magnitude of impacts somewhat, because conditions may change within the study area further in the future. However, this is not likely, based on the current outlook for employment, population growth, and social change.

Impacts to *recreation and land use* are considered moderately negative. Major impacts include continued access restrictions to areas within current mine operations, new access restrictions to Goslin Flats (which is used to access Saddle Butte and Azure Cave), and indirect impacts to recreationists in the vicinity of the Goslin Flats heap leach pad. There would also be loss of agricultural land in Goslin Flats and continuation of landscape disturbance in the areas surrounding the existing mining operations. The heap leach pad built in Goslin Flats would cause a major new disturbance visible to travellers on Seven-mile Road and Bear Gulch Road, both which provide access to the town of Zortman and recreational use areas in the Little Rocky Mountains.

New areas of *visual impacts* would be caused by the proposed Goslin Flats heap leach pad and associated conveyor system, and the proposed Carter Gulch waste rock repository. VRM Class II objectives would not be met from close in viewpoints (0-5 mi.), and from those viewpoints with views of the mine pit highwalls. VRM Class II objectives would be met from the more distant viewpoints (>5 mi.) without clear views of the mine pit highwalls.

Impacts on *transportation* for Alternative 4 are similar to those previously described for Alternatives 2 and 3, including the impact of convoyed truck trips through the towns of Zortman and Landusky. However, under Alternative 4, the duration of the impact regarding limitation of public access to the Little Rocky Mountains increases. For Alternatives 1, 2, and 3, duration of

limited public access would be only until the year 2001 or 2002; with Alternative 4 the duration extends until the year 2008 because of the extended mine life. The inclusion of the conveyor to Goslin Flats would increase the area subject to public access closure.

Assuming development of reasonably foreseeable future activities, approximately 1.1 million Troy ounces of gold would be produced from the Zortman and Landusky mines, and Pony Gulch deposit. Other impacts to *geologic resources* include disturbance of about 17 additional acres at the clay pits to mine about 1.82 million yd^3 of clay. About 16 additional acres would be disturbed at the LS-1 and King Creek quarries to mine limestone.

Mining and reclamation activities would result in significant *noise* impacts at the towns of Zortman and Landusky, the Pow Wow Grounds, and Azure Cave. Direct and cumulative impacts to *air quality* from mine expansion and enhanced reclamation would be significant at the town of Zortman. Impacts to air quality in Landusky would not be significant. Impacts relating to *hazardous materials* are ranked as moderate negative for this alternative and any of the expansion alternatives, since the expansion and extended mine life increase the likelihood for exposure or incidents to occur.

Impacts to *ACEC* increase under Alternative 4. There is potential for moderate impact to Azure Cave. Alternative 4 involves removal of riparian areas and ponds for the construction of the conveyor and Goslin Flats facilities, and, therefore, a probable water source for bats resident to Azure Cave would be eliminated. These impacts can be mitigated through reclamation of riparian areas and the creation of surface water ponds near the cave. Alternative 4 would have a moderately negative effect on the Little Rocky Mountains and Old Scraggy Peak ACEC nomination. This is because impacts to Native American cultural and historic values would occur due to increased surface and visual disturbance from expanded mining, construction of a conveyor, and construction of the Goslin Flats facilities.

Alternative 5

Alternative 5 is similar to Alternative 4 with agency mitigation added to the reclamation plan and the leach pad located in Upper Alder Gulch. As mentioned above, steep terrain exists in the Carter Gulch/Alder Gulch area, and this would present some *water quality/* acid rock drainage problems because of the large volume of acid underdrainage requiring capture and treatment. A positive side of this alternative is that both waste rock and leaching facilities would be limited to a single drainage area. Alternative 5 also addresses the issue of flow lost to the north by routing runoff from the reclaimed Landusky pit into King Creek. Also, the additional mitigation measures are expected to have a positive long-term impact on water quality. Therefore, water quality impacts are considered overall moderate and negative for Alternative 5.

Impacts to *soil resources* are expected to be similar to those described for Alternative 3. Possible mitigation would be to use all available cover soil and not limit cover thickness to 8 inches. The *vegetation* reclamation success is 95 percent with the addition of the agency reclamation measures. Overall impacts to vegetation resources are considered moderate negative due to the impacts that would be related to additional disturbance of forest resources (1,550 acres) and riparian vegetation (27 acres). Only 0.2 acres of wetlands would be affected. Impacts on *wildlife resources* are also related to the effectiveness of reclamation (95 percent) and are considered to be similar to that for Alternative 4, with the exception of lower potential for sedimentation and water quality impacts to aquatic life due to the Alder Gulch heap leach facility. Overall, impact to wildlife resources is ranked as a low to moderate negative impact, based on the residual water quality impacts, reduced sedimentation, the extent of disturbance, and the reclamation effectiveness.

Regarding Native American *cultural resources*, the impacts associated with Alternative 5 are similar to those described for Alternative 4, i.e., high impacts for continued operation, expansion, and new activities and facilities. The deletion of a conveyor belt and the leach pad in Goslin Flats would result in no disturbance to known historic or prehistoric resources, making this alternative the most favorable of the expansion alternatives (number 3 on Table ES-3).

The *socioeconomic* impacts of mine expansion under Alternative 5 would be somewhat lower but essentially the same as those for Alternative 4. Closure effects of the alternative would be the same as those for Alternative 4. In the long-term, the quality of life, as perceived by all groups within the study area, may improve somewhat because of the greater probability of reclamation success and the correction of existing water quality problems. Some additional benefit to quality of life may be perceived by Native Americans of the Fort Belknap Indian Reservation, because of the restoration of drainage to King Creek.

The *recreation and land use* impacts related to Alternative 5 are considered similar to those for

Alternative 4. Major impacts again consist of continued access restrictions to areas affected by current mine operations and the continuation/expansion of landscape disturbance in areas surrounding existing mining operations, which results in impacts to the recreational setting of the area.

Alternative 5 involves continued and expanded activities at the Zortman and Landusky mines. New disturbance would generally be confined to areas adjacent to existing disturbances which would lessen the *visual impact*. VRM Class II objectives would not be met from close in viewpoints (0-5 mi.), and from those viewpoints with views of the mine pit highwalls. VRM Class II objectives would likely be met from the more distant viewpoints (>5 mi.) without clear views of the mine pit highwalls.

Transportation impacts would be similar to those described for Alternative 4, with a slight increase in the duration of the number of convoy truck trips through the town of Zortman.

Approximately 1.0 million Troy ounces of gold would be produced from the Zortman and Landusky mines as a result of implementation of this Alternative. Impacts to other *geologic resources* include 20.5 additional acres of disturbance at the clay pits to mine about 1.9 million yd^3 of clay. About 16 additional acres would be disturbed at the LS-1 and King Creek quarries to mine about 776,000 yd^3 of limestone.

Mining and reclamation activities would result in significant *noise* impacts at Zortman and Landusky, the Pow Wow Grounds, and Azure Cave. Noise associated with Alternative 5 would have the least impact of any of the mine expansion alternatives. Impacts relating to *hazardous materials* are ranked as moderate negative for this alternative and any of the expansion alternatives, since the expansion and extended mine life increase the likelihood for exposure or incidents to occur.

Direct and cumulative impacts to *air quality* from mine expansion and enhanced reclamation would be significant at the town of Zortman. Impacts to air quality in Landusky would not be significant.

Impacts to *ACEC* under Alternative 5 are similar to those described for Alternative 4, with a slightly lower impact expected on the proposed Little Rocky Mountains ACEC, since this alternative does not include a conveyor or facilities in Goslin Flats.

Alternative 6

Alternative 6 is similar to Alternative 5, but with the Zortman Mine waste rock disposal facility located at Ruby Flats (near the existing Goslin Flats leach pad). From a *water quality* perspective, this alternative is expected to best reduce any potential water quality problems derived from the new facilities, since construction is in an environment with a gentle hydraulic gradient and underlying saturated, low permeability bedrock. Additionally, Alternative 6 routes surface runoff from the reclaimed Landusky pit complex to the south into Montana Gulch thereby further reducing flows to the north of the Little Rocky Mountains. Overall, water quality impacts are ranked low and negative for Alternative 6 for these reasons.

Soil resources impacts are expected to be similar to those described for Alternative 3. Overall soil disturbance increases to 2,422 acres, however. Total forest disturbance decreases to 1,245 acres, compared to Alternative 5, and the disturbance of riparian and wetlands decreases under Alternative 6. Effectiveness of reclamation is predicted to be approximately 95 percent. Impacts are rated moderate negative for vegetation. *Wildlife* impacts are ranked as low to moderate negative. This reflects the loss of habitat and increased sedimentation plus the expected reduced water quality impacts due to the increased reclamation and the location of the facilities in the Goslin Flats area.

Cultural resources impacts for Alternative 6 are considered to be high and negative, similar to the impact rankings for all expansion alternatives. This alternative, along with Alternatives 4 and 7, ranked number 4 (least desirable) in Table ES-3.

The *socioeconomic* impacts of mine expansion under Alternative 6 would be lower than that of Alternative 4 because less time would be devoted to mining, and ZMI's operations would be closed a full year earlier than under the other expansion alternatives. Closure effects of Alternative 6 would be the same as those of Alternative 4. In the short term, locating both the heap leach and waste rock repository in the Goslin Flats area may increase impacts somewhat to recreation south of the Little Rocky Mountains. In the long term, the quality of life as perceived by all groups within the study area, may improve somewhat more because of the greater probability of reclamation success and the correction of existing water quality problems.

Alternative 6 would increase the amount of highly visible land disturbance in the Goslin Flats and Ruby Flats areas which would cause a major increase in impacts to the recreational setting of surrounding land. Because of

this, the impacts on dispersed *recreation and land use* for Alternative 6 are considered high and negative in comparison to the other mine expansion alternatives. There would be continued access restrictions to the areas affected by current mine operations and a new access restriction to Goslin Flats which is used to access Battle Butte and the Azure Cave. There would be loss of agricultural land in Goslin Flats and Ruby Flats. However, there would be continuation of mining as a land use in the Little Rocky Mountains.

Alternative 6 involves continued and expanded activities at the Zortman and Landusky mines. New disturbance in the Goslin and Ruby Flats area would increase, causing a significant increase in *visual impacts* to that area. VRM Class II objectives would not be met from close in viewpoints (0-5 mi.), and from those viewpoints with views of the mine pit highwalls. VRM Class II objectives would likely be met from the more distant viewpoints (>5 mi.) without clear views of the mine pit highwalls.

Transportation impacts under Alternative 6 would be very similar to those described for Alternatives 4 and 5. Public access to the Little Rocky Mountains would be limited through the year 2007, a slight decrease over Alternatives 4 and 5.

Including reasonably foreseeable future activities, approximately 1.1 million Troy ounces of gold would be produced from the Zortman and Landusky mines, and Pony Gulch deposit. Other impacts to *geologic resources* include 21 additional acres of disturbance at the clay pits to mine clay. About 16 additional acres would be disturbed at the LS-1 and King Creek quarries to mine limestone.

Mining and reclamation activities would result in significant *noise* impacts at Zortman and Landusky, the Pow Wow Grounds, and Azure Cave. Direct and cumulative impacts to *air quality* from mine expansion and enhanced reclamation would be significant at the Zortman. Impacts to air quality in Landusky would not be significant. Impacts to air quality from Alternative 6 would have the least overall impact of any of the mine expansion alternatives.

Regarding *ACEC*, Alternative 6 is predicted to have a moderate negative impact on Azure Cave and on the Little Rocky Mountains and Old Scraggy Peak ACEC nominations, similar to Alternative 4.

Alternative 7 (Preferred)

Using the existing disturbed areas for waste rock storage eliminates a significant impact to several resource areas. The water balance reclamation covers would enhance the evapotranspiration component of the water budget by providing a thicker soil profile and thus greater rooting depth. These improvements have a positive impact on predicted water quality effects of the proposed mine expansion. The improved soil profile would be expected to provide water storage when the plant cover is dormant, and the impact analysis shows that the reclamation covers would be effective in reducing infiltration. Therefore, overall *water quality* impacts under Alternative 7 are predicted to be low negative, with a positive moderate impact resulting from the predicted reclamation success.

Similarly, the predicted success of reclamation would lessen the amount of soil loss. Also, Alternative 7 results in less soil disturbance than the other mine expansion alternatives (2,083 acres). The overall impact ratings for *soil resources* are moderate negative for both soil productivity and soil erosion. The placement of 3.5 feet of soil on the disturbed areas would provide a superior growth medium for supporting long term cover of protective vegetation in comparison to the other alternatives. This would also result in a positive effect on reclamation success for *vegetation* impacts. The percent effectiveness of the reclamation plan is predicted to be 99 percent under Alternative 7, the highest of any alternative. Overall, vegetation impacts are ranked low negative. Overall impacts to *wildlife* resources are considered negligible to low and negative under Alterative 7. This is because disturbance-related impacts are offset by the enhanced reclamation and resultant increase in water quality, the lower acres of habitat lost because of the use of existing disturbed area for waste rock disposal, and the additional mitigation involving planting of grasses and forbs for wildlife use.

Cultural resources impacts under Alternative 7 are considered high and negative, similar to those under Alternatives 4 through 6. This is because of the disturbance associated with the mine expansion, which would result in low negative impacts to prehistoric archaeological and historic sites, relatively high and negative impacts to Native American cultural resources. This alternative, along with Alternative 4 and 6, is ranked as least favorable (number 4) in Table ES-3.

The *socioeconomic* impacts of mine expansion under Alternative 7 would be essentially the same as those of Alternative 4. Closure effects of Alternative 7 also would be the same as those of Alternative 4. In the long-term, the quality of life, as perceived by all groups

within the study area, may improve further because surface disturbance would be reduced and there would be a greater probability of reclamation success and correction of existing water quality problems. Some additional benefits to quality of life may be perceived by Native Americans of the Fort Belknap Indian Reservation because of the restoration of drainage to King Creek under this alternative and the effects of the enhanced reclamation plan aimed at increasing wildlife habitat.

Recreation and *land use* impacts under this alternative are still considered moderate and negative. Alternative 7 impacts would generally be the same as those described for Alternative 4, except for the slightly less disturbance at Zortman Mine, which would limit the visual impacts which indirectly effect the recreation setting of surrounding lands. Alternative 7 still presents the continued access restrictions and loss of agricultural lands in Goslin Flats, with continuation of mining as a land use for the Little Rocky Mountains.

The waste rock dump at the Zortman Mine would be placed on existing disturbed land, reducing *visual impacts*. VRM Class II objectives would not be met from close in viewpoints (0-5 mi.), and from those viewpoints with views of the mine pit highwalls. VRM Class II objectives would likely be met from the more distant viewpoints (>5 mi.) without clear views of the mine pit highwalls.

Transportation impacts under Alternative 7 would be considered high and negative because of the restriction of public access to the Little Rocky Mountains through the year 2008 and medium negative with respect to truck convoys through Zortman. However, there would be no significant impact for Landusky, since reclamation convoys would not pass through that town.

Including reasonably foreseeable developments, approximately 1.1 million Troy Ounces of gold would be produced from the Zortman and Landusky mines, and Pony Gulch deposit. Impacts to other *geologic resources* include 3 additional acres of disturbance at the Seaford clay pit to mine clay. About 16 additional acres would be disturbed at the LS-1 and King Creek quarries to mine limestone. Alternative 7 would result in the least disturbance to clay pits and limestone quarries of any of the mine expansion alternatives. However, new areas would be mined on Ruby Flats for reclamation cover soil.

Mining and reclamation activities would result in significant *noise* impacts at the towns of Zortman and Landusky, the Pow Wow Grounds, and Azure Cave.

Direct and cumulative impacts to *air quality* from mine expansion and enhanced reclamation would be significant at the town of Zortman. Impacts to air quality in Landusky would not be significant. Impacts relating to *hazardous materials* are ranked as moderate negative for this alternative and any of the expansion alternatives since the expansion and extended mine life increase the likelihood for exposure or incidents to occur.

Impacts to *ACEC*, under Alternative 7 are similar to those predicted for Alternatives 4 and 6.

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TABLE ES-1

SUMMARY OF ALTERNATIVES - ZORTMAN MINE

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Agency Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action or CPA)	Alternative 5 - Agency Mitigated Expansion and Reclamation with Leach Pad in Upper Alder Gulch	Alternative 6 - Agency Mitigated Expansion and Reclamation with Waste Rock Facility on Ruby Flats	Alternative 7 - Agency Mitigated Expansion and Reclamation with Waste Rock Repository Located in Existing Mine Facilities (Preferred)
Mine							
Location	97 acres in 6 pits - Ross Pit - South Alabama Pit - North Alabama Pit - OK Pit - Ruby Pit - Mint Pit	97 acres in 6 pits - Ross Pit - South Alabama Pit - North Alabama Pit - OK Pit - Ruby Pit - Mint Pit	97 acres in 6 pits - Ross Pit - South Alabama Pit - North Alabama Pit - OK Pit - Ruby Pit - Mint Pit	Vertical and lateral expansion of mine pit complex; 103 additional acres	CPA	CPA	CPA
Extraction	No additional mining	No additional mining	No additional mining	Open pit, drill, blast, load - 80 million tons ore - 60 million tons waste rock	CPA	CPA	CPA
Ore Transport	Not applicable	Not applicable	Not applicable	Truck to primary crusher and conveyor to leach pad	Truck haul	CPA	CPA
Waste Rock Transport	Not applicable	Not applicable	Not applicable	Truck haul to Carter Gulch repository	CPA	Conveyor to Goslin Flats and truck haul to Ruby Flats	Stage at mine site, backfill, cover facilities
Ore Prep, Handling, and Storage							
Location	None	None	None	Primary crush below truck shop near 84 leach pad; secondary & tertiary crushing at Goslin Flats	All ore crushing near mine site	CPA	CPA
Crushing	None	None	None	Crush oxide and unoxidized	CPA	CPA	CPA
Stockpile	None	None	None	Separate piles at head of conveyor	At mine site or near Upper Alder leach pad; separate at truck load-out	CPA	CPA
Conditioning	None	None	None	Blend unoxidized ore with oxide ore	CPA	CPA	CPA

TABLE ES-1 - SUMMARY OF ALTERNATIVES - ZORTMAN MINE (Continued)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Agency Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action or CPA)	Alternative 5 - Agency Mitigated Expansion and Reclamation with Leach Pad in Upper Alder Gulch	Alternative 6 - Agency Mitigated Expansion and Reclamation with Waste Rock Facility on Ruby Flats	Alternative 7 - Agency Mitigated Expansion and Reclamation with Waste Rock Repository Located in Existing Mine Facilities (Preferred)
Ore Transport							
Location	Not applicable	Not applicable	Not applicable	Alder Gulch route to Goslin Flats, 2.5 acre conveyor corridor	New truck haul route (Antoine Butte) to Upper Alder leach pad	CPA	CPA
Method	Not applicable	Not applicable	Not applicable	Partially covered overland conveyor to Goslin Flats heap leach pad	Haul trucks	CPA conveyor system	CPA conveyor system
Beneficiation (Heap Leaching)							
Location	116 current acres at 7 existing heap leach sites - 79 pad (inactive) - 80/81 pad (inactive) - 82 pad (inactive) - 83 pad (inactive) - 84 pad (inactive) - 85/86 pad (inactive) - 89 pad (active)	116 current acres at 7 existing heap leach sites - 79 pad (inactive) - 80/81 pad (inactive) - 82 pad (inactive) - 83 pad (inactive) - 84 pad (inactive) - 85/86 pad (inactive) - 89 pad (active)	116 current acres at 7 existing heap leach sites - 79 pad (inactive) - 80/81 pad (inactive) - 82 pad (inactive) - 83 pad (inactive) - 84 pad (inactive) - 85/86 pad (inactive) - 89 pad (active)	Goslin Flats heap leach 205 acres	Upper Alder Gulch, heap leach, 180 acres	Goslin Flats, heap leach, 205 acres	Goslin Flats heap leach, 205 acres
Method	Valley leach	Valley leach	Valley leach	Modified flat pad	Valley leach	CPA	CPA
Process Solution Storage							
Location	Existing facilities	Existing facilities	Existing facilities	Goslin Flats	Upper Alder Gulch	Goslin Flats	Goslin Flats
Method	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds

TABLE ES-1 - SUMMARY OF ALTERNATIVES - ZORTMAN MINE
(Continued)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Agency Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action or CPA)	Alternative 5 - Agency Mitigated Expansion and Reclamation with Leach Pad in Upper Alder Gulch	Alternative 6 - Agency Mitigated Expansion and Reclamation with Waste Rock Facility on Ruby Flats	Alternative 7 - Agency Mitigated Expansion and Reclamation with Waste Rock Repository Located in Existing Mine Facilities (Preferred)
Processing							
Location	Existing process plant, 8.5 acres, 1 site	Existing process plant, 8.5 acres, 1 site	Existing process plant, 8.5 acres, 1 site	Goslin Flats, 23 acres	Existing process plant	Goslin Flats, 23 acres	Goslin Flats, 23 acres
Method	Existing Facilities	Existing Facilities	Existing Facilities	Cyanide solution, carbon adsorption, electrowinning, smelting	CPA	CPA	CPA
Mine Waste Disposal							
Waste Rock	25 acres in 3 Dumps - Alder Gulch (3,365,000 tons) - Ruby Gulch (850,000 tons) - OK Dump (1,235,000 tons)	25 Acres in 3 Dumps - Alder Gulch (3,365,000 tons) - Ruby Gulch (850,000 tons) - OK Dump (1,235,000 tons)	Alder Gulch, OK and Ruby Dumps backfilled into pit	New repository in Carter Gulch of Alder Gulch, 162 additional acres; truck haul, bottom-up construction	CPA	New repository on Ruby Flats; conveyor transport and truck haul, bottom-up construction lined impoundment	New repository constructed over existing mine facilities
Spent Heap Leach Ore or Tailings	Reclaim in place	Reclaim in place	85/86 leach pad/dike removed for pit backfill; Ruby Gulch tailing removed for pit backfill; Other facilities reclaimed in place	Reclaim facilities in place; portion of 85/86 pad leached on Goslin Flats leach pad	85/86 leach pad & dike removed for pit backfill; Ruby Gulch tailing removed for pit backfill; Other facilities reclaimed in place	85/86 leach pad & dike removed for pit backfill; Ruby Gulch tailing removed for pit backfill; Other facilities reclaimed in place	85/86 leach pad & dike removed for pit backfill; Ruby Gulch tailing removed for pit backfill; Other facilities reclaimed in place
Other Solid Waste	Lab wastes to ASARCO smelter, empty cyanide barrels crushed and buried in heap, sludge from water treatment plant to 89 leach pad	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

TABLE ES-1 - SUMMARY OF ALTERNATIVES - ZORTMAN MINE
(Concluded)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Agency Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action or CPA)	Alternative 5 - Agency Mitigated Expansion and Reclamation with Leach Pad in Upper Alder Gulch	Alternative 6 - Agency Mitigated Expansion and Reclamation with Waste Rock Facility on Ruby Flats	Alternative 7 - Agency Mitigated Expansion and Reclamation with Waste Rock Repository Located in Existing Mine Facilities (Preferred)
Other Facilities							
Access Roads	24 acres existing	24 acres existing	24 acres existing	23 additional acres of access road disturbance	CPA	CPA	CPA
Limestone Quarry	None	None	13 acres, LS-1 site south of Green Mountain	13 acres disturbance, LS-1 site, south of Green Mountain	13 acres disturbance, LS-1 site, south of Green Mountain	13 acres disturbance; LS-1 site, south of Green Mountain	13 acres disturbance, LS-1 site, south of Green Mountain
Clay Pit (borrow)	Seaford Clay Pit, 4.2 acres existing, no additional disturbance	Seaford Clay Pit, 4.2 acres existing, 3.0 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, 3.5 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, 10 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, 11.5 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, 12 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, 4 acres additional disturbance
Top Soil Stockpile	Various locations, 15.5 acres	Various locations, 15.5 acres	Various locations, 15.5 acres	Goslin Flats, 48 additional acres	Alder Gulch	CPA and Ruby Flats	CPA and Ruby Flats
Power Corridor	Existing Facilities	Existing Facilities	Existing Facilities	Buried construction, 9 additional acres	CPA	CPA	CPA
Solution Pipeline	Existing Facilities	Existing Facilities	Existing Facilities	10" pipeline along conveyor route	Existing Facilities	CPA	CPA
Reclamation							
Mine Pits	Existing permit requirements	Existing permit requirements	Partial backfill pit and Enhanced Reclamation	Partial backfill pit to drain by gravity, revegetate, divert surface water inflows, cover and revegetate benches and pit floor	Enhanced CPA Reclamation with additional backfill	Enhanced CPA Reclamation with additional backfill	Enhanced CPA Reclamation with additional backfill
Waste Rock Dumps and Repositories	Existing permit requirements	Existing permit requirements, cap modifications	Enhanced reclamation covers, B or C, Modified Alder Gulch and OK dumps used as pit backfill	Concurrent reclamation, capping, revegetation, waste segregation/ encapsulation, Covers A, B or C	Enhanced CPA Reclamation, Covers B or Modified C, with OK dump used as pit backfill	Enhanced CPA Reclamation, Covers B or Modified C with OK dump used as pit backfill	Enhanced reclamation water balance covers
Leach Pads	Existing permit requirements	Existing permit requirements, geochemical testing, Reclamation Cover A	Enhanced reclamation Covers B or Modified C on heap leach pads, CPA with minor modifications	Neutralize in-place with fresh water rinses, perforate liner, capping, revegetation	Enhanced CPA Reclamation, Covers B or Modified C on heap leach pads	Enhanced CPA Reclamation, covers B or Modified C on heap leach pads	Enhanced reclamation water balance covers

TABLE ES-2

SUMMARY OF ALTERNATIVES - LANDUSKY MINE

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Agency Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action, or CPA)	Alternative 5 - Agency Mitigated Expansion (Zortman Mine Leach Pad in Upper Alder Gulch) and Reclamation	Alternative 6 - Agency Mitigated Expansion (Zortman Mine Waste Rock Facility at Ruby Flats) and Reclamation	Alternative 7 - Agency Mitigated Expansion and Reclamation with Zortman Waste Rock Repository Located on Existing Mine Facilities
Mine							
Location	Existing disturbance of 235 Acres in 5 Pits - Queen Rose Pit - August Pit - Little Ben Pit - Gold Bug Pit - Niseka Pit	Same as Alternative 1	Same as Alternative 1	Vertical expansion of existing South Gold Bug pit	CPA	CPA	CPA
Extraction	Open pit, drill, blast, load; permitted disturbance	Same as Alternative 1	Same as Alternative 1	Open pit, drill, blast, load; additional 7.6 million tons ore & 7.0 million tons waste rock	CPA	CPA	CPA
Ore Transport	Truck to 87/91 heap leach pad	Same as Alternative 1	Same as Alternative 1	Truck to expanded 87/91 heap leach pad	CPA	CPA	CPA
Waste Rock Transport	Truck to Gold Bug waste rock repository	Same as Alternative 1	Same as Alternative 1	Truck to expanded Gold Bug waste rock repository	CPA	CPA	CPA
Ore, Prep, Handling, and Storage	All ore run of mine; no stockpiles, crushing, or conditioning	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Ore Transport							
Location	Existing Roads	Existing Roads	Existing Roads	Existing Roads	Existing Roads	Existing Roads	Existing Roads
Method	Truck Haul	Truck Haul	Truck Haul	Truck Haul	Truck Haul	Truck Haul	Truck Haul

TABLE ES-2 - SUMMARY OF ALTERNATIVES - LANDUSKY MINE
(Continued)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Agency Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action, or CPA)	Alternative 5 - Agency Mitigated Expansion (Zortman Mine Leach Pad in Upper Alder Gulch) and Reclamation	Alternative 6 - Agency Mitigated Expansion (Zortman Mine Waste Rock Facility at Ruby Flats) and Reclamation	Alternative 7 - Agency Mitigated Expansion and Reclamation with Zortman Waste Rock Repository Located on Existing Mine Facilities
Beneficiation (Heap Leaching)							
Location	280 Current Acres at 8 Existing Heap Leach Sites - 79 pad (inactive) - 80/81/82 pad (inactive) - 83 pad (inactive) - 84 pad (inactive) - 85/86 pad (leaching) - 87 pad (leaching) - 91 pad (loading & leaching) - 87/91 pad (loading & leaching)	Same as Alternative 1	Same as Alternative 1	87/91 pad expansion	CPA	CPA	CPA
Method	Valley Leach	Valley Leach	Valley Leach	Valley Leach	Valley Leach	Valley Leach	Valley Leach
Process Solution Storage							
Location	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities
Method	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond
Processing							
Location	2 sites - 87 pad - Landusky Plant	2 sites	2 sites	2 sites	2 sites	2 sites	2 sites
Method	Existing facilities, Merrill-Crowe and Carbon Adsorption	Same as Alternative 1	Same as Alternative 1	Same processes as currently used; Merrill-Crowe and Carbon Adsorption	CPA	CPA	CPA

TABLE ES-2 - SUMMARY OF ALTERNATIVES - LANDUSKY MINE
(Continued)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Agency Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action, or CPA)	Alternative 5 - Agency Mitigated Expansion (Zortman Mine Leach Pad in Upper Alder Gulch) and Reclamation	Alternative 6 - Agency Mitigated Expansion (Zortman Mine Waste Rock Facility at Ruby Flats) and Reclamation	Alternative 7 - Agency Mitigated Expansion and Reclamation with Zortman Waste Rock Repository Located on Existing Mine Facilities
Mine Waste Disposal							
Waste Rock	171 acres existing disturbance, 184 acres permitted, in 3 facilities - Montana Gulch (8,000,000 tons) - Mill Gulch (17,000,000 tons) - Gold Bug Repository Plus Heap Leach Pad Embankments (14,000,000 tons)	Same as Alternative 1	Same as Alternative 1	Expand Gold Bug Repository; 7.0 million tons generated during expansion used as pit backfill	CPA with additional backfill	CPA with additional backfill	CPA with additional backfill
Spent Heap Leach Ore	Reclaim in place	Reclaim in place	Reclaim in place, enhanced barrier reclamation covers	Reclaim in place, CPA barrier reclamation covers	Reclaim in place enhanced barrier reclamation covers	Reclaim in place enhanced barrier reclamation covers	Reclaim in place water balance reclamation cover.s
Other Solid Waste	Lab wastes to ASARCO smelter, empty cyanide barrels crushed, buried in heap, municipal waste to County landfill	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Other Facilities							
Limestone Quarry	King Creek quarry, 3 acres existing disturbance, no additional disturbance	King Creek quarry, 3 acres existing disturbance, no additional disturbance	King Creek quarry, 3 acres existing disturbance, 19 acres additional disturbance	King Creek quarry, 3 acres existing disturbance, 3 acres additional disturbance	King Creek quarry, 3 acres existing disturbance, 3 acres additional disturbance	King Creek quarry, 3 acres existing disturbance, 3 acres additional disturbance	King Creek quarry, 3 acres existing disturbance, 3 acres additional disturbance
Clay Pit (borrow)	Williams Pit, 26 acres existing disturbance, no additional disturbance	Williams Pit, 26 acres existing disturbance, 6 acres additional disturbance	Williams Pit, 26 acres existing disturbance, 9 acres additional disturbance	Williams Pit, 26 acres existing disturbance, 7 acres additional disturbance	Williams Pit, 26 acres existing disturbance, 9 acres additional disturbance	Williams Pit, 26 acres existing disturbance, 9 acres additional disturbance	Williams Pit, 26 acres existing disturbance, 0 acres additional disturbance

TABLE ES-2 - LANDUSKY MINE
(Concluded)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Agency Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action, or CPA)	Alternative 5 - Agency Mitigated Expansion (Zortman Mine Leach Pad in Upper Alder Gulch) and Reclamation	Alternative 6 - Agency Mitigated Expansion (Zortman Mine Waste Rock Facility at Ruby Flats) and Reclamation	Alternative 7 - Agency Mitigated Expansion and Reclamation with Zortman Waste Rock Repository Located on Existing Mine Facilities
Other Facilities, Continued							
Top Soil Stockpile	Various Locations	Various Locations	Various Locations	Various Locations	Various Locations	Various Locations	Various Locations
Power Corridor	Existing Facilities	Existing Facilities	Existing Facilities	Buried construction, 9 additional acres, line connecting to Zortman Mine	CPA	CPA	CPA
Solution Pipeline	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities
Reclamation							
Mine Pits	Existing permit requirements	Existing permit requirements	Partial backfill pit, enhanced reclamation covers, drainage notch to direct surface water to Montana Gulch	Partial backfill pit to drain by gravity, revegetate, divert surface water inflows, cover and revegetate benches and pit floor; surface water to August drain tunnel	Partial backfill pit, enhanced reclamation covers, direct surface water to King Creek	Partial backfill pit, enhanced reclamation covers, drainage notch to direct surface water to Montana Gulch	Partial backfill pit, water balance covers, divert surface water to King Creek; highwall runoff to Montana Gulch
Waste Rock Dumps and Repositories	Existing permit requirements	Existing permit requirements, geochemical testing, Reclamation Cover A	Enhanced Reclamation Covers, B or Modified C on waste rock facilities	Concurrent reclamation, capping, revegetation, waste segregation/encapsulation	Enhanced CPA Reclamation, Covers B or Modified C on waste rock facilities	Enhanced CPA Reclamation, Covers B or Modified C on waste rock facilities	Enhanced reclamation water balance covers
Leach Pads	Existing permit requirements	Existing permit requirements, geochemical testing, Reclamation Cover A	Enhanced Reclamation Covers, B or Modified C on heap leach pads, CPA procedures	Neutralize in-place with fresh water rinses, perforate liner, capping, revegetation	Enhanced CPA Reclamation, Covers B or Modified C on heap leach pads	Enhanced CPA Reclamation, Covers B or Modified C on heap leach pads	Enhanced reclamation water balance covers

TABLE ES-3

SUMMARY OF IMPACTS[1]

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
WATER RESOURCES														
Surface Water Quality	-H		-H		+L		-M		-M		-L		-L	
Groundwater Quality	-H		-H		+L		-M		-M		-L		-L	
% Infiltration	Flats 21.4% Slopes 18.8%		19.7% 17.7%		0.12% 10.35%		0.94% 3:1 10.35%		0.12% 10.35%		0.12% 10.35%		0.006% 5%	
Volume of Water Requiring Capture and Treatment (gpm average over 20 years)	390-460 gpm		370-440 gpm		250-320 gpm		260-330 gpm		230-320 gpm		270-340 gpm		200-270 gpm	
Overall Cumulative Impact Ranking	-H		-M		-L		-M		-M		-L		-L	
"Long-Term" Reclamation Success (water quality)	-H		-H		+M		+L		+M		+M		+M	
SOIL RESOURCES														
• Soil Disturbance (cumulative; in acres)	1248 ac.		1257 ac.		1293 ac.		2212 ac.		2272 ac.		2422 ac.		2083 ac.	
• Soil Productivity	-H		-H		-M		-M		-M		-M		-M	
• Soil Erosion	-H		-H		-M		-M		-M		-M		-M	
• Total Soil Loss from Major Facilities (tons/acre/year)	3.38		3.38		1.76		1.77		1.63		1.73		1.31	
CULTURAL RESOURCES														
• Overall Impact Level	-M		-M		-L		-H		-H		-H		-H	
• Relative Ranking (1 = most favorable)	2		2		1		4		3		4		4	

TABLE ES-3 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
WILDLIFE AND AQUATICS														
• Special Status Species	NI		NI		NI		NI		NI		NI		NI	
• Nesting Raptors	NI		NI		NI		NI		NI		NI		NI	
• Habitat Loss (in acres)	1248 ac.		1257 ac.		1293 ac.		2212 ac.		2272 ac.		2422 ac.		2083 ac.	
• Residual Long-term Water Quality Effects	-M		-M		-L		-M		-M		-L		+L	
• Sedimentation Effects	-L		-L		-L		-M		-L/NI		-M		-M	
• Long-term Wildlife Mortality	NI		NI		NI		NI		NI		NI		NI	
• Noise Effects	NI		NI		NI		NI		NI		NI		NI	
• Long-term Reclamation Effects	-H		-M		-L		-L		-L		-L		NI	
• Overall Cumulative Wildlife Impacts	-H		-M		-L		-M		-L/M		-L/M		-L/NI	
VEGETATION AND WETLANDS														
• Special Status Species Habitat	NI		NI		NI		NI		NI		NI		NI	
• Sole Source of Veg. Used by Native Americans	NI		NI		NI		NI		NI		NI		NI	
• Wetland Directly Impacted (in acres)	0		0		0		1.06 ac.		0.02 ac.		1.06 ac.		1.06 ac.	
• Non-Wetland Waters Directly Impacted (in acres)	4 ac.		4 ac.		4 ac.		7.01 ac.		6.01 ac.		6.21 ac.		6.51 ac.	
• Riparian Vegetation Impacted (Cumulative; in acres)	16 ac.		16 ac.		16 ac.		26 ac.		43 ac.		26 ac.		25 ac.	
• Forest Removed (Cumulative; in acres)	1029 ac.		1029 ac.		1029 ac.		1387 ac.		1550 ac.		1245 ac.		1285 ac.	
• Reclamation Plan Revegetation Effectiveness (% revegetation expected)	25%		35%		95%		95%		95%		95%		99%	
• Overall Cumulative Vegetation Impacts	-H		-H		-M		-M		-M		-M		-L	

TABLE ES-3 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
SOCIOECONOMICS														
Employment														
• Montana employment (cumulative; in job-years)	561		744		909		5,000		4,821		4,524		5,156	
• Phillips County employment (cumulative; in job-years)	437		571		698		3,480		3,356		3,173		3,608	
• Blaine County employment (cumulative; in job-years)	20		26		32		144		139		133		133	
Earnings														
• Montana earnings (cumulative; in millions of 1994 dollars)	$14.8		$19.5		$23.8		$126.4		$121.8		$114.8		$130.6	
• Phillips County earnings (cumulative; in millions of 1994 dollars)	$12.3		$16.0		$19.6		$95.6		$92.2		$87.4		$99.3	
• Blaine County earnings (cumulative; in millions of 1994 dollars)	$0.4		$0.5		$.06		$2.6		$2.5		$2.4		$2.7	
Tax Revenues														
• Montana direct tax revenues (cumulative; in millions of 1994 dollars)	$0.44		$0.44		$0.44		$4.46		$4.30		$3.60		$4.29	
• Phillips County tax revenues (cumulative; in millions of 1994 dollars)	$0.25		$0.25		$0.25		$2.63		$2.57		$2.44		$2.61	
• Malta School Districts direct tax revenues (cumulative; in millions of 1994 dollars)	$0.12		$0.12		$0.12		$1.25		$1.22		$1.15		$1.24	

TABLE ES-3 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
SOCIOECONOMICS - Tax Revenues (Continued)														
• Dodson High School District direct tax revenues (cumulative; in millions of 1994 dollars)	$0.11		$0.11		$0.11		$1.12		$1.10		$1.03		$1.11	
• Landusky School District direct tax revenues (cumulative; in millions of 1994 dollars)	$0.07		$0.07		$0.07		$0.73		$0.72		$0.68		$0.73	
• City of Malta direct tax revenues (cumulative; in 1994 dollars)	Negligible		Negligible		Negligible		< $10,000		< $10,000		< $10,000		$10,000	
• County Hard Rock Trust Reserve district tax revenues (cumulative; in millions of 1994 dollars)	$0.06		$0.06		$0.06		$0.59		$0.57		$0.48		$0.57	
RECREATION AND LAND USE														
Developed Recreation (campgrounds, picnic areas, Pow Wow grounds)	-L	-M	-L	-M	-L	-L	-L/M	-M	-L	-M	-M	-M	-L/M	-M
Disposed Recreation (hiking, sightseeing, ORV, hunting, picnicking)	-M	-M	-L/M	-M	-L	-L	-M	-M	-L	-M	-H	-M	-M	-M
Land Use	-H	-H	-M	-M	-L	-L	-M	-M	-L	-M	-H	-M	-M	-M
VISUAL RESOURCES	-H		-H		-H		-H		-H		-H		-H	

TABLE ES-3 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
TRANSPORTATION														
• Traffic Capacity	-L		-L		-L		-L		-L		-L		-L	
• Accidents	-L		-L		-L		-L		-L		-L		-L	
• Transport of Hazardous Materials	-L		-L		-L		-L		-L		-L		-L	
• Public Access to Parts of the Little Rocky Mountains (duration of impact - until __year__)	-H (until 2001)		-H (until 2001)		-H (until 2002)		-H (until 2008)		-H (until 2008)		-H (until 2007)		-H (until 2008)	
• Safety in Local Communities	-L	-L	-M	-M	-M	-M	-M	-M	-M	-M	-M	-M	-M	NI
(# convoyed truck trips thru town per day; duration in peak year)	0	0	300 trips 12 days	300 trips, 27 days	300 trips, 14 days	300 trips, 35 days	300 trips, 17 days	300 trips, 27 days	300 trips, 25 days	300 trips, 27 days	300 trips, 14 days	300 trips, 27 days	300 trips, 37 days	0
NOISE[2] (in dBA)														
• Cumulative Mine Noise Impacts, Town of Zortman	60 dBA		60 dBA		60 dBA		66 dBA		63 dBA		67 dBA		66 dBA	
• Cumulative Mine Noise Impacts, Town of Landusky	62 dBA		62 dBA		62 dBA		63 dBA		62 dBA		63 dBA		63 dBA	
• Cumulative Mine Noise Impacts, Pow Wow Grounds	55 dBA NI		55 dBA NI		55 dBA NI		59 dBA		59 dBA		59 dBA		59 dBA	
• Cumulative Mine Noise Impacts, Azure Cave	55 dBA NI		55 dBA NI		55 dBA NI		66 dBA		58 dBA		66 dBA		66 dBA	

TABLE ES-3 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
AIR[3] (in $\mu g/m^3$)														
• 24-hour and Annual PM_{10} Mining and Reclamation Impacts, Estimated at Town of Zortman	32 $\mu g/m^3$ NI 8 $\mu g/m^3$ NI		57 $\mu g/m^3$ NI 14 $\mu g/m^3$ NI		68 $\mu g/m^3$ NI 17 $\mu g/m^3$ NI		348 $\mu g/m^3$ 87 $\mu g/m^3$		373 $\mu g/m^3$ 93 $\mu g/m^3$		241 $\mu g/m^3$ 60 $\mu g/m^3$		440 $\mu g/m^3$ 110 $\mu g/m^3$	
• Cumulative 24-Hour PM_{10} Impacts, Estimated at Town of Zortman	134 $\mu g/m^3$ NI		159 $\mu g/m^3$		170 $\mu g/m^3$		402 $\mu g/m^3$		405 $\mu g/m^3$		273 $\mu g/m^3$		472 $\mu g/m^3$	
• 24-hour and Annual PM_{10} Mining and Reclamation Impacts, Estimated at Landusky Mine	85 $\mu g/m^3$ NI 14 $\mu g/m^3$ NI		85 $\mu g/m^3$ NI 25 $\mu g/m^3$ NI		85 $\mu g/m^3$ NI 31 $\mu g/m^3$ NI		85 $\mu g/m^3$ NI 31 $\mu g/m^3$ NI		85 $\mu g/m^3$ NI 32 $\mu g/m^3$ NI		85 $\mu g/m^3$ NI 32 $\mu g/m^3$ NI		85 $\mu g/m^3$ NI 32 $\mu g/m^3$ NI	
• Cumulative 24-Hour PM_{10} Impacts, Estimated at Town of Landusky	110 $\mu g/m^3$ NI		121 $\mu g/m^3$ NI		127 $\mu g/m^3$ NI		115 $\mu g/m^3$ NI		115 $\mu g/m^3$ NI		115 $\mu g/m^3$ NI		115 $\mu g/m^3$ NI	
GEOLOGY														
• Disturbance for Reclamation Materials Clay and Limestone (in acres)	0 ac.	0 ac.	3 ac.	6 ac.	16.5 ac.	28 ac.	23 ac.	10 ac.	24.5 ac.	12 ac.	25 ac.	12 ac.	17 ac.	3 ac.
• Cumulative Disturbance for Reclamation Materials Clay and Limestone (in acres)	4.2 ac.	29 ac.	7.2 ac.	35 ac.	20.7 ac.	57 ac.	27.2 ac.	39 ac.	28.7 ac.	41 ac.	29.2 ac.	41 ac.	21.2 ac.	32 ac.
• Anticipated Gold Production (in Troy ounces)	0 oz.		0 oz.		0 oz.		960,000 oz.		960,000 oz.		960,000 oz.		960,000 oz.	
• Anticipated cumulative Gold Production plus Reasonably Foreseeable (in Troy ounces)	1.3 million oz.		1.3 million oz.		1.3 million oz.		2.42 million oz.		2.26 million oz.		2.42 million oz.		2.42 million oz.	

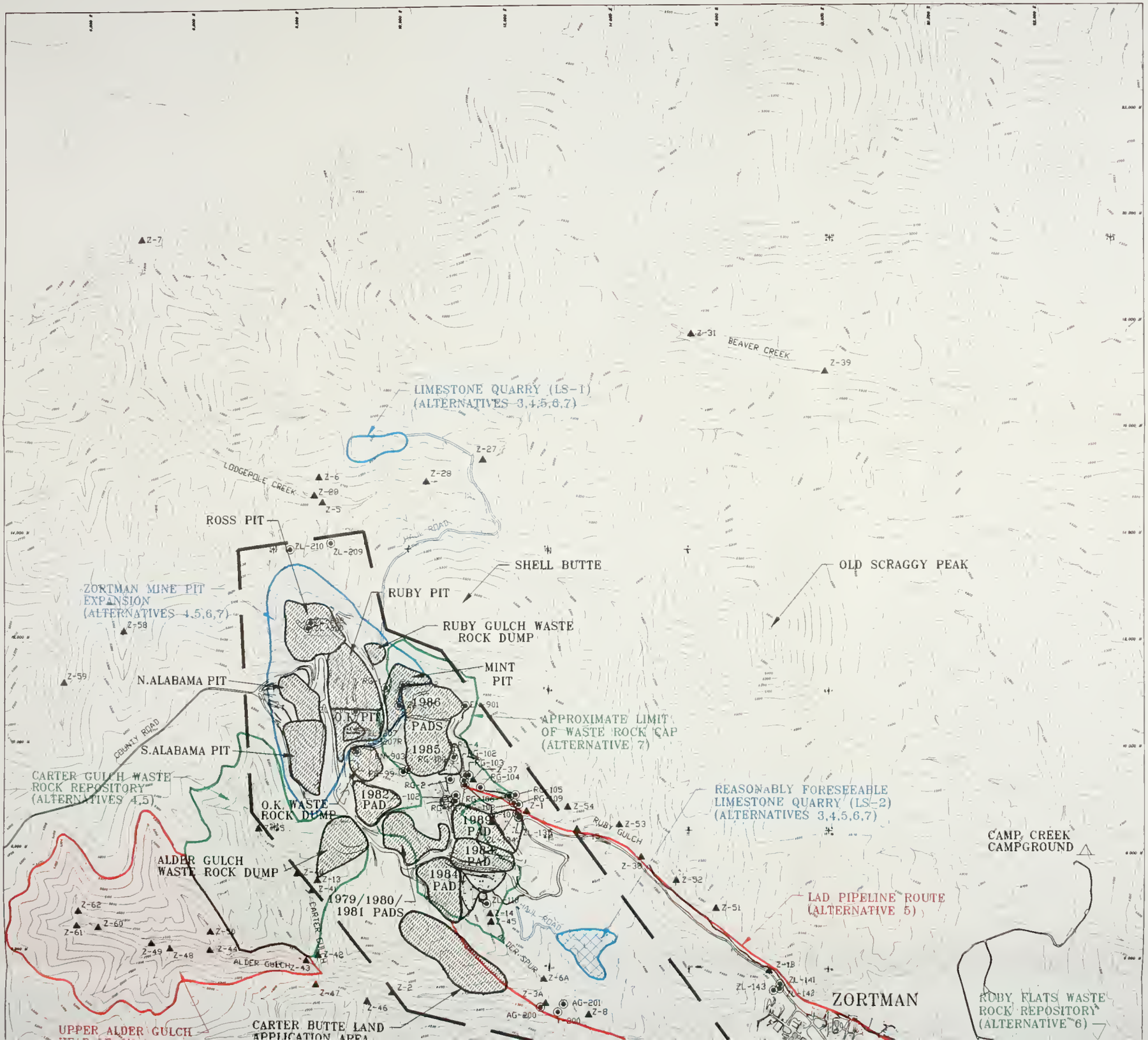
TABLE ES-3 - SUMMARY OF IMPACTS[1]
(Continued)

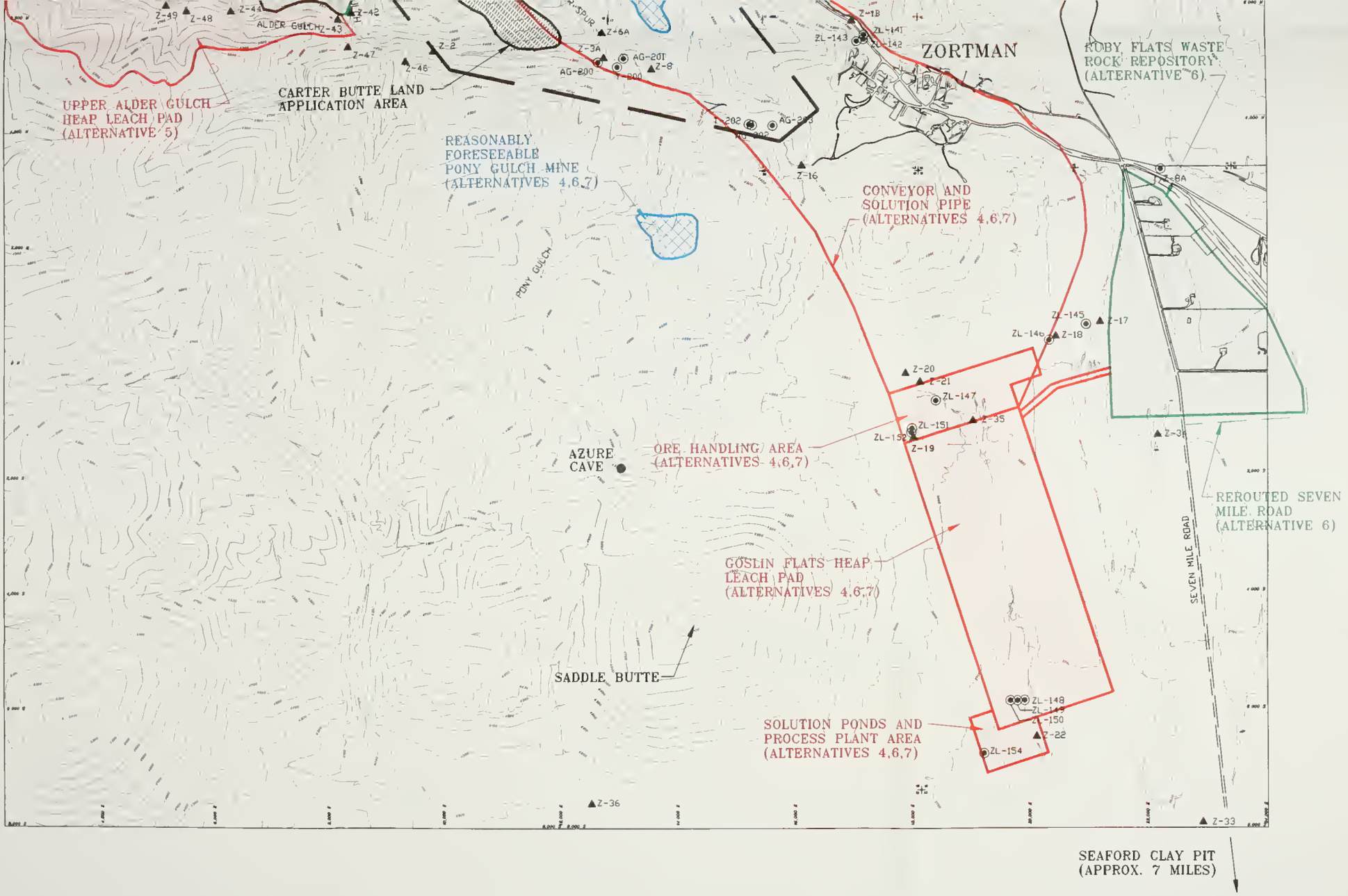
Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
ACECs (Areas of Critical Environmental Concern)														
• Azure Cave (and associated bat habitat)	NI		NI		NI		-M		NI		-M		-M	
• Prairie Dog Towns	NI		NI		NI		NI		NI		NI		NI	
• Little Rocky Mountains (proposed)	NI		NI		NI		-M		-L		-M		-M	
• Saddle Butte (proposed)	NI		NI		NI		NI		NI		NI		NI	
• Old Scraggy Peak (proposed)	NI		NI		NI		-M		-M		-M		-M	
HAZARDOUS MATERIALS	-L		-L		-L		-M		-M		-M		-M	

Notes:

[1] Where applicable, impacts are differentiated by Zortman Mine (Z) and Landusky Mine (L)
[2] Significance threshold is 55 dBA, the estimated level above which noise would interfere with outdoor activity.
[3] Significance thresholds are the 24-Hour, PM_{10} standard of 50 $\mu g/m^3$; and the Annual PM_{10} standard of 150 $\mu g/m^3$.

Key:
- \- = Negative impact
- \+ = Positive impact
- H = High level of impact (significant)
- M = Moderate level of impact
- L = Low level of impact
- NI = Negligible impact


LIMESTONE QUARRY (LS-1)
(ALTERNATIVES 3,4,5,6,7)
BEAVER CREEK
LODGEPOLE CREEK
ROSS PIT
HAUL ROAD
SHELL BUTTE
OLD SCRAGGY PEAK
ZORTMAN MINE PIT
EXPANSION
(ALTERNATIVES 4,5,6,7)
RUBY PIT
RUBY GULCH WASTE
ROCK DUMP
MINT
PIT
N.ALABAMA PIT
1986
PADS
APPROXIMATE LIMIT
OF WASTE ROCK CAP
(ALTERNATIVE 7)
COUNTY ROAD
S.ALABAMA PIT
1985
PAD
CARTER GULCH WASTE
ROCK REPOSITORY
(ALTERNATIVES 4,5)
O.K. WASTE
ROCK DUMP
1982
PAD
REASONABLY FORESEEABLE
LIMESTONE QUARRY (LS-2)
(ALTERNATIVES 3,4,5,6,7)
RUBY GULCH
1983
PAD
1984
PAD
CAMP CREEK
CAMPGROUND
ALDER GULCH
WASTE ROCK DUMP
1979/1980/
1981 PADS
CARTER GULCH
HAUL ROAD
LAD PIPELINE ROUTE
(ALTERNATIVE 5)
ALDER GULCH
DEER SPUR
ZORTMAN
RUBY FLATS WASTE
ROCK REPOSITORY
(ALTERNATIVE 6)
UPPER ALDER GULCH
CARTER BUTTE LAND
APPLICATION AREA



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SCALE IN FEET

LEGEND

- EXISTING FACILITY
- EXISTING DIKE FILL
- PROPOSED LEACH PADS COMPLEX AND CONVEYOR
- PROPOSED WASTE ROCK REPOSITORIES
- PROPOSED EXPANDED PIT COMPLEX AND QUARRIES
- REASONABLY FORESEEABLE FACILITY
- ▲ SURFACE WATER MONITORING STATION
- ◉ GROUND WATER MONITORING WELL
- EXISTING PLANT LOCATION
- — — PERMIT BOUNDARY (EXISTING)

BASE MAP FROM ZORTMAN MINING, INC. 1994

EXISTING AND ALTERNATIVE FACILITIES LOCATION WITH SURFACE WATER AND GROUNDWATER MONITORING LOCATIONS AT ZORTMAN MINE

ZOR-FAC

EXHIBIT 1


Fort Belknap Indian Reservation Boundary
SOUTH BIGHORN CREEK
KING CREEK
KING CREEK
LIMESTONE QUARRY
(ALTERNATIVES 3,4,5,6,7)
SHIFT GULCH
LANDUSKY MINE PIT
EXPANSION AND
BACKFILL AREAS
(ALTERNATIVES 4,5,6,7)
AREA OF ADDITIONAL ORE
(ALTERNATIVES 4,5,6,7)
QUEEN ROSE
PIT
AUGUST #2 WASTE
ROCK DUMP
AUGUST #1 WASTE
ROCK DUMP
MISSION PEAK
AUGUST LITTLE
BEN PITS
MONTANA GULCH
WASTE ROCK DUMP
GOLDBUG
WASTE
ROCK DUMP
1991 PAD
1987 PAD
GOLDBUG PIT BACKFILL
(ALTERNATIVES 4,5,6,7)
1985/1986
PADS
1984
PAD
1983
PAD
SOUTH GOLD BUG PIT
(ALTERNATIVES 4,5,6,7)
SULLIVAN CREEK
ROCK CREEK
L-21
L-6
L-39
L-19
L-20
L-5
L-38
L-31
L-32
L-35
L-37
L-27
L-29
ZL-139
ZL-125
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ZL-119
ZL-105
ZL-155
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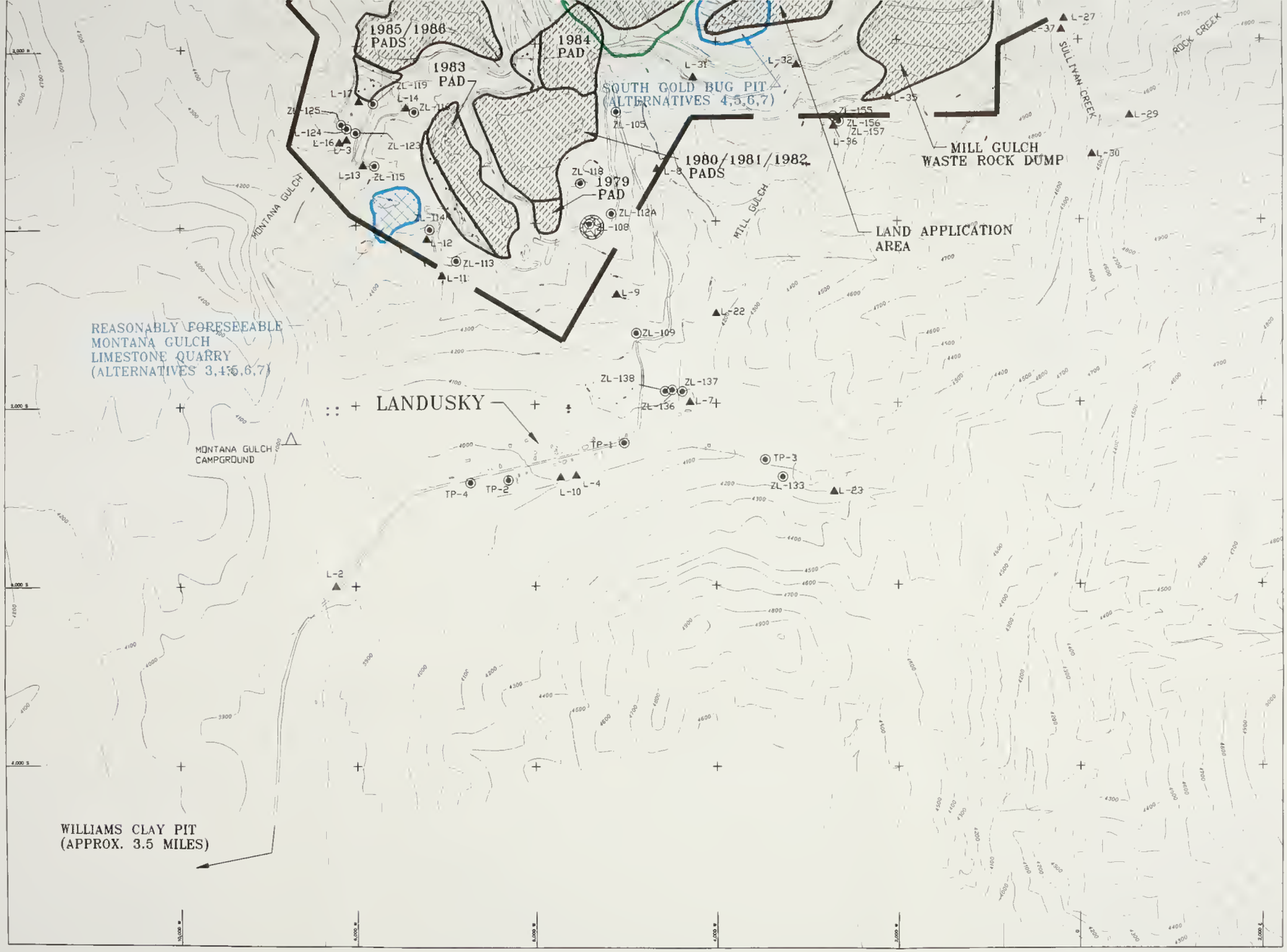
ZL-131
EN-907
EN-908
EN-906



LEGEND

- EXISTING FACILITY
- EXISTING DIKE FILL
- PROPOSED LEACH PADS COMPLEX
- PROPOSED WASTE ROCK REPOSITORIES
- PROPOSED EXPANDED PIT COMPLEX AND QUARRIES
- REASONABLY FORESEEABLE FACILITY
- ▲ SURFACE WATER MONITORING STATION
- ◉ GROUND WATER MONITORING WELL
- EXISTING PLANT LOCATION
- PERMIT BOUNDARY (EXISTING)

N

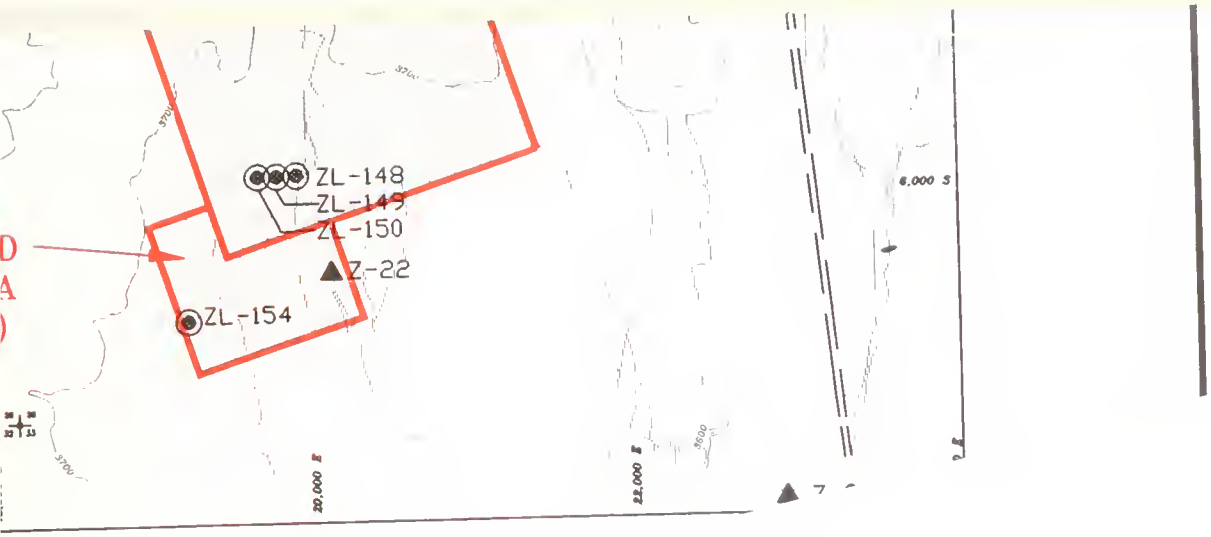
0 400 800 1600
SCALE IN FEET

BASE MAP FROM: ZORTMAN MINING, INC. 1994

EXISTING AND ALTERNATIVE FACILITIES LOCATION WITH SURFACE WATER AND GROUNDWATER MONITORING LOCATIONS AT LANDUSKY MINE

LAND-FAC

EXHIBIT 2



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