

Draft Environmental Impact Statement

Executive Summary

Stillwater Mining Company's Revised Water Management Plans and Boe Ranch LAD

November 2010



Beartooth Ranger District
Custer National Forest

Yellowstone Ranger District
Gallatin National Forest

**Draft Environmental Impact Statement
Stillwater Mining Company's
Revised Water Management Plans and Boe Ranch LAD**

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Montana Department of Environmental Quality

Cooperating agency: Montana Department of Natural Resources & Conservation

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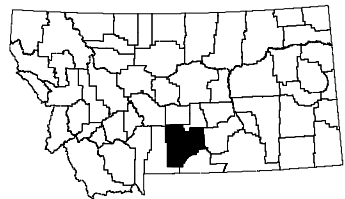
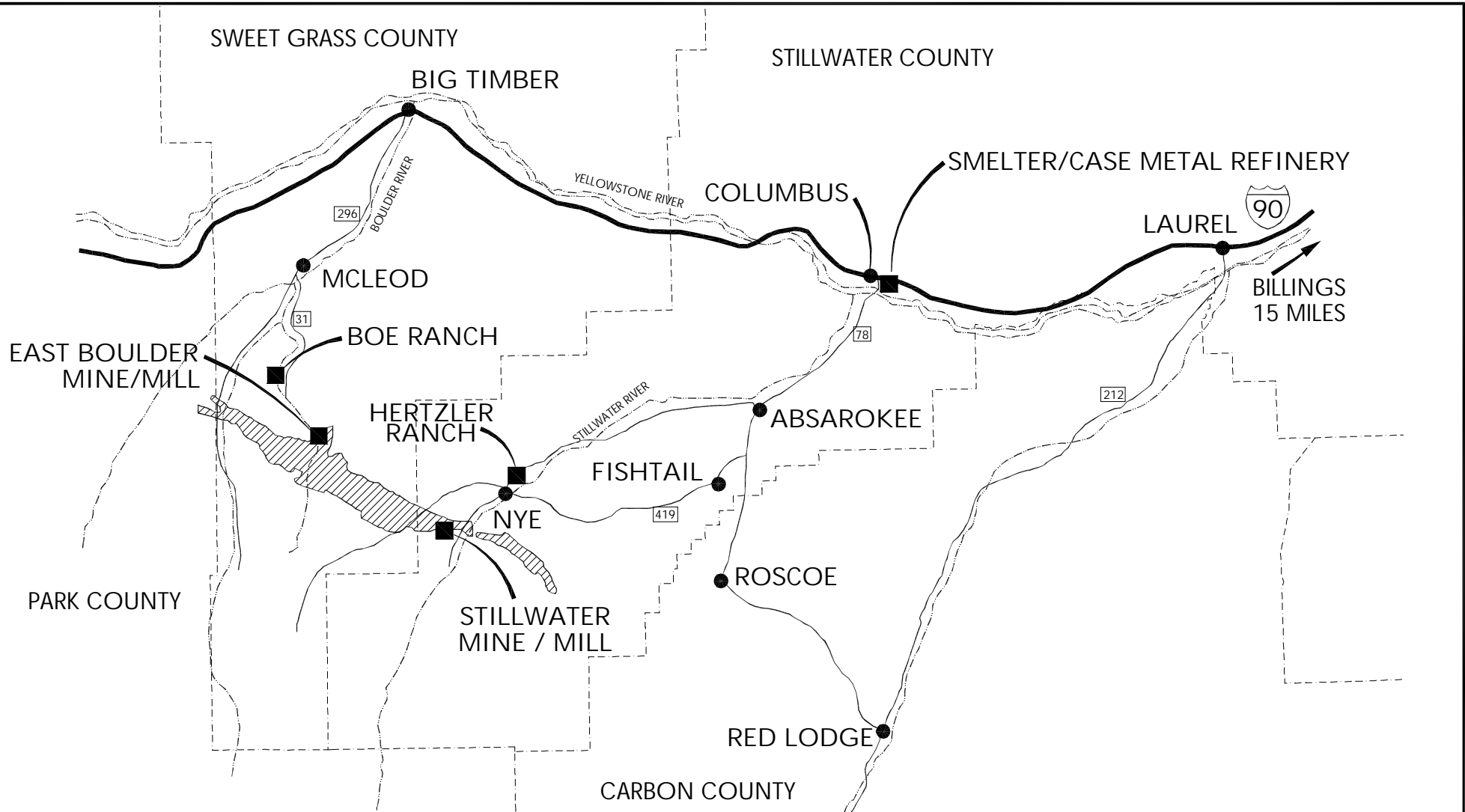
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Abstract: This Draft Environmental Impact Statement (EIS) for the Stillwater Mining Company's (SMC) Revised Water Management Plans and Boe Ranch LAD describes the land, people, and resources potentially affected by proposed revisions. The purpose of SMC's proposed revisions are twofold: 1) to develop and implement closure and post-closure water management plans for adit water, tailings impoundments, and storm water for the Stillwater and East Boulder mines; and 2) to construct and operate a pipeline and land application disposal system at SMC's Boe Ranch property, if needed, to dispose of treated adit and tailings waters from the East Boulder Mine during operations and at closure. This Draft EIS analyzes SMC's proposed revisions as well as agency-proposed modifications to the revised water management plans (e.g., reclamation cover requirements, reclamation cap design, use of biological treatment systems for treatment of undiluted tailings water at closure, relocation of tailings slimes as necessary to facilitate capping the tailings impoundments, and post-closure water routing and channel design). The major federal and state actions include the approval of all necessary permits to implement the revised water management plans, including construction and operation. The No Action Alternatives, Proposed Action Alternatives, and Agency-Mitigated Alternatives are analyzed in detail. The Preferred Alternatives are 3A, 3B, and 3C.

Send Comments to: Patrick Pierson (USDA Forest Service) or Emily Corsi (DEQ)

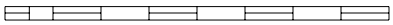
Comments Due: 45 days after the Notice of Availability is published in the *Federal Register*



PROJECT LOCATION
SWEET GRASS / STILLWATER COUNTIES
MONTANA

LEGEND
 Stillwater Mining Company's Claim Area



STILLWATER MINING COMPANY DRAFT EIS Sweet Grass / Stillwater Counties, MT		
LOCATION OF THE STILLWATER AND EAST BOULDER MINES		
0 5 10 15 20 MILES 		FIGURE 1-1
DWG: 1200 PRO LOC.dwg LAYOUT: 1-1		
DRAWN BY: ETC	PREPARED BY: DMC	DATE: 4/10/2007

Executive Summary

This executive summary provides an overview of the contents of the Draft Environmental Impact Statement (DEIS) for the Stillwater Mining Company's Closure and Post-Closure Water Management Plans and Boe Ranch LAD. The DEIS discloses potential environmental, cultural, biological, and physical consequences of implementing alternatives related to closure of Stillwater and East Boulder mine facilities sometime in the future. This summary does not provide all of the information contained in the DEIS. If more detailed information is desired, please refer to the DEIS and the referenced reports.

S.1 Introduction

Stillwater Mining Company (SMC) submitted applications in late 2000 to the Montana Department of Environmental Quality (DEQ), the Custer National Forest (CNF), the Gallatin National Forest (GNF), and the Montana Department of Natural Resources and Conservation (DNRC) to amend its operating permits for the Stillwater Mine (Permit #00118) and the East Boulder Mine (Permit #00149). The Stillwater Mine is in Stillwater County near Nye, Montana (MT). The East Boulder Mine is in Sweet Grass County south of Big Timber, MT.

SMC operates two underground mines in Montana that produce platinum group metals. Operations at the Stillwater Mine began in 1985, and ore production is approximately 777,100 tons per year (SMC 2009c). Although permitted in 1993, operations at the East Boulder Mine did not begin until 1998. Ore production at the East Boulder Mine is approximately 407,400 tons per year (SMC 2008c). SMC upgrades the ore at each mine by crushing, grinding, flotation, and filtration to produce a concentrate. This concentrate is shipped by truck to the Stillwater Smelter and Base Metal Refinery (BMR) in Columbus, MT for further upgrading. From the BMR, SMC ships the product to New Jersey for final refining.

For each mine, every 100 tons of ore fed to the mill generates 99 tons of tailings. These tailings are pumped from the mill to underground sand and paste plants where the coarse sand fraction of tailings is separated from the slimes fraction (finest-sized particle). The sand is dewatered, cement is added, and about 58 percent of the total tailings is used to backfill underground workings. The remainder of the tailings are pumped to the respective tailings impoundments at the Hertzler Ranch and the East Boulder Mine. The tailings impoundment at the Stillwater Mine is used to balance water storage.

As of April 2008, the Stillwater Mine had 10 amendments and 49 minor revisions to its Plan of Operations. The East Boulder Mine had one amendment and 20

minor revisions to its Plan of Operations. The ownership of lands at the Stillwater and East Boulder Mines is listed below in Table S-1.

Table S-1 Ownership of Lands at the Stillwater and East Boulder Mines

Parameter	Ownership ¹		
	USFS (acres)	Private (acres)	Total (acres)
Stillwater Mine			
Permit Area	473	2,002	2,475
Total Disturbance	74.5	638.3	712.8
Permitted			
Disturbance to Date	35.9 ²	401.0	436.9
East Boulder Mine			
Permit Area	397	933	1,330
Total Disturbance	265.3	0	265.3
Permitted			
Disturbance to Date	199.6	0	199.6

Note:

1. As of April 2008.

2. Roads and adits as of April 2008.

Sources: Weimer 2008a, Wolfe 2008.

SMC's applications include three separate proposals that the agencies analyze in this Draft Environmental Impact Statement (EIS): one proposal involves the Stillwater Mine and two of the proposals involve the East Boulder Mine. SMC requests approval from DEQ, CNF, GNF, and DNRC to:

- Develop and implement closure and post-closure water management plans (WMPs) for adit water, tailings impoundments, and storm water for the Stillwater and East Boulder mines. SMC proposes to discharge water directly to the Stillwater and East Boulder rivers once adit and tailings waters have met Montana state water quality standards or, in the case of nitrogen, have met the Montana Pollution Discharge Elimination System (MPDES) permit nondegradation limits of 100 pounds per day (lbs/day) in the Stillwater River and 30 lbs/day in the East Boulder River; and
- Construct and operate a pipeline and land application disposal (LAD) system at its Boe Ranch property, if needed, to dispose of treated adit and tailings waters from the East Boulder Mine during operations and at closure.

This EIS analyzes the following proposed modifications to the reclamation and Water Management Plans:

- Changing reclamation cover requirements from an average of four to six feet to an average of two feet for all tailings impoundments (cover material is defined as glacial till, waste rock, or a combination of materials);
- Changing the reclamation cap design on all tailings impoundments from a domed or convex configuration to a concave configuration with

- positive drainage following the deposited tailings gradient (this includes removal of any requirement for tailings grading prior to cap placement);
- Evaluating the use of Biological Treatment Systems (BTS) for treatment of undiluted tailings waters at closure (test report dated May 2007);
 - Evaluating the potential relocation of tailings slimes to alternative locations as necessary to expedite and facilitate the capping process (e.g., to mine workings and lined storage ponds); and
 - Evaluating changes in post-closure water routing and channel design.

Descriptions of all alternatives considered in this EIS are contained in Chapter 2 and are summarized in Tables 2-6, 2-7, 2-8, and Appendix C.

S.1.1 General Location and Geographic Setting

The Stillwater Mine is in Stillwater County near Nye, Montana (MT). The East Boulder Mine is in Sweet Grass County south of Big Timber, MT. The Boe Ranch is located northwest of the East Boulder Mine (Figure 1-1).

S.2 Purpose and Need

As described above, the Proposed Actions are the basis for the analyses documented in this EIS. The Proposed Actions encompass several purposes.

First, the purpose and need for closure and post-closure WMPs for the Stillwater and East Boulder mines is to respond to the intent of the regulations for the Montana Metal Mine Reclamation Act (MMRA) 82–4–301 *et seq.* Montana Code Annotated (MCA) and US Forest Service (USFS) regulations (36 Code of Federal Regulations [CFR] 228, Subpart A). These regulations require each mine to have a closure and post-closure WMP to meet water quality standards during and after reclamation.

The agencies concluded that earlier analyses did not address the type and duration of water management and treatment with enough specificity, nor were they detailed enough to use in determining closure and post-closure reclamation bond calculations.

Second, the purpose and need of the East Boulder Mine Boe Ranch LAD System Proposed Action is to provide additional operating flexibility, to optimize options for treatment and disposal of adit and tailings waters, and to allow mine waste

Mine Life Terms

For the purpose of this analysis, the terms “operations,” “closure,” and “post-closure” will be defined as follows:

Operations: The period when active mining is taking place, tailings are being generated, and active adit water treatment is ongoing.

Closure: The period when mining and milling operations have ceased, tailings impoundments are being dewatered and reclaimed, mine facilities are removed, and adit and tailings impoundment water treatment is ongoing.

Post-Closure: The period when reclamation has been completed, and water treatment is no longer required. Monitoring and maintenance would continue.

waters to be beneficially used in an agricultural setting during the life of the mine and at closure.

SMC's current WMP for the Stillwater Mine was approved on June 28, 1998, for LAD of treated mine waters at the Hertzler Ranch. SMC has proposed the Boe Ranch LAD system as an enhancement of the approved East Boulder Mine LAD system, which would allow for storage of all mine discharge waters during the non-growing season with subsequent LAD of the water during the ensuing growing season. SMC believes that the Boe Ranch location would increase the evaporation potential of the treated mine waters because the area is windier and drier than the mine area. SMC also believes the grassland vegetation would enhance the overall nitrogen removal efficiency of the LAD system. SMC contends the Boe Ranch is better suited for a LAD system than the East Boulder Mine LAD areas because it is not hydrologically connected to the East Boulder River.

S.3 Alternatives

Nine alternatives were considered in this MEPA/NEPA analysis, including the following: three No Action Alternatives, SMC's three Proposed Actions, and three Agency-Mitigated Alternatives. Please see Table S-2 for the naming convention of alternatives. These alternatives are summarized below.

Table S - 2 Alphanumeric Naming Convention of Alternatives

	No Action	Proposed Action	Agency-Mitigated
Stillwater Mine and Hertzler Ranch LAD System	1A	2A	3A
East Boulder Mine	1B	2B	3B
Boe Ranch LAD System	1C	2C	3C

The revised water management plans under consideration address the management of all mine waters generated during operations, closure, and post-closure at both mines. The plans are summarized here. Differences between the alternatives are summarized in Tables S-4, S-5, and S-6, which can be found in Section S.7. For more detailed descriptions of these water management plans by alternative, please refer to Chapter 2.

Adit water:	Ground water intercepted by the mine workings that exits the adits.
Tailings water:	Water deposited in the tailings impoundment.
Storm water:	Rain and snowmelt that must be managed on the mine property.

During operations at both mines, SMC uses water (process water) during production and processing of the ore for milling, concentrating, and controlling dust. Used process water is eventually routed to the tailings impoundment for storage as supernatant water. Supernatant water is drawn from the tailings impoundment as needed and is treated along with adit water in the biological treatment system at the respective mine for reuse as process water, or it is routed to the percolation pond and/or land application system for disposal. Water that is land applied undergoes further treatment for nitrogen. Percolation provides no treatment; it is only a water disposal method.

At closure, the tailings impoundments at both mines and Hertzler Ranch require capping. Enough of the tailings mass water would need to be removed so that the reclamation cap could be installed. The tailings waters at the mines would be evaporated over the tailings mass or removed to receive biological treatment prior to disposal. The Hertzler Ranch tailings mass water would

be evaporated over the tailings mass or land applied. This water would not receive biological treatment prior to land application disposal. Adit water produced during closure would be treated in the biological treatment system at the respective mine then routed to the percolation pond and/or land application system for disposal. The time frames for closure vary from 12 to 36 months, depending on the alternative.

Post-closure, adit water would be treated until it met criteria, then discharged to ground water through percolation ponds and underground workings or to the respective river through a constructed channel. Underdrain water would be collected above the liner at the base of the tailings mass in the Hertzler Ranch and East Boulder tailings impoundments. The Stillwater tailings impoundment does not have an underdrain. Post-closure, the underdrains would be decommissioned and plugged, or the underdrain water would be percolated. Each tailings impoundment is expected to leak at rates less than 1 gpm. Post-closure, storm water and seepage through the reclamation cover would not be treated and would be routed through constructed channels into sedimentation basins and/or to the respective river.

Each alternative has a water monitoring plan for operations and closure, and all but the No Action Alternatives have monitoring plans for post-closure. The descriptions that follow highlight the differences among the alternatives.

Sources of Tailings Waters

There are several sources of tailings waters to be managed during closure and post-closure. They have different volume, treatment, and disposal needs.

Supernatant water:	The freestanding water on tailings that needs to be disposed of before reclamation can begin.
Water in the tailings mass:	The water held within the tailings mass that is freed upon tailings consolidation.
Underdrain water:	Tailings water that has infiltrated through the tailings mass and discharged through the underdrain.
Liner leakage:	Tailings water that has infiltrated through the tailings impoundment and leaks through the liner.
Seepage through the cover:	Water that infiltrates through the cover to the tailings interface and discharges laterally to the embankment edge.

S.3.1 Stillwater Mine Closure and Post-Closure Water Management Plan No Action Alternative 1A

Under this alternative, the existing closure and post-closure water management plans are primarily conceptual (Table S-4). The plans have not been adequately analyzed or approved and do not contain sufficient detail to be implemented. Closure of the Stillwater and Hertzler Ranch tailings impoundments would take up to three years to evaporate the tailings waters and would not address the issue of dry tailings blowing from the impoundments.

The thicknesses of the tailings impoundment caps are different based on the availability of salvaged soil. The Stillwater impoundment would be capped by 42 inches of waste rock and/or borrow material and 8 inches of soil. The Hertzler Ranch impoundment would be capped by 48 inches of borrow material and 24 inches of subsoil/soil. Both caps would have a mounded configuration to shed water. Decommissioning of the underground at the Stillwater Mine is not defined under this alternative, nor is there an estimate of the time it would take to flood the workings. The operating and closure monitoring plans for this alternative have been approved by the agencies.

S.3.2 Stillwater Mine Closure and Post-Closure Water Management Plan Proposed Action Alternative 2A

A detailed closure and post-closure water management plan has been proposed by SMC (Table S-4). Approximately 35 million gallons (MG) of tailings waters, which include supernatant and waters residing in the tailings mass, would have to be removed from the Stillwater tailings impoundment so that the reclamation cap could be installed. About 45 MG of tailings waters would have to be removed from the Hertzler Ranch tailings impoundment before the reclamation cap could be installed. SMC proposes a 12-month period would be necessary to dewater the impoundments and treat and dispose of adit and tailings waters. By the end of this 12-month period, SMC estimates no further treatment of mine waters would be necessary.

Based on the amount of available salvaged soil, SMC has proposed to cap the Stillwater impoundment with 24 inches of waste rock and/or borrow material and 8 inches of soil. SMC's proposal for the Hertzler Ranch tailings impoundment cap would be 24 inches of borrow material and 24 inches of subsoil/soil. Both caps would have a swale configuration that would focus drainage across the cap to one discharge point. SMC's proposal estimates that decommissioning of the underground workings could be accomplished in six weeks and that the mine would flood in 11 to 38 years, depending on the rate of ground water inflow and total volume of workings at closure. The monitoring plan for this alternative is the existing plan and has been approved by the agencies.

S.3.3 Stillwater Mine Closure and Post-Closure Water Management Plan Proposed Action Alternative 3A

This alternative outlines the agencies' suggested modifications to SMC's proposed closure and post-closure plan water management plan (Table S-4). The agencies concur with SMC's estimates that 35 MG of tailings waters would have to be removed from the Stillwater tailings impoundment and 45 MG from the Hertzler Ranch tailings impoundment prior to installing the respective reclamation caps. The agencies propose a more conservative 18-month period to dewater these impoundments and treat and dispose of adit and tailings waters. The agencies estimate that it could take up to 24 months after closure for the adit water nitrogen concentration to decline sufficiently so that no further treatment would be necessary.

The agencies propose that the Stillwater impoundment be capped by 42 inches of waste rock and/or borrow material and 8 inches of soil. The Hertzler Ranch impoundment would be capped by 48 inches of borrow material and 24 inches of subsoil/soil. Both caps would have a swale configuration that would focus drainage across the cap to one discharge point. The agencies would extend the decommissioning of the underground workings from six to twelve weeks. The agencies would route adit water underground and flood the mine workings in 4 to 11 years, depending on the rate of ground water inflow and total volume of workings at closure. This alternative would increase the scope of the operational monitoring plan to include the volume of supernatant water, the grade and direction of the slope across both tailings impoundments, and the concentrations of dissolved salts in mine waste waters (adit, tailings, and supernatant waters). The agencies would also augment the closure and post-closure monitoring to include mine pool water quality and elevation and maintenance of routing structures for ground water flow out of the off-shaft, storm water drainage, and seepage through the reclamation cover.

S.3.4 East Boulder Mine Closure and Post-Closure Water Management Plan No Action Alternative 1B

Under this alternative, the existing closure and post-closure water management plans are primarily conceptual (Table S-5). The plans have not been adequately analyzed or approved, and do not contain sufficient detail to be implemented. The Boe Ranch LAD system would not be built and all mine waste waters would be managed at the East Boulder Mine percolation pond and LAD areas. Currently, only LAD Area 6 (10.2 acres) has been built; LAD areas 2, 3-Upper, and 4 (36.4 acres) have been approved by the agencies but not constructed by SMC. The East Boulder Mine LAD feed pond has limited storage of 0.7 MG. Closure of the East Boulder tailings impoundment would take up to three years to evaporate the supernatant and tailings mass waters and would not address the issue of dry tailings blowing from the impoundments.

The East Boulder tailings impoundment would be capped by 48 inches of waste rock and/or borrow material (including boulders) and 28 inches of subsoil/soil. The cap would have a mounded configuration to shed water. Decommissioning of the underground at the East Boulder Mine is not defined under this alternative, and the geology and geometry of the workings of this mine are such that it would not flood. The monitoring plan for this alternative has been approved by the agencies.

S.3.5 East Boulder Mine Closure and Post-Closure Water Management Plan Proposed Action Alternative 2B

A detailed closure and post-closure water management plan has been proposed by SMC (Table S-5). Approximately 40 MG of tailings waters would have to be removed from the East Boulder tailings impoundment before the reclamation cap could be installed. SMC proposes a 12-month period would be necessary to dewater the impoundment and treat and dispose of adit and tailings waters. By the end of this 12-month period, SMC estimates no further treatment of mine waters would be necessary. The Boe Ranch LAD system would not be built unless Alternative 2C or Alternative 3C is also selected and implemented; otherwise, all mine waste waters would be managed at the East Boulder Mine.

SMC has proposed to cap the East Boulder impoundment with 24 inches of waste rock and/or borrow material (including boulders) and 28 inches of subsoil/soil. The cap would have a swale configuration that would focus drainage across the cap to one discharge point. SMC's proposal estimates that decommissioning of the underground workings could be accomplished in six weeks, and the geology and geometry of the workings of this mine are such that it would not flood. The monitoring plan for this alternative is the existing plan and has been approved by the agencies.

S.3.6 East Boulder Mine Closure and Post-Closure Water Management Plan Agency-Mitigated Alternative 3B

This alternative outlines the agencies' suggested modifications to SMC's proposed closure and post-closure plan water management plan (Table S-5). The agencies concur with SMC's estimate that 40 MG of tailings waters would have to be removed from the East Boulder tailings impoundment prior to installing the reclamation cap. The agencies propose a more conservative 18-month period to dewater the impoundment and treat and dispose of adit and tailings waters. The agencies estimate that it could take up to 24 months after closure for the adit water nitrogen concentration to decline sufficiently so that no further treatment would be necessary. The Boe Ranch LAD system would not be built unless Alternative 2C or Alternative 3C is also selected and implemented; otherwise, all mine waste waters would be managed at the East Boulder Mine.

The agencies propose that the East Boulder tailings impoundment be capped by 48 inches of waste rock and/or borrow material (including boulders) and 28 inches of soil. The Hertzler Ranch impoundment would be capped by 48 inches of subsoil/soil. The cap would have a swale configuration that would focus drainage across the cap to one discharge point. The agencies would extend the decommissioning of the underground workings from six to twelve weeks. The geology and geometry of the workings of this mine are such that it would not flood. This alternative would increase the operational monitoring plan to include the volume of supernatant water, grade and direction of the slope across the tailings impoundment, and the concentrations of dissolved salts in the mine waste waters (adit, tailings, and supernatant waters). The agencies would augment the closure and post-closure monitoring to include maintenance of routing structures for storm water drainage and seepage through the reclamation cover.

S.3.7 Boe Ranch LAD System No Action Alternative 1C

Under this alternative, the existing closure and post-closure water management plans are primarily conceptual (Table S-6). The plans have not been adequately analyzed or approved and do not contain sufficient detail to be implemented. The Boe Ranch LAD system would not be built, and all mine waste waters would be managed at the East Boulder Mine percolation pond and LAD areas. Currently, only LAD Area 6 (10.2 acres) has been built; LAD areas 2, 3-Upper, and 4 (36.4 acres) have been approved by the agencies but not constructed by SMC. The East Boulder Mine LAD feed pond has limited storage of 0.7 MG. Closure of the East Boulder tailings impoundment would take up to three years to evaporate the supernatant and tailings mass waters and would not address the issue of dry tailings blowing from the impoundments.

The East Boulder tailings impoundment would be capped by 48 inches of waste rock and/or borrow material (including boulders) and 28 inches of subsoil/soil. The cap would have a mounded configuration to shed water. Decommissioning of the underground at the East Boulder Mine is not defined under this alternative, and the geology and geometry of the workings of this mine are such that it would not flood. The monitoring plan under this alternative is the same as for the East Boulder Mine and has been approved by the agencies.

S.3.8 Boe Ranch LAD System Proposed Action Alternative 2C

A detailed closure and post-closure water management plan for the East Boulder Mine and Boe Ranch LAD system has been proposed by SMC (Table S-6). Approximately 40 MG of tailings waters would have to be removed from the East Boulder tailings impoundment before the reclamation cap could be installed. SMC proposes a 12-month period would be necessary to dewater the impoundment and treat and dispose of adit and tailings waters. By the end of this 12-month period, SMC estimates no further treatment of mine waters would be necessary. SMC would have the option to dispose of treated water at the East Boulder Mine percolation ponds, LAD areas, and if approved and constructed,

the Boe Ranch LAD system (194.1 acres containing ten center pivots and a 108 MG LAD storage pond). The LAD storage pond would have a High-Hazard Dam Classification during operations, closure, and post-closure.

SMC has proposed to cap the East Boulder impoundment with 24 inches of waste rock and/or borrow material (including boulders) and 28 inches of subsoil/soil. The cap would have a swale configuration that would focus drainage across the cap to one discharge point. SMC's proposal estimates that decommissioning of the underground workings could be accomplished in six weeks, and the geology and geometry of the workings of this mine are such that it would not flood. The monitoring plan for this alternative would be the proposed Boe Ranch Operational Plan that is under consideration.

S.3.9 Boe Ranch LAD System Agency-Mitigated Alternative 3C

This alternative outlines the agencies' suggested modifications to SMC's proposed closure and post-closure plan water management plan (Table S-6). The agencies concur with SMC's estimate that 40 MG of tailings waters would have to be removed from the East Boulder tailings impoundment prior to installing the reclamation cap. The agencies propose a more conservative 18-month period to dewater the impoundment and treat and dispose of adit and tailings waters. The agencies estimate that it could take up to 24 months after closure for the adit water nitrogen concentration to decline sufficiently so that no further treatment would be necessary. SMC would have the option to dispose of treated water at the East Boulder Mine percolation ponds, LAD areas, and if approved and constructed, the Boe Ranch LAD system. The agencies would reduce the overall size of the Boe Ranch LAD system due to mass wasting concerns (187 acres containing nine center pivots and a 108 MG LAD storage pond). This alternative would increase the rate of LAD application to facilitate the flushing of salts from the root zone of soil. SMC would be required to monitor the flow rate of the East Boulder River during the irrigation season so that the LAD application rate could be adjusted as needed to prevent nitrogen exceedances in surface water. The LAD storage pond would have a High-Hazard Dam Classification during operations and closure, but the High-Hazard Dam Classification would not continue post-closure.

The agencies propose that the East Boulder tailings impoundment be capped by 48 inches of waste rock and/or borrow material (including boulders) and 28 inches of soil. The cap would have a swale configuration that would focus drainage across the cap to one discharge point. The agencies would extend the decommissioning of the underground workings from six to twelve weeks. The geology and geometry of the workings of this mine are such that it would not flood. This alternative would augment the operational monitoring plan to include the volume of supernatant water, direction and grade of the slope across the tailings impoundment, and the concentrations of dissolved salts in the mine waste waters (adit, tailings, and supernatant waters). The agencies would augment the closure and post-closure monitoring to include maintenance of routing structures for storm water drainage and seepage through the reclamation cover.

S.4 Scope of Decisions To Be Made

S.4.1 Decisions To Be Made

The Director of the DEQ and the Forest Supervisor for the CNF and GNF must make decisions on SMC's requests to amend its permits. These decisions will be documented in a Record of Decision (ROD). The decision-making process will lead to the selection of one of the following possible alternatives for each of the three proposals addressed in this EIS:

- Denial of the proposed amendments (DEQ) or request for revisions (CNF or GNF) (No Action Alternatives 1A, 1B, and 1C);
- Approval of the Proposed Actions amending the existing permits and plans of operations for the Stillwater Mine, East Boulder Mine, and Boe Ranch (Proposed Action Alternatives 2A, 2B, and 2C); or
- Approval of an Agency-Mitigated Alternative to the proposed actions (Mitigated Alternatives 3A, 3B, and 3C); or
- Approval of some combination of the Proposed Action and agency-specified mitigation measures.

DEQ can deny the proposed amendments pursuant to state law. The USFS' authority to deny mining proposals is limited by federal law. The operator then would have the option of revising the plan accordingly or appealing the decision through the courts. Please see Chapter 1 for more details on the agencies' roles, authority, and responsibilities. Table 1-2 lists the permits, licenses, approvals, and consultations potentially required for amendments to SMC's Plans of Operations for the Stillwater and East Boulder mines.

S.4.2 Decisions That Will Not Be Made

This Draft EIS considers only the revisions to the Stillwater Mining Company's water management plans for the Stillwater Mine and Hertzler Ranch LAD and the East Boulder Mine. This analysis is not a reassessment of these mines. The record of decision based upon this analysis would amend the water management plans for closure at these facilities and provide additional operational flexibility for the East Boulder Mine if the Boe Ranch LAD system is approved by the agencies and constructed by SMC.

S.5 Public Participation Summary

S.5.1 Application Review

The agencies received Stillwater Mining Company's (SMC's) proposed amendments to its approved Plan of Operations in December 2000. After reviewing SMC's proposals to ensure the information contained was adequate to complete an environmental analysis, the agencies deemed the proposals complete on July 27, 2001. The agencies issued press releases and published legal notices in local newspapers soliciting public comment on the Proposed Actions. SMC submitted changes to the Proposed Actions and the agencies accepted them in January 2007.

S.5.2 Scoping

Scoping for SMC's three Proposed Actions began in July 2001 with the distribution of a scoping document that informed readers of the agencies' intent to conduct environmental analyses of SMC's Proposed Actions. The agencies mailed approximately 400 copies of the scoping document to individuals, agencies, organizations, and businesses that might be interested in or affected by the Proposed Actions and subsequent decisions. The scoping document solicited comments to assist the agencies in identifying specific issues and concerns to be addressed in the MEPA/NEPA EIS analysis.

The USFS published a notice of intent to prepare an EIS in the *Federal Register* (USFS 2001). DEQ and the USFS held two public scoping meetings (July 18, 2001 in Absarokee, MT and July 19, 2001, in Big Timber, MT) to discuss the Proposed Actions and to receive public comments. A total of 60 participants attended these meetings. Representatives from DEQ and the USFS described the Proposed Actions, and attendees were provided an opportunity to ask questions and submit comments at both meetings.

After public scoping meetings, the agencies and SMC hosted field trips at the Stillwater Mine (August 9, 2001), the East Boulder Mine, and the Boe Ranch LAD area (August 11, 2001) locations. A total of 14 persons attended these field trips.

In addition to attending and commenting at the public scoping meetings and participating in project-related field trips, nine individuals also submitted written comments identifying issues and concerns. Please see Chapter 2 for further details.

S.6 Issue Identification and Issue Statements

The agencies' analysis of comments identified 17 potential issues. Five issues were identified as significant or potentially significant because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict. The agencies are directed by MEPA/NEPA to focus environmental analyses on significant issues and to dismiss nonsignificant issues [Administrative Rules of Montana (ARM) 17.4.615(2)(b) and (c) and 40 Code of Federal Regulations (CFR) 1500.4(b), (c), and (g)].

S.6.1 Significant Issues

The project's purpose and need as well as significant issues govern the range of reasonable alternatives considered in the environmental analysis. Alternatives must meet, at least partially, the project's purpose and need and address one or more of the significant issues. Table S-3 lists the significant issues by the location of alternative components. For more detail on the significant issues, the reader is directed to Chapter 2.

Issue 1: Water Quality and Quantity

Implementation of the Proposed Actions could change the existing quality and quantity of water around the Stillwater Mine, the East Boulder Mine, and/or the East Boulder Mine Boe Ranch LAD area.

Issue 2: Wildlife and Aquatic Resources

Implementation of portions of the Proposed Actions could affect aquatic resources near both mines at closure and post-closure, as well as wildlife (including sensitive and threatened and endangered species) and aquatic resources on and near the Boe Ranch during operations and closure.

Issue 3: Irrigation Practices

Implementation of the Boe Ranch LAD system could affect natural resources (e.g., alterations of natural plant communities, the spread of noxious weeds, and potential for mass wasting) depending on the specific irrigation practices used.

Issue 4: Cultural Resources

Implementation of the Boe Ranch LAD system Proposed Action could adversely affect cultural resources on the property.

Issue 5: Stability of the Boe Ranch LAD Storage Pond

Implementation of Proposed Action 2C would result in construction and long-term operation and closure use of a 32-acre LAD storage pond. Concerns included storage pond embankment stability, potential property and water quality damage in the event of dam failure, and ability of the pond to pass a 100-year storm event.

Table S-3 Issues to be Addressed by Alternatives Relative to Location

Issues (and Sub-issues)	Stillwater Mine (Closure and Post-Closure Water Management Plan)			East Boulder Mine (Closure and Post-Closure Water Management Plan)			Boe Ranch LAD System		
	No Action 1A	Proposed Action 2A	Agency-Mitigated Alternative 3A	No Action 1B	Proposed Action 2B	Agency-Mitigated Alternative 3B	No Action 1C	Proposed Action 2C	Agency-Mitigated Alternative 3C
1. Water Quality and Quantity	X	X	X	X	X	X	X	X	X
2. Wildlife and Aquatic Resources	-	X (Aquatics)	X (Aquatics)	-	X (Aquatics)	X (Aquatics)	-	X	X
3. Irrigation Practices	-	-	-	-	-	-	-	X	X
4. Cultural Resources	-	-	-	-	-	-	-	X	X
5. Stability of LAD Storage Pond	-	-	-	-	-	-	-	X	X

Notes:

1. "X" means the issue is pertinent to the location and the alternative.
2. "-" means the issue is not applicable to or is not addressed by that alternative.

S.6.2 Issues Considered But Dismissed

Twelve preliminary issues identified during project scoping were not relevant to the Proposed Actions since they were beyond the scope of this environmental analysis or have been addressed by federal or state law, regulation, or policy. For more detail on issues considered but dismissed, the reader is directed to Chapter 2.

Issue 6: Bonding (Financial Assurance)

Comments indicated that the MEPA/NEPA analysis should address the reclamation bond needed to cover closure and post-closure treatment and monitoring. Law, regulation, or policy has addressed this issue.

Issue 7: Incorporation of Operational Stipulations/Mitigations

Comments suggested that the ROD for this analysis should require SMC to reevaluate and amend operating plans when new disposal methods for tailings and waste rock are identified. Law, regulation, or policy has addressed this issue.

Issue 8: Potential Water Quality Impacts from Boe Ranch LAD System Mist into the East Boulder River

Comments identified a concern that possible adverse effects could occur to the East Boulder River from mist from the operation of the Boe Ranch LAD center pivots. Experience obtained through monitoring the Hertzler Ranch LAD pivots indicates that mist from the center pivots would not likely travel the mile to the East Boulder River due to evaporation.

Issue 9: Water Quality Effects Caused by Phosphates in Treated Adit and Tailings Waters

Comments suggested that phosphates could be released from the Boe Ranch LAD system and affect water quality. Monitoring data to date indicate that phosphates are not a substantive issue in the East Boulder Mine treated waste waters.

Issue 10: Storm Water Pollution Prevention Plan (SWPPP)

The comments indicated that the SWPPP for the East Boulder Mine should be reviewed and updated to encompass the proposed Boe Ranch LAD system. Review of SMC's SWPPP is a standard part of the Plan of Operations and law, regulation, or policy has addressed this issue.

Issue 11: Wetlands and Riparian Zones

Comments indicated that the MEPA/NEPA analysis should evaluate the potential effects from construction and operation of the Boe Ranch LAD system on wetlands and riparian zones. Neither wetlands nor riparian zones have been identified along the pipeline route to the proposed Boe Ranch LAD facilities. The potential for adverse effects to wetlands appears to be low.

Issue 12: Tailings Impoundment Stability

Comments indicated the tailings impoundments should be evaluated for stability. These analyses have already been performed in previous environmental analyses, and the proposed action under consideration does not include any changes to these tailings impoundments, nor would the water management plans considered affect impoundment stability during operations, closure, and post-closure.

Issue 13: Public Participation

Some scoping participants felt that there should be a higher level of public involvement, particularly with review and comment on preliminary drafts of the EIS. The agencies have met or exceeded all MEPA/NEPA procedural requirements and notification for public involvement. Law, regulation, or policy has addressed this issue.

Issue 14: MEPA/NEPA Process

Several comments were noted that requested that the document comply with the various components of MEPA and NEPA. Law, regulation, or policy has addressed this issue.

Issue 15: Effects of Nitrates and Trace Metal Bioaccumulation on Ruminants

Comments requested that the analysis address the potential for nitrogen and trace metals (mainly cadmium, copper, chromium, lead, and zinc) to accumulate in ruminants through grazing under the Boe Ranch LAD system center pivots. The reader is directed to a detailed discussion of this issue in Chapter 2. In summary, low metals concentrations and the potential for nitrate bioaccumulation in animals through ingestion of vegetation at the Boe Ranch LAD area is not considered an issue to be evaluated in this analysis.

Issue 16: Effects of Nitrates and Trace Metals on Waterfowl

Comments suggested that waterfowl using the Boe Ranch LAD storage pond would be affected by nitrates and trace metals (mainly chromium, lead, and zinc). The East Boulder Mine treated adit water meets or is lower than MPDES permit effluent limits for direct discharge to the East Boulder River. The potential for adverse effects to waterfowl is not considered a significant issue to be evaluated in this analysis.

Issue 17: Effects of Trace Metal Accumulation on Plants and Soils

Comments indicated that trace metal concentrations in adit and tailings waters could pose a risk of accumulation in soil beneath the Boe Ranch LAD center pivots. Trace metal concentrations in adit and tailings waters have been analyzed and range from non-detectable to near detection limits. Metals at these concentrations would not provide an accumulation risk to soils, ground water, or plant tissues, and effects are not reasonably foreseeable, so this issue will not be discussed further.

S.7 Alternatives Considered in Detail

In response to agency and public issues, the following alternatives were developed and analyzed in detail. A general description of each of the alternatives is provided in Section 3 of this summary. Major differences among the alternatives are listed below in tables S-4, S-5, and S-6.

- Stillwater Mine Closure and Post-Closure Water Management Plan No Action Alternative 1A
- Stillwater Mine Closure and Post-Closure Water Management Plan Proposed Action Alternative 2A
- Stillwater Mine Closure and Post-Closure Water Management Plan Agency-Mitigated Alternative 3A
- East Boulder Mine Closure and Post-Closure Water Management Plan No Action Alternative 1B
- East Boulder Mine Closure and Post-Closure Water Management Plan Proposed Action Alternative 2B
- East Boulder Mine Closure and Post-Closure Water Management Plan Agency-Mitigated Alternative 3B
- Boe Ranch LAD System No Action Alternative 1C
- Boe Ranch LAD System Proposed Action Alternative 2C
- Boe Ranch LAD System Agency-Mitigated Alternative 3C

The agencies performed extensive analyses to evaluate the effects of each of the alternatives on ground and surface water. The reader wishing to review these analyses, including assumptions made and methodology used, is directed to Chapter 3 and Appendix C.

S.7.1 Preferred Alternatives

Three alternatives must be selected, one for each location. The agencies' preferred alternatives are the following:

- Stillwater Mine Closure and Post-Closure Water Management Plan Agency-Mitigated Alternative 3A
- East Boulder Mine Closure and Post-Closure Water Management Plan Agency-Mitigated Alternative 3B
- Boe Ranch LAD System Agency-Mitigated Alternative 3C

Table S-4 Major Differences Among Alternatives - Stillwater Mine and Hertzler Ranch LAD System

	No Action Alternative 1A	Proposed Action Alternative 2A	Agency-Mitigated Alternative 3A
Closure/Post-Closure Water Management Plan	Inadequate closure and post-closure water management plan (impoundment and underground workings).	Detailed closure and post-closure water management plan.	Agency-modified closure and post-closure water management plan.
Closure Impoundment Timeframe Stillwater: 35 MG Hertzler Ranch: 45 MG	Unspecified, but up to 3 years to evaporate over tailings mass.	12 months to dewater impoundments, pump, treat, and discharge all mine waters.	18 months to dewater impoundments, pump, treat, and discharge all mine waste waters.
Impoundment Cap Thickness	<u>Stillwater</u> : 42" of waste rock/borrow and 8" of soil.	<u>Stillwater</u> : 24" of waste rock/borrow and 8" of soil/borrow.	<u>Stillwater</u> : 42" of waste rock/borrow and 8" of soil.
	<u>Hertzler Ranch</u> : 48" of borrow and 24" of subsoil/soil.	<u>Hertzler Ranch</u> : 24" of borrow and 24" of subsoil/soil.	<u>Hertzler Ranch</u> : 48" of borrow and 24" of subsoil/soil.
Impoundment Cap Configuration	<u>Stillwater</u> : Swale.	<u>Stillwater</u> : Swale.	<u>Stillwater</u> : Swale.
	<u>Hertzler Ranch</u> : Mounded.	<u>Hertzler Ranch</u> : Swale.	<u>Hertzler Ranch</u> : Swale.
Underground Decommissioning and Mine Flooding	<u>Decommission</u> : undefined .	<u>Decommission</u> : 6 weeks .	<u>Decommission</u> : 12 weeks .
	<u>Mine Flooding</u> : undefined.	<u>Mine Flooding</u> : 11 - 38 years (depending on the ground water and workings volumes).	<u>Mine Flooding</u> : 4 -11 years (depending on the ground water and workings volumes).
Monitoring	Approved Plan.	Approved Plan.	<u>Increased Operations Monitoring</u> : <ul style="list-style-type: none"> • Supernatant Volume. • Tailings Grade. • Salts Concentrations. <u>Increased Closure/Post-Closure Monitoring</u> : <ul style="list-style-type: none"> • Mine Pool Levels and water quality (Nitrogen and Salts) of Mine Pool.

Table S-5 Major Differences Among Alternatives - East Boulder Mine

	No Action Alternative 1B	Proposed Action Alternative 2B	Agency-Mitigated Alternative 3B
Closure/Post-Closure Water Management Plan	Inadequate closure and post-closure water management plans (impoundment and underground workings).	Detailed closure and post-closure water management plans.	Agency-modified closure and post-closure water management plans.
Closure Impoundment Timeframe 40 MG	Unspecified, but up to 3 years to evaporate over tailings mass.	12 months to dewater impoundment, pump, treat, and discharge all mine waters.	18 months to dewater impoundment, pump, treat, and discharge all mine waste waters.
Impoundment Cap Thickness	48" of waste rock/borrow/boulders and 28" of subsoil/soil.	24" of waste rock/borrow/boulders and 28" of subsoil/soil.	48" of waste rock/borrow/boulders and 28" of subsoil/soil.
Impoundment Cap Configuration	Mounded.	Swale.	Swale.
Underground Decommissioning and Mine Flooding	<u>Decommission:</u> undefined.	<u>Decommission:</u> 6 weeks.	<u>Decommission:</u> 12 weeks.
	<u>Mine Flooding:</u> N/A.	<u>Mine Flooding:</u> N/A.	<u>Mine Flooding:</u> N/A.
Monitoring	Approved Plan.	Approved Plan.	<u>Increased Operations Monitoring:</u> <ul style="list-style-type: none"> • Supernatant Volume. • Tailings Grade. • Salts Concentrations. <u>Increased Closure/Post-Closure Monitoring:</u> <ul style="list-style-type: none"> • Water quality. • Function of Water Management Facilities.

Table S-6 Major Differences Among Alternatives - Boe Ranch LAD System

	No Action Alternative 1C	Proposed Action Alternative 2C	Agency-Mitigated Alternative 3C
Operations, Closure/Post-Closure Water Management Plan	All mine waste waters managed at mine site (Same as 1B).	Detailed operational and closure WMP at Boe Ranch and post-closure water management plan at mine site.	Agency-modified operational and closure WMP at Boe Ranch and post-closure water management plan at mine site.
Water Management Facilities	Water treatment at mine site <u>Mine Site:</u> LAD Areas 6: 10.2 acres. LAD Areas 2, 3, 4: 36.4 acres. LAD feed pond: 0.7 MG.	Water treatment at mine site <u>Mine Site:</u> LAD Areas 6: 10.2 acres. LAD Areas 2, 3, 4: 36.4 acres. LAD feed pond: 0.7 MG	Water treatment at mine site <u>Mine Site:</u> LAD Areas 6: 10.2 acres. LAD Areas 2, 3, 4: 36.4 acres. LAD feed pond: 0.7 MG
		<u>Boe Ranch:</u> Boe Ranch LAD Area: 194.1 acres. Pivots: 10. Application: agronomic rate LAD Storage Pond: 108 MG.	<u>Boe Ranch:</u> Boe Ranch LAD Area: 186.9 (166 for modeling purposes) acres. Pivots: 9 (7 for modeling purposes). Application: greater than agronomic rate as needed to manage water and soil resource LAD Storage Pond: 108 MG.
Closure Timeframe (40 MG)	Unspecified, but up to 3 years to evaporate over tailings mass at mine site.	12 months to dewater impoundment, pump, treat, and discharge all mine waste waters, preferentially at Boe Ranch.	18 months to dewater impoundment, pump, treat, and discharge all mine waste waters, preferentially at Boe Ranch.
LAD Storage Pond High-Hazard Classification	N/A	<u>Operations:</u> high-hazard.	<u>Operations:</u> high-hazard.
		<u>Closure:</u> high-hazard.	<u>Closure:</u> high-hazard.
		<u>Post-Closure:</u> high-hazard.	<u>Post-Closure:</u> not high-hazard.
Monitoring	N/A	Proposed Boe Ranch Operational Plan.	<u>Increased Operations Monitoring:</u> <ul style="list-style-type: none"> • Salts Concentrations. • Streamflow <u>Increased Closure Monitoring:</u> <ul style="list-style-type: none"> • Water Quality. • Function of Water Management Facilities • Streamflow

S.8 Alternatives Considered But Dropped From Detailed Analysis

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of this analysis, duplicative of the alternatives considered in detail, incorporated into alternatives considered in detail, determined to be components that would cause unnecessary environmental harm, or are already addressed by law, regulation or policy. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for the reasons summarized below. The reader is referred to Chapter 2 for a detailed discussion of these alternatives.

➤ **Plugging the Adits to Prevent Discharge of Water**

This suggestion for an alternative would reduce the amount of adit water ultimately discharged to the surface environment. The agencies concluded that plugging the adits with tailings, waste rock, or cement would not prevent adit water discharge. Water pressure would increase and could result in uncontrolled discharges through fractures in the rock. The ability to treat water discharged from fractures would be limited if the adits were plugged. The plugging options reviewed would not adequately address the purpose and need and could violate the MT Water Quality Act in the short term.

➤ **Closure and Post-Closure Water Treatment Evaluations**

This suggestion for an alternative indicated that changes to SMC's closure and post-closure water management plans at the two mine sites should not be included in this analysis. This suggestion was based on the expectation that closure for these mines would be far in the future and that new non-nitrate explosives might be developed. The Proposed Action was developed in response to state and federal regulations, and the agencies cannot eliminate consideration of SMC's closure and post-closure water treatment methodology.

➤ **Long-term Treatment of Adit Water and Runoff from the Tailings Impoundments before Discharging**

This suggestion for an alternative would not allow SMC to discharge adit water and runoff from the tailings impoundment at the Stillwater and East Boulder mines directly to rivers even if the water meets non-degradation standards for water quality. Instead, the water should be discharged through percolation ponds or wetlands constructed specifically for this purpose. The MPDES permit effluent limits for both mines are based on nondegradation standards, and water that meets these limits may be directly discharged to the respective rivers without affecting their quality. If the discharges from the mines meet permit effluent limits by the end of the closure period, the agencies could not

require SMC to construct wetlands or percolation ponds to dispose of mine waters.

- **Alternative Waste Rock and Tailings Disposal Methods**

This suggestion for an alternative would require evaluation of alternate methods of reclaiming waste rock piles and disposing of tailings. Use of alternate methods may require different closure and post-closure water management plans. SMC currently places up to 60 percent of waste rock and tailings underground. The agencies have directed SMC to explore the use of tailings paste technology, which SMC has done. If SMC should choose to paste tailings, a MEPA/NEPA analysis would be required at that time.
- **Boe Ranch LAD System Montana Pollutant Discharge Elimination System (MPDES) Permit Alternative**

This suggests that the Boe Ranch LAD system should be covered with an MPDES Permit. Both mines currently have MPDES permits for mine water discharges. An alternative need not be developed to evaluate the need for an MPDES permit at the Boe Ranch LAD system. The agencies have the option of requiring a Montana Ground Water Pollution Control System (MGWPCS) which addresses discharges to ground water.
- **Alternative Locations for the Proposed LAD System**

This suggestion indicated that the MEPA/NEPA analysis should consider alternate locations for the proposed LAD facilities, such as additional sites on the Gallatin National Forest and other state and private lands. The use of the Boe Ranch meets the purpose and need. No alternative sites were identified with physical or climatological advantages over the Boe Ranch, which is owned by SMC. The agencies cannot require SMC to purchase other private lands. The analyses disclosed in this document conclude that the use of the Boe Ranch would meet all state and federal water quality standards.

S.9 Comparison of Effects

The following tables and figures provide a summary of the effects of implementing each alternative. Information is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. Detailed effects analysis for each Alternative is found in Chapter 4 of the EIS.

S.9.1 Stillwater Mine Closure and Post-Closure Water Management Plan Alternatives 1A, 2A, and 3A Closure Effects

- Table S-7 Closure and Post-Closure Effects Comparison Among Alternatives

- Water Quality Figures for Alternatives 1A, 2A, and 3A
 - Figure S-1 Projected Nitrogen Load to the Stillwater River by Alternative and Adit Flow Rate
 - Figure S-2 Projected Nitrogen Concentration in Ground Water by Alternative and Adit Flow Rate
 - Figure S-3 Projected Nitrogen Concentration in the Stillwater River by Alternative and Adit Flow Rate
 - Figure S-4 Projected Salts Concentration in Ground Water by Alternative and Adit Flow Rate
 - Figure S-5 Projected Salts Concentration in the Stillwater River by Alternative and Adit Flow Rate

S.9.2 East Boulder Mine Closure and Post-Closure Water Management Plan Alternatives 1B, 2B, and 3B Closure Effects

- Table S-8 Closure and Post-Closure Effects Comparison Among Alternatives
- Water Quality Figures for Alternatives 1B, 2B, and 3B
 - Figure S-6 Projected Nitrogen Load to the East Boulder River
 - Figure S-7 Projected Nitrogen Concentration in Ground Water
 - Figure S-8 Projected Nitrogen Concentration in the East Boulder River
 - Figure S-9 Projected Salts Concentration in Ground Water
 - Figure S-10 Projected Salts Concentration in the East Boulder River

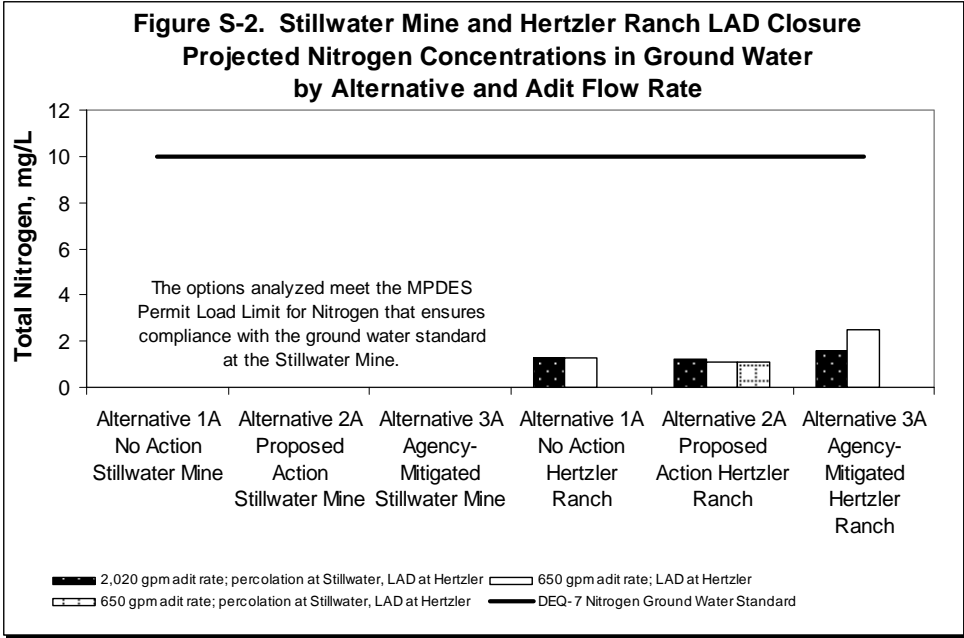
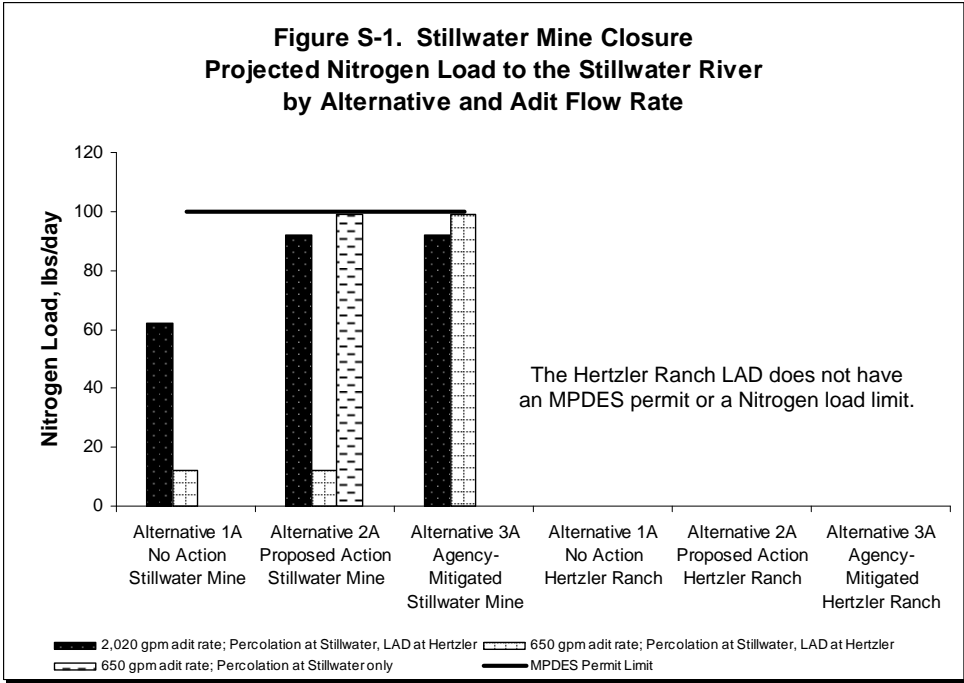
S.9.3 Proposed Boe Ranch LAD System Alternatives 1C, 2C, and 3C Operational and Closure Effects

- Table S-9 Operational, Closure, and Post-Closure Effects Comparison Among Alternatives
- Water Quality Figures for Alternatives 1C, 2C, and 3C
 - Figure S-11 Projected Operational Nitrogen Load to the East Boulder River
 - Figure S-12 Projected Operational Nitrogen Concentration in Ground Water
 - Figure S-13 Projected Operational Nitrogen Concentration in the East Boulder River
 - Figure S-14 Projected Operational Salts Concentration in Ground Water
 - Figure S-15 Projected Operational Salts Concentration in the East Boulder River
 - Figure S-16 Projected Closure Nitrogen Load to the East Boulder River
 - Figure S-17 Projected Closure Nitrogen Concentration in Ground Water
 - Figure S-18 Projected Closure Nitrogen Concentration in the East Boulder River

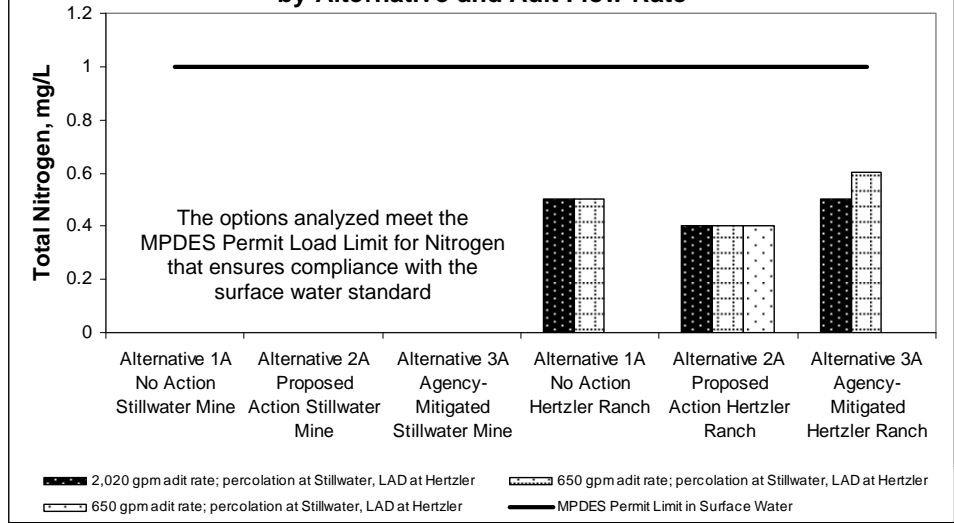
- Figure S-19 Projected Closure Salts Concentration in Ground Water
- Figure S-20 Projected Closure Salts Concentration in the East Boulder River

Table S-7 Effects Comparison Among Alternatives - Stillwater Mine and Hertzler Ranch LAD System

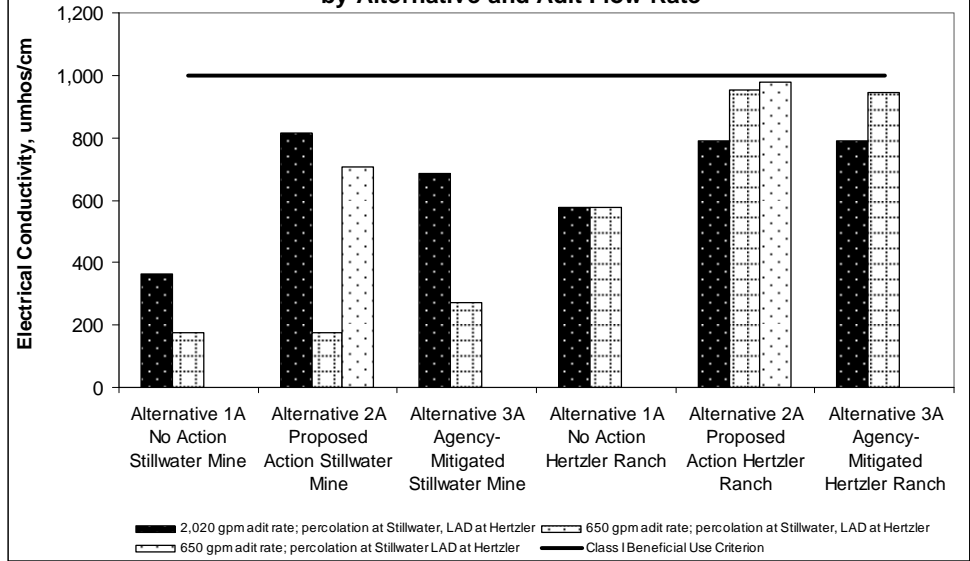
	No Action Alternative 1A	Proposed Action Alternative 2A	Agency-Mitigated Alternative 3A
Water Quality and Quantity – 20+ years operational data at Stillwater Mine and 10+ years at operational data at Hertzler Ranch			
Closure	Nitrogen and Salts: @ 650 gpm – 2,020 gpm adit water and 80 MG tailings waters disposal- In compliance with surface and ground water standards/recommendations at the Stillwater Mine and Hertzler Ranch.	Nitrogen and Salts: @ 650 gpm – 2,020 gpm adit water and 80 MG tailings waters disposal- In compliance with surface and ground water standards/recommendations at the Stillwater Mine and Hertzler Ranch. <i>Summary:</i> Analysis shows disposal of mine waters at a rate of 650 gpm to 2,020 gpm at the Stillwater Mine and Hertzler Ranch during closure (12 months) would comply with nitrogen and salts water quality standards/recommendations*. *Unforeseen circumstances during closure could jeopardize compliance within a 12-month period and produce short-term exceedances .	Nitrogen and Salts: @ 650 gpm – 2,020 gpm adit water and 80 MG tailings waters disposal at closure - In compliance with surface and ground water standards/recommendations at the Stillwater Mine and Hertzler Ranch. <i>Summary:</i> Analysis shows disposal of mine waters at closure (18 months) would comply with water quality standards/recommendations.
	Surface Water Quantity: No effects	Surface Water Quantity: No effects	Surface Water Quantity: No effects
Post-Closure	Nitrogen and Salts: @ 650 gpm – 2,020 gpm adit water and 80 MG tailings waters disposal - Not in compliance with surface and ground water standards/recommendations at the Stillwater Mine and Hertzler Ranch.		
	Surface Water Quantity: No effects	Surface Water Quantity: No effects	Surface Water Quantity: No effects
Wildlife and Aquatic Resources (Aquatics Only) – 20+ years of operational water quality and biomonitoring data			
Closure and Post-Closure	TDS < 250 mg/L No effects to aquatic communities based on water quality/quantity projections.	TDS < 250 mg/L No effects to aquatic communities based on water quality/quantity projections.	TDS < 250 mg/L No effects to aquatic communities based on water quality/quantity projections.



**Figure S-3. Stillwater Mine and Hertzler Ranch LAD Closure
Projected Nitrogen Concentrations in the Stillwater River
by Alternative and Adit Flow Rate**



**Figure S-4. Stillwater Mine and Hertzler Ranch LAD Closure
Projected Salts Concentration in Ground Water
by Alternative and Adit Flow Rate**



**Figure S-5. Stillwater Mine and Hertzler Ranch LAD Closure
Projected Salts Concentration in the Stillwater River
by Alternative and Adit Flow Rate**

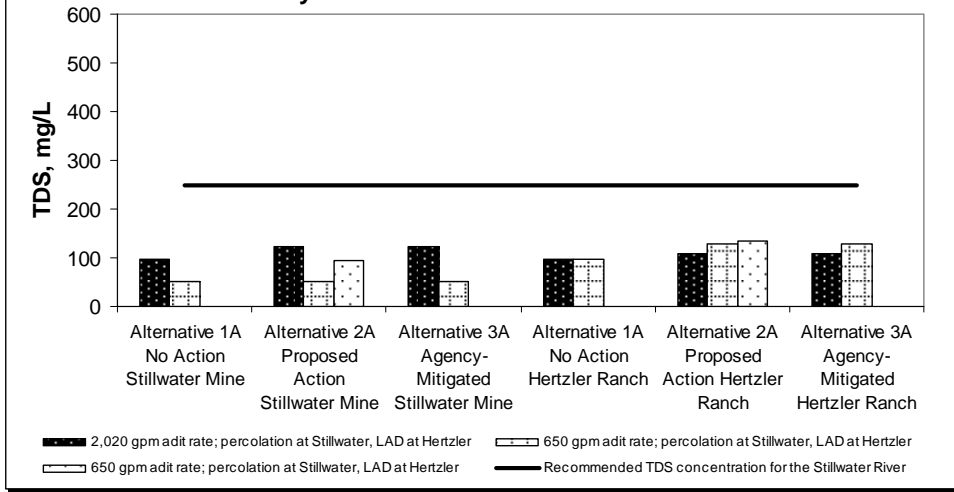
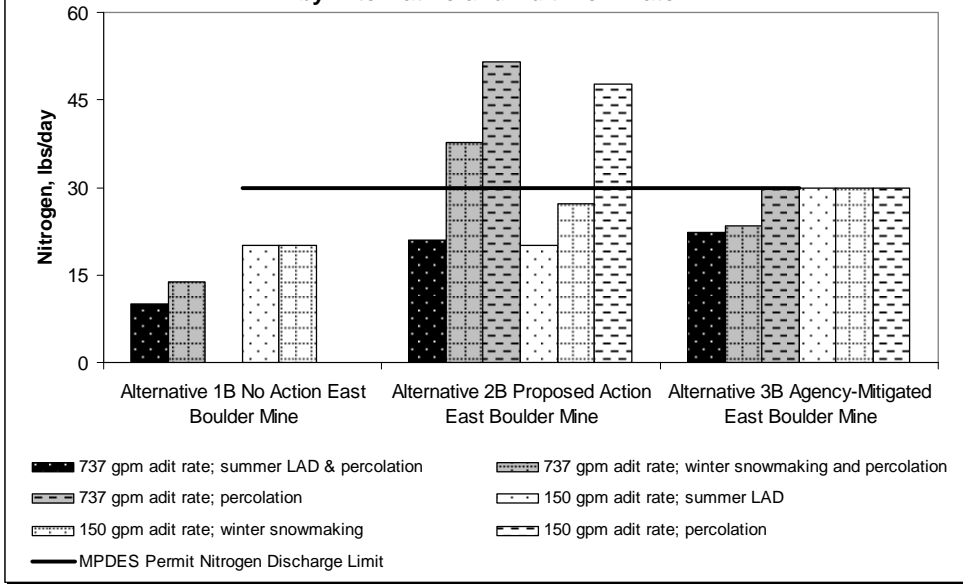


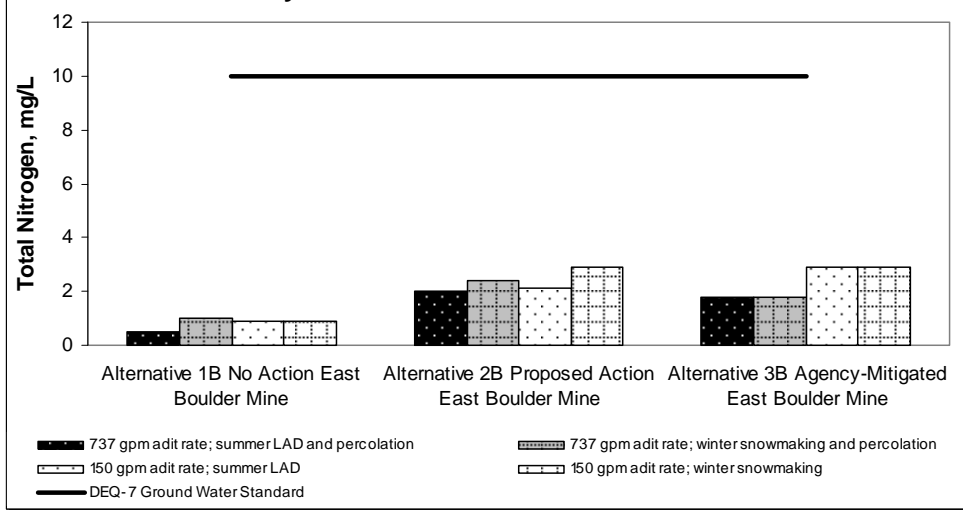
Table S-8 Effects Comparison Among Alternatives - East Boulder Mine

	No Action Alternative 1B	Proposed Action Alternative 2B	Agency-Mitigated Alternative 3B
Water Quality and Quantity – 10 years operational data at East Boulder			
Closure	Nitrogen and Salts: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal - In compliance with surface and ground water standards/recommendations at the East Boulder Mine.	Nitrogen: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal when closure commences in summer using LAD - In compliance with surface and ground water standards/recommendations at the East Boulder Mine. Nitrogen: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal when closure commences in winter using snowmaking or snowmaking plus percolation – Not in compliance with ground water standards at East Boulder Mine. Salts: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal - In compliance with surface water recommendation at East Boulder Mine. Analysis shows disposal of mine waters at closure commencing in summer (12 months) would comply with water quality standards.* *Unforeseen circumstances could jeopardize compliance within a 12-month period.	Nitrogen: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal - In compliance with surface and ground water standards at the East Boulder Mine. Analysis shows disposal of mine waters at closure (18 months) would comply with water quality standards. Salts: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal – In compliance with surface and ground water standards/recommendations at the East Boulder Mine. Analysis shows disposal of mine waters at closure (18 months) would comply with water quality recommendations.
	Surface Water Quantity: N/A.	Surface Water Quantity: N/A.	Surface Water Quantity: N/A.
Post-Closure	Nitrogen and Salts: @ 150 gpm – 737 gpm adit water disposal- In compliance with surface and ground water standards/recommendations at the East Boulder Mine .	Nitrogen and Salts: @ 150 gpm – 737 gpm adit water disposal- In compliance with surface and ground water standards/recommendations at the East Boulder Mine .	Nitrogen and Salts: @ 150 gpm – 737 gpm adit water disposal- In compliance with surface and ground water standards/recommendations at the East Boulder Mine.
	Surface Water Quantity: a 737 gpm adit water discharge rate would be in compliance with the East Boulder Mine MPDES permit limits.	Surface Water Quantity: a 737 gpm adit water discharge rate would be in compliance with the East Boulder Mine MPDES permit limits.	Surface Water Quantity: a 737 gpm adit water discharge rate would be in compliance with the East Boulder Mine MPDES permit limits.
Wildlife and Aquatic Resources (Aquatics Only) – 10 years of operational water quality and biomonitoring data			
Closure	TDS < 250 mg/L No effects to aquatic communities based on water quality/quantity projections.	At 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal Nitrogen and Salts loads may have short-term adverse impact on aquatic communities if the state standard of 1 mg/L Nitrogen is violated or an exceedance of 250 mg/L TDS recommendation occurs.	Extension of closure timeline (18 months) would reduce the possibility of a short-term adverse impact on aquatic communities.
Post-Closure	TDS < 250 mg/L No effects to aquatic communities based on water quality/quantity projections.	TDS < 250 mg/L No effects to aquatic communities based on water quality/quantity projections.	TDS < 250 mg/L No effects to aquatic communities based on water quality/quantity projections.

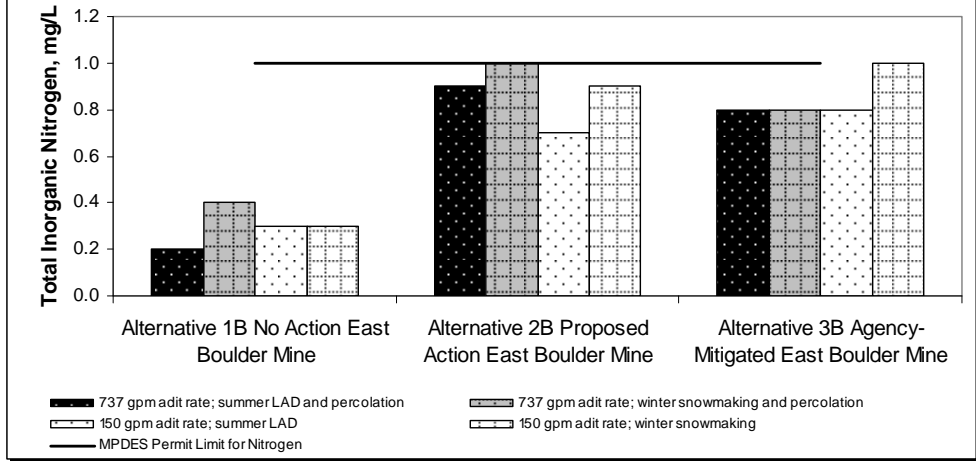
**Figure S-6. East Boulder Mine Closure
Projected Nitrogen Load to the East Boulder River
by Alternative and Adit Flow Rate**



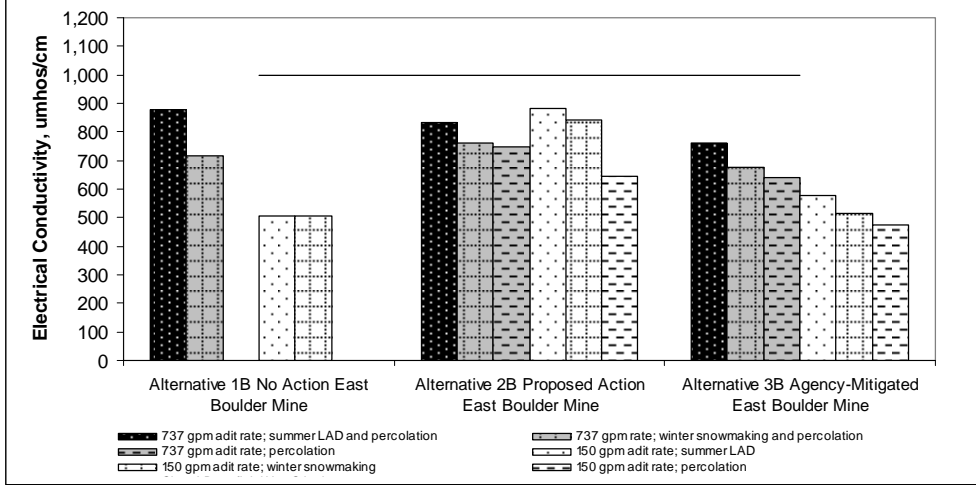
**Figure S-7. East Boulder Mine Closure
Projected Nitrogen Concentration in Ground Water
by Alternative and Adit Flow Rate**



**Figure S-8. East Boulder Mine Closure
Projected Nitrogen Concentration in the East Boulder River
by Alternative and Flow Rate**



**Figure S-9. East Boulder Mine Closure
Projected Salts Concentration in Ground Water
by Alternative and Adit Flow Rate**



**Figure S-10. East Boulder Mine Closure
Projected Salts Concentration in the East Boulder River
by Alternative and Adit Flow Rate**

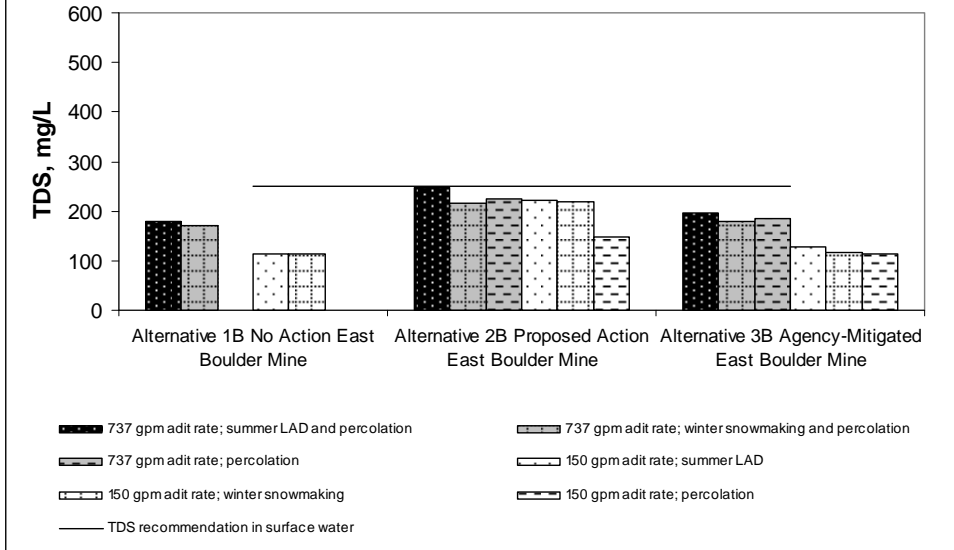


Table S-9 Effects Comparison Among Alternatives - Boe Ranch LAD System

	No Action Alternative 1C	Proposed Action Alternative 2C	Agency-Mitigated Alternative 3C
Water Quality and Quantity			
Operations	N/A. The Boe Ranch LAD System would not be built.	Nitrogen: @ 150 gpm – 737 gpm - In compliance with surface and ground water standards/recommendations at the East Boulder Mine and the Boe Ranch. Salts: @ 150 gpm – 737 gpm - In compliance with surface water TDS recommendations at the East Boulder Mine. Background TDS concentration exceeds the surface water recommendation at the Boe Ranch.	Nitrogen and Salts: @ 150 gpm – 737 gpm - In compliance with surface and ground water standards/recommendations at the East Boulder Mine and the Boe Ranch
	Surface Water Quantity: N/A.	Surface Water Quantity: N/A.	Surface Water Quantity: N/A.
Closure	N/A.	Nitrogen: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal – In compliance with surface and ground water standards at the East Boulder Mine. Not in compliance for 150 gpm at the Boe Ranch. Salts: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal- In compliance with surface water TDS recommendations at the East Boulder Mine. Background TDS concentration exceeds the surface water recommendation at the Boe Ranch.	Nitrogen and Salts: @ 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal- In compliance with surface and ground water standards/recommendations at East Boulder Mine and the Boe Ranch. The agencies would monitor the streamflow in the East Boulder River; if streamflow is less than 3 cfs, the volume of water disposed by LAD would be reduced to meet criterion. Background TDS concentration exceeds the surface water recommendation at the Boe Ranch.
		<i>Summary:</i> Analysis shows disposal of all mine waters at a rate of 737 gpm at the Boe Ranch during closure (12 months) would comply with nitrogen standards but the background TDS concentration at the Boe Ranch exceeds the surface water recommendation. Disposal of all mine waters at a rate of 150 gpm at the Boe Ranch during closure (12 months) would not comply with nitrogen surface water quality standards.* *Unforeseen circumstances could jeopardize compliance within a 12-month period.	Analysis shows disposal of mine waters at closure (18 months) would comply with water quality standards/recommendations.
		Surface Water Quantity: N/A.	Surface Water Quantity: N/A.
Post-Closure	N/A.	No additional mine-related effects.	No additional mine-related effects.
Wildlife and Aquatic Resources			
Operations	N/A.	TDS < 250 mg/L in East Boulder River No effects to wildlife/aquatic communities.	TDS < 250 mg/L in East Boulder River No effects to wildlife/aquatic communities.

	No Action Alternative 1C	Proposed Action Alternative 2C	Agency-Mitigated Alternative 3C
Closure	N/A.	No effects to wildlife communities. Aquatic communities: If all mine waters are disposed at Boe Ranch (150 gpm – 737 gpm adit water and 40 MG tailings waters), salt loads may have short-term adverse impacts on aquatic communities if an exceedance of 250 mg/L TDS occurs.	No effects to wildlife communities. Aquatic communities: Extension of closure timeline (18 months) would reduce the possibility of a short-term adverse impact on aquatic communities.
Post-Closure	N/A.	TDS <250 mg/L No effects to wildlife/aquatic communities.	TDS < 250 mg/L No effects to wildlife/aquatic communities.
Irrigation Practices			
Operations	N/A.	At 150 gpm – 737 gpm adit water disposal long-term changes in plant composition and noxious weed populations would occur.	Same as Alternative 2C
		At 150 gpm – 737 gpm adit water disposal there is increased potential for mass wasting at center pivots 4, 9, and 10.	The agencies would eliminate center pivot 10. Center pivots 4 and 9 would be operated with increased monitoring to reduce the potential for mass wasting.
		At 150 gpm – 737 gpm adit water disposal there are increased nitrogen and salts loads in soils: soil productivity may not be maintained due to annual flushing.	At 150 gpm – 737 gpm adit water disposal would increase the nitrogen and salt loads in soils: soil productivity would be maintained due to annual flushing.
Closure	N/A.	At 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal long-term changes in plant composition and noxious weed populations.	Same as Alternative 2C
		At 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal there is increased potential for mass wasting at center pivots 4, 9, and 10 due to additional 40 MG of tailings water disposal during 12-month closure period.	The agencies would eliminate center pivot 10. Center pivots 4 and 9 would be operated with increased monitoring to reduce the potential for mass wasting, and the water would be applied over an 18-month closure period.
		At 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal there are increased nitrogen and salt loads in soils: soil productivity may not be maintained due to annual flushing.	At 150 gpm – 737 gpm adit water and 40 MG tailings waters disposal would increase the nitrogen and salt loads in soils: soil productivity would be maintained due to annual flushing.
Post-Closure	N/A.	No Additional Mine-Related Effects.	No Additional Mine-Related Effects.
Cultural Resources			
Operations, Closure, and Post-Closure	N/A.	Direct adverse effects to the Boe Ranch drive-line site.	Direct adverse effects to the Boe Ranch drive-line site.

	No Action Alternative 1C	Proposed Action Alternative 2C	Agency-Mitigated Alternative 3C
<i>Stability of Boe Ranch LAD Storage Pond</i>			
Operations and Closure	N/A.	Meets engineering standards for high-hazard dam: No effects projected to property, water quality, or stability.	Meets engineering standards for high-hazard dam: No effects projected to property, water quality, or stability. The DEQ would require an Operations, Maintenance, and Emergency Preparedness Plan that meets DNRC high-hazard dam requirements, reducing potential effects to property, water quality, and stability.
Post-closure	N/A.	Meets engineering standards for high-hazard dam: No effects projected to property, water quality, or stability.	Reduced potential for effects to property, water quality, and stability due to elimination of high-hazard dam . LAD storage pond volume would be reduced to less than 50 acre feet.

Figure S-11. East Boulder Mine and Boe Ranch LAD Operations Projected Nitrogen Load by Alternative and Adit Flow Rate

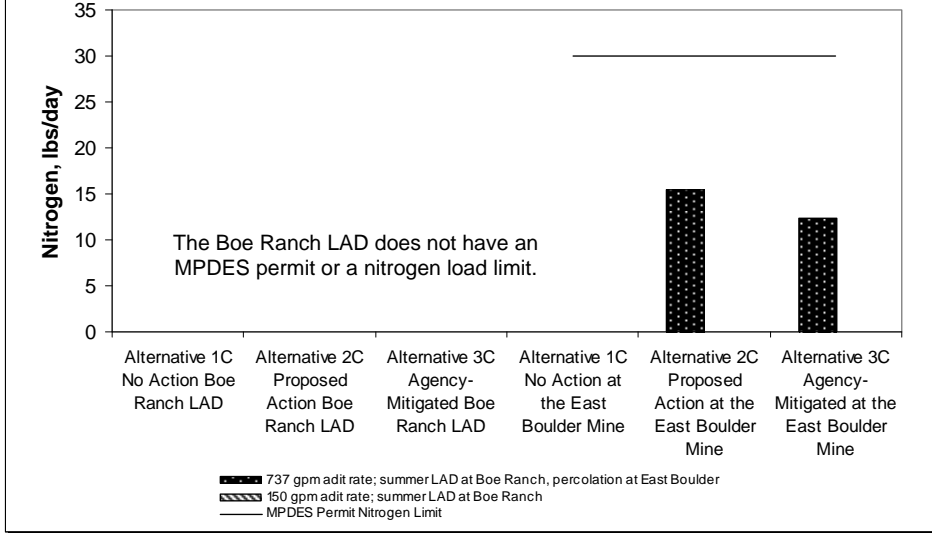
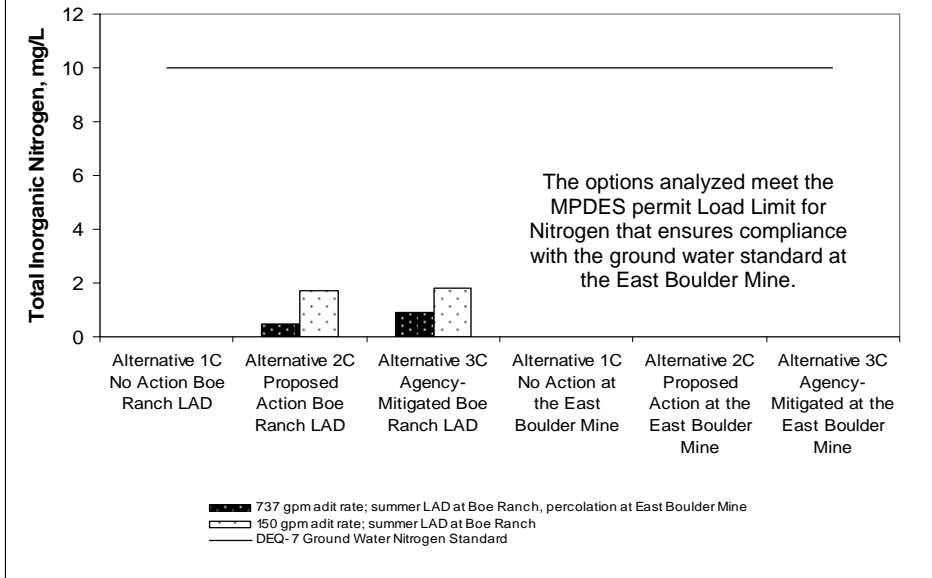


Figure S-12. East Boulder Mine and Boe Ranch LAD Operations Projected Nitrogen Concentration in Ground Water by Alternative and Adit Flow Rate



Note: This nitrogen criterion is met for all alternatives if the streamflow in the East Boulder River is 3.0 cfs or greater. The concentrations listed on this figure are for post-irrigation withdrawal losses in the East Boulder River if streamflow is 2 cfs. The Agency-Mitigated Alternative would adjust LAD rates if streamflow was 3 cfs or less to meet the nitrogen criterion.

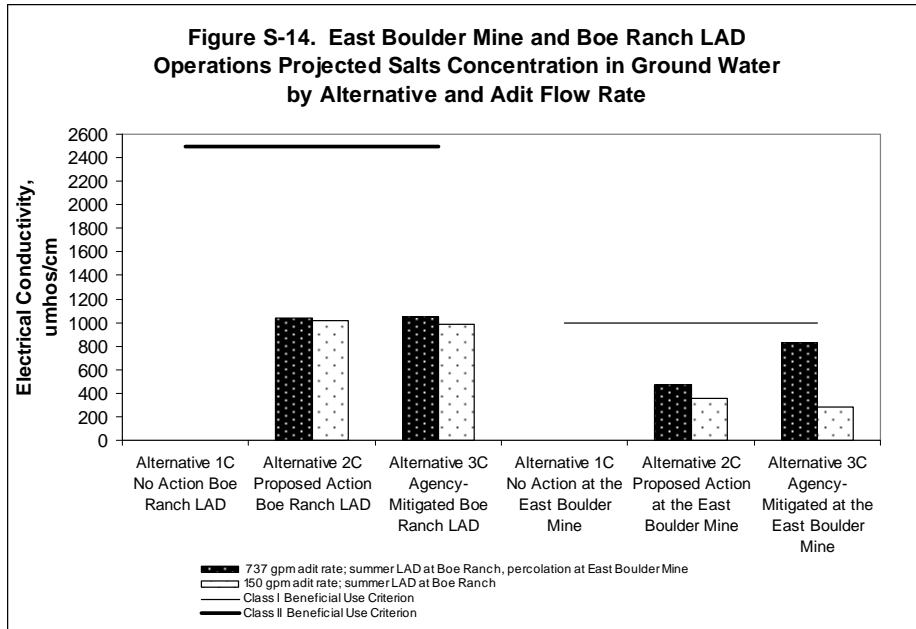
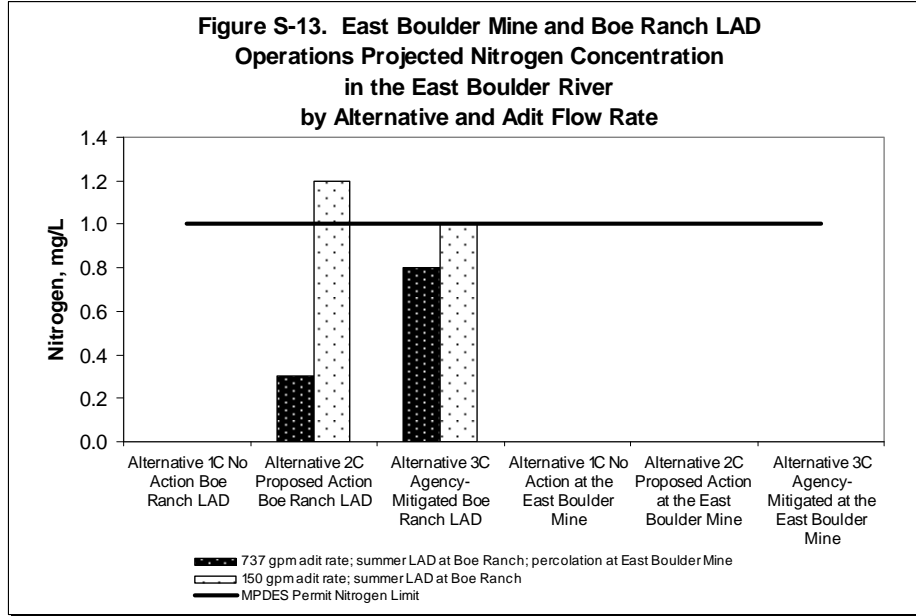


Figure S-15. East Boulder Mine and Boe Ranch LAD Operations Projected Salts Concentration in the East Boulder River by Alternative and Adit Flow Rate

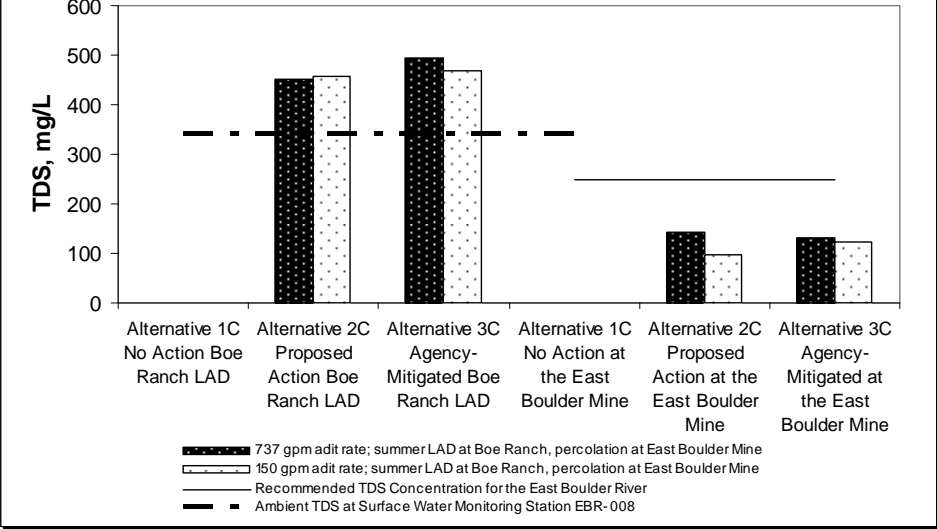


Figure S-16. East Boulder Mine and Boe Ranch LAD Closure Projected Nitrogen Loading by Alternative and Adit Flow Rate

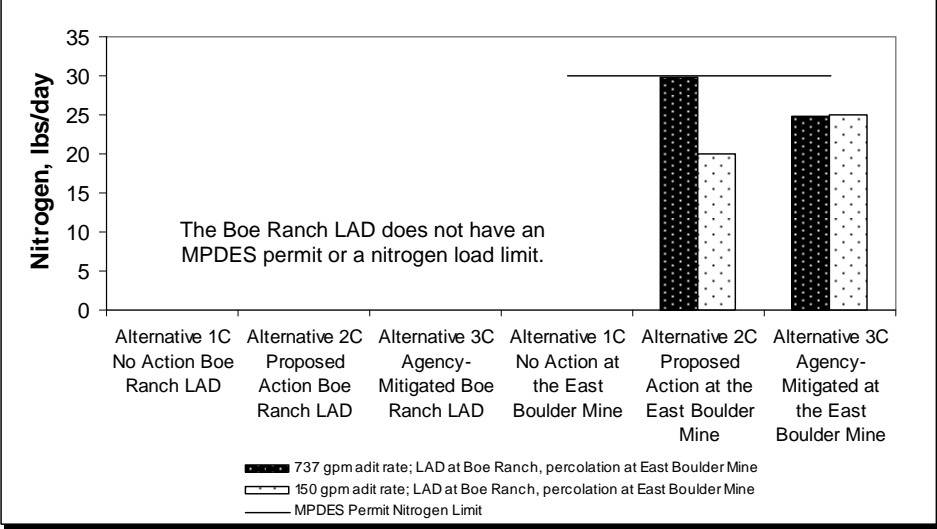


Figure S-17. East Boulder Mine and Boe Ranch LAD Closure Projected Nitrogen Concentration in Ground Water by Alternative and Adit Flow Rate

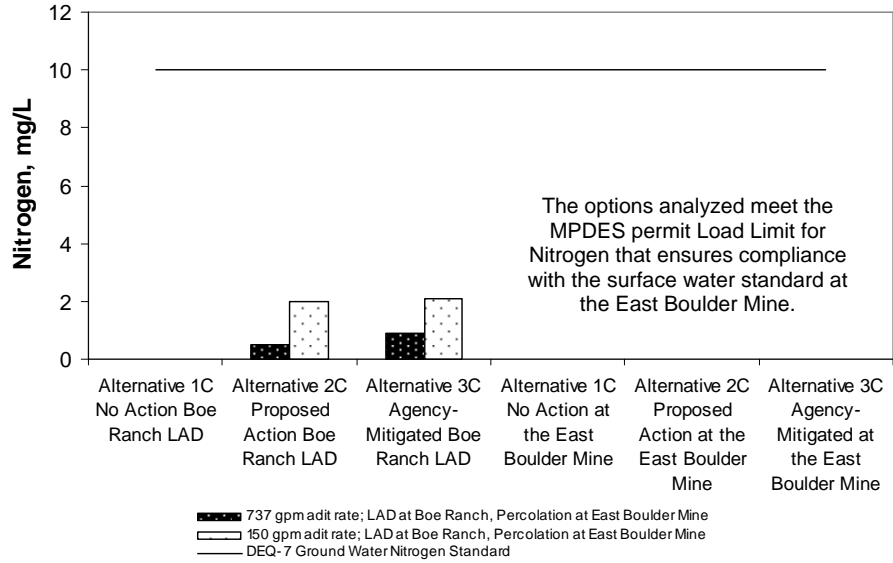
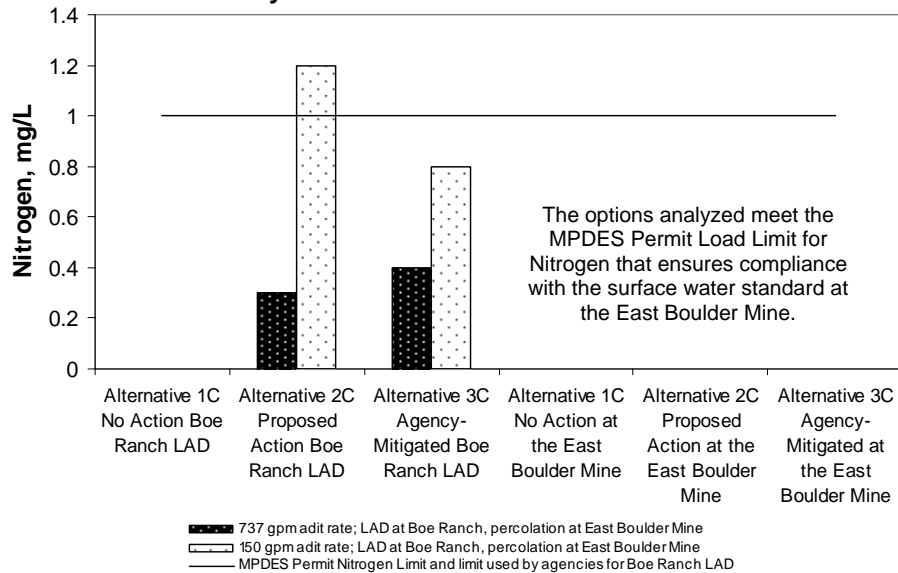
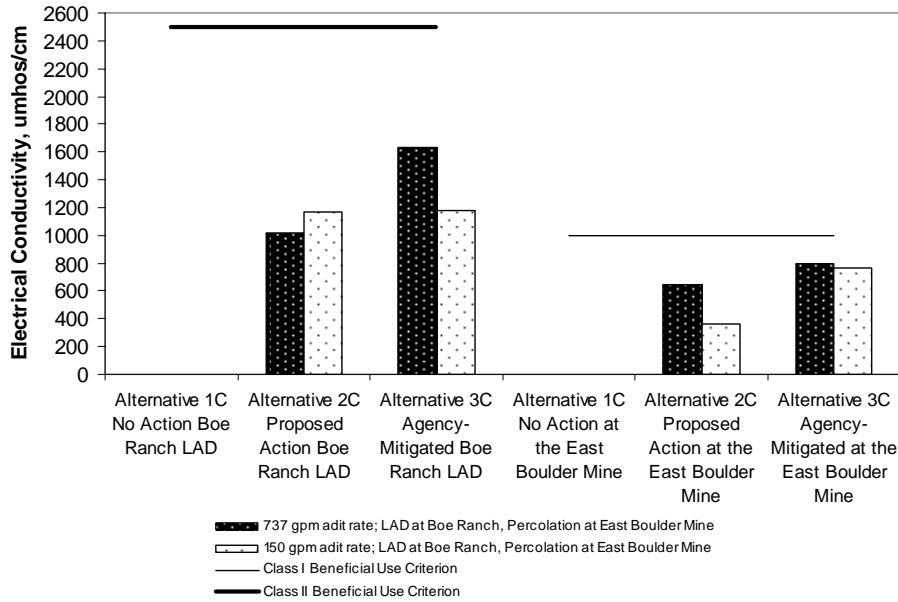


Figure S-18. East Boulder Mine and Boe Ranch LAD Closure Projected Nitrogen Concentration in the East Boulder River by Alternative and Adit Flow Rate



**Figure S-19. East Boulder Mine and Boe Ranch LAD Closure
Projected Salts Concentration in Ground Water
by Alternative and Adit Flow Rate**



**Figure S-20. East Boulder Mine and Boe Ranch LAD Closure
Projected Salts Concentration in the East Boulder River
by Alternative and Adit Flow Rate**

