MOLYCORP, INC. SITE
(CURRENTLY CHEVRON MINING, INC.)

Proposed Cleanup Plan **December 2009**

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan presents the U.S. Environmental Protection Agency's (EPA's) Preferred Alternative for cleaning up mining-related contamination at the Molycorp, Inc. (currently Chevron Mining, Inc.) site ("Site"). This Proposed Plan is issued by EPA, the lead enforcement agency for Site activities. This Proposed Plan reflects input by the New Mexico Environment Department (NMED), the lead agency for communication and coordination of Site activities through the Federal/State Agreement, dated December 5, 2007, as well as the New Mexico Energy, Minerals, and Natural Resources Department's Mining and Minerals Division (MMD). This Plan is available on the internet at www.epa.gov/earth1r6/6sf/6sf-decisiondocs.htm.

INSIDE THIS PLAN

PURPOSE OF THE PROPOSED PLAN

- Present EPA's rationale to the public for the proposed cleanup of contamination at Molycorp, Inc. Site
- Solicit public review and comment on the proposed action and the supporting documents contained in the Administrative Record file
- Provide history and background information about the Site
- Provide details about where additional information is available

The EPA, in consultation with NMED, will select a final remedy after considering all information submitted during a 30-day public comment period. Attachment 1 provides a Comment Sheet to provide EPA with comments during the public comment period. The EPA may modify the Preferred Alternative or select another response action based on new information or public comments. The public is encouraged to comment on the Preferred Alternative, as well as all the other alternatives presented in this Proposed Plan, or to suggest other alternatives. A glossary is included at the end of this document to define key terms.

The EPA is issuing this Proposed Plan in accordance with and as part of its public participation responsibilities under the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA), Section 113(k)(2)(B), 117(a), and 121(f)(1)(G), 42 U.S.C. §9613(k)(2)(B), 9617(a), and 9621(f)(1)(G) and under Sections 300.430(f)(2) and (3) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the Final Remedial Investigation (RI) Report, Final Feasibility Study (FS) Report, Revision 3, and other documents contained in the Administrative Record file for the Site.

HOW TO PARTICIPATE

The EPA is providing a variety of ways for you to comment on the Proposed Plan, learn more about the project, and get involved.

Provide Comments to EPA

Your comments will help EPA make final decisions about the cleanup, and they may result in a final cleanup plan that differs from this one. The final cleanup plan (or "selected remedy") will appear in a document called a Record of Decision, which is expected to be completed in 2010.

Written comments must be postmarked by January 29, 2010. See the last page of this document for instructions on how to submit your comments.

HIGHLIGHT 1 – PUBLIC COMMENT PERIOD AND MEETING

PUBLIC COMMENT PERIOD:
December 31, 2009 - January 29, 2010
EPA will accept written comments on the Proposed Plan during the comment period.

PUBLIC MEETINGS:
January 21, 2010, 6:30-8:30 pm
January 28, 2010; 6:30-8:30 pm

VFW Hall Post 7688, Hwy 522,
2 miles north of Questa, NM at 6:30 p.m. Oral and written comments will be accepted at the meeting.

Attend Public Meetings

To help you understand and comment on this Proposed Plan, EPA will host two public meetings at the VFW Hall, located on Hwy 522 approximately 2 miles north of Questa. The first meeting will take place on Thursday, January 21, 2010. At this meeting, EPA will discuss the contents of the plan, help you understand the cleanup alternatives, and answer questions.

The EPA will host the second meeting on Thursday, January 28, 2010. At this meeting, EPA will listen to public comments and discuss next steps.

Read Project Documents

The EPA has established three places where you can read project documents and view the Administrative Record for the Site. Be sure to call ahead for business hours. Also, please call for an appointment if you desire to review the files at EPA's or NMED's offices.

Village of Questa
2500 Old State Road 3, P.O. Box 260, Questa, NM (505) 586-0694

New Mexico Environment Department
1190 St. Francis Drive, P.O. Box 26110, Santa Fe, NM (505) 827-2340

U.S. Environmental Protection Agency – Region 6
1445 Ross Avenue, Suite 1200, Dallas, TX (214) 665-6427

Talk with EPA Staff

If you have any questions or need additional information, contact:

Technical Issues
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Purcell.mark@epa.gov

Community Involvement
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Dallas, TX 75202
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Hoey.phyllis@epa.gov

HIGHLIGHT 2 – PREFERRED ALTERNATIVE AT A GLANCE

Mill Area

- Remove PCB-contaminated soil from the Mill Area for low occupancy, commercial/industrial land use and transport soil to off-Site treatment/disposal facility
- Cover Mill Area with 6 inches or more of amended Spring Gulch waste rock (depending on land use) and revegetate with native plants at mill decommissioning
- Use institutional controls for residential land use, ground-water use, and well drilling restrictions

Mine Site Area

- Partially/completely remove and/or regrade waste rock piles at the Mine Site Area to between 3 horizontal to 1 vertical (3H:1V) to 2H:1V interbench slopes
- Cover regraded waste rock piles with 3 feet of amended Spring Gulch waste rock pile material and revegetate with native plants
- Place removed waste rock in repository (or at other waste rock piles as appropriate) at the mine site and cover/revegetate
- Collect seepage and seepage-impacted ground water with existing and new collection systems and extraction wells at the mine site with conveyance directly to the Mill Area
- Construct new water treatment plant at mill site and treat collected water to remove contaminants at start of remedial action
- Maintain water in underground mine at elevation below Red River and treat contaminated water withdrawn from mine
- Use institutional controls for residential land use, ground-water use and well drilling restrictions

Tailing Facility Area

- Cover tailing impoundments with 3 feet of soil and revegetate with native plants at cessation of tailing disposal operations
- Collect and extract (pump) seepage-impacted ground water with upgraded seepage barrier systems and new pumping wells south and southeast of Dam No. 1 at the tailing facility
- Pipe unused irrigation water in eastern diversion channel to prevent infiltration through buried tailing near Change House
- Refurbish existing water treatment plant or construct new plant and treat seepage-impacted water to remove contaminants at start of remedial action
- Use institutional controls for residential land use, ground-water use and well drilling restrictions
- Conduct additional ground-water characterization

Red River, Riparian, and South of Tailing Facility Area

- Protect trout by controlling inputs of acidic, metal-laden water at seeps/springs along mine site reach of Red River
- Remove molybdenum-contaminated soil south of tailing facility and dispose on Site
- Remove tailing spills along Red River riparian area and dispose on Site

Eagle Rock Lake

- Install inlet storm water controls
- Dredge sediments and dispose on Site

SITE BACKGROUND

The Site is located near the village of Questa in Taos County, New Mexico. Chevron Mining, Inc. or CMI (formerly Molycorp, Inc.) is the owner and operator of the Site, which includes an active underground molybdenum mine, a milling facility, a historic open pit and large waste rock piles. The mine site encompasses approximately three square miles of land located 3.5 miles east of the village of Questa. The Site also includes active tailing disposal impoundments (tailing facility) covering approximately two square miles of land also owned by CMI and located west of the village of Questa. A 9-mile tailing pipeline runs from the mill site to the tailing facility predominantly along Highway 38 (and the Red River). *See* Site Location Map (Figure 1).

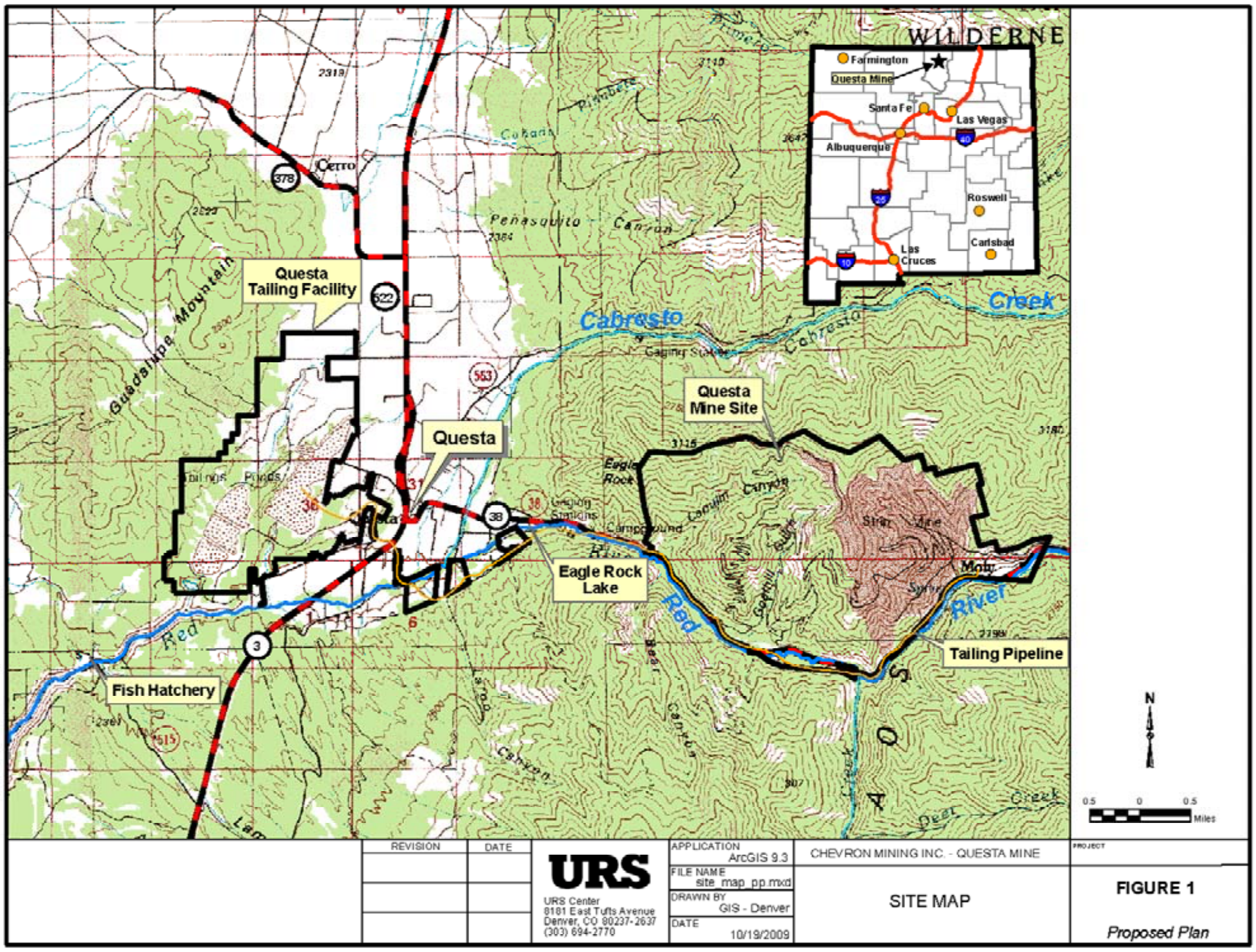
The Red River, a tributary of the Rio Grande, approximately parallels the southern boundary of the mine site and tailing facility. A popular multiple-use watershed, the Red River is designated a cold water fishery and is home to a state fish hatchery located one mile downstream of the tailing facility. The river provides water for irrigation and livestock watering, recreation, and serves as wildlife habitat. The river is also the source of water for small lakes upstream and downstream of the mine site, including Eagle Rock Lake, a popular fishing spot for the local community. The Red River and the Rio Grande, in the vicinity of their confluence, were designated a Wild and Scenic River by Congress in 1983.

The Molybdenum Corporation of America (Molycorp) began mining the Site in 1920. Underground mining operations were conducted until 1958, resumed in 1981 and continue today. Open pit mining was conducted between 1965 and 1983. The Union Oil Company of California (UNOCAL) acquired Molycorp in 1977. Chevron Oil Company merged with UNOCAL in 2005 and combined its mining subsidiaries Molycorp and the Pittsburg and Midway Mining Company to become CMI in 2007.

Open pit mining resulted in the excavation and dumping of approximately 328 million tons of acid generating and potentially acid generating waste rock into nine large piles surrounding the open pit. The extraction of molybdenum from ore through milling and concentrating operations produces tailing (a solid waste byproduct), which is transported as slurry through the pipeline to the tailing impoundments. Well over 100 million tons of fine grained tailing have been deposited at the tailing facility since its construction in 1966.

Waste rock, tailing, runoff, and leachate released at or from the Site contain hazardous substances, pollutants or contaminants (hereinafter contaminants) such as aluminum, arsenic, cadmium, fluorite, manganese, molybdenum, sulfate, zinc and sulfuric acid (low pH). Constant breakage of the tailing pipeline from 1966 to 1991 resulted in numerous spills of tailing into the Red River and/or along its floodplain, as well as into a local *acequia* (irrigation ditch). From the mid-1980s to early 1990s, these releases were in violation of Molycorp's National Pollutant Discharge Elimination System (NPDES) Permit NM0022306, issued by EPA on August 6, 1985. Other actual and potential releases include (1) waste water discharges exceeding NPDES permit limits at the Outfall

002, (2) uncontrolled surface-water runoff, (3) acid rock drainage (ARD) from waste rock to ground water and, subsequently, to surface water at zones of ground-water upwelling (i.e., seeps and springs), and (4) seepage from the tailing impoundments to ground water, as well as surface water via seeps and springs.



Soil contamination has occurred at both the mine site and tailing facility areas. Operations in the mill area have contaminated soil primarily with polychlorinated biphenyls (PCBs) and molybdenum, whereas surface soil in the valley south of the tailing facility has been contaminated with molybdenum by (1) uncontrolled runoff directly from the tailing facility, (2) uncontrolled waste water discharges from the tailing facility, and (3) contaminated shallow ground water upwelling near ground surface.

Eagle Rock Lake is located a mile west of the mine site, adjacent to the Red River. Bottom sediments of the lake have been contaminated with several heavy metals, including aluminum, arsenic, and zinc. These metals are transported into the lake with sediment and surface water of the Red River primarily during storm events.

Previous Investigations

Beginning in the late 1970s, EPA, the U.S. Department of the Interior – Bureau of Land Management (BLM) and other various state and federal agencies began documenting major impacts to Red River water quality and aquatic biota due to mining and mining-related activities. Based on an Expanded Site Investigation (ESI) conducted in the mid-1990s by NMED, it was concluded that the mine waste rock and tailing ponds contain hazardous substances and releases of these substances to ground water and surface water at the Site had occurred. An EPA hydrological study completed in 1998 found a probable hydraulic connection between the tailing ponds and the Red River, as well as between the mine waste rock, natural weathering features (known as hydrothermal scars), and seepage discharges to the Red River.

Previous Removal Actions

The Upper Dump Sump is an unlined, earthen, bowl-shaped depression used as an emergency basin for operational and maintenance purposes of the tailing pipeline. It is located across Highway 38 from the CMI administrative area at the mine site. In 2002 and early 2003, Molycorp removed tailing from an area near the Upper Dump Sump under the direction and oversight of NMED. Approximately 8,650 cubic yards were removed and disposed at the tailing facility.

In 2004, Molycorp removed two underground storage tanks (USTs) containing gasoline and used oil and 53 old aboveground storage tanks (ASTs), along with visibly stained soil associated with past spills at the mine site under the direction and oversight of NMED. Soils were contaminated with gasoline- and diesel-range organics, volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). The maximum depth of excavation in the vicinity of the ASTs was 12 feet. The maximum depth of excavation beneath the USTs was 25 feet. All petroleum-contaminated soil was shipped off-site for disposal at a permitted facility in Colorado. The tanks were cleaned, then transported (either intact or cut into sections) to a recycling facility in Colorado. The diesel oil spill from one AST contaminated soil to a depth of 60 feet, but did not significantly affect ground water. Monitoring of the ground water in the vicinity of the spill continues today.

Water Management

Since 1975, Molycorp (and now CMI) has operated a seepage interception system at the tailing facility that consists of shallow rock-filled trenches and seepage barrier drains, as well as ground-water extraction wells. The trenches and drains are constructed to depths of approximately 20 feet. The system collects approximately 420 gallons per minute (gpm). Most of this contaminated water (335 gpm) is discharged to the Red River via Outfall 002 pursuant to CMI's NPDES permit, while the remainder (85 gpm) is pumped back to the tailing impoundments to reduce the manganese load discharged through Outfall 002. This recirculation of the contaminated water is to comply with the NPDES permit discharge limit for manganese.

CMI has also operated ground-water collection systems along the southern boundary of the mine site since 2002 as part of the NPDES permit Best Management Practices (BMPs). These systems include ground-water withdrawal wells located between several waste rock piles and the Red River to collect ARD-impacted ground water. They also include seepage interception systems (French drains) along the northern bank of the river to collect ARD-impacted ground water discharging into the river at seeps and springs. The contaminated water collected by these systems is pumped to the mill and used to either transport slurry to the tailing facility during milling operations or is pH-adjusted with hydrated lime and used for pipeline maintenance and dust suppression at the tailing facility. The contaminated water is not used in the milling and floatation process due to poor water quality.

CMI has constructed several lined and unlined catchments to collect and manage seepage and storm-water runoff at the mine site. Two catchments (an upper catchment and a lower pumpback catchment) are used to collect and divert leachate and storm water runoff from the Capulin Waste Rock Pile to the Goathill Gulch drainage via a horizontal borehole. Seepage from the toe of Goathill North Waste Rock Pile is allowed to mix with the diverted seepage from the Capulin Waste Rock Pile and flow uncontrolled down the Goathill Gulch drainage. This combined flow drains to the Goathill Gulch subsidence area and seeps into the underground mine workings. Both lined and unlined storm-water catchments have been constructed within the major drainages to prevent runoff from flowing into the Red River. The catchments temporarily collect runoff from the drainages and waste rock piles, which allow the water to either infiltrate into the subsurface (into the ground) or to be pumped to the open pit where it seeps into the underground mine workings.

Previous Reclamation Activities

Molycorp conducted interim reclamation at two waste rock piles to address instability concerns under the direction and oversight of MMD and NMED: the Goathill North Waste Rock Pile in 2004/2005 and the Sugar Shack West Waste Rock Pile in 2008.

CERCLA Enforcement Activity

In the 1990s, NMED initiated negotiations with Molycorp to develop a ground-water discharge permit under the New Mexico Water Quality Act for mining operations that, at the time, were unregulated by NMED. In the late 1990s, after negotiations stalled on the permit for the mine, NMED requested that EPA list the Site on the National Priorities List (NPL) of Superfund Sites. The Site was proposed to the NPL on May 11, 2000, in accordance with Section 105 of CERCLA, 42 U.S.C. § 9605. At about the same time, after regulatory hearings, NMED issued discharge permit DP-1055 for the mine site.

An Administrative Order on Consent for Remedial Investigation and Feasibility Study (CERCLA Docket No. 6-09-01) was entered into by EPA and Molycorp in September 2001 for Molycorp to perform the RI/FS and EPA to perform the Baseline Human Health Risk Assessment (HHRA) and Baseline Ecological Risk Assessment (BERA). The work plans to perform the RI/FS were completed in 2002 and amended several times afterward based on preliminary testing results or other information or input provided by stakeholders. Field investigations were conducted intermittently from 2002 to 2008. The RI and FS reports were completed in 2009, as were the EPA's HHRA and BERA. This Proposed Plan is based primarily on the RI, FS, and HHRA/BERA reports.

Public Participation Activities

EPA has held several community meetings and availability sessions since 2001 to provide status updates on the RI/FS and risk assessments. In 2002, EPA went door-to-door in the Questa community to provide an opportunity for residents to talk with EPA officials privately about their concerns regarding the Site. Based on some of these discussions, EPA expanded its field investigation to conduct additional environmental sampling in an area south of the tailing facility where residents reported sick livestock grazing in pastures, as well as air monitoring at the northeastern perimeter of the tailing facility. This led to the discovery of soil contamination south of the tailing facility. Also, in response to community concerns, EPA collected samples of vegetables, garden soil and irrigation water from three private gardens in the village of Questa in August 2003. Results from this study were presented to the community and used in EPA's comprehensive multi-pathway HHRA.

The Agency for Toxic Substances and Disease Registry (ATSDR) completed a Public Health Assessment for the Site on February 28, 2005. Conclusions made by ATSDR include the following:

- Some private wells had elevated concentrations of several contaminants (primarily metals) that increased the risk of adverse health effects, to varying degrees, if people drank water from the affected wells regularly. No adverse effects are likely today as long as people avoid drinking contaminated well water.

- Based on limited information about levels of dust blowing from the tailing facility and professional judgment, worst case estimates of past exposures to metals contamination from breathing in tailing dust were too low to result in short- or long-term health effects. However, intermittently high dust levels could have resulted in short-term eye and respiratory irritation and an increase risk of respiratory problems in sensitive groups (people with asthma or other respiratory disease, the elderly, and children). Recent studies indicate that adverse health effects are unlikely today.

- The village of Questa's municipal water meets applicable water quality standards and is not expected to cause adverse health effects.

EPA has also periodically met with stakeholders on an individual basis, including the village of Questa, Amigos Bravos, the Rio Colorado Reclamation Committee (RCRC) [currently the Red River Reclamation Group (R3G), the community group which received EPA's Technical Assistance Grant], Taos County, BLM, and the U.S.

Department of Agriculture - Forest Service (USFS). In 2003, residents and the village of Questa expressed concerns with the possibility that tailing was used as bedding material for the Questa municipal water supply pipes that could potentially contaminate drinking water in their homes if the pipes were damaged. These concerns led EPA to request NMED's Drinking Water Bureau to sample several residential taps. This sampling was performed in August 2003. In July 2005, EPA sampled a number of private wells located within a two-mile radius of the tailing facility at the request of local residents. The laboratory analytical results were provided to the property owners in August 2005. The results showed no exceedances of federal drinking water or state water quality standards. Excavation work in the vicinity of Hunt's Pond in November 2003 uncovered tailing from a previous tailing pipeline spill. The tailing was removed by CMI and the RI was expanded to include the pond. In 2005, after concerns were expressed by the RCRC about oil sheens on water within the *acequia*, EPA sampled the water within the *acequia* at several locations throughout the irrigation system. In 2007, concerns expressed by the village of Questa about potential gaps with the investigation for determining if ground water contamination was present along the eastern flank of the tailing facility led EPA to include additional monitoring wells in that area for further ground-water testing.

The findings of EPA's HHRA and BERA were presented to the community on August 23, 2007. Preliminary clean-up options developed as part of the FS were presented to the community and other key stakeholders on May 13, 2008.

SITE CHARACTERISTICS

Based on the findings of the RI and the HHRA and BERA, the following five areas of the Site are being addressed by this Proposed Plan:

- Mill Area
- Mine Site Area
- Tailing Facility Area
- Red River, Riparian, and South of Tailing Facility Area
- Eagle Rock Lake

Mill Area

The Mill Area is an operating milling facility located on the eastern boundary of the mine site. It includes the crushers, mill, concentrator building, assay lab, reagent tanks and stores, thickeners, warehouse, and decline shop. A floatation mill (present mill) was constructed in the mid-1960s to process ore coming from the open pit. It has been expanded several times to its current capacity of 18,000 tons per day (tpd).

The Mill Area is characterized by the contamination of surface soil (0-2 feet) with molybdenum and PCBs. The elevated molybdenum concentrations [33 – 38,300 milligrams per kilogram (mg/kg)] occur at locations around tanks and buildings near the mill complex and in the historic mine tailing material placed within the boundary of the Mill Area. The PCB concentrations occur around electrical transformers. Based on selected sampling, the extent of PCB contamination (Aroclors 1248, 1254, and 1260) appears to be throughout the Mill Area. The concentrations measured in the soil are 0.02 – 140 mg/kg (Aroclor 1248), 0.02 – 20 mg/kg (Aroclor 1254) and 0.02 – 7.6 mg/kg (Aroclor 1260). Only one sampling location had an Aroclor concentration greater than 50 mg/kg, the Toxic Substances Control Act (TSCA) land disposal threshold.

For the purpose of the FS, an estimate was made of the areal extent and volume of affected soil that exceeds the preliminary remediation goal (PRG) for PCBs established under TSCA of 25 mg/kg for low occupancy use (commercial/industrial), as well as 1 mg/kg and 10 mg/kg for high occupancy use (residential). The 10 mg/kg TSCA level requires capping of PCB levels between 1 mg/kg and 10 mg/kg. Similar estimates were also made for affected soil exceeding EPA's human health risk-based residential PRG of 503 mg/kg for molybdenum. Assuming an approximate 2-foot depth of contamination, based on the depth of sampling performed during the RI, the estimated areas and volumes of soil for a depth of excavation of 2.5 feet is as follows:

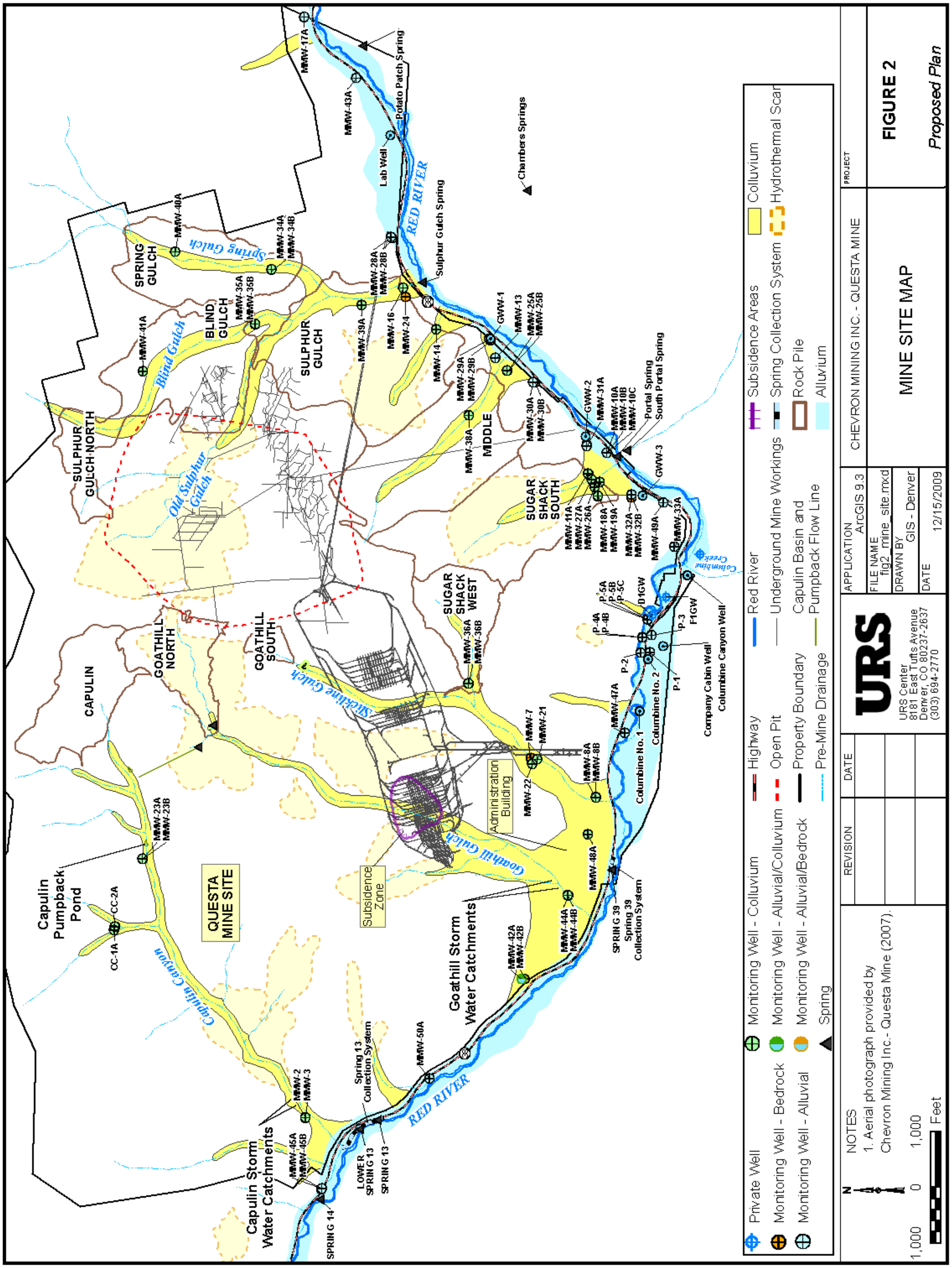
- > 25 mg/kg PCBs – 0.6 acres and 2,400 cubic yards (yd^3)
- >10 mg/kg PCBs – 0.8 acres and 3,300 yd^3
- > 1 mg/kg PCBs and > 503 mg/kg molybdenum – 28 acres and 113,000 yd^3
- > 503 mg/kg molybdenum-only soil – 12 acres and 49,000 yd^3.

Mine Site Area

The Mine Site Area is located in the Sangre de Cristo Mountains in an area of high topographic relief on the north side of the Red River Valley. Deeply incised, steep-sided valleys or drainages dissect the mine site and surrounding area. The mine site has no permanent residents. CMI maintains a work force between 100 and 300 full-time workers, plus a number of contractors, and is the major employer in the area. Several on-site water production wells are used for industrial purposes.

Most of the land surrounding the mine is used for recreational purposes, including hiking, hunting, whitewater kayaking, fishing and camping. Small parcels of private land once occurred along the Red River in front of the mine for seasonal use. Following the discovery of ground-water contamination in these areas, the properties were purchased by CMI and the structures removed. There are no current residents along the mine reach of the river.

The Mine Site Area consists primarily of an administrative area, an inactive open pit, waste rock piles surrounding the open pit, former and current underground mine workings, fuel storage tanks, past and current explosive storage areas, former landfills, and a subsidence area (a surface expression from active underground block caving operations). The mine is bounded to the south by the Red River and Highway 38. *See* Mine Site Map (Figure 2).



Private Well
Monitoring Well - Bedrock
Monitoring Well - Alluvial
Monitoring Well - Colluvium
Monitoring Well - Alluvial/Colluvium
Monitoring Well - Alluvial/Bedrock
Spring
Highway
Open Pit
Property Boundary
Pre-Mine Drainage
Red River
Underground Mine Workings
Capulin Basin and Pumpback Flow Line
Subsidence Areas
Spring Collection System
Rock Pile
Alluvium
Colluvium
Hydrothermal Scar
NOTES
1. Aerial photograph provided by Chevron Mining Inc.- Questa Mine (2007).
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Feet
URS
URS Center
8181 East Tufts Avenue
Denver, CO 80237-2637
(303) 694-2770
REVISION
DATE
APPLICATION
ArcGIS 9.3
FILE NAME
fig2_mine_site.mxd
DRAWN BY
GIS - Denver
DATE
12/15/2009
CHEVRON MINING INC. - QUESTA MINE
MINE SITE MAP
PROJECT
FIGURE 2
Proposed Plan
QUESTA MINE SITE
Capulin Pumpback Pond
Capulin Storm Water Catchments
Goathill Storm Water Catchments
Capulin Canyon
CAPULIN
GOATHILL NORTH
GOATHILL SOUTH
SUGAR SHACK WEST
SUGAR SHACK SOUTH
MIDDLE
SULPHUR GULCH NORTH
SULPHUR GULCH
BLIND GULCH
SPRING GULCH
Old Sulphur Gulch
Blind Gulch
Spring Gulch
Sulphur Gulch
Slickline Gulch
Goathill Gulch
Columbine Creek
RED RIVER
Subsidence Zone
Administration Building
Chambers Springs
Sulphur Gulch Spring
Potato Patch Spring
Lab Well
Portal Spring
South Portal Spring
Company Cabin Well
Columbine Canyon Well
Columbine No. 1
Columbine No. 2
Spring 13 Collection System
Spring 39 Collection System
LOWER SPRING 13
SPRING 13
SPRING 14
SPRING 39
CC-1A
CC-2A
MMW-2
MMW-3
MMW-7
MMW-8A
MMW-8B
MMW-10A
MMW-10B
MMW-10C
MMW-11A
MMW-13
MMW-14
MMW-16
MMW-17A
MMW-18A
MMW-19A
MMW-21
MMW-22
MMW-23A
MMW-23B
MMW-24
MMW-25A
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MMW-27A
MMW-28A
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MMW-29A
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MMW-30B
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MMW-32A
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MMW-33A
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MMW-36A
MMW-36B
MMW-38A
MMW-39A
MMW-40A
MMW-41A
MMW-42A
MMW-42B
MMW-43A
MMW-44A
MMW-44B
MMW-45A
MMW-45B
MMW-47A
MMW-48A
MMW-49A
MMW-50A
GWW-1
GWW-2
GWW-3
P-1
P-2
P-3
P-4A
P-4B
P-5A
P-5B
P-5C
D1GW
F1GW

Some drainages at the mine site, as well as other drainages in the Red River Valley, contain natural areas of highly eroded rock that are locally referred to as alteration or hydrothermal scars. These scars are characterized by steep slopes, a lack of soil and vegetation, iron oxide staining and clay formation, rapid erosion, and common slumping and landsliding. Runoff from these scars contains high levels of iron oxides that turn the water orange, giving the Red River its name. The scars are thought to develop as a result of landslides and erosion in areas that become susceptible to mass wasting. The mass transport processes locally prevent soil and vegetation development and results in formation of debris fans at the mouths of the drainages. CMI's administrative area is located on one of the largest debris fans in the valley, known as the Goathill Gulch debris fan. Besides the waste rock piles, these scars and debris fans are also a source of ARD.

Surface-water and storm-water runoff are managed at the mine site in accordance with NPDES and state permits through the use of catchments, pumpback ponds and detention basins. Ground water at the mine site occurs in the alluvium beneath the Red River, as well as the colluvium within the side drainages and the underlying bedrock. CMI currently dewaters the underground mine and discharges the water to the tailing facility.

The Mine Site Area is characterized by the massive waste rock piles, natural scars and debris fans, which are the primary sources of metals, other inorganic compounds, and acidity that contaminate ground water and surface water as ARD. ARD generation and mobilization is one of the primary processes that cause contamination at the Mine Site Area. Acid generation is the result of iron and sulfide oxidation. When sulfide-bearing (pyritic) rock such as the molybdenum ore body is mined and exposed to oxygen and water, the pyrite begins to oxidize and produces ARD. An important difference between mine-related ARD and natural acidic drainages from scars/debris fans is that mining greatly increases the surface area of pyrite and other sulfides exposed to air and water, thereby increasing substantially the rate and quantity of acidity produced. The increased quantities of acidic production from mining increase the concentrations of heavy metals that leach from the rock to ground water and surface water.

There are approximately 328 million tons of acid-generating or potentially acid-generating waste rock that surrounds the open pit in nine large piles. Slopes of the piles range from 1.6 horizontal to 1 vertical (1.6H:1V) to 3H:1V. The volume of waste rock in each pile varies from under a million yd^3 to over 40 million yd^3. The largest three waste rock piles, Sugar Shack South (40.7 million yd^3), Middle (38.2 million yd^3), and Sulphur Gulch South (24.7 million yd^3), are located along Highway 38 and the Red River and are referred to as the Roadside Rock Piles. They range in height from 750 feet to nearly 1,600 feet. Temperatures within the piles have been measured up to 145 degrees Fahrenheit (ºF), indicating that significant sulfide oxidation and acid generation are occurring. Several of the waste rock piles cover pre-existing hydrothermal scars within the drainages.

ARD production at the mine site is facilitated by three primary mechanisms: water from infiltration of precipitation, moisture within ambient air circulating through the piles, and upwelling of bedrock water. The water-rock reaction produces acidic conditions, which leaches metals and other inorganic chemicals from the rock. This ARD then seeps into the colluvial and bedrock ground water beneath the waste rock piles. Concentrations of metals in ground water within the colluvium beneath some of these piles are the highest concentrations measured in ground water at the mine site. Maximum concentrations detected for metals and other inorganic compounds are: aluminum – 520 mg/L; arsenic – 0.08 mg/L; cadmium – 0.022 mg/L; fluoride – 170 mg/L; manganese – 340 mg/L; zinc – 45 mg/L; and sulfate – 9,800 mg/L. The pH ranges from 2.8 – 4.8. The bedrock ground waters in some locations also have elevated levels of metals, but to a lesser extent than the colluvial ground water.

Based on the steep gradient, the majority of this ARD-contaminated colluvial ground water flows down the steeply-incised side drainages to commingle with ground water of the Red River alluvial aquifer at the confluence with the side drainages. Debris fans which are comprised partly of scar material are present at the mouth of some drainages and represent contributing sources of ARD to the ground water as it flows into the alluvial aquifer. The contaminated ground water flowing into the alluvial aquifer tends to move along the northern flank of the aquifer as it commingles with alluvial water and moves downgradient (westward) along the mine site. Although the metal concentrations in the alluvial aquifer are not as high as those in the colluvial and bedrock ground waters at the mine site, they are elevated above background levels[1]. The maximum concentrations of some metals include aluminum – 190 mg/L; arsenic – 0.095 mg/L; cadmium – 0.13 mg/L; fluoride – 42.5 mg/L; manganese – 45 mg/L; zinc – 8.5 mg/L and sulfate 2,580 mg/L. The pH of the alluvial aquifer ranges from 2.2 to 7.4 and shows the affect of acidity from ARD.

The contaminated alluvial ground water enters the surface water of the Red River at zones of ground water upwelling as seeps and springs. The two most significant springs at the mine site are Springs 13 and 39, both representing areas of multiple springs. Red River flow measurements taken by the U.S. Geological Survey (USGS) show these two areas to be the most significant areas of ground-water upwelling within the mine site reach.

Spring 39 is located approximately 1,000 feet upstream of the confluence of Goathill Gulch and the Red River. Shallow ground water seeps from the north bank of the river where white precipitates (aluminum hydroxide) have formed that are visible along a 200-foot reach of the riverbank. It is within a large (about 3,500-foot long) zone of ground water upwelling caused by restriction of the alluvial aquifer by the Goathill Gulch debris fan. The debris fan has restricted the alluvial aquifer and redirected the flow of the Red River to the south side of the valley. This restriction results in the vertical flow of ground water up into the river. Measurements of the magnitude of ground water to surface water discharge indicate a gain ranging from 3-5 cubic feet per second (cfs) along this upwelling zone. Prior to the installation and start-up of the seepage interception system

[1] Reference background levels were determined for the northern portion of the alluvial aquifer as part of the RI and for the mine site colluvial and bedrock ground waters as part of the USGS Baseline Pre-mining Ground-Water Quality Study and included background levels from natural scar-affected drainages.

in February 2003, the highest flow rate measured from Spring 39 was 3 gpm. The seepage interception system was installed under the NPDES permit requirements for Best Management Practices.

Spring 39 water is characterized by moderately high levels of metals and slightly acidic pH values. Ranges of concentrations detected for metals and other inorganic contaminants include aluminum (<1-32 mg/L); fluoride (<1-12 mg/L); manganese (<1-3.5 mg/L); zinc (<0.1-3.7 mg/L) and sulfate (<50-1,100 mg/L). The pH of the spring ranges from 4.3-7.5, but is typically about 5. Concentrations of these metals (with the exception of fluoride) have general decreased since startup of the seepage interception system.

<u>Spring 13</u> is located approximately 700 feet upstream of the Red River and Capulin Canyon confluence. Spring 13 consists of several small springs (including a Lower Spring 13) along the northern riverbank. Flow rates range from 0-3 gpm for individual springs. The zone of upwelling is believed to be caused by a bedrock valley constriction and shallow bedrock depth (40-50 feet), which reduces the cross-sectional area of the alluvium, hence forcing ground water up into the river.

This area has been the site of considerable activity and investigation over the years. In 1979, at the request of the U.S. Army Corps of Engineers, Molycorp provided fill materials and assistance in repairing the riverbank after a flood (peak flow of 700 cfs) eroded the bank halfway into Highway 38. The fill material may have included some waste rock from the mine. In the mid-1990s, over concern by state regulators of the accumulation of white precipitates (aluminum hydroxide) along the riverbank, anoxic drains (limestone cobble) were installed by NMED with assistance from Molycorp to neutralize (buffer) the acidity and reduce the concentration of dissolved metals in ground water. In the fall 2002, Molycorp constructed the Spring 13 seepage interception drain system.

The Spring 13 area is characterized as a highly mineralized zone. A red zone of iron oxides and ferricrete (iron cemented sediments) was discovered during the construction of the anoxic drains and seepage interception drains at 5-10 feet depths in native and fill materials, as well as monitoring well MMW-50 at a depth of 45 feet. Analytical results show the spring water (Spring 13 and Lower Spring 13) to be fairly acidic and laden with metals. Key metals and other inorganic contaminants are aluminum (27-129 mg/L); fluoride (3.8-49.7 mg/L); manganese (3.4-17.5 mg/L); zinc (0.8-5.5 mg/L); and sulfate (573-1,990 mg/L). The pH ranges from 2.8- 4.9, but typically is about 3.5. Although the seepage interception system was constructed in 2002, concentrations of these contaminants have not changed appreciably over time. The source of the acidic, metal-laden water at Spring 13 is likely the surrounding and upgradient Red River alluvial aquifer, with a small portion coming from the bedrock. However, the concentration of contaminants in the spring water is higher than concentrations in the alluvial or bedrock water. This increase may be from the mineralized bedrock and alluvial sediments (ferricrete) and fault zones observed in the area. Other possible sources are pulses of acidic drainage in runoff from scars and dissolution of metals from the fill material used to stabilize the riverbank in 1979.

Surface water at the mine occurs as perennial flow within Goathill Gulch and storm water and seepage that collects in catchments. The upper catchment and lower pumpback catchment near the toe of the Capulin Waste Rock Pile contain acidic, metal-laden seepage-impacted water. Key metals and other inorganic contaminants include aluminum (22-1,400 mg/L), cadmium (0.01-0.76 mg/L), fluoride (4.3-208 mg/L), manganese (13-730 mg/L) zinc (6.1-170 mg/L) and sulfate (294-17,000 mg/L). The pH ranges from 2.4-4.2. The seepage flowing from the Goathill North Waste Rock Pile is similar to the Capulin Waste Rock Pile, with pH values ranging from 2.3-4.5. Concentration ranges of key metals and other inorganic contaminants are aluminum – 11 to 1,750 mg/L, fluoride – 2.9 to 175 mg/L, manganese – 2.2 to 601 mg/L, zinc 1 to126 mg/L, and sulfate – 780 to 17,400 mg/L.

Tailing Facility Area

The tailing facility is an unlined impoundment located on a broad alluvial plain about five miles west of the mine site and one mile west of Questa. It covers an area of approximately 1,000 acres and contains over 100 million tons of tailing. The facility was built within two natural southwest draining arroyos by construction of earthen-filled dams. The largest of these dams are Dam No. 1 and Dam No. 4 located at the southern end of the impoundments. Dam No. 1 was constructed in 1966; Dam No. 4 in 1971. Diversion channels were constructed along the west and east perimeter of the tailing impoundments in 1975 to divert surface water flow around the facility to the Red River. In 1983, Molycorp built an ion exchange treatment plant to remove molybdenum from decant water below Dam No. 4, before discharging to the Red River. Before then, waste water discharges to the river were untreated.

Tailing deposition is currently active behind Dam No. 4. Ponds atop the facility are maintained by decant water from the tailing slurry. These ponds support vegetation and wildlife, including waterfowl. Land access to the facility is restricted by a fence in most places. To suppress wind-blown tailing dust, CMI has placed an interim soil cover on portions of the tailing impoundments following cessation of active deposition. CMI also uses straw and water to suppress dust at the facility and monitors air quality (particulate matter greater than 10 microns in size or PM10 monitoring) at six stations surrounding the perimeter of the facility.

The land surrounding the tailing facility to the northeast, east, and south includes residential land in and near Questa and agricultural pasture lands used for farming, irrigation, and livestock grazing. Commercial uses occur along the highway in Questa. A school is located approximately 1,000 feet northeast of the facility. The Red River and its riparian floodplain bound the facility to the south. Between the Red River and the tailing facility in the area of Dam No. 1 is a low-lying riparian valley approximately half a mile wide. To the north, west, and southwest are public lands managed by BLM. These lands are in the Guadalupe Mountains and the Red River Canyon and are primarily uninhabited. The Red River State Fish Hatchery is located about a mile downriver of the tailing facility, where several workers and their families (a total of 9 people, including 2 children) currently work and live.

Shallow ground water occurs within the alluvial aquifer beneath the eastern arroyo and a basal bedrock (volcanic) aquifer beneath the western arroyo. Upper and basal portions of the alluvial aquifer contain discontinuous clay layers over the entire area[2]. The source of the village of Questa's municipal water is from the alluvial aquifers by supply wells located to the north and east of the tailing facility. These supply wells are upgradient to ground water beneath the tailing facility, which generally flows in a south-southwesterly direction. While most of the Questa residences are connected to the municipal water supply, there are several private wells located in the vicinity of the tailing facility. People are not thought to use these private wells; however, access to these wells is not restricted and it is possible people could use this water for domestic (or agricultural) purposes now or in the future. Several seeps and springs occur between the tailing facility and the Red River. Some of these springs are used as a water source for the fish hatchery operations as well as consumption by residents and visitors. *See* Tailing Facility Map (Figure 3).

The Tailing Facility Area is characterized by the contamination of ground water primarily with molybdenum and sulfate, as well as tailing sediment within the tailing ponds with primarily molybdenum. This contamination is caused from (1) deposition of tailing by slurry, (2) conveyance of excess mine water from the mine site to the tailing facility, (3) pumping back of contaminated water collected by the seepage interception systems to the Dam 5A impoundment, and to a lesser extent, (3) precipitation infiltrating and percolating through the impoundments. The leachate resulting from these processes seeps downward, as well as laterally through the earthen dams, into ground water. This leachate is referred to as tailing seepage.

Tailing Solids

Tailing is composed of primarily quartz and feldspar, with lesser amounts of clay. Calcite is also present. Pyrite (iron sulfide) is the dominant sulfide mineral, although galena (lead sulfide), chalcopyrite (copper-iron sulfide) and molybdenite (molybdenum disulfide or MoS_2) were also identified. Pyrite and calcite each comprise up to approximately three percent of the tailing. Acid-Base Accounting (ABA) testing on surface and subsurface tailing showed some tailing with the potential to generate acid, while other tailing is acid consuming. All samples had near neutral paste pH values, indicating that any acid being generated is currently being neutralized.

Chemical analysis of tailing solid samples collected at the mill showed elevated (maximum) concentrations for molybdenum (268 mg/kg), copper (151 mg/kg), and zinc (161 mg/kg). The pH of the tailing samples from the mill have near circumneutral pH values (6-9) due to the fact that the milling and floatation of molybdenum ore is an

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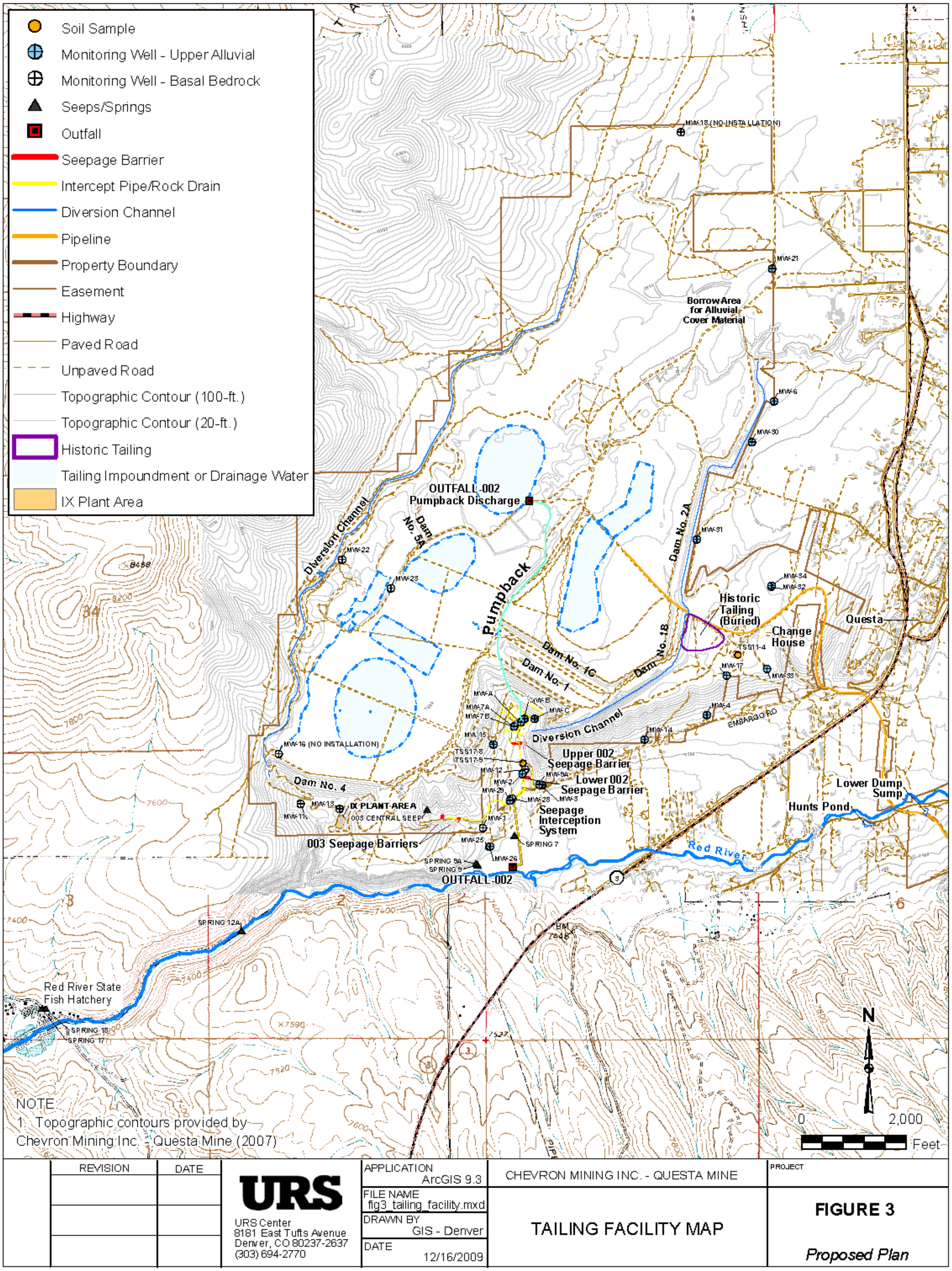
[2] Because of the discontinuous nature of the clay layers within the alluvial strata at the Tailing Facility Area, the EPA, NMED and others interpret the alluvial aquifer as being one continuous aquifer. However, CMI interprets the alluvial aquifer as two separate aquifers and refers to them as the Upper Alluvial Aquifer and Basal Alluvial Aquifer in the Final RI Report.


Soil Sample
Monitoring Well - Upper Alluvial
Monitoring Well - Basal Bedrock
Seeps/Springs
Outfall
Seepage Barrier
Intercept Pipe/Rock Drain
Diversion Channel
Pipeline
Property Boundary
Easement
Highway
Paved Road
Unpaved Road
Topographic Contour (100-ft.)
Topographic Contour (20-ft.)
Historic Tailing
Tailing Impoundment or Drainage Water
IX Plant Area
MW-18 (NO INSTALLATION)
MW-21
Borrow Area for Alluvial Cover Material
MW-6
MW-30
OUTFALL-002 Pumpback Discharge
Diversion Channel
Dam No. 5A
Dam No. 2A
MW-31
MW-22
MW-23
Pumpback
MW-34
MW-32
Historic Tailing (Buried)
Questa
Change House
Dam No. 1B
Dam No. 1C
Dam No. 1
TSS11-4
MW-17
MW-33
MW-4
EMBARGO RD
MW-14
Diversion Channel
MW-16 (NO INSTALLATION)
Upper 002 Seepage Barrier
Lower 002 Seepage Barrier
Dam No. 4
IX PLANT AREA
003 CENTRAL SEEP
Seepage Interception System
003 Seepage Barriers
SPRING 7
SPRING 9A
SPRING 9
MW-26
OUTFALL-002
Lower Dump Sump
Hunts Pond
Red River
SPRING 12A
Red River State Fish Hatchery
SPRING 18
SPRING 17
N
0
2,000
Feet
NOTE:
1. Topographic contours provided by Chevron Mining Inc. - Questa Mine (2007)
REVISION
DATE
URS
URS Center
8181 East Tufts Avenue
Denver, CO 80237-2637
(303) 694-2770
APPLICATION
ArcGIS 9.3
FILE NAME
fig3_tailing_facility.mxd
DRAWN BY
GIS - Denver
DATE
12/16/2009
CHEVRON MINING INC. - QUESTA MINE
TAILING FACILITY MAP
PROJECT
FIGURE 3
Proposed Plan

alkaline process. Analysis of tailing solids in the tailing facility showed molybdenum concentrations ranging between 102 and 334 mg/kg, with an average of about 200 mg/kg.

Tailing Pond Surface Water

Currently, tailing pond water and sediments are present behind Dam Nos. 1, 4, 5A and in the decant ponds. The source of the water for the ponds is the decant water from tailing slurry, water piped from the mill during non-milling periods, and precipitation. The water quality within the impoundments reflects the chemical nature of the tailing and process water from milling operations. Elevated concentrations were detected for molybdenum (0.5-2.8 mg/L), manganese (0.01-4.3 mg/L), fluoride (3-10 mg/L), and sulfate (628-1,890 mg/L). Trace levels of diesel fuel no. 2 and gasoline were detected in a few samples.

Tailing Pond Sediment

Analytical results for tailing pond sediment show molybdenum concentrations (85-19,400 mg/kg) to be two orders of magnitude higher than the surficial tailing material. Other metals with elevated concentrations in the tailing sediments include: cadmium (0.4-4.7 mg/kg), copper (51-2,100 mg/kg), lead (21-357 mg/kg), manganese (488-4,760 mg/kg), nickel (26-79 mg/kg), selenium (0.6-5 mg/kg), silver (0.5-8.4 mg/kg) and zinc (97-569 mg/kg).

Alluvial Aquifer

Tailing-seepage contamination occurs in several areas for the uppermost section of the alluvial aquifer. The first is southeast of Dam No. 1, in the vicinity of the Change House and monitoring wells MW-17 and MW-4. Molybdenum exceeds EPA's 0.05 mg/L risk-based PRG with concentrations ranging from 0.21 mg/L to 1.3 mg/L. Sulfate concentrations in this area are below the 600 mg/L New Mexico ground-water standard for domestic use. The second area is south of Dam No. 1, beginning at the Dam face and extending directly south along the axis of the drainage to near the Red River. Concentrations of molybdenum range from greater than 3 mg/L near the Dam face, to 0.2 mg/L near the river. Sulfate also exceeds the New Mexico standard, with concentrations ranging over 900 mg/L throughout the impacted area. The third area of seepage impacts is along the eastern flank of Dam No. 4. In this area, seeps contain elevated levels of molybdenum (0.58 mg/L) and sulfate (1,560 mg/L) above the risk-based PRG and state standard.

Tailing-seepage contamination also occurs in the basal portion of the alluvial aquifer, but to a much lesser extent than in the upper portion of the aquifer. Isolated areas of elevated molybdenum concentrations are located south and southeast of Dam No. 1, but the significance of these areas is uncertain. Sulfate levels remain below the New Mexico standard, but have increased over time in some areas.

Basal Bedrock Aquifer

The Basal Bedrock (volcanic) Aquifer is highly transmissive (convey large volumes of water per a given time) beneath the tailing facility in an area believed to be associated with fracture systems and paleochannels. Tailing-seepage contamination occurs in the

Basal Bedrock Aquifer, primarily south of Dam No. 4. Elevated concentrations of molybdenum above the risk-based PRG of 0.05 mg/L are detected at monitoring wells near the Dam (approximately 0.7 mg/L at MW-11). Trends in the molybdenum and sulfate levels sharply increased from 2006 to 2008 in response to an increase of mining, milling, and tailing disposal operations (molybdenum levels increased from about 0.4 mg/L in 2006 to near 1.0 mg/L in 2007 at MW-13). With operations significantly curtailed in 2009, the contaminant levels correspondingly decreased. It is noted that currently neither molybdenum nor sulfate levels exceed New Mexico standards in the Basal Bedrock Aquifer.

There are several seeps and springs located south and southwest of the tailing facility which flow to the Red River. Some are located as far as the Red River State Fish Hatchery about one mile downstream of the facility. Sample analytical results show concentrations of molybdenum and sulfate in the springs to be elevated and, hence, contaminated by tailing seepage. The pathway for contaminant migration is the leaching of tailing seepage downward from the tailing facility to ground water that migrates through fractures to surface water of the Red River via seeps and springs. Although the concentrations of molybdenum at some springs exceed the risk-based PRG for ground water (0.76 mg/L at Spring 12), they do not exceed ecological screening levels for surface water.

Red River, Riparian and South of Tailing Facility Area

Red River

The Red River is designated as a cold-water trout stream that flows east to west from its headwaters near the town of Red River, past the southern boundary of the mine site and Eagle Rock Lake, where it enters a broad valley upstream of the village of Questa. The river flows through the valley past the southern boundary of the tailing facility and enters a narrow, steep canyon to the confluence with the Rio Grande. The river also provides water for irrigation and livestock watering, and serves as recreational areas and wildlife habitat.

The Red River is characterized by primarily metals contamination in surface water. Aluminum (0.5-3.7 mg/L) exceeds the acute ecological screening level criterion (0.75 mg/L) in an area downstream of Spring 39 to the USGS gauging station (about one mile downstream of the mine site). The highest aluminum concentrations were observed just downstream of where Spring 13 discharges into the Red River. Biological monitoring during the RI (fish biomass and density; benthic macroinvertebrate density) shows this reach of the Red River to be the most impaired at and upstream of the Site. Chronic toxicity (serial dilution) tests using Spring 13 and 39 waters supported these findings, showing the spring water to be toxic to trout. Water from Spring 39 is less toxic than water from Spring 13.

Aluminum, cadmium (0.0002-0.0013 mg/L), and copper (not detected [ND] – 0.041 mg/L) exceed chronic ecological criteria for the same areas of the Red River. Significant increases in the concentrations of these metals are observed in areas of ground-water upwelling at and downstream of the Capulin Canyon/Spring 13 and Goathill Gulch/Spring 39 areas.

Red River Riparian Area

The Red River Riparian Area includes riparian soil along the river's floodplain. The low-lying area sustains vegetation and is habitat to a variety of animals. The tailing pipeline runs along the floodplain near the river for much of its 9-mile length. Hunt's Pond is a small man-made pond located within the floodplain of the river and near the tailing pipeline. As part of the historic tailing spills investigation, tailing spill samples were collected along the tailing pipeline, which in certain locations is adjacent to the Red River. When tailing was discovered near Hunt's Pond, it was included in the tailing spills investigation.

The Red River Riparian Area is characterized by metals contamination in tailing spills. Elevated concentrations were detected for molybdenum (9.7-62.5 mg/kg), barium (57-698 mg/kg), copper (19-135 mg/kg), lead (18-108 mg/kg), selenium (0.63-2.4 mg/kg), and zinc (51-497 mg/kg). A portion of the tailing spill deposits have been removed by CMI under the direction of NMED and the volume of the remaining tailing spills is approximately 3,800 yd^3, most of which is located near the Lower Dump Sump.

South of Tailing Facility Area

The South of Tailing Facility Area includes a low lying riparian valley located south of Dam No. 1 toward the Red River. The distance of this valley from the dam to the river is over half a mile. Current and reasonably anticipated future land uses are residential, commercial, recreational, agriculture (irrigated pastures), livestock grazing, gardening and wildlife habitat. Within this valley, residential properties are located fairly close to the dam face. Ground water in this area is a current and potential drinking water source. It is also used for other domestic and agricultural purposes.

Acequia ditches located in this valley provide water for irrigation. The water is diverted from the Red River or Cabresto Creek seasonally (typically from May through August). The irrigation return water eventually discharges to the Red River south of the tailing facility.

To the west, the riparian valley does not extend out in front of Dam No. 4, as it narrows in the approach to the Red River Gorge. Dam No. 4 is closer to the Red River than Dam No. 1, at a distance of about 2,000 feet, and is located within a steep canyon that opens into the Red River Gorge. The rugged landscape of the Red River Gorge and canyon west of the valley is within BLM-managed public lands and remains very isolated and remote. Ground water is used for drinking water in this area by visitors and employees of the Red River State Fish Hatchery, including several full-time workers and their families (a total of nine people, including two children) that live at the hatchery. Future use of ground water for drinking is anticipated to continue at the Red River State Fish Hatchery, but is not expected to increase beyond such use considering the remoteness of the area.

The area south of the tailing facility is characterized by primarily molybdenum contamination (0.75-596 mg/kg) in surface soil, with the highest concentrations occurring near the Outfall 002 discharge point and the Red River. Local residents claim that livestock (cattle, sheep) became ill after grazing in the valley. Symptoms described by residents were indicative of molybdenosis, a copper deficiency caused by increased uptake of molybdenum. EPA's Site-specific PRGs for molybdenum in soil are 11 mg/kg for protection of livestock, 41 mg/kg for protection of other large herbivorous mammals (deer and elk) and 54 mg/kg for the protection of other wildlife (birds). The area of soil with molybdenum concentrations exceeding 11 mg/kg is approximately 8 acres. The volume of contaminated soil is about 26,000 yd^3. The source of the molybdenum is the tailing facility.

Eagle Rock Lake

Eagle Rock Lake is located approximately 1,000 feet downstream of the mine site on public land managed by the USFS. It is a former gravel pit that was excavated during the construction of Highway 38 in the mid-1950s. Diverted water from the Red River flows into the lake at a gated inlet and back into the river through an outlet. The USFS controls the inlet gate. The lake is approximately 3 acres in size and 7-8 feet deep. It is a popular fishing spot for the local community and is stocked with rainbow trout from the Red River State Fish Hatchery nearly every two weeks from spring to fall.

Eagle Rock Lake is characterized by metals contamination in the lake bottom sediments. Concentration ranges for key metals are aluminum (11,800 – 70,500 mg/kg), arsenic (6.4 – 16.2 mg/kg), nickel (16.6 – 378 mg/kg), selenium (1.3 – 12.2 mg/kg), and zinc (185 – 5,250 mg/kg). The volume of contaminated sediment covering the 3-acre lake bottom, assuming a 3-foot excavation depth, is approximately 15,000 yd^3. The source of the metals contamination is sediment carried by the Red River, which enters the lake in suspension through the inlet gate during periods of high flow (e.g., storm events).

SCOPE AND ROLE OF RESPONSE ACTION

This is the first CERCLA response action to be conducted at the Site. This action will address mining-related contamination on a Site-wide basis at the following areas:

- PCB and molybdenum contamination in soil at the Mill Area;
- Contaminated ground water and surface water impacted by acid-rock drainage (ARD) and leaching of metals from waste rock at the Mine Site Area
- Waste rock at the Mine Site Area
- Contaminated ground water impacted by tailing seepage at the Tailing Facility Area

- Tailing and tailing pond sediment following cessation of tailing disposal operations;

- Contaminated surface water in the Red River (through response actions at the Mine Site Area for controlling ground-water discharges to the river);

- Molybdenum contamination in soil at South of Tailing Facility Area;

- Tailing spills (as hot spots) in the Red River Riparian Area;

- Contaminated sediment in Eagle Rock Lake

PCBs are addressed by the preferred remedy identified in this Proposed Plan. Although the concentrations of PCBs (140 mg/kg) are not so high as to be several orders of magnitude above levels that allow for unrestricted use and unlimited exposure, they are in an area of active milling and, hence, their potential for increased mobility from constant truck and foot traffic, and periodic road grading and snow-plowing operations is elevated. Therefore, the PCBs are considered principle threat waste and, consistent with the expectations of the NCP, shall be treated.

Other source materials (waste rock and tailing) at the Site are not considered to be principal threat waste. These low-level threat wastes will be addressed in the remedy primarily through consolidation and containment.

SUMMARY OF SITE RISK

As part of the RI, EPA conducted the HHRA and BERA to determine any potential threat to public health, welfare, or the environment resulting from the release or threatened release of a hazardous substance, pollutant, or contaminant (hereinafter "contaminant") at or from the Site. Based on the findings of the HHRA and BERA, EPA has determined that there is sufficient risk to human health and the environment due to the release of PCBs, aluminum, beryllium, cadmium, manganese, molybdenum, zinc, acidity, and other contaminants at the Site. Further, it is EPA's judgment that the Preferred Alternative is necessary to protect public health or welfare or the environment from the actual or threatened releases of the contaminants from this Site, which may present an imminent and substantial endangerment. <u>*See also*</u> Appendix 1: *What is risk and how is it calculated.*

Human Health Risk

The HHRA evaluated potential human health risks that may result from current and future exposure to mining-related contamination present at the Site if no remediation is performed. Mining-related contamination has been documented in soil, ground water, surface water and sediment at and in the vicinity of the mine site and tailing facility.

Potential receptors and routes of exposure (oral, dermal, inhalation) were evaluated based on current and reasonably anticipated future use of the land and ground water. A combination of Site visits, analysis of land use patterns, experience with mine sites, and information gathering in the community was used to identify how people may come into contact with Site-related contamination. The HHRA provides information to help EPA establish remedial priorities and serves as a scientific basis for regulatory and remedial actions for the Site.

The potential receptors evaluated in the HHRA are:

- Current residents (near the tailing facility) and future residents
- School children near the tailing facility
- Current and future recreational visitors, trespassers
- Current and future sport anglers
- Future commercial/industrial workers
- Future construction workers

It is noted that potential exposure to current workers at the mine site are covered under Mine Safety Health Administration (MSHA) regulations (for an operating mine) and are not evaluated in the HHRA.

The results of the HHRA suggest that only the following exposure scenarios are likely to present unacceptable risk:

- Incidental ingestion associated with normal hand-to-mouth contact after contact with contaminated soil (dermal contact) by *future residents*;

- Drinking water use of contaminated ground water drawn from rural domestic wells or industrial wells by *current residents* (near tailing facility), *future residents, and on-Site commercial/industrial workers*;

- Incidental ingestion of and dermal contact with contaminated tailing pond sediment by *current and future recreational visitors;*

- Incidental ingestion of seepage or seepage-contaminated surface water in mine site catchment basins, and seeps/springs from waste rock piles and along the Red River by *current and future recreational visitors*.

Exposure by inhalation (breathing) of interior dust or particulates (PM10) in ambient air by residents, school children, workers, and recreational visitors was estimated to pose no health risk. Other potential exposure scenarios and pathways estimated not to pose health risk were (1) current and future residents near the tailing facility via ingestion of homegrown produce or consumption of beef from livestock raised in contaminated areas near the tailing facility, (2) anglers (fishermen) via ingestion of brown trout, and (3) current and future recreational visitors via ingestion of edible riparian plants.

It is noted that the HHRA considered only resident brown trout, since they spend their entire life in the Red River. Stocked rainbow trout, on the other hand, are typically in the river and Eagle Rock Lake a very short time before being caught by fishermen. Nevertheless, stocked rainbow trout were collected and analyzed during the study to address any health concerns the community might have with eating the rainbow trout. The results of those tests showed that concentrations of all metals except arsenic were below levels that could present a health risk. Further testing on the arsenic showed it to be of a form (organic) having low toxicity and, therefore, posed little or no human health threat. The source of the arsenic was determined to be the fish feed used at the state fish hatchery. The New Mexico Department of Game and Fish (NMDGF) took immediate steps to ensure that feed used at its hatcheries has the lowest possible amount of arsenic to assure the public safety.

At the time the risk assessment was performed, EPA considered some areas of the mine site and the tailing facility to be suitable areas for potential future residential or commercial development. For the mine site, the Administrative Area, the Mill Area, and the Red River Riparian Area were considered suitable for residential land use. Redevelopment of the Roadside Waste Rock Piles and other rock piles for residential or commercial land use was not considered as likely but was also evaluated. All areas at and in the vicinity of the tailing facility were evaluated under the potential future residential land use scenario, including the tailing facility, tailing facility riparian area, and the area south of the tailing facility.

In May 2009, CMI recorded a Deed of Conservation Easement for the mine site (including the Mill Area) and Declarations of Restrictive Covenants for the mine site and tailing facility at the County Clerk Office. These documents establish legal restrictions for residential land use, as well as other uses at the mine site and tailing facility. The Conservation Easement has been granted to the village of Questa for the purpose of forever conserving the natural and economic values of the mine site property. It will become effective when mining activities, including mineral beneficiation, permanently cease. Following termination of mining and milling, the majority of the property shall be returned to its undeveloped state and remain as such. Specifically designated areas (already substantially disturbed) may be developed for economic use. The covenants, conditions, and restrictions established by the declarations run with the land and are binding on the owner and all successive owners of any interest in the property.

For risk assessment purposes, toxic chemical effects are separated into two categories of toxicity: carcinogenic (cancer) effects and non-carcinogenic effects. For residential exposures, children are evaluated for non-cancer exposures and a combination of child and adult exposures are evaluated for cancer-causing contaminants (carcinogens). Because young children generally have higher intake rates and lower body weights, compared to older children and adults, they tend to have higher chemical exposures per kilogram of body weight. Therefore, evaluating young children is a conservative approach and yields the highest risk estimates for exposure to contaminants. Cancer risk is based on the exposure duration of 30 years; age-adjusted exposure factors are used integrating exposure from birth until age 30 by combining exposure assumptions for two age groups: young children (birth to six years in age) and adults.

In general, EPA recommends a target non-cancer hazard index (HI) value of 1 or a target excess lifetime cancer risk range of 10^{-4} to 10^{-6} as threshold values for evaluating potential human health impacts. This cancer risk range equates to one excess cancer in ten thousand individuals (10^{-4} = 10,000) to one excess cancer in one million individuals (10^{-6} = 1,000,000). The NMED recommends a target excess lifetime cancer risk range of $1x10^{-5}$ to $1x10^{-6}$ and a HI threshold value of 1. Results of the HHRA were compared to these EPA and NMED target (acceptable) values to assist in determining whether response action is necessary at the Site.

Risk to Future Residents Who May Incidentally Come into Contact With and Ingest Contaminated Soil

For future residents, risks and hazards were evaluated for incidental ingestion of and dermal contact with surface soil (0-24 inches) and interior dust, and inhalation of particulates released from surface soil. Subsurface soil was not evaluated in the HHRA as soil below 2 feet was not sampled during the RI.

Cancer risks associated with exposure to soils at the mine site for future residents exceeded EPA's target risk range only for the Mill Area. The cancer risk is two excess cancers in ten thousand individuals or $2x10^{-4}$ for reasonable maximum exposure (RME), due primarily to exposure to PCBs in soil. Cancer risks, based on RME, that are associated with exposure to soil at the Tailing Facility Area are within EPA's acceptable risk range of 10^{-4} to 10^{-6} for current and future residents.

Children are evaluated for residential exposure for health hazards other than cancer. For the mine site, non-cancer health hazards are associated with exposure to contaminated soil at the Mill Area. The total HI based on RME is 8, due primarily to molybdenum exposure, which can cause toxic effects on the liver, kidney, and the gastro-intestinal (GI) tract. Toxic effects include elevated uric acid that may cause gout-like symptoms and physiological copper deficiency. Hazard Indices, based on RME, for current and future residents exposed to contaminants in soil at the tailing facility are at or below the threshold of 1, suggesting that non-cancer health effects are unlikely to occur as a result of this exposure pathway.

For future commercial/industrial workers, future construction workers and recreational visitors, risks and hazards were evaluated for incidental ingestion of, dermal contact with, and inhalation of particulates released from surface soil. To be protective of future indoor and outdoor workers at the Site, the commercial/industrial scenario assumed that the worker spends most of the day outdoors. Based on RME, cancer risks are estimated below or within EPA's acceptable risk range and HIs are below the threshold of 1 or are not expected to be significant for all of these receptors.

The Mill Area is currently used for active mineral processing operations, including access controls, storm-water management, and environmental response actions under permits issued by the state mining and ground-water quality programs and the federal NPDES program.

At this time, EPA considers the reasonably anticipated future land uses following closure of the mine to be forestry and any long-term water management and treatment required under a CERCLA cleanup or state permitting action. Such uses are approved post-mining land uses (PMLUs) under the New Mexico Mining Act Permit No. TA001RE. The permit requires reclamation to a condition that allows for the re-establishment of a self-sustaining ecosystem appropriate for the life zone of the surrounding areas, not conflicting with the approved PMLU. The Institutional Controls or ICs (Conservation Easement and Restrictive Covenants) established by CMI in May 2009 restrict residential uses at the mine (including the Mill Area) as well as ground-water and surface-water uses.

Risk to Residents, Future Residents and Future Commercial/Industrial Workers Who may Consume Contaminated Ground Water

Potential risk and hazards from exposure to contaminated ground water were estimated for two groups of human receptors. First, people would use the ground water drawn from a private well or industrial/commercial well as a drinking water supply, such as current and future residents and future commercial or industrial on-Site workers. Second, exposure to ground water might also occur if, during construction, excavation penetrated into the saturated zone. Shallow alluvial ground water may be present at sufficiently shallow depths for this scenario to occur, at least in portions of the Site. Therefore, construction workers are evaluated for incidental exposure (ingestion and dermal contact) to contaminated ground water in the upper alluvial aquifer. Risks and hazards were estimated on a well by well basis.

<u>Mine Site Ground Water</u>: Wells located on or near the mine site are screened in one of the following three ground-water units: (1) the Red River alluvial aquifer, (2) colluvium in side drainages and, in some cases, colluvial debris fans at the mouths of the side drainages, and (3) bedrock beneath the alluvium and colluvium.

For future residents and future on-Site workers, background concentrations of several inorganic constituents may make important contributions to total risks and hazards due to exposure to contaminated ground water. However, several contaminants of potential concern (COPCs) make important incremental increases to risk above background in many wells at the mine site. Cancer risks from exposure of future residents and on-Site workers to contaminated ground water within the alluvium, colluvium, and bedrock are exclusively from exposure to arsenic. Non-cancer health hazards are from exposure to metals and other inorganic contaminants such as fluoride, aluminum, iron, molybdenum, manganese, antimony, zinc, cadmium, arsenic and vanadium.

Alluvial Aquifer: Cancer risk estimates from exposure to alluvial ground water range from $6x10^{-6}$ to $2x10^{-3}$ for future residents and $3x10^{-6}$ to $9x10^{-4}$ for workers. These risks exceed the EPA acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$, with 16 of 37 wells exceeding the range for future resident and 9 of 37 wells for the future workers. Cancer risks also exceeded the NMED target risk range of $1x10^{-5}$ to $1x10^{-6}$. Elevated cancer risks associated with alluvial ground water occur sporadically along the Red River. These risks appear to be associated with high natural background.

Health hazards, as estimated by HI, exceed the threshold of 1 for future residents in most alluvial wells (35 of 37 wells), ranging from 0.003 to 204 depending on target organ. For commercial/industrial workers, the HIs range widely from 0.0005 to 45 depending on the target organ.

Colluvial Ground Water Unit: Total cancer risks among colluvial wells range from $2x10^{-5}$ to $4x10^{-3}$ for future residents and $1x10^{-5}$ to $2x10^{-3}$ for future workers. The cancer risks exceed both the EPA and NMED acceptable risk range. Eleven (11) of 14 wells exceeded the EPA risk range for future residents and 7 of 14 wells for future workers. Mine-related impacts may make an incremental contribution to already high background arsenic concentrations in colluvial ground water in drainage features that extend up onto the mine site.

For health hazards, HIs for residents that might use colluvial ground water for drinking range from 0.01 to 1,474 depending on the target organ. Hazard Indices for commercial/industrial workers range widely from 0.002 to 324 depending on target organ. The central nervous system (CNS) had an HI (6) above the EPA threshold value for construction workers.

The highest concentrations of contaminants measured in colluvial ground-water samples were taken from monitoring wells MMW-23A (toe of Capulin Waste Rock Pile) and MMW-38A (Middle Waste Rock Pile).

Bedrock Ground Water Unit: Total cancer risks among bedrock wells range from $3x10^{-5}$ to $9x10^{-4}$ for future residents and $1x10^{-5}$ to $4x10^{-4}$ for future workers. Arsenic concentrations in bedrock wells beneath colluvium at the toe of the western most waste rock pile of the Roadside Waste Rock Piles, beneath colluvium associated with the Goathill debris fan, and beneath colluvium near the mouth of Capulin Canyon are sufficiently high that cancer risks exceed EPA's and NMED's acceptable risk range. Eight (8) of 22 wells exceed the EPA risk range for the future resident and 6 of 22 wells exceed the range for the commercial/industrial worker. Such risks are greater than risks estimated for reference background wells, suggesting that arsenic concentrations along this reach of the river may be influenced by mining operations.

Non-cancer health hazards from exposure to bedrock ground water are above EPA's target HI of 1 at many locations. Hazard Indices range from 0.003 to 239 for future residents and 0.0007 to 53 for commercial/industrial workers depending on the target organ.

The highest concentrations of contaminants measured in bedrock ground-water samples were taken from monitoring wells MMW-36B (toe of Sugar Shack West Waste Rock Pile) and MMW-45B (near the mouth of Capulin Canyon at the southwestern edge of the mine site).

The Mine Site Area is currently used for active underground mining operations, including access controls, surface-water, ground-water, and storm-water management, and environmental response actions under permits issued by the state mining and ground-water quality programs and the federal NPDES program.

<u>Tailing Facility Ground Water:</u> Wells located at or near the tailing facility produce water from one of the following two shallow water-bearing units: (1) Alluvial Aquifer (upper and basal portion), and (2) Basal Bedrock Aquifer.

Alluvial Aquifer: Ground-water contamination at the tailing facility is primarily located within the upper portion of the Alluvial Aquifer beneath the tailing facility, as well as south and southeast of the facility, near Dam No. 1 and the Change House. To a lesser extent, ground-water contamination is present in the basal portion of the Alluvial Aquifer. Contamination is mostly confined to CMI property, but does extend beyond the property in certain areas of the valley south of the tailing facility (as far south as the Outfall 002 discharge point at the Red River and west of the discharge point). There are many private wells in close proximity to the tailing facility that produce water from the Alluvial Aquifer. However, there are no current residents known to use ground water drawn from private wells as drinking water or other domestic uses in the areas of ground-water contamination, but the potential for such use exists. The anticipated future use of the ground water in the area south and southeast of the tailing facility is expected to be drinking water and other domestic uses, as well as agricultural use.

Cancer risks are due exclusively to exposure to arsenic and exceed both the EPA's and NMED's acceptable risk range. However, when compared to background risk, the risks are similar, suggesting they are not related to mining activities

Health hazards, as estimated by HI, exceed EPA's target HI of 1 in numerous alluvial wells. The HI values range from 0.005 to 80 for current and future residents and from 0.001 to 18 for future on-Site commercial/industrial workers depending on the target organ. Contaminants of potential concern (COPCs) that affect target organs for which the HI is greater than 1 are molybdenum (GI tract, kidney, and liver), aluminum (GI tract and CNS), iron (GI tract and liver), manganese (CNS), and vanadium (metabolism). Only risk associated with molybdenum exposure significantly exceeds background risk. The distribution of HIs above 1 due to molybdenum exposure are in wells located primarily along the south and southeastern perimeter of the tailing facility, as well as the area south of the facility (near Outfall 002 discharge point to Red River).

Non-cancer HIs for construction workers are all estimated to be less than the target HI of 1 for all alluvial wells.

Basal Bedrock (volcanic) Aquifer: Ground-water contamination in the Basal Bedrock Aquifer is located primarily south of Dam No. 4 within and near the Red River Canyon, some of which is on BLM-managed land. Currently, there are no known users of the ground water, with the exception of the state fish hatchery, located about a mile downstream of the tailing facility. Some workers and their families live at the fish hatchery in residential dwellings. Those buildings are supplied drinking water from nearby spring, which is sourced by this aquifer. Because of the remoteness of the area and rugged terrain, the anticipated future use of ground water in this area is expected to remain the same, but could potentially increase.

Cancer risks due to potential exposure of current and future residents and future on-Site commercial/industrial workers that drink contaminated ground water are due exclusively to exposure to arsenic. Cancer risks fall within the EPA acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$, but exceed NMED's target risk level ($1x10^{-5}$). However, risks associated with arsenic are similar to background risk and are unlikely related to mining activities. Exposure to bedrock ground water is not estimated for construction workers.

Health hazards exceeded EPA's target HI threshold of 1 at some locations. HIs for exposure to COPCs in ground water range from 0.001 to 15 for future residents and 0.0002 to 3 for on-Site commercial/industrial workers, depending on the target organ. The HI estimates are due primarily to exposure to molybdenum (GI tract, liver, and kidney). Molybdenum concentrations in some wells are statistically greater than background and the median exposure point concentration (EPC) is greater than the PRG of 0.05 mg/L

Risk to Current and Future Recreational Visitors who may Incidentally Contact and Ingest Contaminated Tailing Pond Sediment

Recreational users may be exposed to contaminants in sediment via incidental ingestion and dermal contact while wading. Children 7 to 16 years of age were evaluated for these exposure pathways.

Cancer risks for recreational visitors, for both the mine site and tailing facility, are within or below EPA's acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$ for sediment. Non-cancer health hazards are above the EPA target threshold of 1 for sediment at the tailing ponds. The HI for exposure at the tailing ponds is 2, which is due mostly to exposure to molybdenum (GI tract, liver, and kidney).

Risk to Current and Future Recreational Visitors who may Incidentally Contact and Ingest Surface Water in Mine Site Catchments and Seeps/Springs at Waste Rock Piles and along Red River

Recreational users may be exposed to contaminants in surface water via incidental ingestion and dermal contact while playing in surface water bodies at or near the Site. Children 7 to 16 years of age were evaluated for these exposure pathways.

Cancer risks, based on RME for a recreational user (child between 7-16 years of age), associated with exposure to surface water are within or below EPA's acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$ and NMED's target risk level of $1x10^{-5}$ for all surface water exposure areas. Cancer risk is due exclusively to exposure to arsenic. Total cancer risks are estimated for catchment basins ($8x10^{-7}$), catchment basin seepage ($1x10^{-5}$), seeps and springs associated with waste rock piles ($7x10^{-6}$), and seeps and springs adjacent to the Red River ($2x10^{-6}$).

Hazard Index estimates for mine site catchment basins, catchment basin seepage, and seeps and springs associated with waste rock piles and adjacent to the Red River are above the threshold of 1. An HI of 3 for the CNS was calculated for recurring visits to the catchment basins and is due to potential exposure to manganese. A higher HI for catchment basin seepage (48) was estimated for the CNS due to exposure to manganese, and high HIs were also estimated for the gastrointestinal system (3), and kidney (2) for cadmium and beryllium. A total HI for seeps and springs associated with rock piles was estimated to be 51. HI estimates by target organ were 45 for the CNS due mainly to exposure to manganese, 2 for the kidney (cadmium and beryllium) and 3 for the gastrointestinal system (cadmium and beryllium). Finally, a total HI for recurring exposure to seeps and springs adjacent to the Red River is 2; however, no HI based on individual target organs exceeded unity.

It is noted that risk estimates for surface water at the mine site catchment basins, catchment basins seepage, and seeps and springs associated with the waste rock piles are likely to be overestimated, especially for current conditions. Surface water that occurs in these areas is poorly accessible at best and current visits to any of these waters are either very infrequent, or do not occur. In the future, visitors might access these sites more readily and exposure could be more frequent. However, visits to these locations would likely still be less frequent than visits to the river and lakes.

Ecological Risk

The first phase of the ecological risk assessment (ERA) was to perform a screening level ERA (SLERA) to determine if further investigation was warranted. The SLERA was performed informally and indicated a potential for ecological receptors (plants and animals) to be adversely affected by exposure to environmental media (soil, water, sediment) at the Site. The SLERA also indicated the need to perform the BERA to quantify the estimations of ecological risk and provide information to help EPA establish remedial priorities. The BERA was performed as the second phase of this risk assessment process and serves as a scientific basis for regulatory and remedial actions for the Site.

The BERA focused on the potential ecological effects associated with chemical contamination, primarily Site-related contaminants in surface water, sediment, and surface soils at and adjacent to the mine site and tailing facility, and within the Red River and riparian corridor, including Eagle Rock Lake and Hunt's Pond. The BERA also assessed potential ecological effects from ground water to surface water interactions at zones of ground-water upwelling to the Red River. Extensive Site-specific data were collected and used, wherever practicable, to estimate risk and develop quantitative cleanup levels that are protective. The Site-specific information included plant and animal tissue residue data, toxicity test data, bioaccumulation factors, and (for Red River aquatic biota) population- or community-level studies (for fish, benthic invertebrates, terrestrial plants, and small animals), and aquatic and riparian habitat quality evaluations.

The BERA also included extensive data collection in reference areas unaffected by Site contamination to ascertain background conditions or concentrations for comparative purposes to Site data. This effort included the collection of Red River chemistry and biological data from its head waters near the town of Red River to just upstream of the mine site, thus providing EPA with environmental data over most of the Red River Watershed. It also included collection of chemistry and biological data from Upper Fawn Lakes, as a reference area for Eagle Rock Lake and Hunt's Pond.

It is noted that the extent of the RI/FS data collection allowed EPA to share the information with other EPA programs and other federal and state agencies involved in the Red River Watershed assessment and cleanup. Red River chemistry data were shared with the state for developing a total maximum daily load (TMDL) for aluminum in the Red River. Data collection efforts were also coordinated with data gathering efforts for injury assessment by federal and state natural resource trustee agencies. This was done through a Site Planning Team comprised of representatives from EPA, USFWS, USFS, BLM, and the New Mexico Office of Natural Resources Trustees (ONRT).

Results of the BERA show the greatest ecological risks at this Site are to (1) aquatic life (primarily resident brown trout) in the Red River by exposure to aluminum, and to a lesser degree, copper and zinc in surface water at and downstream of Spring 13 and other springs, (2) wildlife and/or livestock in the area south of the tailing facility by exposure to molybdenum in terrestrial plants that have taken up molybdenum from soil, (3) wildlife (deer/elk) on the tailing facility by exposure to molybdenum in tailing and plants (via dietary exposure), and (4) benthic macroinvertebrate populations (aquatic insects such as the larvae of mayflies and other invertebrates) exposed to degraded Eagle Rock Lake bottom sediments contaminated with several metals, including aluminum, zinc, nickel, and copper.

Resident Brown Trout in the Red River

- Long-term (chronic) exposure to elevated concentrations of primarily aluminum, as well as copper and zinc, in surface water of the Red River at and downstream of Spring 13, and to a lesser degree at other seeps and springs along the river may cause severe adverse effects to exposed trout. These findings are based on surface water concentrations of contaminants (compared to aquatic toxicity data) and whole body fish concentrations, as well as other supplemental lines of evidence, including abundance and diversity data and laboratory toxicity test data in which trout were exposed to Spring 13 and Spring 39 water.

Risk estimates (expressed as Hazard Quotients or HQs) calculated from comparison of surface water concentrations to trout-based toxicity reference values (TRVs) for chronic exposures were low, but considered significant, as HQs exceed EPA's threshold value of 1 for aluminum along several reaches of the Red River from upstream of the mine site to the tailing facility. The maximum HQ of 2 was calculated for the river reach downstream of the Cabresto Creek and Red River confluence. HQs for chronic exposure to the springs and seeps in contact with the river range up to 31 for aluminum.

Whole body residue-based HQs for large brown trout exceeded the threshold value of 1 for copper (2-5) and zinc (5-14) for areas of the Site and upstream of the Site (reference locations), with Site location HQs being greater than HQs for reference locations. The highest HQ for copper (5) was from near the Questa Ranger Station, located about a mile downstream of Spring 13.

Abundance and diversity data show a significant reduction in the numbers and pounds of brown trout beginning upstream of the mine site and continuing until downstream of Highway 522. The 7-day laboratory toxicity tests (serial dilution tests) using early life stage rainbow trout exposed to water from Springs 13 and 39 showed both springs were toxic at very low dilutions (5-10 percent).

These results reveal that even with substantial dilution by Red River water, Spring 13 and Spring 39 can cause severe adverse effects in exposed trout. Since the degree that spring water is diluted by river water undoubtedly varies over time, acutely toxic conditions to fish may occur when spring water discharges during low flow conditions in the Red River.

No conclusions are drawn on the potential for adverse effects to the stocked legal size rainbow trout based on the results of the early life stage rainbow trout in toxicity tests as the stocked trout are expected to reside in the river for only a short period of time prior to being taken by fishermen.

Based on the findings of the BERA, the recommended PRG for total aluminum in Red River surface water is 1 mg/L for Spring 13 and 0.8 mg/L for Spring 39. Remedial measures to reduce aluminum concentrations in surface water are also expected to reduce levels of copper and zinc.

- Short-term (acute) exposure to elevated aluminum concentrations in surface water during or following storm events may result in adverse effects to trout both upstream and along the Site. However, trout are likely to avoid turbid water during storm events if possible, which would likely reduce the risks associated with acute exposures to aluminum.

Wildlife and Livestock in Red River Riparian Area South of Tailing Facility

- Exposure to elevated molybdenum concentrations in surface soil, and in some cases terrestrial plants through uptake and accumulation, in the area south of the tailing facility may cause adverse affects (molybdenosis) to sensitive receptors such as livestock (cattle) and sensitive wildlife. This is an important issue because some large herbivorous mammals (including domestic cattle and sheep, as well as members of the deer family such as mule deer and elk) can exhibit molybdenosis if too much molybdenum is ingested. Molybdenosis is caused by decreased absorption of copper, an essential nutrient, when molybdenum concentrations are increased (i.e., molybdenum competes with copper absorption).

  Ecotoxicity data for molybdenum in soil are sparse, and as a result additional investigations (Site-specific toxicity testing with rye grass and earthworms; bioavailability investigations with two different forms of molybdenum) have been performed since completion of the BERA to understand better the potential toxicity and bioavailability of molybdenum in Site soil.

  Based on these tests and additional literature review, the TRV for molybdenum in surface soil has been revised as shown:

  - 54 mg/kg TRV – protects a representative avian (bird) receptor (based on western kingbird) in the riparian corridor;

  - 11 mg/kg TRV – protects livestock (cattle, sheep) in areas that grazing is likely. This TRV is derived to protect against molybdenosis in livestock

  - 41 mg/kg TRV – protects wildlife (resident large mammals such as mule deer and Rocky Mountain elk)

  The HQs calculated for molybdenum within the riparian area south of the tailing facility, based on the revised TRVs, are 11 (livestock), 3 (deer/elk), and 2 (western kingbird). These HQs are above EPA's threshold value of 1 and warrant response action. The PRG established to protect wildlife and livestock is 11 mg/kg.

Wildlife (deer/elk) Exposed to Tailing Waste at Tailing Facility

- Long-term (chronic) exposure to elevated molybdenum concentrations in tailing and plants (which take up molybdenum) may cause adverse affects (molybdenosis) to wildlife (deer/elk). The calculated HQ of 4 exceeds EPA's threshold value of 1, based on the Site-specific TRV of 41 mg/kg and exposure point concentration of 184 mg/kg (geometric mean) for tailing. The mule deer and Rocky Mountain elk are the receptors evaluated for risk because of their known year-round occurrence at the tailing facility, likelihood of use of the tailing facility over varying frequencies and durations, diet, and potential sensitivity to dietary exposures of molybdenum based on sensitivity observed in cattle.

A PRG of 41 mg/kg for molybdenum in soil is established for the protection of deer and elk at the tailing facility.

Benthic Macroinvertebrates in Contaminated Sediment of Eagle Rock Lake

- Exposure to Eagle Rock Lake sediments may cause adverse effects to the benthic macroinvertebrate populations (aquatic insects and other invertebrates) due to exposure to elevated concentrations of several metals. HQs estimated for zinc (14), copper (8), and nickel (6) in sediment are above EPA's threshold value of 1 and also above reference HQs from Upper Fawn Lakes (the reference lakes located east of the mine site). The exposure point concentration for zinc in sediment at Eagle Rock Lake (1,742 mg/kg dry weight) is nearly six-fold higher than that of the reference Upper Fawn Lakes (309 mg/kg). Sediment toxicity tests based on Eagle Rock Lake sediment did not show toxicity. However, analysis of macroinvertebrate tissue showed concentrations of aluminum, copper, nickel and zinc above reference levels for tissue collected from Upper Fawn Lakes. Finally, the surface of the sediments of Eagle Rock Lake is covered with a semi-gelatinous 'floc' (assumed to be comprised primarily of aluminum hydroxide) that degrades the microhabitat utilized by the macroinvertebrates.

  Benthic macroinvertebrates are considered important in the BERA because they are sensitive indicators of water and sediment quality. They also serve as a major food source for fish and, therefore, warrant protection by this proposed remedy.

Aquatic Life and Benthic Macroinvertebrates in Tailing Pond Surface Water and Sediment

- The highest sediment HQ considering all river and lake/pond locations is for molybdenum at the tailing ponds (HQ – 1,416). Elevated concentrations of copper in tailing pond sediments would also be of concern if tailing ponds are identified as suitable habitat for benthic macroinvertebrates. However, tailing ponds are currently not considered suitable aquatic habitats, primarily because they are part of the active tailing disposal facility.

- Tailing pond surface water was found to be non-toxic or only minimally toxic (relative to the toxicity test controls) in tests exposing daphnids (water-column crustaceans) to the tailing pond water. As stated above, tailing ponds are currently not considered suitable aquatic habitats because they are part of the active tailing disposal facility.

Aquatic invertebrate community data suggest that aquatic invertebrates are neither abundant nor diverse, most likely due to the combination of poor water and sediment quality, low nutrient content, limited organic carbon content, low oxygen levels and operational activities (tailing ponds are often disturbed via filling and other activities).

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are developed for the five areas to be addressed by the proposed remedy to protect human health and the environment. They specify the media and contaminants of concern (COCs), potential exposure routes and receptors, and remediation goals. In a proposed plan, remediation goals are considered preliminary cleanup levels or PRGs. These proposed cleanup levels become the final contaminant-specific cleanup levels in the Record of Decision (ROD). A PRG establishes acceptable contaminant levels or range of levels for the exposure route. The PRG is developed during the RI/FS and is based on health- or ecological-based criteria developed by EPA in risk assessment or federal/state numeric standards considered by EPA to be Applicable or Relevant and Appropriate Requirements (ARARs) for the Site.

Preliminary ARARs that provide numeric standards as PRGs for the Site are the New Mexico Water Quality Act regulations [Section 20.6.2 of the New Mexico Administrative Code (NMAC)] for abatement or protection of ground water and the federal TSCA requirements for cleanup of PCBs in soil.

Current and anticipated future uses of the Site are also considered in the development of the RAOs. The property owned by CMI at the Mill Area, Mine Site Area, and Tailing Facility Area is currently operated under conditions prescribed by Mining Permit No. TA001RE. The permit conditions limit the allowable future PMLU. Additionally, the ICs (Conservation Easement and Restrictive Covenants) recorded by CMI in 2009 will allow for alternate future land uses, while restricting residential and other uses on its property.

A further consideration EPA made with respect to developing RAOs is the position taken by NMED on the use of ICs. The NMED will not accept permanent ground-water use restrictions as a substitute for active remediation. The New Mexico Water Quality Act regulations of Section 20.6.2.4000 NMAC (Prevent and Abatement of Water Pollution) require abatement or protection of all ground water of the State of New Mexico having a background concentration of 10,000 mg/L or less total dissolved solids (TDS) for use as domestic or agricultural water supply. Further, such regulations require abatement of ground-water pollution to meet water quality standards at any place of withdrawal for present or reasonably foreseeable future use, which include those areas of ground-water contamination beneath waste to be left in place (i.e., waste rock, tailing).

Therefore, based on these New Mexico Water Quality Act ground-water regulations, as identified preliminary ARARs for this CERCLA response action, the location of point of compliance (POC) for attaining ground-water standards is all ground water at the Site, including ground-water beneath the waste rock and tailing that will be left in place.

Mill Area

For the Mill Area, RAOs were developed to mitigate risks to human health estimated from potential exposure to PCB and molybdenum contamination in soil. Ecological risk was not assessed for this area due to a lack of suitable habitat and ecological receptors. TSCA requirements for PCB contamination drive the development of the RAOs.

Mill Area RAO
The RAO for the Mill Area is to:

- Protect humans by preventing direct contact/ingestion of Mill Area soil that has concentrations of molybdenum and/or PCBs greater than federal ARARs and/or Site-specific risk-based cleanup levels for soil.

Proposed Cleanup Levels for Soil – Human Health
The PRGs for the Mill Area are based on TSCA requirements for PCBs and Site-specific risk-based levels for molybdenum for the future resident, commercial/industrial worker, construction worker, and recreational visitor. *See* Table 1.

Table 1 Preliminary Remediation Goals for Soil – Human Health

COC	Risk-Based or ARAR	PRG (mg/kg)			
		Resident	Commercial/ Industrial Worker	Construction Worker	Recreational Visitor
Molybdenum	Risk-based HI = 1	503	5,110	2,978	7,546
PCBs	TSCA	1	25	25	25

Mine Site Area

For the Mine Site Area, RAOs were developed to mitigate both human health and ecological risk associated with exposure to ground water, Red River surface water, seeps/springs, rock pile seepage catchments, soil and acid rock drainage. They were also developed in consideration of the forestry PMLU approved under Mining Permit No. TA001RE, as well as the Closure/Closeout Plans developed under TA001RE and Discharge Permit DP-933. The area will be returned to a condition that allows for re-establishment of a self-sustaining ecosystem appropriate for the life zone of the surrounding area following closure, not conflicting with the approved post-mining land use. Additionally, the ICs (Restrictive Covenants) recorded by CMI in 2009 that restrict future residential use and ground-water and surface water use were considered, as well as NMED's position on ICs being used as a substitute for active ground-water abatement. Therefore, the RAOs address not only the risk associated with the incidental dermal contact/ingestion of surface water by the recreational visitor/trespasser, but also the potential hypothetical future resident's use of contaminated ground water drawn from private wells as a drinking water supply.

Mine Site Area RAOs

The RAOs for the Mine Site Area are to:

- Prevent ingestion by humans of ground water containing mine-related inorganic COCs[3] exceeding state/federal ARARs or preliminary Site-specific risk-based cleanup levels.

- Eliminate or reduce, to the maximum extent practicable, leaching and migration of inorganic COCs[3] and acidity from waste rock (acid rock drainage) to ground water at concentrations and quantities that have the potential to cause exceedances of the numeric ground-water ARARs or preliminary Site-specific risk-based cleanup levels.

- Restore contaminated ground water to meet state/federal ARARs or preliminary Site-specific risk-based cleanup levels for inorganic COCs[3].

- Eliminate or reduce, to the maximum extent practicable, the migration of mine-related inorganic COCs[3] in ground water to Red River surface water at concentrations that would result in surface water concentrations exceeding preliminary surface water ARARs or Site-specific risk-based cleanup levels.

- Protect Red River aquatic species from chronic exposure to inorganic COCs[3] and acidity at Springs 13 and 39 by eliminating or reducing discharge, to the maximum extent practicable, of Springs 13 and 39 water to the Red River at levels that result in total aluminum concentrations below the preliminary Site-specific risk-based cleanup level of 1.0 mg/L in Red River surface water at Spring 13 and 0.8 mg/L in Red River surface water at Spring 39.[4]

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[3] Inorganic COCs include metals.

[4] The following provides a basis for this RAO:

The EPCs for total aluminum in Red River surface water, based on four sampling events over two years (and not including any storm events or snow melt conditions) are 0.91 mg/L upstream of Spring 39, 0.67 mg/L adjacent to Spring 39 and 1.41 mg/L adjacent to Spring 13. The corresponding chronic TRVs for trout, based on trout-specific toxicity data and the mean hardness of each area, are 0.77 mg/L (upstream of Spring 39), 0.95 mg/L (Spring 39), and 0.97 mg/L (Spring 13).

The methodology for evaluating the achievement of the 1.0 mg/L (i.e., 0.95 mg/L and 0.97 mg/L trout chronic TRVs rounded to 1.0 mg/L for Spring 13) and 0.8 mg/L (i.e., 0.77 rounded to 0.8 mg/L for Spring 39) risk-based cleanup levels for total aluminum will be based on monthly monitoring of total aluminum concentrations in the Red River. Sample collection will take place within a period of 2 hours or less of each other at an upstream and downstream location of each of these two springs in the Red River, approximately equidistant from the north bank and mid-channel, at approximately mid-depth. Sampling locations will be just upstream of all known Spring 13 and Spring 39 discharges to the Red River and approximately mid way between the most downstream Spring 13 and Spring 39 discharges to the river and the next Red River sampling station.

- Prevent future transport of mine site soil containing inorganic COCs[3] to surface water entering the Red River to prevent future adverse impacts to habitat, physical toxicity, and exceedance of surface water quality ARARs.

- Protect recreational visitor/trespasser by reducing exposure (incidental ingestion) of surface water containing beryllium, cadmium, and manganese exceeding federal drinking water standards or preliminary Site-specific risk-based cleanup levels.

- Maintain underground mine water elevations below those of the Red River, prevent ingestion by humans, and treat ground water from the underground mine workings containing mine-related inorganic COCs[3] exceeding preliminary state/federal ARARs or Site-specific risk-based cleanup levels.

Proposed Cleanup Levels for Ground Water – Human Health

The New Mexico water quality standards, including maximum contaminant levels (MCLs)[5] and EPA risk-based criteria comprise many of the PRGs for ground water at the mine site. However, background water quality plays a significant role in the development of the ground-water PRGs. Prior to the start of the RI/FS, it was recognized that the highly mineralized area at and surrounding the mine site, as well as the acid rock drainage produced by hydrothermal scars at the mine site and upriver of the mine site, could result in natural background levels for some COCs that are higher than New Mexico water quality standards. The NMED obtained the support of the USGS, funded by CMI, to conduct a baseline pre-mining water quality study from 2001 to 2005[6]. The objective of the study was to determine or infer the pre-mining ground-water quality at the mine site. In addition to the USGS background study, the Red River alluvial aquifer

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Monitoring will not take place, nor will this RAO and its requirements be applicable during precipitation events and for a period of a minimum of 2 days after stream flow returns to pre-precipitation flow rates. To verify a return to baseline water quality following a storm event, monitoring of select indicator parameter(s) (e.g., turbidity or conductivity) will also be part of the monthly monitoring program, as well as monitoring baseline gauge height after the storm event.

The concentration limit for further action is the exceedance in the downstream sample of the preliminary cleanup level of 1.0 mg/L total aluminum for Spring 13 and 0.8 mg/L total aluminum for Spring 39. This limit does not apply when the upstream total aluminum concentration exceeds 1.0 mg/L for Spring 13 and 0.8 mg/L total aluminum for Spring 39. In cases where the upstream sample concentration exceeds the 1 mg/L limit for Spring 13 and 0.8 mg/L total aluminum for Spring 39, the temporary limit for further action to be applied to the downstream sample is 1.3 times the total aluminum concentration measured in the upstream sample. The factor of 30% is designed to minimize false positives. The analytical variability was assessed through the analysis of field duplicate samples. The standard deviation due to sampling/analysis variability is about 16% for each of the two measurements at a spring. The uncertainty in measurement is estimated from this standard deviation for both the upstream and downstream concentrations as approximately 30%.

Therefore, total aluminum concentrations below Spring 13 and Spring 39 are not allowed to increase beyond 1.3 times the concentration in water collected just upstream of Spring 13 and Spring 39.

[5] NM MCLs adopt by reference the federal MCLs (40 CFR, Part 141)
[6] USGS Baseline and Pre-mining Ground Water Quality Investigation: Report 25; Professional Paper 1728)

background water quality was studied as part of the RI by CMI. These studies found that background water quality for several metals and other inorganic COCs is higher than New Mexico standards for bedrock, colluvial, and the northern portion of the alluvial ground water. Further, the USGS study found that there were differences in background water quality for the side drainages at the mine site based on differing mineralogy from drainage to drainage and the presence or lack of hydrothermal scars within those drainages. Therefore, the PRGs for ground water at the mine site include background levels. *See* Table 2[7].

Table 2: Ground Water PRGs – Mine Site, Human Health

COC Dissolved	New Mexico standard (except where noted) (mg/L)	Site-Specific PRGs for Mine Site Ground Water Based on Background Concentrations (mg/L)						
		Colluvial				Bedrock		Alluvial[5]
		Capulin Canyon		Goat Hill Gulch	Roadside Rock Pile Drainages	Capulin Canyon	All Other	Northern Portion Along Mine Site
		Unaffected By Scar	Affected By Scar					
Aluminum	5.0[1]		100	350	23 -92			37.4
Antimony	0.004[2]							
Arsenic	0.1							
Beryllium	0.013[2]	0.08	0.08					
Cadmium	0.01		0.04	0.1	0.02 – 0.04			
Chromium (total)	0.05			0.6				
Cobalt	0.05[1]		0.3	0.5	0.25 – 0.3	0.1		
Copper	1.0[3] 0.4[2]			6.0	1.4 – 2.0			
Fluoride	1.6	20	30	28	3.7 – 8	5.0	3.0	4.5
Iron	1.0[3]	34	50	5.0	1.0 – 65		2.0	32.4
Manganese	0.2	41	50	41	6.3 – 21	40	6.0	6.2
Molybdenum	0.05[2]							
Nickel	0.2[1,2]		0.8	1.1	0.2 – 0.7	0.2		
Nitrate	10 1.0[2]							
Sulfate	600[3]	850	2,200	3,100	913 – 2,030	2,000	1,900	1,260
Vanadium	0.081[2]							
Zinc	10[3] 3.1[2]							
TDS	1,000	1,700	2,700	4,600	1,327 – 2,800	2,900	3,500	2,150

[7] EPA policy is generally to clean up to background levels, if such levels exceed standards or health-based criteria (Role of Background in the CERCLA Cleanup Program, OSWER 9285.6-07P). Under New Mexico Water Quality Act regulations, the numeric criteria for a specific constituent do not have to be achieved if that constituent is present in natural background concentrations above the numeric criteria [20.6.24101(B) NMAC]. EPA and NMED approved the natural background levels depicted in this table as preliminary cleanup levels for the specific areas identified.

pH	6-9		3.7	3	3 – 4.2			4

(1) NM Standard for Irrigation
(2) Health-based criterion developed by EPA
(3) NM Standard for Domestic Water Supply
(4) NM MCL (adopts by reference federal MCL in 40 CFR Part 141)
(5) Site-specific PRGs for the Red River Alluvial Aquifer based on background concentrations apply only for the northern edge or flank of the aquifer. This is documented in a May 8, 2009 letter from EPA/NMED to CMI.

Proposed Cleanup Levels for Surface Water – Human Health
The PRGs developed to protect the recreational visitor or trespasser from incidental ingestion of surface water in mine site catchments and seeps/springs at waste rock piles and along the Red River are presented in Table 3. They are preliminary Site-specific risk-based cleanup levels developed in EPA risk assessment.

Proposed Cleanup Levels for Surface Water – Trout
The PRGs developed for Red River surface water for total aluminum at Springs 13 and 39 are preliminary Site-specific, risk-based cleanup levels that will improve water quality and overall protection of trout (survival and growth measures). *See* Table 4. The PRGs will also take into account storm events in the Red River Valley and the related changes caused by those storms to surface water quality, including adverse impacts in chemistry and toxicity from hydrothermal scar drainages to the Red River. These events influence background water quality of the Red River.

Table 3: Surface Water PRGs – Mine Site, Human Health

Medium	COC	PRG (mg/L) Recreational Visitor/Trespasser
Surface Water	Beryllium	0.2
	Cadmium	0.3
	Manganese	28

Table 4: Surface Water PRGs – Mine Site, Trout

COC	Exposure	PRG (mg/L)	Assessment Endpoint
Aluminum (total)	Chronic	0.643 – 1.158[1] (1.0 – Spring 13; 0.8 – Spring 39)	Survival, growth
Aluminum (total)	Acute	37.208 – 45.483	Survival

[1] The PRG for aluminum is hardness dependent.

Proposed Cleanup Levels for Surface Soil – Ecological
Although there was no significant risk associated with surface soil at the mine site, surface soil PRGs have been developed to ensure that CERCLA response actions are protective of terrestrial plants and animals from exposure to molybdenum in the cover

materials proposed for source containment alternatives at the waste rock piles. The proposed use of Spring Gulch Waste Rock Pile material as an on-Site borrow for cover material led to testing of the Spring Gulch waste rock for suitability. A significant portion of the Spring Gulch Waste Rock Pile was estimated to be non-acid generating by CMI. Because of concerns with elevated molybdenum in the Spring Gulch rock above the molybdenum PRG (300 mg/kg) developed by EPA for protecting terrestrial plants and animals at the mine site, additional Site-specific testing was performed for molybdenum toxicity, bioaccessibility, and bioavailability. Based on the results of this testing, EPA developed a molybdenum suitability criterion of 600 mg/kg for screening the borrow material. The 600 mg/kg suitability criterion is higher than the 300 mg/kg molybdenum PRG because a significant portion of the molybdenum in Spring Gulch rock is of a form (molybdenite [MoS_2]) which is not readily bioavailable for ecological receptors. Additionally, EPA developed a successful plant growth performance-based PRG for the cover material to ensure that molybdenum uptake from borrow material to plants shall not be at a level that exceeds the risk-based concentrations considered protective of herbivorous native wildlife or inhibits attainment of revegetation success standards necessary for an effective evapo-transpiration (ET) cover system to prevent acid rock drainage and the attainment of ground-water cleanup levels (*see* Table 5).

Table 5: Surface Soil and Plant PRGs – Mine Site Ecological

COC	Soil PRG (mg/kg)	Receptor or Criterion
Molybdenum	300	Terrestrial plants and animals
Molybdenum	600	Suitability Criterion for Screening Borrow Material
Successful Plant Growth Performance-Based PRG		
Molybdenum uptake from borrow material to plants shall not be at a level such that inhibits attainment of re-vegetation success standards or exceeds risk-based concentrations for herbivorous native wildlife.[1]		

[1] This is a performance-based PRG for which the criteria will be developed using data from laboratory studies on plant uptake and toxicity using cover material as well as field monitoring results. The time frame for development of the PRG criteria will include now through implementation and monitoring of the remedy. Parameters likely to require field monitoring on a 5-year basis include cover material molybdenum concentrations, plant molybdenum concentrations, and revegetation success. A work plan will be developed under the direction and oversight of EPA, NMED, and MMD.

Tailing Facility Area

Like the mine site, the tailing facility is an operating facility. The approved post-mining land use specified in Mining Permit TA001RE is wildlife habitat. At present, in accordance with TA001RE, the area will be reclaimed to a condition that allows for re-establishment of a self-sustaining ecosystem appropriate for the life zone of the surrounding areas following closure.

Additionally, the Restrictive Covenants recorded by CMI in 2009 for the tailing facility provide legal controls to restrict all residential uses, ground-water and surface-water uses, as well as protects the integrity of any CERCLA response action or state reclamation. After termination of tailing disposal operations, the property may be used for light industries (including renewable energy projects) and park, recreation, or athletic field uses. Chevron Technology Ventures, in working with CMI, EPA and the New Mexico regulatory agencies, plans to construct a 1 megawatt solar energy facility at the northeastern portion of the tailing facility in 2010. The solar facility is to be operated as a pilot demonstration for a period of five years and would test concentrating photovoltaic (CPV) technology. In conjunction with the solar project, CMI would also demonstrate the effectiveness of alternate cover depths of 1, 2, and 3 feet for the protection of human health and the environment.

The New Mexico ground-water regulations under Section 20.6.2 NMAC for abatement and protection of all ground water of the State of New Mexico having concentrations of 10,000 mg/L or less TDS (preliminary ARARs) are partially driving the ground-water cleanup. Just as important to the remedy selection is the EPA health-based criterion of 0.05 mg/L for molybdenum in ground water. This value was developed in the risk assessment based on an oral reference dose (RfD) of 0.005 micrograms per kilogram per day (µg/kg-day) for soil in EPA's Integrated Risk Information System (IRIS) database. Since ground water use in this area is for drinking water, and New Mexico's water quality standard for molybdenum of 1.0 mg/L is for irrigation, EPA believes the health-based criterion of 0.05 mg/L is more protective and selects it as the molybdenum PRG.

The 0.05 mg/L PRG drives the remedy selection for the Tailing Facility Area as it expands significantly the areas requiring ground-water remediation. Ground water in the area south of Dam No. 4 does not exceed New Mexico water quality standards, but does exceed the molybdenum health-based PRG.

Other considerations for remedy selection include the receptors or potential receptors that could benefit from remediation of contaminated ground water. Areas of ground water contamination delineated by the RI are generally south and southeast of Dam No. 1 in the alluvial aquifers within the riparian valley, and south of Dam No. 4 in the basal volcanic bedrock aquifer within the Red River Canyon and Gorge area. There are current and anticipated future residential and agricultural uses of the ground water in the riparian valley south of Dam No. 1. However, for the basal bedrock aquifer south of Dam No. 4, the area of ground-water contamination is mostly public lands managed by BLM and unpopulated. The area is very remote, rugged terrain with no current users of the ground water, with the exception of the Red River State Fish Hatchery, located about a mile downstream of the tailing facility. There are several workers and their families (a total of nine people, including two children) which currently take up permanent residence at the Hatchery and reside in dwellings having potable water sourced from the basal bedrock aquifer. The likelihood of additional future users of ground water in this area is far less than in the valley south of Dam No. 1.

For the Tailing Facility Area, RAOs were developed to protect current and future residents and future on-Site industrial/commercial workers that may use contaminated ground water drawn from private or commercial wells for drinking. The RAOs were also developed to protect the recreational visitor or trespasser that may incidentally contact and ingest tailing material (tailing pond sediments).

Tailing Facility Area RAOs
The RAOs for the Tailing Facility Area are to:

- Eliminate or reduce ingestion by humans of ground water drawn from private wells containing mine-related inorganic COCs[8] exceeding preliminary state/federal ARARs or Site-specific risk-based cleanup levels.

- Restore contaminated ground water at and off-site of the tailing facility to meet preliminary state/federal ARARs or Site-specific risk-based cleanup levels for inorganic COCs[8].

- Eliminate or reduce, to the maximum extent practicable, the seeping and migration of inorganic COCs[8] from tailing to ground water at concentrations and quantities that have the potential to cause exceedances of the preliminary numeric ground-water ARARs or Site-specific risk-based cleanup levels for ground water.

- Protect recreational visitor/trespasser by reducing or eliminating exposure (dermal contact/ingestion) to tailing in the ponded area that contains molybdenum at concentrations exceeding preliminary Site-specific health-based cleanup levels.

- Protect aquatic and aquatic-dependent life by reducing or eliminating exposure to tailing in the ponded areas that contains metals at concentrations exceeding preliminary Site-specific risk-based cleanup levels.

The RAO to eliminate or reduce seepage of tailing liquids to ground water addresses the New Mexico regulations in Section 20.6.2 NMAC for prevention, abatement, and protection of ground water (preliminary ARARs). The placement of a minimum of 3 feet of soil cover and successful revegetation at the tailing facility as an effective ET cover system are necessary for reducing net percolation through the tailing. Therefore, such requirements are included in the remedial alternatives considered for the CERCLA response actions for source containment and ground water remediation. In light of the tailing facility being an operating facility, the cover placement would occur only after tailing disposal operations cease.

[8] Inorganic COCs include metals.

The ecological risk to aquatic and aquatic-dependent receptors exposed to the tailing ponds would also be addressed after cessation of tailing disposal operations.

Proposed Cleanup Levels for Ground-Water – Human Health

The New Mexico water quality standards of Section 20.6.2 NMAC, including MCLs[9] and EPA risk-based criteria comprise all of the PRGs for ground water at the Tailing Facility Area. Background was evaluated for ground-water reference areas off the facility property, but did not play a role in the PRGs developed. *See* Table 6.

Proposed Cleanup Levels for Tailing Sediment – Human Health

A PRG of 8,918 mg/kg for molybdenum has been developed to protect the recreational visitor or trespasser from incidental contact and ingestion of molybdenum in tailing pond sediment at the tailing facility. The PRG is a Site-specific health-based criterion.

Proposed Cleanup Levels for Tailing and Tailing Sediment – Ecological Receptors

The PRGs selected to protect benthic macroinvertebrate populations from exposure to inorganic COCs in tailing pond sediment are Site-specific risk-based criteria. The PRGs selected to protect wildlife from exposure to lead and zinc in tailing pond sediments via the food web (Wren, Kingfisher) and molybdenum in tailing (deer, elk, Western Kingbird) are also Site-specific risk-based criteria. *See* Table 7.

Table 6: Ground Water PRGs – Tailing Facility, Human Health

COC[1]	PRG (mg/L)	ARAR/TBC[2]
Aluminum	5.0	NM Irrigation Standard
Antimony	0.006	NM MCL
Arsenic	0.01	NM MCL
Beryllium	0.013	NM MCL
Cadmium	0.005	NM MCL
Chromium (total)	0.05	NM MCL
Cobalt	0.05	NM Irrigation Standard
Copper	1.0	NM Domestic Water Supply Standard
Fluoride	1.6	NM Human Health Standard
Iron	1.0	NM Domestic Water Supply Standard
Manganese	0.2	NM Domestic Water Supply Standard
Molybdenum	0.05	EPA Health-Based Criterion[4]
Nickel	0.1[3]	NM MCL
Nitrate	1.0	EPA Health-Based Criterion[4]
Sulfate	600	NM Domestic Water Supply
TDS	1,000	NM Domestic Water Supply
Uranium	0.03	NM MCL
Vanadium	0.081	EPA Health-Based Criterion[4]
Zinc	3.1	EPA Health-Based Criterion[4]
pH	6 – 9	NM Domestic Water Supply Standard

1. Dissolved.
2. NM MCLs adopt by reference the federal MCLs (40 CFR Part 141)
3. The federal MCL was remanded in 1995. EPA is reconsidering MCL for Nickel.
4. PRG for non-cancer assumes child.

[9] NM MCLs adopt by reference the federal MCLs (40 CFR, Part 141)

Table 7: Ecological PRGs – Tailing Facility

Sediment PRGs (Benthic Macroinvertebrates)		
COC	**PRG (mg/kg)**	**Information Source**
Aluminum	25,500	Lowest ARCS TEL
Cadmium	0.99	CB TEC
Chromium	43.4	CB TEC
Copper	31.6	CB TEC
Lead	35.8	CB TEC
Manganese	630	Lowest ARCS TEL
Molybdenum	10	DMS TV
Nickel	22.7	CB TEC
Selenium	2.0	EPA R3 SL
Silver	1.0	EPA R3 ESL
Zinc	121	CB TEC
Food Web Model PRGs – Sediment		
COC	**PRG (mg/kg)**	**Receptor**
Lead	17	Wren
Zinc	37	Wren
Zinc	109	Kingfisher
Tailing PRGs		
COC	**PRG (mg/kg)**	**Receptor**
Molybdenum	41	Deer, Rocky Mountain Elk
Molybdenum	54	Western Kingbird

ARCS = Assessment and Remediation of Contaminated Sediments Program (EPA 1996)
TEL = Threshold Effects Level
CB = Consensus-based (CB TEC from MacDonald et al. 2000)
TEC = Threshold Effect Concentration
DMS TV = Dutch Ministry of Standards, Target Value
EPA R3 SL = EPA Region 3 Screening Level

Red River and Riparian and South of Tailing Facility Area

Designated uses of the Red River are cold water fishery, irrigation, recreation, and habitat for aquatic and aquatic-dependent wildlife. Red River surface water has been identified to pose an ecological risk from metals contamination (aluminum, copper and zinc) which warrants cleanup to protect aquatic receptors (trout). The surface water will be addressed through reduction of inputs from sources to the river, such as upwelling alluvial ground water and seepage into the river from seeps and springs near the Mine Site Area.

Molybdenum-contaminated soil in the pasture lands south of the tailing facility poses an ecological risk that warrants cleanup to protect wildlife and livestock (cattle, sheep). Although risk to ecological receptors from exposure to tailing spills within the riparian corridor were considered insignificant (with HQs less than 2), there are hot spots of elevated molybdenum concentrations an order of magnitude above the PRG within some of these tailing spills. Additionally, CMI has previously removed several tailing spills along the riparian corridor under the direction of NMED. Therefore, EPA proposes to address the remaining spills having hot spots of molybdenum contamination as part of the CERCLA response action.

Red River and Riparian and South of Tailing Facility Area RAOs
The RAOs are to:

- Eliminate or reduce direct exposure and exposure via accumulation in plants to mining-affected soil and tailing spills that contain molybdenum at concentrations exceeding the preliminary Site-specific risk-based cleanup level for protection of wildlife and livestock.

- Eliminate or reduce direct exposure of fish to Red River surface water along the mine site and tailing facility that exceeds preliminary surface water ARARs or Site-specific risk-based cleanup levels for aluminum (direct toxicity)[10].

Proposed Cleanup Levels for Surface Water and Soil – Ecological
Table 8 contains the PRGs for molybdenum in soil for protection of wildlife and livestock in the riparian corridor and aluminum in Red River surface water for protection of trout (excluding stocked rainbow trout).

Table 8: Ecological PRGs - Red River and Riparian and South of Tailing Facility Area

Surface Water PRGs (trout)		
COC	**Exposure**	**PRG (mg/L)**
Aluminum (total)	Chronic	0.6 – 1.2
Aluminum (total)	Acute	37.2 – 45.5
Surface Soil PRG		
COC	**PRG (mg/kg)**	**Receptor**
Molybdenum	11	Livestock grazing (cattle, sheep)
Molybdenum	41	Deer, Rocky Mountain Elk
Molybdenum	54	Western Kingbird

Eagle Rock Lake

Eagle Rock Lake is a popular fishing spot for the local community and, like the Red River, is routinely stocked with rainbow trout. The anticipated future use of the lake remains the same as the current use. Potential ecological risks have been identified to the benthic macroinvertebrate populations (aquatic insects) that come into contact with lake-bottom sediments. The sediments warrant cleanup under the CERCLA response action, as the aquatic insects are a major food source for fish.

[10] Red River water quality is being addressed through response actions at the Mine Site Area to reduce COCs entering the river from ground water at Springs 13 and 39, including source control measures.

Eagle Rock Lake RAOs
The RAOs for Eagle Rock Lake are to:

- Eliminate or reduce direct exposure of benthic macroinvertebrates (aquatic insects) to mine site-affected sediment in Eagle Rock Lake that exceeds preliminary Site-specific risk-based cleanup levels for aluminum, arsenic, nickel, selenium and zinc.

- Eliminate or reduce the deposition of mine site-affected sediment in Eagle Rock Lake that exceeds preliminary Site-specific risk-based cleanup levels for the Red River sediment COCs (nickel and zinc) for benthic macroinvertebrates.

Proposed Cleanup Levels for Sediment – Ecological
Table 7 (above) contains the PRGs for inorganic COCs (metals) in sediment to protect benthic macroinvertebrate populations in Eagle Rock Lake.

The RAOs and PRGs for sediment in Eagle Rock Lake will mitigate the risk to the macroinvertebrate ecosystem, as well as prevent future degradation of the sediment in the lake by controlling the inflow of mine-affected (as well as scar-affected) surface water and sediment from the Red River into the lake during storm events.

SUMMARY OF REMEDIAL ALTERNATIVES

Twenty-seven alternatives and subalternative combinations were retained for detailed analysis at the five areas of the Site following screening. They are presented below. The alternatives are numbered to correspond with the alternatives presented in the Feasibility Study Report.

Each of the five areas includes a No Action (or No Further Action) alternative which is required by the NCP as a baseline and includes continuation of current measures in place at the Site with no further actions taken.

Mill Area Alternatives

The Mill Area includes five alternatives (and five subalternatives) for remediation of PCBs and molybdenum in soil.

Common Elements: Many of these alternatives include common components. They are land use controls (LUCs), including controlling Site access (fencing, signage, etc.) and implementing institutional controls (restrictive covenants, conservation easement, ground-water use and well drilling restrictions), general maintenance, water quality monitoring, storm-water management, regrading, covering and revegetating the Mill Area, and 5-year reviews. The regrading, covering and vegetation elements are reclamation requirements established in Mining Act Permit TA001RE, Permit Revision 96-2 and Discharge Permit DP-933. With the exception of the No Further Action and

Limited Action alternatives, the remaining alternatives consist primarily of soil removal (excavation), with options for capping, as well as on-Site and off-Site treatment and disposal.

The alternatives include assumptions for low occupancy/commercial/industrial land use and high occupancy/residential land use. In accordance with the Toxic Substances Control Act (TSCA; 40 CFR Part 761.61), the remedial alternatives include the following disposal requirements for PCBs for each land use category:

Low Occupancy Area/Commercial/Industrial Land Use: The cleanup level for bulk PCB remediation waste is ≤25 parts per million [or milligrams per kilogram (mg/kg)] unless otherwise specified. Low occupancy areas where bulk PCB remediation waste remain at concentrations >25 mg/kg and ≤50 mg/kg will be secured by a fence and marked with a sign. Low occupancy areas where bulk PCB remediation waste remain at concentrations >25 mg/kg and ≤100 mg/kg will be covered with a cap meeting TSCA requirements. The commercial/industrial PRG for molybdenum in soil (5,100 mg/kg) was not exceeded at the Mill Area.

High Occupancy/Residential Land Use: The cleanup level for bulk PCB remediation waste is ≤1 mg/kg without further conditions. High occupancy areas where bulk PCB remediation waste remain at concentrations >1 mg/kg and ≤10 mg/kg will be covered with a cap meeting the TSCA requirements. The residential PRG for molybdenum in soil is 503 mg/kg.

The Mill Area remedial alternatives are as follows:

- **Alternative 1** – No Further Action
- **Alternative 2** – Limited Action (ICs, Health and Safety Program and Hazard Communication; Cover at Mill Decommissioning).
- **Alternative 3** – Soil Removal (High Concentrations of PCBs>25 mg/kg) and Off-Site Treatment and Disposal (Low Occupancy/Commercial/Industrial)
- **Alternative 4** – Soil Removal (High Concentrations of PCBs >10 mg/kg) and Treatment and Disposal and Source Containment (High Occupancy/Residential)
    - Subalternative 4A: Soil Removal; Off-Site Treatment and Disposal of PCB Soil; Soil Cap
    - Subalternative 4B: Soil Removal; Off-Site Treatment and Disposal of PCB Soil; Asphalt Cap
- **Alternative 5** – Soil Removal and Treatment and Disposal (High Occupancy/Residential)

- Subalternative 5A: Soil Removal; Off-Site Treatment and Disposal of PCB Soil; Off-Site Disposal of Molybdenum Soil

- Subalternative 5B: Soil Removal; Off-Site Treatment and Disposal of PCB Soil; On-Site Disposal of Molybdenum Soil

- Subalternative 5C: Soil Removal; On-Site Treatment and Disposal of PCB Soil; On-Site Disposal of Molybdenum Soil

Alternative 1 – No Further Action

Capital Cost: $0
O&M Cost: $802,000
Present Value Cost: $327,000
Construction Timeframe: None

Alternative 1 would include no further actions at the Mill Area. Under current operations, public access is restricted and the mine has a worker health and safety program in place that specifically addresses potential risks from exposure to PCBs. Oversight of worker health is a responsibility of thee Mine Safety and Health Administration (MSHA).

Alternative 1 would not meet the RAO for the Mill Area as it would not prevent direct contact/ingestion of contaminated soil by people.

Alternative 2 – Limited Action (ICs; Health and Safety Program, and Hazard Communication)

Capital Cost: $2,078,000
O&M Cost: $923,000
Present Value Cost: $2,451,000
Construction Timeframe: 1.5 years
Time to Achieve RAOs: 1.5 years

Alternative 2 would include limited action to address risk from exposure to PCB-contaminated soil in the Mill Area. Best management practices (BMPs) would be implemented, such as signage, targeted excavation and gravel placement. The excavated soil would be disposed at an appropriate facility off Site. As part of mill decommissioning, approximately 41 acres of the Mill Area would be covered with 6 inches of amended Spring Gulch rock pile material to allow for the development of a self-sustaining forest ecosystem (post-mining land use) comparable to the surrounding region. A visual horizontal indicator or marker would be placed on top of the contaminated soil prior to covering and regrading.

Currently, under the Mining Permit TA001RE Closeout Plan, 3 feet of cover is required for the Mill Area as part of mill decommissioning for the approved PMLU of forestry.

This 3-foot requirement has been identified by EPA as a TBC. In the event the approved PMLU is changed to some other land use such as commercial/industrial, 6-inches may be acceptable. However, for the current PMLU, 3 feet of soil cover would be required. The cover depth would be re-evaluated during design and, if appropriate, modified to be consistent with the cover depth specified in the Closeout Plan. Based on current cost estimates provided in the Final FS Report, Revision 3, the cost for increasing the cover depth from 6 inches to 3 feet would increase roughly $5M to $6M.

Alternative 2 would meet the RAO for the Mill Area by removing soil and placing gravel to prevent direct contact/ingestion by people.

Alternative 3 – Soil Removal (High Concentration of PCBs >25 mg/kg) and Off-Site Treatment and Disposal (Low Occupancy/Commercial/Industrial) (EPA's Preferred Alternative)

Capital Cost: $2,176,000
O&M Cost: $923,000
Present Value Cost: $2,549,000
Construction Timeframe: 1.5 years
Time to Achieve RAOs: 1.5 years

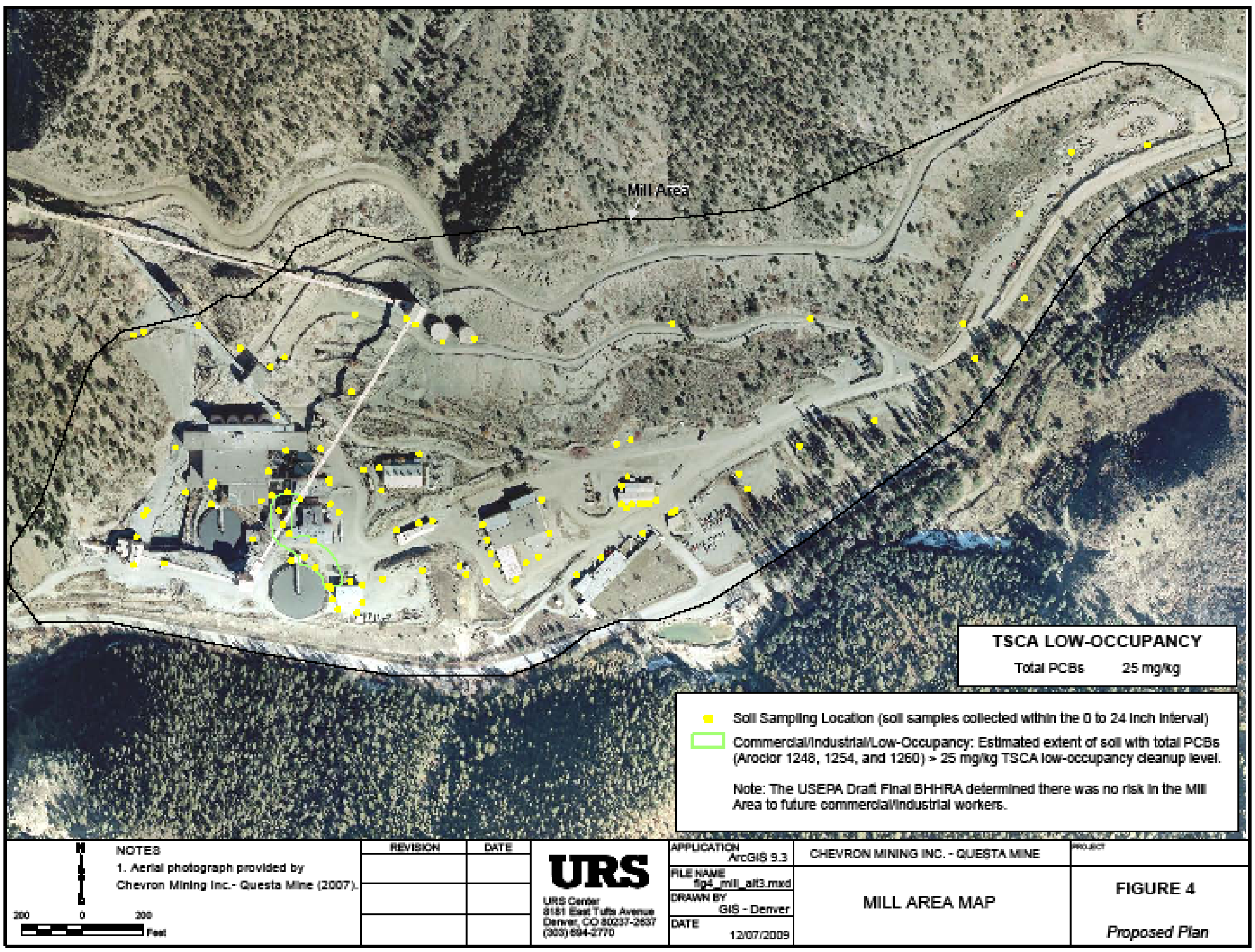
Approximately 2,400 cubic yards of soil with total PCB concentrations above the TSCA cleanup level of 25 mg/kg for low occupancy/commercial/industrial use would be excavated from an area covering about 0.6 acres and transported off-Site for treatment and/or disposal at EPA-approved facilities. <u>*See*</u> Figure 4. The depth of excavation is estimated at 2.5 feet. The excavated soil would be separated into soils containing PCBs >50 mg/kg and those with PCBs ≤50 mg/kg. The >50 mg/kg PCB-soils would be transported to the nearest off-Site facility that accepts and treats PCB-affected soil. The ≤50 PCB-soils would be transported to the nearest off-Site facility that accepts but does not treat the PCB-affected soil. Confirmation soil sampling would be performed to determine if cleanup levels have been attained. If not, additional soil would be excavated until cleanup levels are met or an EPA-acceptable depth has been reached. The excavation would be backfilled with clean fill (Spring Gulch rock pile material) and graded. Screening of the Spring Gulch waste rock would be required to ensure that the material selected as fill does not exceed the screening-level PRG developed for molybdenum. Low occupancy use cleanup standards were selected for this alternative based on the current industrial use of the Mill Area and the approved PLMU of forestry and water management under Mining Act Permit TA001RE-96-2. As part of mill decommissioning, the Mill Area would be covered with 6 inches of amended Spring Gulch waste rock pile material and revegetated to allow for the development of a self-sustaining forest ecosystem comparable to the surrounding region. However, as discussed above for Alternative 2, under the currently approved PMLU of forestry and water management, a 3-foot cover would be required for those portions of the Mill Area to be designated for forestry. The appropriate cover depth would be established during remedial design to be consistent with the Closeout Plan and approved PMLU.

Alternative 3 would meet the RAO for the Mill Area by removing contaminated soil to prevent direct contact/ingestion by people.

Subalternative 4A – Soil Removal; Off-Site Treatment and Disposal of PCB Soil; Soil Cap

Capital Cost: $13,064,000
O&M Cost: $946,000
Present Value Cost: $13,446,000
Construction Timeframe: 3 years
Time to Achieve RAOs: 3 years

Approximately 3,300 cubic yards of soil with concentrations of total PCBs above the TSCA cleanup level of 10 mg/kg for high occupancy/residential use would be excavated



from an area covering 0.8 acre. The remaining soil having concentrations that exceed either the TSCA cleanup level for total PCBs in high occupancy/residential use areas (1 mg/kg) or the residential PRG for molybdenum (503 mg/kg) would be covered with a soil cap. This area covers approximately 28 acres. Soil material needed to meet the requirements of 40 CFR § 761.61(a)(7)(TSCA 2007) would be obtained from an off-Site borrow source which is several hundred miles away (100 to 250 miles). In addition, amended Spring Gulch Rock Pile material would be placed on top of the cap to protect its integrity and allow for development of a self-sustaining ecosystem comparable to the surrounding region (similar to Alternative 2 and 3). The depth of excavation would be determined in a manner consistent with that described in Alternative 3. The PCB-affected soil would be separated and disposed off Site also in a manner consistent with that described in Alternative 3. The restrictive covenants, conservation easement, and well drilling restrictions would prohibit activities that may compromise the integrity of the cap placed over PCB- and molybdenum-contaminated soil.

Subalternative 4A would meet the RAO for the Mill Area by removing/capping contaminated soil to prevent direct contact/ingestion by people.

Subalternative 4B – Soil Removal; Off-Site Treatment and Disposal of PCB Soil; Asphalt Cap

Capital Cost: $10,444,000
O&M Cost: $2,847,000
Present Value Cost: $11,502,000
Construction Timeframe: 3 years
Time to Achieve RAOs: 3 years

Removal activities will be similar to those described for Subalternative 4A with the exception of the cap. An asphalt cap would be constructed as opposed to a soil cap over soil areas exceeding the TSCA cleanup level for PCBs for high occupancy/residential use (1 mg/kg) or the residential PRG for molybdenum (503 mg/kg).

Subalternative 4B would meet the RAO for the Mill Area by removing/capping contaminated soil to prevent direct contact/ingestion by people.

Subalternative 5A – Soil Removal; Off-Site Treatment and Disposal of PCB Soil; Off-Site Disposal of Molybdenum Soil

Capital Cost: $47,269,000
O&M Cost: $1,206,000
Present Value Cost: $47,746,000
Construction Timeframe: 5 years
Time to Achieve RAOs: 5 years

Approximately 113,000 cubic yards of soil having total PCB concentrations above the TSCA cleanup level of 1 mg/kg for high occupancy/residential use areas and 49,000 cubic yards of soil above the residential PRG for molybdenum of 503 mg/kg would be excavated and transported off-Site to appropriate EPA-approved treatment and/or disposal facilities. The depth of excavation would be determined in a manner consistent with that described in Alternative 3. The PCB-affected soil would be separated and disposed off Site also in a manner consistent with that described in Alternative 3. The off-Site disposal of molybdenum-affected soil would be at a solid waste landfill. The area of excavation would cover approximately 40 acres. The excavation would be backfilled with approximately 162,000 cubic yards of amended Spring Gulch Rock Pile fill material, graded and revegetated. Upon decommissioning, areas of the mill outside the remediated footprint area will be regraded, covered with 3 feet of amended Spring Gulch material and revegetated. The approved PMLU for the Mill Area allows for water management (water treatment). Areas required for water management would be excluded from reclamation activities until no longer used for this purpose. Since this alternative would achieve the PRGs that are protective for residential land use, and which are protective for all other uses, the institutional controls recorded by CMI would not be needed for this alternative.

Subalternative 5A would meet the RAO for the Mill Area by removing contaminated soil to prevent direct contact/ingestion by people.

Subalternative 5B – Soil Removal; Off-Site Treatment and Disposal of PCB Soil; On-Site Disposal of Molybdenum Soil

Capital Cost: $43,190,000
O&M Cost: $1,206,000
Present Value Cost: $43,667,000
Construction Timeframe: 5 years
Time to Achieve RAOs: 5 years

Subalternative 5B is similar to 5A except that the excavated molybdenum-contaminated soil is disposed of on-Site. The PCB-contaminated soil is excavated and disposed off-Site at an appropriate treatment, storage, and disposal (TSD) facility as described for Subalternative 5A. On-Site disposal includes either placement in an impoundment at the tailing facility or at an appropriate location at the mine site, possibly the pit repository or a new cell constructed with a liner and designed to comply with applicable disposal regulations. Institutional controls (restrictive covenants, well drilling restrictions) would protect the integrity of the on-site cell or other repository for molybdenum-contaminated soil.

Subalternative 5B would meet the RAO for the Mill Area by removing contaminated soil to prevent direct contact/ingestion by people.

Subalternative 5C – Soil Removal; On-Site Treatment and Disposal of PCB Soil; On-Site Disposal of Molybdenum Soil

Capital Cost: $43,337,000
O&M Cost: $1,206,000
Present Value Cost: $43,814,000

Construction Timeframe: 4.8 years
Time to Achieve RAOs: 4.8 years

Subalternative 5C is similar to 5B except that all PCB-contaminated soil would be treated and disposed of on-site. On-site treatment would consist of the use of a direct-fired thermal desorption unit, which heats the soil to temperatures ranging from 1,200 ºF to 2,000 ºF to destroy the organic compounds. The air emissions generated from the thermal desorption process would be collected and treated on-site. Although the soil would be treated for PCBs, molybdenum would remain in the soil at concentrations above the residential cleanup level of 503 mg/kg. Therefore, the PCB-treated soils containing molybdenum would be combined with the molybdenum-only contaminated soil and disposed of in a manner consistent with Alternative 5B. Institutional controls (restrictive covenants, well drilling restrictions) would protect the integrity of the on-site cell or other repository for molybdenum-contaminated soil.

Subalternative 5C would meet the RAO for the Mill Area by removing contaminated soil to prevent direct contact/ingestion by people.

Mine Site Area Alternatives

The Mine Site Area includes three alternatives and two subalternatives for mitigating inorganic compounds (primarily metals) and acidity in soil and ground water. A significant consideration for this area is addressing the following major side drainages and waste rock piles at the mine site: (1) Sulphur Gulch drainage containing Sulphur Gulch North, Spring Gulch, and Blind Gulch waste rock piles, (2) Roadside Rock Pile drainages containing Sulphur Gulch South, Middle, and Sugar Shack South waste rock piles, (3) Goathill/Slickline Gulch drainages containing Goathill North, Goathill South, and Sugar Shack West waste rock piles, and (4) Capulin drainage containing the Capulin waste rock pile. In addition, the open pit and subsidence zone are included in the Mine Site Area because they are current components of CMI's water management and are features created by past and current mining activities which allow contaminated surface water to enter the underground mine workings.

Common Elements: Many of these alternatives include common components. Land use controls (LUCs) would continue to restrict Site access with signage and fencing and layered institutional controls (conservation easement, restrictive covenants, and ground-water use and well drilling restrictions) put in place by CMI in 2009 would restrict residential and commercial land uses, as well as other uses for all media. Management and treatment of storm water, surface water and ground water would also continue. The physical features at the mine site (open pit, subsidence zone, old underground workings, and decline) would continue to capture and drain colluvial and bedrock ground water to the underground mine, where it would be withdrawn and treated as part of mine dewatering operations. Dewatering would maintain the water level in the mine at an elevation below the Red River. The seepage interception systems for Springs 13 and 39 would continue to be operated. Ground-water and geotechnical monitoring and general site maintenance of storm-water diversions would continue. Five-year reviews would be conducted as required under CERCLA and the NCP to determine if the remedy remains protective.

The Mine Site Area alternatives are as follows:

- **Alternative 1** – No Further Action

- **Alternative 2** – Limited Action (ICs; Storm-Water, Surface-Water, and Ground-Water Management and Treatment)

- **Alternative 3** – Source Containment; Storm-Water, Surface-Water, and Ground-Water Management; Ground-Water Extraction and Treatment

    - Subalternative 3A – 3H:1V: Balanced-Cut-Fill, Partial/Complete Removal, Regrade, and Cover for 3 horizontal to 1 vertical (3H:1V) Slopes; Storm-Water, Surface-Water, and Ground-Water Management; Ground-Water Extraction and Treatment. Subalternative evaluated on a rock pile by rock pile basis.

    - Subalternative 3B – 2H:1V: Balanced-Cut-Fill, Regrade, and Cover for 2H:1V Slopes; Storm-Water, Surface-Water, and Ground-Water Management; Ground-Water Extraction and Treatment. Subalternative evaluated on a rock pile by rock pile basis.

Alternative 1 – No Further Action

Capital Cost: $0
O&M Cost: $20,198,000
Present Value Cost: $8,265,000
Construction Timeframe: None
Time to Achieve RAOs: Not Achieved

This alternative continues the current actions that are in place within the Mine Site Area with no further actions. The three existing alluvial ground-water withdrawal wells in front of the Roadside Rock Piles, seepage interception systems at Springs 13 and 39, and pumping from the underground mine would continue. The total amount of water collected by these systems is approximately 770 gpm. This collected water is pumped to the mill and used to transport tailing slurry to the tailing facility during milling period. During non-milling periods, the collected water is pumped to the mill, pH adjusted using hydrated lime and conveyed through the tailing pipeline for maintenance purposes and for dust control at the tailing facility. The operation of the seepage interception system at Springs 13 and 39 is performed as Best Management Practices (BMPs) under the EPA NPDES Permit (NM0022306). The current storm-water controls and conveyance of storm water to the open pit would continue, as well as the collection and conveyance of Capulin and Goathill North Waste Rock Pile seepage to the subsidence zone. The 8,720- and 8,920-foot storm-water diversions at the Roadside Rock Piles would be maintained to continue conveyance of runoff to the open pit. Ground-water and geotechnical monitoring and general site maintenance would also continue.

Based on numerical and analytical analyses, the achievement of preliminary ground-water cleanup levels could not be demonstrated for this alternative. It could not be demonstrated that existing ground-water extraction systems will achieve all preliminary cleanup levels at all locations in the alluvial aquifer, as well as bedrock and colluvial ground water.

Alternative 1 would not meet all the RAOs for the Mine Site Area. The continuation of the ground-water extraction and seepage interception systems partially reduces the migration of inorganic COCs in surface water, sediment, and ground water to the Red River. Without source containment for the waste rock piles, Alternative 1 would not eliminate or reduce ARD to ground water that would cause exceedances of the numerical ground-water ARARs or preliminary cleanup levels. The ICs recorded by CMI would restrict the use of ground water by people, but may not prevent exposure to surface water at the seepage catchments and pumpback pond by trespassers.

Alternative 2 – Limited Action (Institutional Controls; Storm-Water, Surface-Water, and Ground-Water Management and Treatment)

Capital Cost: $150,000
O&M Cost: $20,455,000
Present Value Cost: $8,524,000
Construction Timeframe: 1 year
Time to Achieve RAOs: Not Achieved

Alternative 2 is similar to Alternative 1 except that seepage at the toe of Capulin Waste Rock Pile would be piped to the Capulin seepage catchment and pumpback ponds and a fence installed around the catchment/pond system to prevent exposure by a visitor/trespasser to the seepage. Also, general maintenance of storm-water diversions would be sized to meet, at a minimum, the 100-year, 24-hour storm event or an alternative design required by EPA. Water treatment is also added as a remedial component to Alternative 2. A new water treatment plant would either be constructed and operating approximately six (6) months prior to mill decommissioning or earlier at years 0, 10, 20, or 30 of the remedial action. A description of the water treatment system and associated costs are provided as part of Subalternative 3A.

Based on numerical and analytical analyses, the achievement of preliminary ground-water cleanup levels could not be demonstrated for this alternative. It could not be demonstrated that existing ground-water extraction systems will achieve all preliminary cleanup levels at all locations in the alluvial aquifer, as well as bedrock and colluvial ground water.

Alternative 2 would meet some, but not all, of the RAOs for the Mine Site Area. Storm water, surface-water runoff, and sediment control prevents transport of mine site soil to surface water entering the Red River. Recreational visitors/trespassers would be protected from direct contact with seepage and seepage catchments through the use of piping and fencing. Ground-water extraction and seepage interception systems partially reduce the migration of mine-related inorganic COCs to the Red River. However, without source containment for the waste rock piles, Alternative 2 would not eliminate or reduce ARD to ground water that would cause exceedances of the numerical ground-water ARARs or preliminary cleanup levels. The ICs recorded by CMI would restrict the use of ground water by people.

Subalternative 3A – Source Containment [3H:1V: Balanced-Cut-Fill, Partial/Complete Removal, Regrade, and Cover for 3H:1V Slopes]; Storm-Water, Surface-Water, and Ground-Water Management; Ground-Water Extraction and Treatment (EPA's Preferred Alternative)

Capital Cost: $600,351,000
O&M Cost: $68,772,000
Present Value Cost: $309,982,000
Construction Timeframe: 25 years
Time to Achieve RAOs: 10 years – alluvial ground water[11] [12]
PRGs may not be met for colluvial/bedrock ground water[13]

Table 9 – Mine Site Water Treatment

Year 0 Construction, 30-year Period of Analysis	
Capital Cost:	$20,263,000
O&M Cost:	$41,063,000
Present Value Cost:	$34,541,000
Year 10 Construction, 40-Year Period of Analysis	
Capital Cost:	$20,263,000
O&M Cost:	$41,063,000
Present Value Cost:	$17,559,000
Year 20 Construction, 50-Year Period of Analysis	
Capital Cost:	$20,263,000
O&M Cost:	$41,063,000
Present Value Cost:	$8,926,000

[11] Based on the findings of the RI, the alluvial aquifer in the area of Spring 13 and MMW-45A, near Capulin Canyon, may be impacted or partially impacted from natural sources. In this case, cleanup levels might not be achieved in these areas as a result of implementing Subalternative 3A. If this area is impacted by mining-related sources, cleanup should also occur in less than 10 years.
[12] Analytical results show that some extraction wells and the underground mine dewatering would need to operate in perpetuity to maintain cleanup levels in the alluvial aquifer.
[13] It could not be demonstrated that cleanup levels would be achieved for colluvial and bedrock ground water at certain locations at the mine site, in particular under the footprint of the remaining waste rock piles, when assuming a reduction in waste rock seepage of approximately 60 percent (a preliminary estimate for FS purposes only). The 60-percent reduction does not represent a design performance criterion for the cover system. A higher performance criterion would be required in design of the store and release/ET cover system to reduce infiltration to a level that would be protective of ground water, thus allowing achievement of the cleanup levels.

Year 30 Construction, 60-Year Period of Analysis	
Capital Cost:	$20,263,000
O&M Cost:	$41,063,000
Present Value Cost:	$4,538,000

Subalternative 3A – 3H:1V includes source containment for the waste rock piles consisting of balanced-cut-fill, partial/complete removal, and regrade of rock piles to 3 horizontal to 1 vertical (3H:1V) interbench slopes, followed by placement of a minimum of 3-foot cover of amended Spring Gulch Waste Rock Pile material and vegetation. The cover and vegetation would function as a store and release (evapo-transpiration or ET) cover that has the capacity to limit net percolation by storing precipitation within the cover for a period long enough for water to be removed by evaporation and transpiration and that any net percolation would not cause an exceedance of ground-water standards. Because of the steep slopes of the underlying bedrock at the mine site, only Goathill South Waste Rock Pile could achieve the 3H:1V slope with a balanced-cut-fill within the regraded pile. The other waste rock piles would be selected for partial or complete removal because the interbench 3H:1V slopes are not achievable with an in-place regrade. The total volume of waste rock that would be removed for this subalternative is approximately 122 million cubic yards (yd^3), the majority of this material coming from the Roadside Waste Rock Piles (Sulphur Gulch South – 34.7 million yd^3; Middle – 34.7 million yd^3; and Sugar Shack South – 25.7 million yd^3). Some regraded rock piles, such as the Capulin rock pile, would be expanded from their current area of disturbance to achieve the 3H:1V slopes. With the removal of waste rock, underlying bedrock slopes would be exposed for some rock piles, including areas of hydrothermal scars. The Sugar Shack South Waste Rock Pile-regrade would expose approximately 33 acres of underlying slope containing scar material; the Sulphur Gulch South regrade, 32 acres of scar material. The underlying bedrock that is exposed with slopes shallower than 1.9H:1V would be covered and reclaimed if feasible; those steeper than 1.9H:1V would not be covered due to constructability constraints on steep slopes. The covers would be revegetated with native grasses, shrubs, forbs and trees.

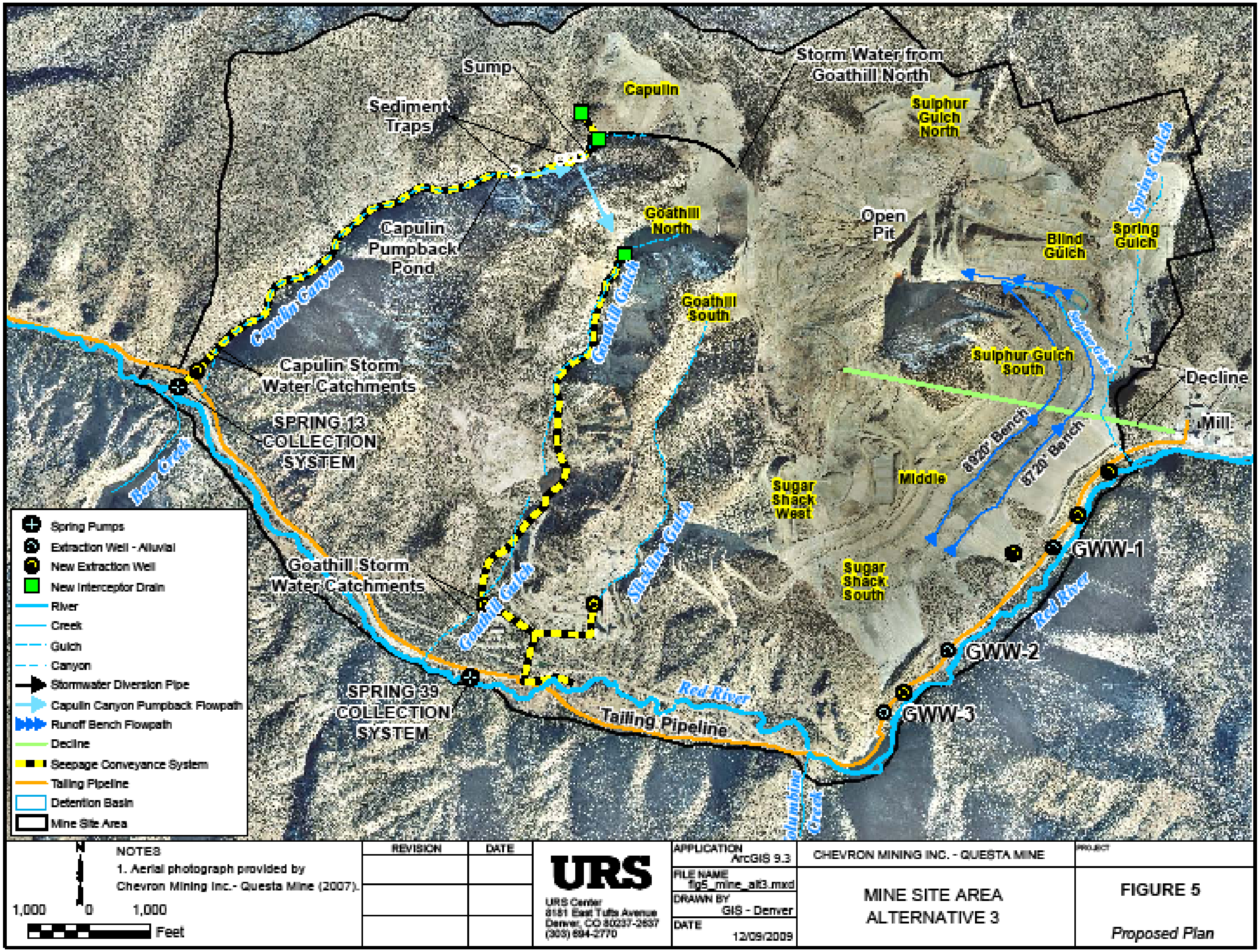
One or more on-site repositories would be selected during the remedial design for placement of the waste rock to be removed under Subalternative 3A. The selection of the repositories will be based on the volume of waste rock to be removed, the capacity of the repository, and other criteria. The use of the open pit as a repository for waste rock is one option that would be considered in design, as well as other rock piles or other areas on Site.

Subalternative 3A – 3H:1V includes the same storm-water, surface-water, and ground-water management components as Alternative 2, except that additional ground-water extraction and treatment components are added. Two new seepage interceptor drains would be constructed near the toe of Capulin Waste Rock Pile during the rock pile regrade, and one new interceptor drain would be constructed near the toe of Goathill North Waste Rock Pile. These drains would collect additional seepage from the rock piles that would be piped directly to the mill site. Additional ground-water withdrawal wells would also be constructed in the side drainages to capture seepage and seepage-impacted colluvial ground water before it enters the Red River alluvial aquifer. These withdrawal wells would be located at the base of the Roadside Waste Rock Pile drainages, in lower Goathill Gulch near the head of the debris fan, in lower Slickline Gulch between existing monitoring wells MMW-21 and MMW-48A, and in lower Capulin Canyon. The current Capulin seepage collection and pumpback system would be decommissioned to prevent future exposure by visitors/trespassers to seepage. All seepage and seepage-impacted water collected by these upgraded systems would be piped to a water treatment facility to be built on Site.

The primary treatment technology includes lime neutralization/chemical precipitation/high density sludge (HDS) process with secondary treatment (i.e., reverse osmosis/ultrafiltration or other membrane/filtration technology) if required to achieve discharge limits. A discharge point for the treated water would be evaluated during the remedial design. The preliminary location for the treatment plant is the Mill Area. Options for the timing of construction and operation of the new treatment plant are included with this subalternative, beginning with year 0 for start of construction and a 30-year period of analysis, followed by three subsequent 10-year periods of construction and 30-year periods of analysis. The timing options for water treatment affect the Present Value cost estimates.

Subalternative 3A would achieve the RAOs for the Mine Site Area. Cover of the waste rock piles for source containment would eliminate or reduce, to the maximum extent practicable, the generation and migration of ARD to ground water that would cause exceedances of the numerical ground-water ARARs or preliminary Site-specific cleanup levels. The additional seepage interceptor drains and ground-water withdrawal wells within side drainages, combined with the existing ground-water and seepage collections systems, would eliminate or reduce, to the maximum extent practicable, the further migration of mining-related COCs in ground water, and to surface water of the Red River. The source containment and expanded ground-water remediation systems would allow for attainment of ground-water ARARs or preliminary Site-specific cleanup levels. They would also protect Red River aquatic species from chronic exposure to COCs and acidity caused by mining-related activity at Springs 13 and 39 through the ground water to surface water migration pathway. Storm water, surface-water runoff, and sediment control prevents transport of mine site soil to surface water entering the Red River. Recreational visitors/trespassers would be protected from direct contact with seepage and seepage catchments through the use of piping and fencing. The ICs recorded by CMI would restrict the use of ground water by people.

Figure 5 depicts the ground-water components of Subalternative 3A. Figure 6 depicts a cross-section view of the regrade for Sugar Shack South waste rock pile.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Sediment Traps
Capulin
Storm Water from Goathill North
Sulphur Gulch North
Spring Gulch
Open Pit
Blind Gulch
Spring Gulch
Capulin Pumpback Pond
Goathill North
Capulin Canyon
Goathill Gulch
Goathill South
Sulphur Gulch South
Capulin Storm Water Catchments
Decline
Mill
SPRING 13 COLLECTION SYSTEM
Bear Creek
8920' Bench
8720' Bench
Sugar Shack West
Middle
Slickline Gulch
GWW-1
Goathill Storm Water Catchments
Goathill Gulch
Sugar Shack South
Red River
GWW-2
SPRING 39 COLLECTION SYSTEM
Red River
Tailing Pipeline
GWW-3
Columbine Creek
Spring Pumps
Extraction Well - Alluvial
New Extraction Well
New Interceptor Drain
River
Creek
Gulch
Canyon
Stormwater Diversion Pipe
Capulin Canyon Pumpback Flowpath
Runoff Bench Flowpath
Decline
Seepage Conveyance System
Tailing Pipeline
Detention Basin
Mine Site Area
N
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NOTES
1. Aerial photograph provided by Chevron Mining Inc.- Questa Mine (2007).
REVISION
DATE
URS
URS Center
8181 East Tufts Avenue
Denver, CO 80237-2637
(303) 694-2770
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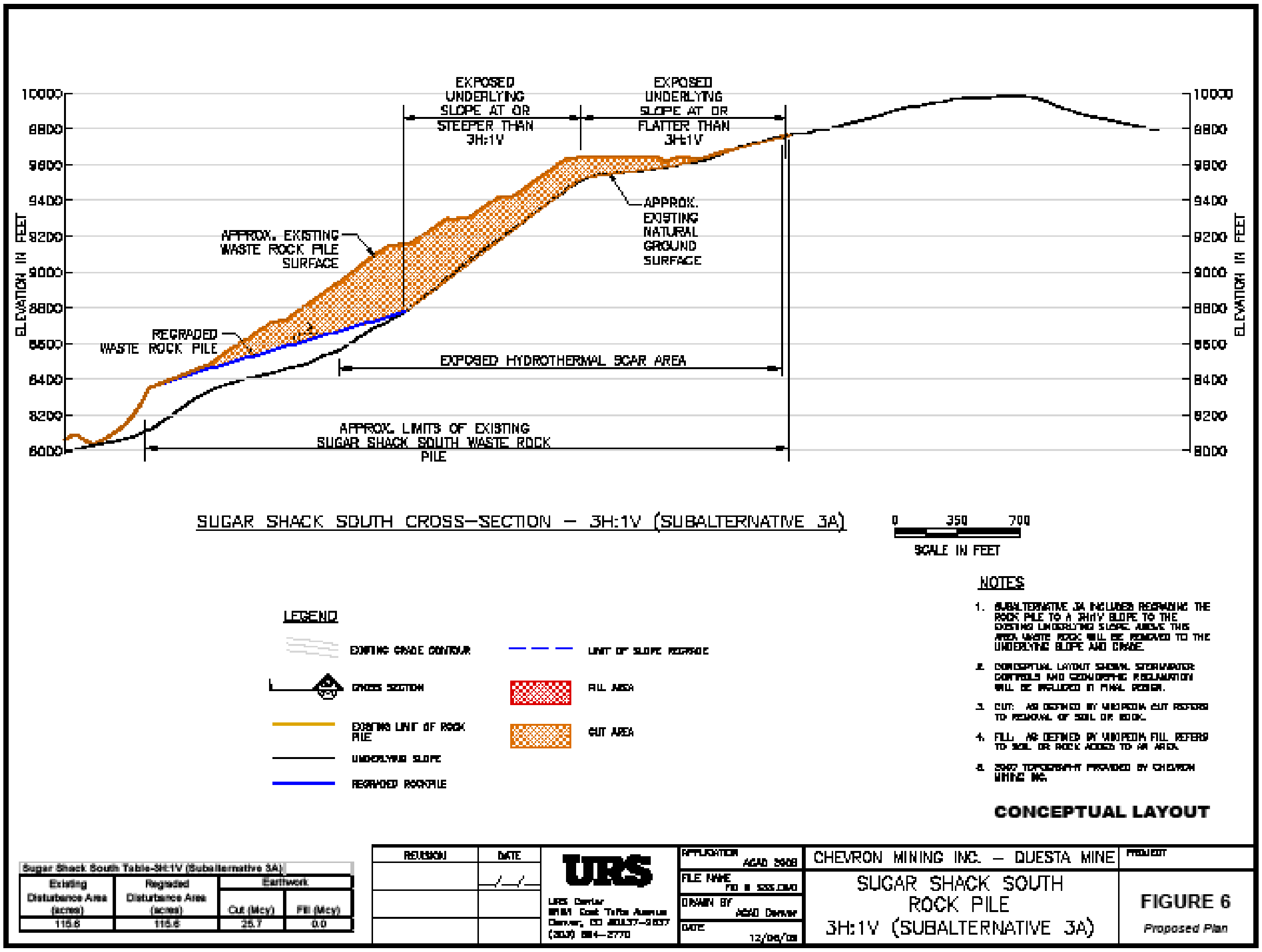
DATE 12/09/2009
CHEVRON MINING INC. - QUESTA MINE
MINE SITE AREA
ALTERNATIVE 3
PROJECT
FIGURE 5
Proposed Plan



Subalternative 3B – Source Containment [2H:1V: Balanced-Cut-Fill, Regrade, and Cover for 2H:1V Slopes]; Storm-Water, Surface-Water, and Ground-Water Extraction and Treatment (EPA's Preferred Alternative)

Capital Cost: $231,488,000
O&M Cost: $71,720,000
Present Value Cost: $114,421,000
Construction Timeframe: 28 years
Time to Achieve RAOs: 10 years – alluvial ground water[14] [15]
PRGs may not be met for colluvial/bedrock ground water[16]

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[14] Based on the findings of the RI, the alluvial aquifer in the area of Spring 13 and MMW-45A, near Capulin Canyon, may be impacted or partially impacted from natural sources. In this case, cleanup levels might not be achieved in these areas as a result of implementing Subalternative 3A. If this area is impacted by mining-related sources, cleanup should also occur in less than 10 years.
[15] Analytical results show that some extraction wells and the underground mine dewatering would need to operate in perpetuity to maintain cleanup levels in the alluvial aquifer.

Subalternative 3B includes the same general components as Subalternative 3A except a balanced-cut-fill within and between the waste rock piles would be used to achieve a minimum interbench slope of 2H:1V. *See* Figure 7, below. The waste rock piles that have an in-place regrade are Capulin, Goathill North, and Sugar Shack West. The waste rock piles with a balanced-cut-fill achieved by moving waste rock material to other rock piles are Goathill South, Sugar Shack South, Middle, and Sulphur Gulch South. Material moved from the waste rock piles would be placed at either Spring Gulch or Sulphur Gulch North/Blind Gulch waste rock piles. It is assumed that a waste rock repository at the mine site would not be necessary. The water treatment options are the same as Subalternative 3A.

Subalternative 3B is also the Preferred Alternative, in combination with Subalternative 3A, as EPA recognizes that regrading all waste rock piles to the minimum 3H:1V interbench slopes might be impractical due to the steep underlying bedrock slopes and other factors. However, the 3H:1V interbench slope (Subalternative 3A) is preferred over the 2:1V interbench slope (Subalternative 3B). Each waste rock pile would be evaluated during the remedial design phase with the objective of achieving the 3H:1V slope. Criteria to be used in determining whether the 3H:1V slope can or cannot be achieved would include the underlying bedrock slope, stability and factor of safety[17], the volume of waste rock that would have to be removed, the potential expansion of the rock pile footprint and area of increased disturbance, the demonstration of successful cover and revegetation on varying slopes through test plots to ensure effective performance and protection of ground water, and exposure of scars.

Subalternative 3B would achieve all the RAOs for the Mine Site Area, similar to Subalternative 3A.

Tailing Facility Area Alternatives

Four alternatives and two subalternatives for the Tailing Facility Area are presented below. The tailing facility is an operating facility and, therefore, components of the remedial alternatives for cover and containment would not be implemented for the tailing impoundments until after cessation of tailing disposal. The other components of the remedial alternatives that reduce human health and environmental risk and remediate ground-water contamination would be implemented at the start of remedial action.

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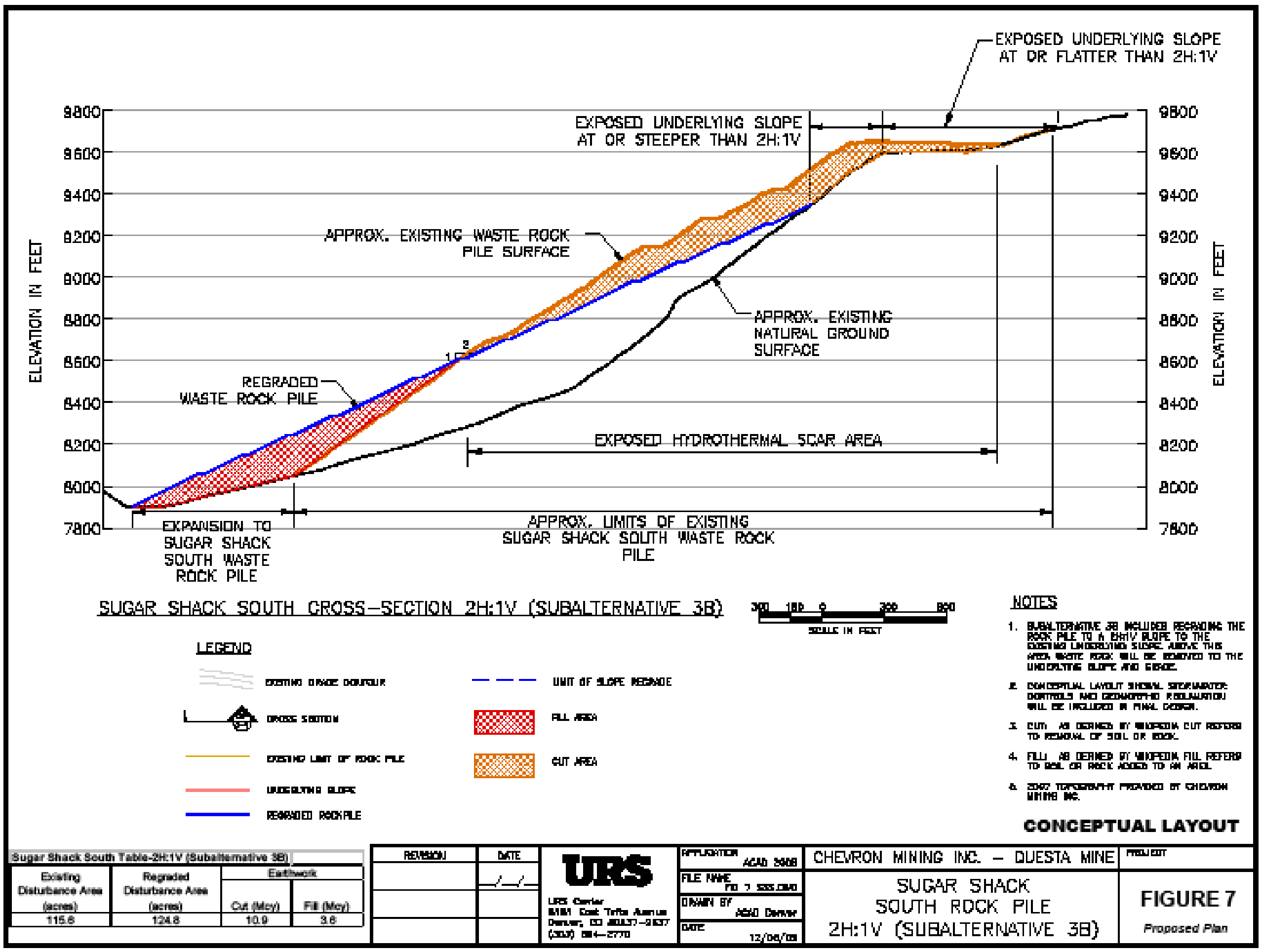
[16] It could not be demonstrated that cleanup levels would be achieved for colluvial and bedrock ground water at certain locations at the mine site, in particular under the footprint of the remaining waste rock piles, when assuming a reduction in waste rock seepage of approximately 60 percent (a preliminary estimate for FS purpose only). The 60-percent reduction does not represent a design performance criterion for the cover system. A much higher performance criterion would be required in design of the store-and-release cover system to reduce infiltration to a level that would be protective of ground water, thus allowing achievement of the cleanup levels.
[17] Factor of Safety for the roadside waste rock piles would be based on consideration of those piles as critical structures.

Common Elements: Many of these alternatives include common components. The ongoing LUCs for controlling access (fencing, signage, etc.) to the facility and legally restricting or limiting land and ground-water use through ICs (restrictive covenants, ground-water use and well drilling restrictions) would continue. The operation of the current seepage interception systems and extraction wells would also continue, as well as ground-water monitoring, general site maintenance, and storm-water management. Discharge of collected water to the Red River would be performed under the existing NPDES permit. The tailing dust control measures would continue for the duration of tailing disposal operations. The ongoing voluntary air monitoring program (PM_{10} monitoring, $PM_{2.5}$ monitoring during earthmoving remediation activities) would be



incorporated into the CERCLA remedy and a contingency plan for dust suppression would be implemented in the event of mining-related exceedances of ambient air quality standards beyond the property boundary that threaten human health.

Source containment is also a component of all alternatives (excluding the No Further Action alternative). Mining Permit TA001RE-96-1 and Discharge Permit DP-933 conditions specify a minimum of 3 feet of soil cover to be placed on the tailing facility, graded, and revegetated at the cessation of tailing disposal operations. The cover type would be a store and release/ET cover designed to prevent the infiltration and percolation of water through the tailing material to ground water that would cause an exceedance of ground water quality standards. A store-and-release/ET cover system is an appropriate cover type for the climate conditions near Questa and the type of borrow materials that are locally available. It would limit net percolation by storing precipitation (from rain and snow) within the cover system for a period long enough for the water to be removed by evaporation and transpiration (uptake in plants). It would also provide a condition that allows for the re-establishment of a self-sustaining ecosystem appropriate for the life zone of the surrounding areas, not conflicting with the approved PMLU. The vegetation would be composed of primarily native grasses.

The cover component of the alternatives also prevents exposure by the recreational visitor/trespasser and wildlife to molybdenum in the tailing and tailing pond sediments within the footprint of the two impoundments. The estimated area to be covered is approximately 1,050 acres. This would include the historic surface tailing adjacent to, but outside the current impoundments. The volume of cover material is estimated at 5.4 million yd^3. The source of the cover material would be the alluvial soils in the northern portion of the tailing facility.

The Tailing Facility Area alternatives are as follows:

- **Alternative 1** – No Further Action
- **Alternative 2** – Limited Action (Institutional Controls; Source Containment; Continued Ground-Water Withdrawal Operations; Piping of Water in Eastern Diversion Channel)
- **Alternative 3** – Source Containment; Continued Ground-Water Withdrawal Operations with Upgraded Seepage Collection; Piping of Water in Eastern Diversion Channel
    - Subalternative 3A – Continue Ground-Water Withdrawal Operations with Upgraded Seepage Collection
    - Subalternative 3B – Continue Ground-Water Operations with Upgraded Seepage Collection and Treatment
- **Alternative 4** – Source Containment; Ground-Water Extraction and Treatment; Piping of Water in Eastern Diversion Channel

Alternative 1 – No Further Action

Capital Cost: $0
O&M Cost: $30,151,000

Present Value Cost: $12,425,000
Construction Timeframe: None
Time to Achieve RAOs: Not Achieved

This alternative continues the current actions that are in place at the Tailing Facility Area with no further actions. Operation of the existing seepage interception systems and pumpback system would continue, as well as the discharge of collected seepage-impacted water to the Red River under the existing NPDES permit. CMI currently operates seepage interception systems that collect tailing water seepage south of Dam No. 1 (002 system) and on the eastern abutment of Dam No. 4 (003 system). *See* Figure 8, below. The shallow seepage interception systems include rock-filled drains, seepage barriers, and extraction wells. The drains are located in trenches that are approximately 20 feet deep. The 002 and 003 seepage interception systems each have an upper and lower seepage barrier, with the lower barriers located further down the drainage. Both the lower 002 seepage barrier and lower 003 seepage barrier have been dry in recent years, but this doesn't imply that complete capture of seepage in these drainages is being achieved. There is evidence that contamination of ground water from tailing seepage is still occurring below these seepage interception systems. The systems currently collect approximately 420 gpm of seepage-impacted water, nearly 80 percent coming from the rock drains and seepage barriers.

The water collected from the seepage interception systems flows by gravity through pipelines to a concrete manhole, where the water combines and flows into a 1,500 foot long pipeline that discharges to the bank of the Red River at permitted Outfall 002. A pumpback system was installed in 2003 to reduce the load of metals (primarily manganese) discharged to the Red River. It pumps a portion of the seepage-impacted water back northward over Dam No. 1 through a 4-inch diameter HDPE pipe to discharge at the Dam No. 5A impoundment. The remaining seepage-impacted water is discharged untreated to the Red River.

Based on an operational water balance seepage loading analysis for the tailing facility, approximately 2,510 gpm of tailing seepage is uncollected by the seepage interception systems. Uncontrolled seepage is primarily documented infiltrating/percolating downward from the portion of the tailing facility in the vicinity of Dam No. 4 (estimated 770 gpm) and Dam No. 5A (estimated 1,700 gpm) to the basal bedrock (volcanic) aquifer. Seepage-impacts to ground water (elevated molybdenum and sulfate) have been detected in nearby monitoring wells south of Dam No. 4, as well as in nearly every spring along the Red River between the tailing facility and the state fish hatchery. Concentrations of molybdenum, and in some instances sulfate, have increased in some wells and springs since 2002. Contaminants also exist in ground water at and downgradient of the seepage interception system south of Dam No. 1, indicating some bypass of tailing seepage around the existing seepage interception systems. Concentrations of sulfate in some deep wells south of Dam No. 1, within the lower alluvial aquifer, also have been increasing over time.

Under Alternative 1, it is estimated that molybdenum concentrations in ground water would not decrease to below the PRG after 30 years of closure. After the tailing impoundments are no longer receiving tailing slurry, infiltration of the tailing seepage would continue due to additional pumpback water, draining of the impounded tailing, and precipitation that collects and infiltrates the impoundment surface. Alternative 1 assumes continued pumpback of approximately 150 gpm of seepage-impacted ground water collected from the seepage interception systems to the Dam No. 5A impoundment, with no cover.

Alternative 1 would not meet the RAOs for the Tailing Facility Area because it does not include cover of the tailing impoundments for source containment. The seeping and migration of COCs from tailing to ground water that could cause exceedances of numerical ground-water ARARs or preliminary Site-specific cleanup levels would not be eliminated or reduced. Exposure to tailing and tailing pond sediment by human and ecological receptors would also not be eliminated or reduced. Remediation of contaminated ground water at and off-site of the tailing facility to meet numerical ground-water ARARs or Site-specific cleanup levels would not be achieved without source containment.

Alternative 2 – Limited Action (Institutional Controls; Source Containment; Continued Ground-Water Withdrawal Operations; Piping of Water in Eastern Diversion Channel)

Capital Cost: $28,472,000
O&M Cost: $16,443,000
Present Value Cost: $32,332,000
Construction Timeframe: 6 years
Time to Achieve RAOs: 15 years following construction of cover

Alternative 2 is the same as Alternative 1, with the exception that unused irrigation water within the eastern diversion channel would be conveyed through a pipe that bypasses the area of historic buried tailing and discharges south near Dam No. 1. The piping of the irrigation water prevents infiltration and percolation through the historic buried tailing to ground water. The historic buried tailing, located north of the Change House, is assumed to be the source of the molybdenum contamination in ground water southeast of Dam No. 1[18] (*see* Figure 8). The leading edge of the contaminant plume (molybdenum) would be allowed to recede by advection and dispersion. Performance monitoring is also included southeast of Dam No. 1, in the area of monitoring wells MW-4 and MW-17, to assess the effectiveness of the piping on achieving cleanup levels for ground water in this area.

Alternative 2 also includes placement of the store-and-release/ET soil cover system, including revegetation, on the tailing impoundments at the cessation of tailing deposition. A limited amount of soil contaminated with molybdenum above the PRG at the dry/maintenance area would also be removed and disposed at the impoundment before cover placement.

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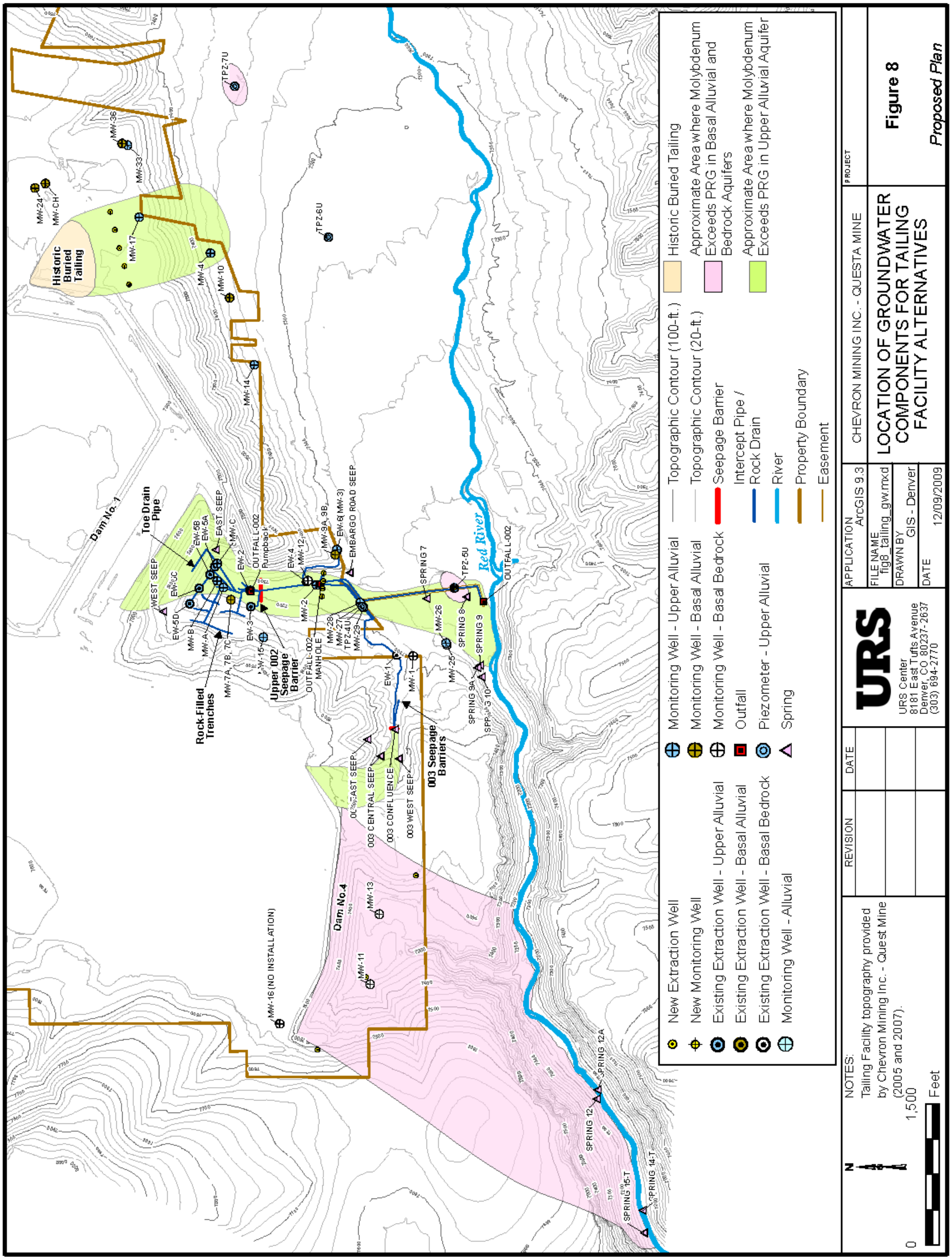
[18] The source of the molybdenum contamination may also be tailing seepage originating from behind Dam No. 1 that has migrated beyond the flank of the Dam in a southeastward direction.


New Extraction Well
New Monitoring Well
Existing Extraction Well - Upper Alluvial
Existing Extraction Well - Basal Alluvial
Existing Extraction Well - Basal Bedrock
Monitoring Well - Alluvial
Monitoring Well - Upper Alluvial
Monitoring Well - Basal Alluvial
Monitoring Well - Basal Bedrock
Outfall
Piezometer - Upper Alluvial
Spring
Topographic Contour (100-ft.)
Topographic Contour (20-ft.)
Seepage Barrier
Intercept Pipe / Rock Drain
River
Property Boundary
Easement
Historic Buried Tailing
Approximate Area where Molybdenum Exceeds PRG in Basal Alluvial and Bedrock Aquifers
Approximate Area where Molybdenum Exceeds PRG in Upper Alluvial Aquifer
NOTES:
Tailing Facility topography provided by Chevron Mining Inc. - Quest Mine (2005 and 2007).
0
1,500
Feet
N
REVISION
DATE
URS
URS Center
8181 East Tufts Avenue
Denver, CO 80237-2637
(303) 694-2770
APPLICATION
ArcGIS 9.3
FILE NAME
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GIS - Denver
DATE
12/09/2009
CHEVRON MINING INC. - QUESTA MINE
LOCATION OF GROUNDWATER COMPONENTS FOR TAILING FACILITY ALTERNATIVES
PROJECT
Figure 8
Proposed Plan
Dam No. 1
Dam No. 4
Red River
Toe Drain Pipe
Rock-Filled Trenches
Upper 002 Seepage Barrier
003 Seepage Barriers
Historic Buried Tailing
WEST SEEP
EAST SEEP
EMBARGO ROAD SEEP
OUTFALL-002
Pumpback
MANHOLE
003 EAST SEEP
003 CENTRAL SEEP
003 CONFLUENCE
003 WEST SEEP
SPRING 7
SPRING 8
SPRING 9
SPRING 9A
SPRING 12
SPRING 12A
SPRING 14-T
SPRING 15-T
MW-16 (NO INSTALLATION)
MW-11
MW-13
MW-1
EW-1
MW-25
MW-26
TPZ-5U
TPZ-6U
TPZ-7U
MW-14
MW-10
MW-4
MW-17
MW-24
MW-CH
MW-33
MW-36

Under Alternative 2, the cleanup levels would be met for ground-water within an estimated timeframe of 15 years following construction of the cover. After the tailing impoundments are no longer receiving tailing slurry and are covered, infiltration of tailing seepage would continue (at a decreasing rate) due to draining of the impounded tailing. Approximately 150 gpm of tailing seepage-impacted ground water collected by the seepage interception systems would be pumped back to the Dam No. 4 and 5A impoundments until cleanup levels are achieved.

Alternative 2 would not meet all of the RAOs for the Tailing Facility Area until a cover system is installed. Cover placed on the tailing impoundments as source containment would eliminate exposure to tailing and tailing pond sediment by people and wildlife. Cover would also eliminate or reduce, to the maximum extent practicable, the seepage/migration of COCs from tailing to ground water that cause exceedances of numerical ground-water ARARs or preliminary Site-specific cleanup levels. The current ground-water extraction and seepage collection systems are inadequate to capture all the seepage south of Dam No. 1. By combining source containment with the operation of existing ground-water extraction and seepage collection systems, and piping of irrigation water, the ground-water ARARs or Site-specific cleanup levels would be achieved south of Dam No. 1 and possibly southeast of Dam No. 1, thereby eliminating or reducing ingestion by people of contaminated ground water drawn from wells in those areas. However, Alternative 2 would not clean up contaminated ground water in the basal bedrock (volcanic) aquifer south of Dam No. 4, nor in the alluvial aquifer below Dam No. 1, where contamination gets beyond the existing seepage collection systems. Alternative 2 would also not clean up contaminated ground water southeast of Dam No. 1 (MW-4/MW-17 area), if the source of contamination is the tailing within the Dam No. 1 impoundment area and not the historic buried tailing located north of the Change House. It is noted that the existing ground-water contamination has recently increased and could potentially migrate past the CMI property boundary. Effective source containment at the cessation of tailing disposal operations may result in contaminant levels decreasing to below preliminary cleanup levels over time, but not through active remediation and engineering controls other than cover.

Subalternative 3A – Source Containment; Continued Ground-water Withdrawal Operations with Upgraded Seepage Collection; Piping of Water in Eastern Diversion Channel

Capital Cost: $28,878,000
O&M Cost: $17,592,000
Present Value Cost: $33,018,000
Construction Timeframe: 6 years
Time to Achieve RAOs: 20 years following construction of cover

Subalternative 3A is the same as Alternative 2 with the addition of upgrading the 002 and 003 seepage barriers to mitigate off-site migration of tailing seepage not being captured by the existing seepage collection systems. The upgrade to the Outfall 002 system includes installation of new ground-water extraction wells across the Dam No. 1 arroyo just downgradient of the location of the existing lower 002 seepage barrier which is dry. It is estimated that four new wells would be placed along a 250-foot wide transect. Each well would be constructed to a depth of approximately 100 feet and pump approximately 30 gpm. The upgrade to the Outfall 003 system would replace the upper 003 seepage barrier with a new barrier that extends 30 feet below the existing barrier. This new barrier would intercept tailing seepage in deeper strata. It is estimated that the upgraded seepage barrier would collect approximately 180 gpm of tailing seepage, an increase of 120 gpm compared to the existing 003 barrier. The estimated additional seepage-impacted ground water collected by the upgraded system is approximately 250 gpm compared to Alternative 2. The total volume of seepage-impacted water to be collected by the existing and upgraded systems would be approximately 790 gpm. A portion of the collected seepage-impacted water would be discharged to the Red River in compliance with current NPDES permit limits, while the remaining portion would be pumped back to the Dam No. 4 and 5A impoundments. *See* Figure 9.

Subalternative 3A also would include additional ground-water characterization in the basal bedrock aquifer south of Dam No. 1 in the area of the former piezometer TPZ-5B and ground-water quality monitoring downgradient of Dam No. 1 and Dam No. 4, as well as southeast of the historic buried tailing to assess the performance and effectiveness of the upgraded seepage barriers, piping in the eastern diversion channel, and source containment in achieving cleanup levels. Cleanup levels would be met for ground water in the Tailing Facility Area within an estimated timeframe of 20 years following construction of the cover.

Similar to Alternative 2, Subalternative 3A would not meet all the RAOs for the Tailing Facility Area, until the cover system is constructed atop the impoundments at the cessation of tailing disposal operations. The additional seepage collection and ground-water extraction improves the ability of this alternative to achieve the RAOs below Dam No. 1. Also like Alternative 2, ground-water remediation would not be performed for the basal bedrock (volcanic) aquifer south of Dam No. 4 or southeast of Dam No. 1 (MW-4/MW-17 area). Therefore, a decrease of COC levels over time by advection and dispersion (as a result of source control) would be necessary to meet ground-water ARARs or preliminary Site-specific cleanup levels in the basal bedrock aquifer and the upper portion of the alluvial aquifer southeast of Dam No. 1 (if the buried historic tailing near the Change House is not the source of ground water contamination southeast of Dam No. 1).

Subalternative 3B – Source Containment; Continued Ground-Water Withdrawal Operations with Upgraded Seepage Collection; Piping of Water in Eastern Diversion Channel; Water Treatment (EPA's Preferred Alternative[19])

[19] Subalternative 3B is the EPA Preferred Alternative with modification. The Preferred Alternative includes the component of Alternative 4 that remediates ground-water southeast of Dam No. 1, as well as specifies treatment of all collected ground water and seepage prior to discharge to Red River, rather than only the seepage that would be pumped back to the Dam 5A area. This is discussed in further detail in the Summary of EPA's Preferred Alternative and Basis for EPA's Preference.

Capital Cost: $29,043,000
O&M Cost: $18,547,000
Present Value Cost: $33,758,000
Construction Timeframe: 6 years
Time to Achieve RAOs: 15 years following construction of the cover

Table 10 – Tailing Facility Water Treatment – Subalternative 3B

Year 0 Construction, 30-year Period of Analysis	
Capital Cost:	$22,076,000
O&M Cost:	$73,027,000
Present Value Cost:	$51,989,000
Year 10 Construction, 40-Year Period of Analysis	
Capital Cost:	$22,076,000
O&M Cost:	$73,027,000
Present Value Cost:	$26,428,000
Year 20 Construction, 50-Year Period of Analysis	
Capital Cost:	$22,076,000
O&M Cost:	$73,027,000
Present Value Cost:	$13,435,000
Year 30 Construction, 60-Year Period of Analysis	
Capital Cost:	$22,076,000
O&M Cost:	$73,027,000
Present Value Cost:	$6,830,000

Subalternative 3B is the same as Subalternative 3A with the addition of water treatment. The total water collection rate for Subalternative 3B would be an estimated 790 gpm, of which approximately 400 gpm would be discharged through the NPDES-permitted Outfall 002. The remaining water (390 gpm) would be treated at the existing ion exchange (IX) plant and/or new treatment plant located south of Dam No. 4. Piping associated with conveyance of water from the various collection/extraction systems at the tailing facility is included in Subalternative 3B. Modifications to the IX plant may be necessary if contaminants in ground water, in addition to molybdenum, require removal. Reverse osmosis (RO) may be included for additional treatment. For Subalternative 3B, cleanup levels would be met for ground water in the Tailing Facility Area within an estimated timeframe of 15 years following construction of the cover.

Subalternative 3B would meet all RAOs for the Tailing Facility Area, similar to Subalternative 3A.

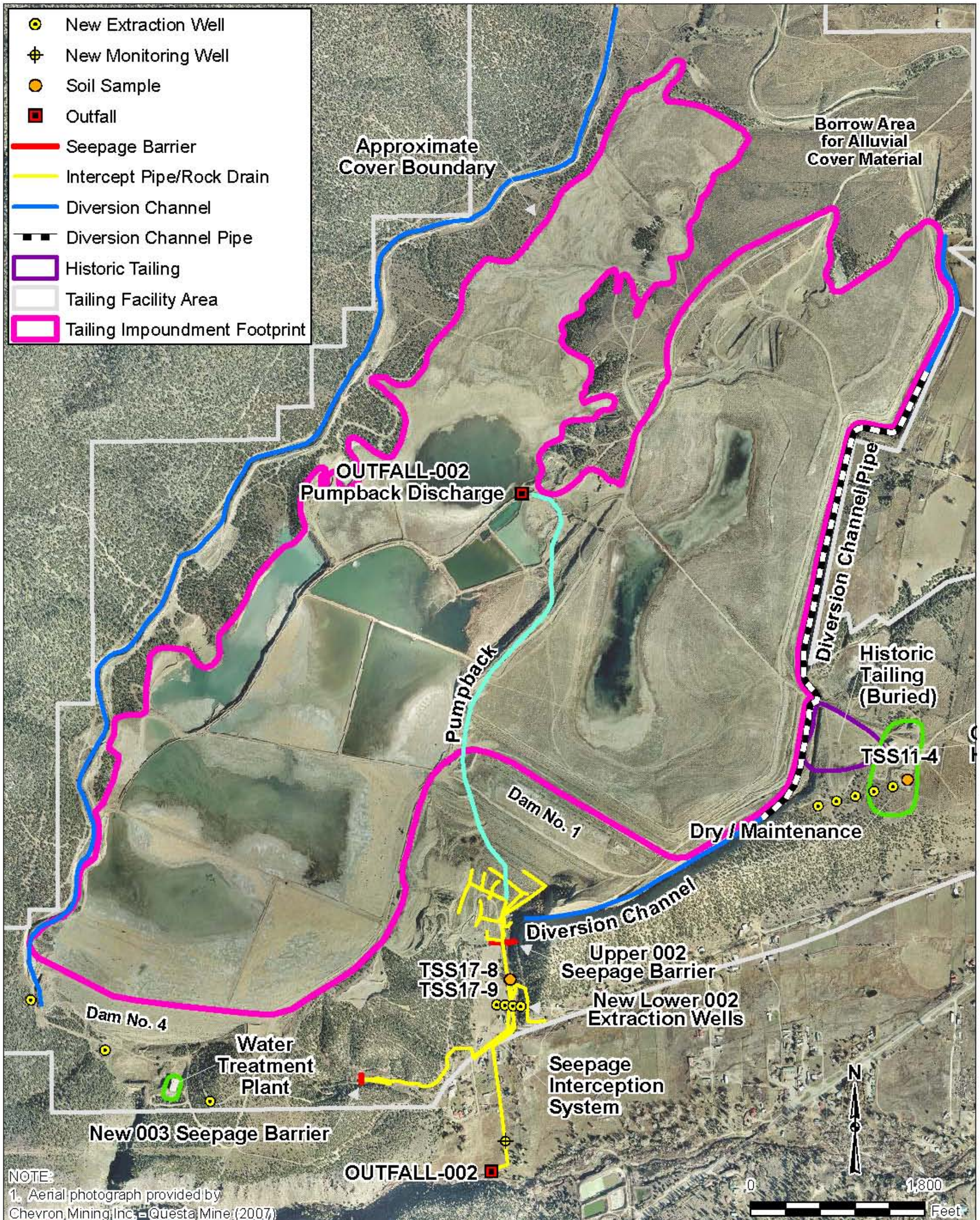
Alternative 4 – Source Containment; Ground-Water Extraction and Treatment; Piping of Water in Eastern Diversion Channel

Capital Cost: $30,442,000
O&M Cost: $20,876,000
Present Value Cost: $35,939,000
Construction Timeframe: 6 years
Time to Achieve RAOs: 8 years following construction of the cover

Table 11 – Tailing Facility Water Treatment – Alternative 4

Year 0 Construction, 30-year Period of Analysis	
Capital Cost:	$54,533,000
O&M Cost:	$197,162,000
Present Value Cost:	$135,051,000
Year 10 Construction, 40-Year Period of Analysis	
Capital Cost:	$54,533,000
O&M Cost:	$197,162,000
Present Value Cost:	$68,653,000
Year 20 Construction, 50-Year Period of Analysis	
Capital Cost:	$54,533,000
O&M Cost:	$197,162,000
Present Value Cost:	$34,899,000
Year 30 Construction, 60-Year Period of Analysis	
Capital Cost:	$54,533,000
O&M Cost:	$197,162,000
Present Value Cost:	$17,741,000

Alternative 4 is the same as Subalternative 3B except that additional ground-water extraction south and southeast of Dam No. 1 and south of Dam No. 4 would be included. *See* Figure 9. Ground-water extraction would be performed southeast of Dam No. 1 (in the area of wells MW-4 and MW-17) to capture molybdenum in the upper alluvial aquifer believed to be associated with the historic buried tailing northwest of the Change House. As in Subalternative 3B, source containment would be included through the use of piping to bypass unused irrigation water in the eastern diversion channel. It is estimated that five extraction wells would be constructed along an east-west line, approximately 240 feet apart, to create a continuous zone of ground-water capture across the contaminant plume. The depth to water in this area ranges between 130 and 150 feet. Therefore, the wells would be constructed to a total depth of 200 feet with 60-foot screens to extract ground water from the upper 60 feet of the alluvial aquifer. Each well would be pumped at approximately 10 gpm for a total extraction rate of 50 gpm. If the additional ground-water characterization in the basal bedrock aquifer south of Dam No. 1 in the area of former piezometer TPZ-5B verifies contamination above cleanup levels, ground-water extraction would be included in this area as well.



REVISION	DATE	URS	APPLICATION ArcGIS 9.3	CHEVRON MINING INC. - QUESTA MINE	PROJECT
		URS Center 8181 East Tufts Avenue Denver, CO 80237-2637 (303) 694-2770	FILE NAME fig9_tailing_alt4.mxd	TAILING FACILITY AREA MAP	FIGURE 9
			DRAWN BY GIS - Denver		
			DATE 12/09/2009		*Proposed Plan*

Additionally, Alternative 4 includes ground-water extraction in the basal bedrock (volcanic) aquifer south of Dam No. 4 (in the area of wells MW-11 and MW-13). The extraction wells would create a zone of hydraulic capture across the former arroyo and prevent further downgradient migration of seepage-impacted ground water from the Dam No. 4 impoundment (including the Dam No. 5A impoundment and decant pond). Based on the 2006 water balance calculations, an estimated 2,510 gpm of seepage-impacted ground water may be available to migrate south of Dam No. 4. It is estimated that hydraulic capture would be achieved by pumping from three wells with a total extraction rate of 3,500 gpm. Figure 4 shows the proposed location of the extraction wells. Depth to ground water south of Dam No. 4 is approximately 200 feet. Therefore, the wells would be constructed to a total depth of approximately 300 feet with 100-foot long screens.

For Alternative 4, cleanup levels would be met for ground water in the Tailing Facility Area within an estimated timeframe of 8 years following closure. It is assumed that all seepage-impacted water collected from extraction wells and seepage barriers would be treated and discharged to the Red River via permitted Outfall 002. The total water collection rate would be approximately 4,300 gpm. With the significant increase in volume of water to be treated in Alternative 4, as compared to Subalternative 3B, the existing water treatment plant (with a capacity of 4.29 million gallons per day) would need modification and upgrade or a new facility would need to be built to increase treatment capacity. The O&M costs associated with treating the larger volumes of water would also be significantly higher.

Alternative 4 would meet all the RAOs for the Tailing Facility Area by collecting and extracting seepage and seepage-impacted ground water at all known areas of ground-water contamination. The additional ground-water extraction for the basal bedrock (volcanic) aquifer south of Dam No. 4 and the alluvial aquifer southeast of Dam No. 1 improve the ability of this alternative to achieve ground-water ARARs or preliminary Site-specific cleanup levels for all ground waters at the Tailing Facility Area.

Red River, Riparian, and South of Tailing Facility Area Alternatives

Three alternatives and two subalternatives are presented below for the Red River, Riparian, and South of Tailing Facility Area. Red River surface water poses a potential ecological risk, but it is addressed through reduction of impacted seeps and springs entering the river along the mine site. Shallow ground water was identified to pose a potential human health risk, but the ground water in the area south of the tailing facility is addressed for the Tailing Facility Area discussed above.

The Red River, Riparian, and South of Tailing Facility Area alternatives are as follows:

- **Alternative 1** – No Further Action

- **Alternative 2** – Cap Soil and Tailing Spill Deposits

- **Alternative 3** – Removal of Soil and Tailing Spill Deposits and Disposal

    - Subalternative 3A – Removal of Soil and Tailing Spill Deposits and Off-Site Disposal

    - Subalternative 3B – Removal of Soil and Tailing Spill Deposits and On-Site Disposal

Alternative 1 – No Further Action

Capital Cost: $0
O&M Cost: $177,000
Present Value Cost: $65,000
Construction Timeframe: None

This alternative would include no additional actions to address potential ecological risks from contact with tailing/soil in the Red River riparian area. CMI has previously removed a large portion of the historic tailing spill deposits in the riparian area (approximately 55 percent) and no additional removal is proposed.

The major component of this alternative would be the continued placement of copper blocks in the area south of the tailing facility to reduce the potential risk to livestock (primarily cattle). CMI currently provides copper blocks to landowners for this purpose. The copper blocks are commonly used to supplement the diet of animals that graze in areas with high molybdenum concentrations in soil and plants. The molybdenum interferes with copper uptake in some animals such as cattle, sheep, and possibly other large herbivorous mammals (deer and elk).

Alternative 1 would not meet the RAOs for the Red River, Riparian, and South of Tailing Facility Area. Direct exposure by ecological receptors would not be eliminated or reduced. Livestock would be protected through use of copper blocks. The RAO for the Red River water quality would be addressed through response actions at the Mine Site Area for source control and reduction of COCs entering the river from ground water.

Alternative 2 – Cap Soil and Tailing Spill Deposits

Capital Cost: $2,080,000
O&M Cost: $558,000
Present Value Cost: $2,281,000
Construction Timeframe: 1.75 years
Time to Achieve RAOs: 1.75 years

Alternative 2 would include placement of a cap over tailing spill deposits along the Red River riparian area (low lying areas) and the area south of the tailing facility. The cap would consist of a layer of soil, erosion mats and/or armoring applied to provide protection of the cap, and revegetation. The estimated area containing tailing spill deposits is approximately 3 acres. Suitable alluvial soil is available from on-Site borrow areas such as the tailing facility for the cap. Capping of tailing spill deposits would require approximately 4,400 yd^3 of soil, assuming a 6-inch or 12-inch depth of cover, depending on the size of the spill.

Approximately 8 acres were identified south of the tailing facility where molybdenum-contaminated soil presented a risk to livestock and wildlife (*see* Figure 10). The area would be capped with approximately one foot of soil and revegetated[20]. Suitable alluvial soil is available at the tailing facility as borrow material and would be appropriately screened prior to transport. The volume of cap material is estimated to be approximately 13,000 yd^3. Due to the wet nature of the soil in this area, dewatering of soil would be performed using shallow trenches for some areas.

Alternative 2 would meet the RAOs by reducing direct exposure to ecological receptors. The RAO for the Red River water quality would be addressed through response actions at the Mine Site Area for source control and reduction of COCs entering the river from ground water.

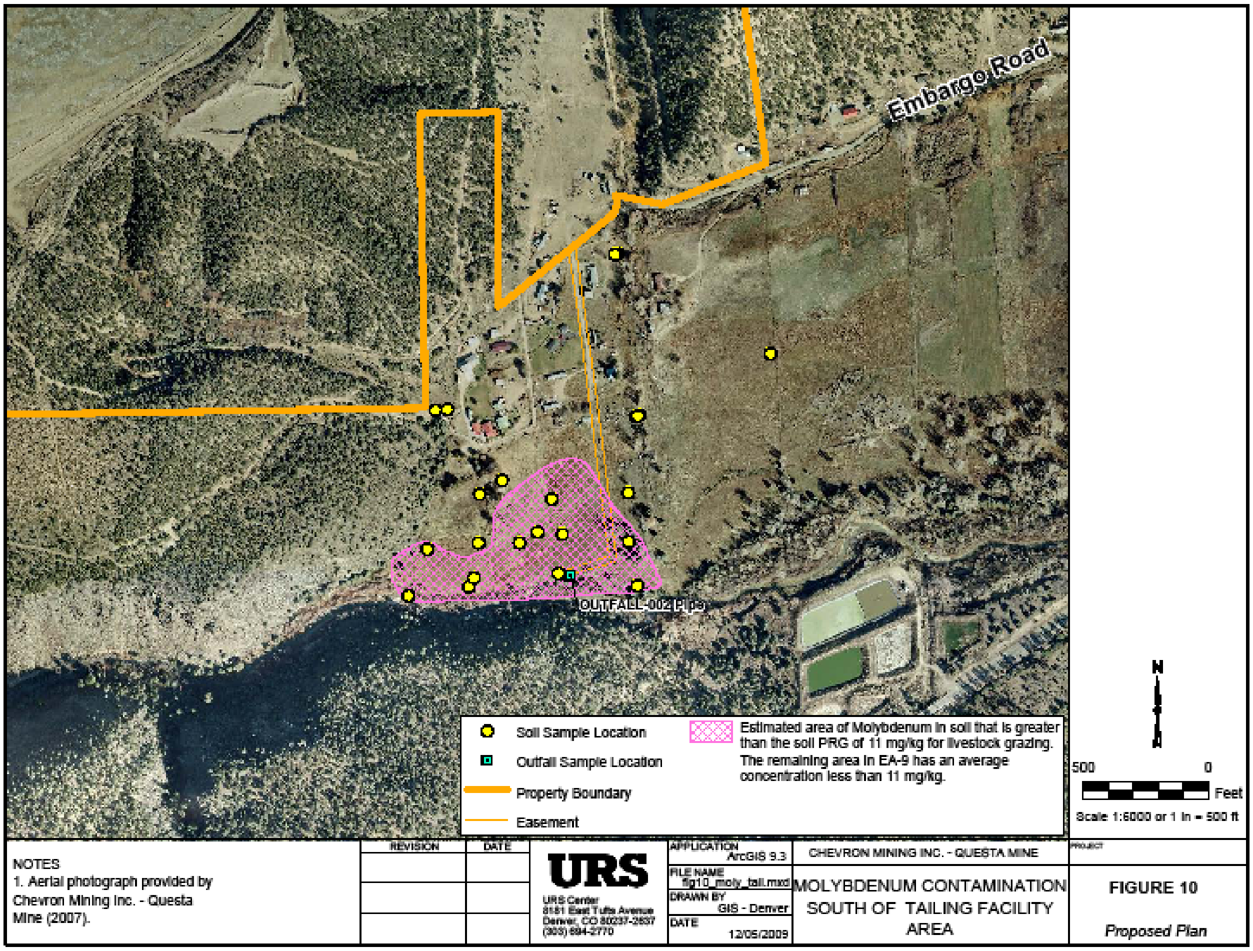
Subalternative 3A – Removal of Soil and Tailing Spill Deposits and Off-Site Disposal

Capital Cost: $5,947,000
O&M Cost: $412,000
Present Value Cost: $6,096,000
Construction Timeframe: 2.25 years
Time to Achieve RAOs: 2.25 years

Subalternative 3A would remove tailing spill deposits in the Red River riparian area and molybdenum-contaminated soil in the area south of the tailing facility, with off-Site disposal of the soil. Excavation of contaminated soil above the preliminary cleanup level of 11 mg/kg in the area south of the tailing facility would protect livestock and other wildlife (deer, elk). Tailing spill deposits excavated above the 54 mg/kg preliminary cleanup level along the Red River riparian corridor would protect wildlife.

The soils south of the tailing facility would be dewatered prior to excavation and stabilized prior to disposal. The initial depth of excavation would be 2 feet, with confirmation soil sampling performed to verify achievement of cleanup levels. If cleanup levels are not achieved, additional excavation would be performed until cleanup levels

[20] One foot of soil cover was estimated for FS purposes, but the actual thickness of the cap would be determined during the remedial design phase to ensure protectiveness not only from direct exposure to contaminated soil/tailing, but also to protect wildlife or livestock from from potential toxic effects from plant uptake of molybdenum.



are met or an EPA-acceptable depth has been reached. Assuming an excavation depth of 2 feet, the volume of contaminated soil to be removed is approximately 26,000 yd^3. The excavations would be backfilled with clean alluvial soil and revegetated. The source of the fill material would be the alluvial borrow area in the northern portion of the tailing facility. The alluvial fill would be appropriately screened prior to transport and placement. The volume of tailing spill deposits is estimated to be 3,800 yd^3. The largest area of tailing outside of the impoundment areas is at the Lower Dump Sump. The excavated soil and tailing would be transported off-Site to an appropriate solid waste landfill.

Subalternative 3A would meet the RAOs by removing the material and eliminating direct exposure to ecological receptors. The RAO for the Red River water quality would be addressed through response actions at the Mine Site Area for source control and reduction of COCs entering the river from ground water.

Subalternative 3B – Removal of Soil and Tailing Spill Deposits and On-Site Disposal (EPA's Preferred Alternative)

Capital Cost: $3,442,000
O&M Cost: $412,000
Present Value Cost: $3,591,000
Construction Timeframe: 2 years
Time to Achieve RAOs: 2 years

Subalternative 3B is the same as Subalternative 3A with the exception of the disposal of the soil and tailing on-Site. The excavated soil and tailing would be transported and placed in an impoundment at the tailing facility. The RAOs would be met for this alternative.

Eagle Rock Lake

Four alternatives and two subalternatives for Eagle Rock Lake are presented below.

Common Elements: The common component to all of the alternatives (excluding the No Action alternative) is the inlet controls to manage storm water entering the lake. Engineering controls would be included on the inlet structure to the lake to reduce the sediment load from entering the lake during storm events or other high flow conditions that entrain sediment in the river. Flows into Eagle Rock Lake range from approximately 100 to 400 gpm. Storm events generate a considerable sediment load in the river that currently originates from drainages upstream of the mine site; no precipitation or sediment currently leaves the mine site as runoff. Controls on the inlet would be designed to automatically close the headgate when either the specific conductance or turbidity of the river increases to values indicative of high sediment load in the river. A stilling well would be constructed near the inlet to house the specific conductance and turbidity probes to activate the headgate. The headgate, which diverts water to the lake from the river, is located approximately 300 feet east (upstream) of the lake inlet.

- **Alternative 1** – No Action
- **Alternative 2** – Inlet Storm Water Controls; In-Lake Capping of Sediment
- **Alternative 3** – Inlet Storm Water Controls; Dredge Sediments and Disposal
    - Subalternative 3A – Inlet Storm Water Controls; Dredge Sediments and Off-Site Disposal
    - Subalternative 3B – Inlet Storm Water Controls; Dredge Sediments and On-Site Disposal
- **Alternative 5** – Inlet Storm Water Controls; Backfill Lake and Construct New Lake

Alternative 4 (Backfill Lake) was screened out prior to the detailed analysis of alternatives.

Alternative 1 – No Action

Capital Cost: $0
O&M Cost: $149,000
Present Value Cost: $54,000
Construction Timeframe: None

Under this alternative, no action would be taken at Eagle Rock Lake to reduce the risk to benthic macroinvertebrates from exposure to contaminated sediment. The contaminated sediment would be left in place.

Alternative 1 would not meet the RAOs for Eagle Rock Lake for protecting the macroinvertebrate community and eliminating or reducing the deposition of mine site-contaminated sediment in the lake.

Alternative 2 – Inlet Storm Water Controls; In-Lake Capping of Sediments

Capital Cost: $286,000
O&M Cost: $495,000
Present Value Cost: $469,000
Construction Timeframe: 1.5 years
Time to Achieve RAOs: 1.5 years

This alternative would include in-lake capping of the lake-bottom sediments. Covering the existing sediments with a cap would provide more suitable sediment for the aquatic insect populations. Capping would include placement of approximately 1 foot of suitable alluvial fill on the bottom of the 3-acre lake. The volume of alluvial fill required for the cap is 4,900 yd^3. The source of the fill would be the borrow area at the tailing facility. The fill would be placed using an excavator around the perimeter of the lake, with an extension on the excavator boom if needed to reach the center of the lake.

Alternative 2 would meet the RAOs for Eagle Rock Lake by reducing direct exposure to the benthic macroinvertebrates and reducing the volume of sediment entering the lake.

Subalternative 3A – Inlet Storm Water Controls; Dredge Sediments and Off-Site Disposal

Capital Cost: $2,274,000
O&M Cost: $495,000
Present Value Cost: $2,457,000
Construction Timeframe: 2.25 years
Time to Achieve RAOs: 2.25 years

This alternative would include dredging of the sediments in the lake that pose a risk to the benthic macroinvertebrate community and the disposal of the excavated sediments at an appropriate off-Site facility. Two types of dredging are available: (1) hydraulic dredging from a barge, or (2) drainage of the lake to allow the sediments to dewater, followed by excavation of the sediments. Hydraulic dredging was selected because it would have less impact to the lake and recreational use of the lake. Additionally, this type of dredging would be quicker than draining and excavating sediments, since the sediments may take several months to naturally dry to a point where they can be excavated.

Hydraulic dredging would remove the sediment by pumping from a barge to a staging area near the lake. Sediments would be allowed to dry in the staging area before haulage and disposal off Site. It is assumed that the sediments can be handled as a solid waste and would be hauled to a solid waste facility. The estimated volume of sediments to be dredged is 15,000 yd^3, based on a 3-foot depth of dredging over the 3-acre lake.

Subalternative 3A would meet the RAOs for Eagle Rock Lake by removing sediment and reducing the volume of sediment entering the lake, thus eliminating exposure to benthic macroinvertebrates.

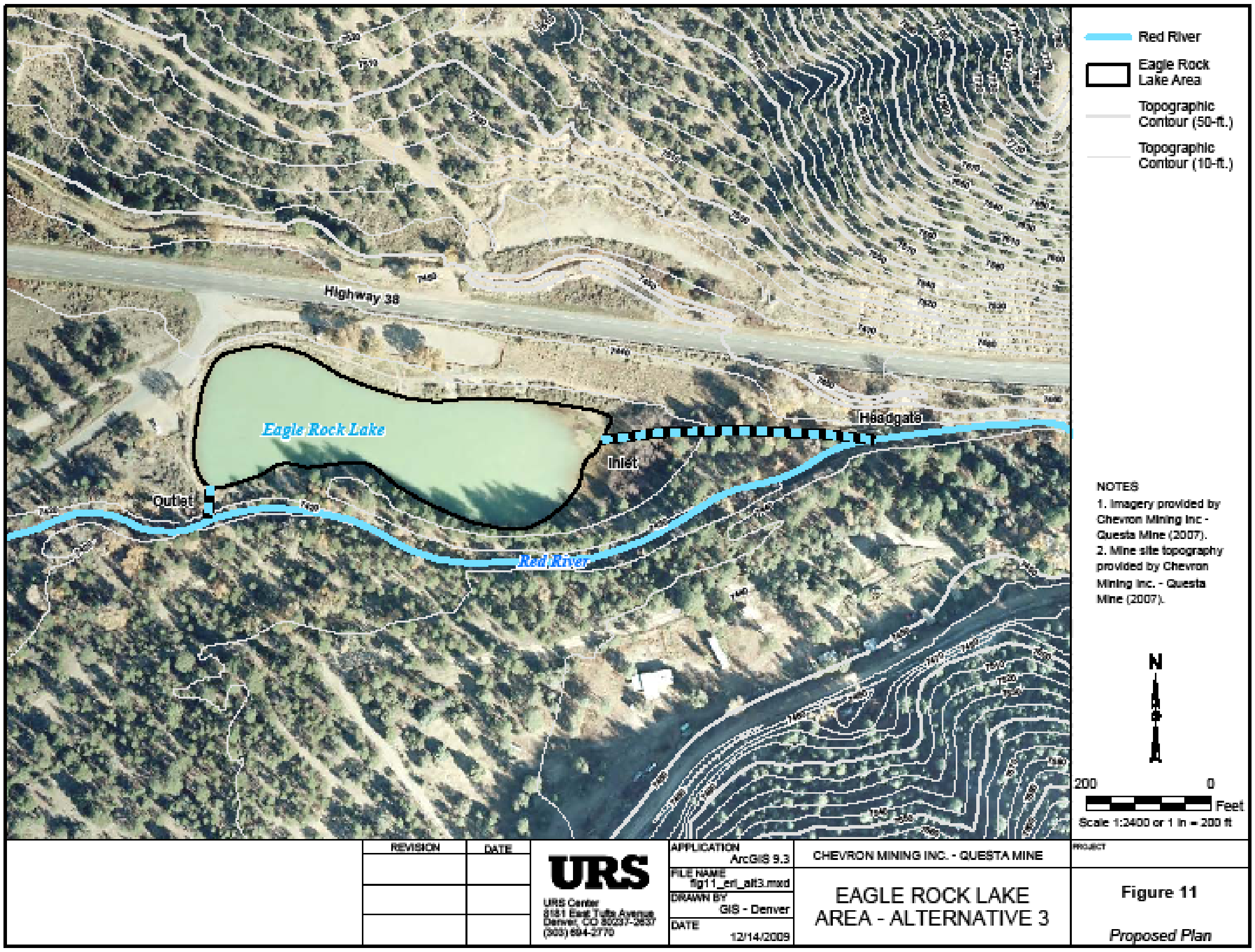
Subalternative 3B – Inlet Storm Water Controls; Dredge Sediments and On-Site Disposal (EPA's Preferred Alternative)

Capital Cost: $1,352,000
O&M Cost: $504,000
Present Value Cost: $1,538,000
Construction Timeframe: 2 years
Time to Achieve RAOs: 2 years

This alternative is the same as Subalternative 3A except for on-Site disposal of sediments. Approximately 15,000 yd^3 of dewatered sediments would be placed at an appropriate on-Site facility. Proposed cells to be constructed at the mine site for the water treatment plant filter cake/sludge could be used to contain these sediments. Each cell is estimated to contain approximately 7,500 yd^3. Therefore, two cells would be needed for the sediments.

Subalternative 3B would meet the RAOs for Eagle Rock Lake by removing sediment and reducing the volume of sediment entering the lake, thus eliminating exposure to benthic macroinvertebrates.

Figure 11 depicts Eagle Rock Lake.



Alternative 5 – Inlet Storm Water Controls; Backfill Lake and Construct New Lake

Capital Cost: $1,299,000
O&M Cost: $527,000
Present Value Cost: $1,495,000
Construction Timeframe: 1.5 years
Time to Achieve RAOs: 1.5 years

This alternative would include draining the lake, constructing a comparable sized lake near the existing lake, backfilling the existing lake with alluvial fill and revegetating. Constructing a new lake would mitigate the risk to macroinvertebrates by providing a more suitable substrate for a macroinvertebrate ecosystem. An estimated 37,000 yd^3 of soil would be excavated to create the new lake. An earthen dam would be constructed on the west side of the lake at a height of less than 10 feet. An inlet and outlet would be constructed, similar to the existing lake, with a headgate at the inlet. Storm-water controls would be added to the inlet of the new lake, similar to Alternatives 2 and 3, to minimize the sediment load entering the lake. The new lake would have a comparable maximum water depth of approximately 8 feet. It would be filled by diverting water from the Red River.

Alternative 5 would meet the RAOs for Eagle Rock Lake by eliminating direct exposure of contaminated sediment to the benthic macroinvertebrates.

EVALUATION OF ALTERNATIVES

The NCP, 40 CFR Part 300, requires EPA to evaluate remedial alternatives against nine criteria to determine which alternative is preferred. The first two criteria are referred to as the "Threshold Criteria." They are the overall protection of human health and the environment and compliance with ARARs. Response actions under CERCLA must satisfy the Threshold Criteria. The next five criteria are referred to as the "Balancing Criteria." They are (1) long-term effectiveness and permanence, (2) reduction of toxicity, mobility or volume through treatment, (3) short-term effectiveness, (4) implementability, and (5) cost. These criteria represent a balance of trade-offs with regards to each alternative. The EPA applies these seven criteria during the Detailed Analysis of Alternatives phase of the Feasibility Study (FS) to identify the relative advantages and disadvantages of each alternative for decision-making. The remaining two criteria (community and state acceptance) are referred to as "Modifying Criteria". They are applied after EPA presents the preferred alternative and its rationale for such preference to the state, and subsequently to the public in the Proposed Plan.

This section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, as well as a comparative analysis between the alternatives for each of the five areas that warrant response actions under CERCLA. A more detailed explanation of this evaluation and comparative analysis is presented in the Detailed Analysis of Alternatives contained in CMI's Final FS Report, Revision 3, dated November 16, 2009.

The nine evaluation criteria defined in the NCP are the following:

Threshold Criteria

Overall Protection of Human Health and the Environment
Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls and/or institutional controls.

Compliance with Applicable or Relevant and Appropriate Requirements
Section 121 (d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, limitations which are collectively referred to as

"ARARs," unless such ARARs are waived under CERCLA section 121(d)(4) and NCP §300.430(f)(1)(ii)(C).

Balancing Criteria

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved. Included with this evaluation is an estimated of the natural resources to be consumed and increased emissions to be produced for each alternative.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Cost

Cost includes estimated capital and annual operations and maintenance costs, as well as present value costs.

Modifying Criteria

State/Support Agency Acceptance

This criterion considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

Community Acceptance

Community acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance. This criterion will be fully considered after the public comment period.

Mill Area

1. Overall Protection of Human Health and the Environment

Alternative 1 (No Further Action) is not protective of human health because it does not address the source of contamination: hence the potential for direct contact/ingestion of PCB- and molybdenum-contaminated soil remains. Alternative 1 does provide LUCs, including access restrictions and recorded institutional controls (Conservation Easement, Restrictive Covenants) to prohibit future residential and commercial uses. Also, mine workers are afforded protection when they comply with worker health and safety and hazard communications program requirements during operation of the mine. Protection is provided under Alternative 2 (Limited Action) by limited excavation of soils containing PCBs greater than 50 mg/kg and gravel placement on soil with PCBs greater than 25 mg/kg. Subalternatives 5A, 5B, and 5C (Soil Removal – High Occupancy Scenario/No Cap) are the most protective of potential future residents because soil would be removed and treated. Subalternatives 4A and 4B (Soil Removal – High Occupancy Scenario/Cap) are also protective of potential future residents, but residual contamination would remain and require long-term management. Alternative 3 (Soil Removal – Low Occupancy Scenario) is protective of future commercial/industrial land uses, as soil with PCB concentrations above the TSCA low occupancy level of 25 mg/kg would be removed and disposed/treated off-Site. With the ICs recorded by CMI in 2009 and the approved PMLU under Mining Permit TA001RE of forestry/light industrial, it is reasonable to anticipate a low occupancy (commercial/industrial) future land use at this time.

Overall, Alternative 3 and Subalternatives 4A, 4B, 5A, 5B, and 5C are more protective of human health than Alternative 2. Alternative 1 is not protective.

2. Compliance with ARARs

The key chemical-specific ARARs are the TSCA regulations of 40 CFR §761, which address the management and cleanup of PCBs. These regulations specify a cleanup level for PCBs of 1 mg/kg for remediating waste in high occupancy areas (i.e., residential areas) without further conditions, 10 mg/kg for removal of waste with installation of a cap (for PCB levels >1 mg/kg and ≤ 10 mg/kg) in high occupancy areas, 25 mg/kg for removal of waste in low occupancy areas (e.g., commercial/industrial) without conditions, and 50 mg/kg for removal of waste when the site is secured by a fence and marked with appropriate signage.

Alternative 1 would not comply with the TSCA soil cleanup levels because no soil is removed. Alternatives 2 and 3 and Subalternatives 4A, 4B, 5A, 5B, and 5C would comply with all preliminary ARARs, including the TSCA requirements at 40 CFR § 761, Subpart D.

3. Long-Term Effectiveness and Permanence

Alternative 1 (No Further Action) is the least effective in the long-term because the PCB- and molybdenum-contaminated soil would remain in place. In Alternative 2 (Limited Action), soil containing PCBs greater than 50 mg/kg would be removed. However, molybdenum-contaminated soil and PCB-contaminated soil less than or equal to 50 mg/kg would remain. Alternative 3 and Subalternatives 5A, 5B, and 5C provide a permanent remedy through removal of contaminated soil. Alternative 3 and Subalternative 5A include off-Site treatment and/or disposal of soil. This is more effective in the long term than Subalternatives 5B and 5C, which include long-term management of contaminated soil on-Site (i.e., impoundment at the tailing facility or repository at the mine site). Off-Site facilities have established reliable controls for long-term management of soils. Subalternatives 4A and 4B also provide a long-term remedy through removal of some soil and capping residual contamination. However they would require maintenance of the soil and asphalt cap, with the asphalt cap requiring less maintenance. ICs are included in each alternative to restrict future human receptor exposure to contaminated soil. Although ICs are not a necessary component of Subalternative 5A to ensure protection of human health, the Conservation Easement and Restrictive Covenants recorded by CMI are already in place and, therefore, appropriately considered as part of the alternative.

Overall, Alternative 3 and Subalternative 5A are the most effective and permanent in the long term, followed by Subalternatives 5B and 5C, Subalternatives 4A and 4B, Alternative 2, and then Alternative 1.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

There would be no reduction of toxicity, mobility, or volume through treatment under Alterative 1 (No Further Action). Molybdenum and PCBs in soil would remain in place and untreated. Alternative 2 (Limited Action) includes limited excavation (PCBs > 50 mg/kg) with off-Site treatment/disposal, but other soils remain. Subalternatives 4A, 4B, 5A, and 5B provide reduction in toxicity, mobility, and volume through treatment of high concentrations (>50 mg/kg) of PCBs in soil (incineration) at an off-Site TSD facility. However, soils with PCB concentrations less than or equal to 50 mg/kg would not be treated prior to disposal. The highest reduction in toxicity, mobility, and volume through treatment would be provided by Subalternative 5C, where all soil with PCB concentrations greater than the residential cleanup level of 1 mg/kg would be treated on-Site by thermal desorption. The quantity of soil that would be removed in Alternative 3 and Subalternatives 4A and 4B are similar, but significantly less than the volume to be removed in Subalternatives 5A, 5B, and 5C. There is no reduction of toxicity, mobility, or volume by treatment of the molybdenum in soil for any of the alternatives.

Overall, Subalternative 5C would provide the greatest reduction in toxicity, mobility, and volume through treatment, followed by Subalternatives 5A, 5B. These would be followed by 3, 4A, and 4B, all of which are similar, then Alternative 2. Alternative 1 would not reduce the toxicity, mobility, or volume of the contamination through treatment.

5. Short-Term Effectiveness

Alternative 1 (No Further Action) provides no increased short-term risk or exposure because no construction-related actions would be implemented that create additional risks to workers or the community. Alternative 2 (Limited Action) would have minimal increased risk from limited excavation/hauling of approximately 200 yd^3 (bulked) PCB soil, and hauling/placement of approximately 2,400 yd^3 of gravel. Potential additional risk to workers and the community may occur during implementation of the targeted soil removal actions in Alternative 3 and Subalternatives 4A and 4B, and the large-scale soil removals in Alternatives 5A, 5B, and 5C. Risks to workers may occur during excavation around buildings with buried utilities. Risks associated with truck haulage and the import of cap material on local roads will increase the potential for traffic hazards in the community. Subalternatives 5A and 5B include increased truck traffic due to the increased volume of soil being handled. There would also be increased risks to workers during the operation of the thermal treatment system and management of byproducts in Subalternative 5C.

Overall, the alternatives from the most effective (least short-term impacts) to the least effective (greatest short-term impacts) for remedy implementation are as follows: Alternative 1, greater than Alternative 2, greater than Alternative 3, greater than Subalternatives 4A, then 4B, then Subalternative 5C, then Subalternatives 5A equal to 5B.

6. Implementability

Alternative 1 (No Further Action) does not include construction activities and would be the easiest to implement. Alternative 2 includes limited construction activities and would be the next easiest to implement. Alternative 3 and Subalternatives 4A, 4B, 5A, 5B and 5C include excavation, transport, and disposal of larger volumes of soil, which is common practice. Excavation and backfill of approximately 2,000 to 3,000 yd^3 of soil in Alternative 3 and Subalternatives 4A and 4B results in shorter construction periods and uses less construction equipment to complete than the 160,000 yd^3 of soil in Subalternatives 5A, 5B, and 5C. Subalternative 5A would include transport of the largest quantity of soil (160,000 yd^3) and the longest haul distances for disposal as three off-Site facilities would be needed (local solid waste landfill for molybdenum soil; RCRA Subtitle C treatment facility for >50 mg/kg PCB-soils; and RCRA Subtitle C non-treatment facility for ≤50 mg/kg PCB-soils). Subalternative 5B would include the second largest quantity of soil to be transported (113,000 yd^3) for treatment/disposal off-Site, followed by Alternative 3 and Subalternatives 4A and 4B with 2,000 to 3,000 yd^3. Subalternatives 5B and 5C would include transport of molybdenum soils (49,000 yd^3) a shorter distance to an on-Site location.

Subalternatives 4A and 4B include import of materials from off-Site locations (clay soil – 100 miles and asphalt – 30 miles). Preparation of the clay soil cap (compaction) to achieve TSCA requirements for Subalternative 4A would result in a longer construction period than asphalt paving in Subalternative 4B.

Subalternative 5C would include on-Site thermal treatment of soil. Thermal desorption contractors are limited and the technology requires multiple treatment trains (i.e., soil preprocessing, soil treatment, air treatment, and PCB recovery), resulting in the on-Site transport of complex equipment and use by specially trained operators. Collection and management of treatment byproducts (air emissions) would require additional sampling and monitoring. Thermal treatment of 113,000 yd^3 of PCB-contaminated soil would take 3-4 years to complete.

Overall, Alternative 1 would be the easiest to implement, followed by Alternative 2. Alternative 3 is the next easiest to implement and notably easier than Subalternatives 4A and 4B, which include clay soil/asphalt transport and placement for the cap. Subalternatives 5A, 5B, and 5C involve the greatest construction activities, including the excavation and backfill of large volumes of soil and transport of soil over large distances (Subalternatives 5A and 5B) or on-Site treatment and disposal of soil (Subalternative 5C).

7. Cost

Table 12 presents a summary of cost for the Mill Area alternatives. All of the alternatives (excluding No Further Action) involve various soil removal and on-Site/off-Site disposal options which significantly affect the cost. Alternatives with the larger volume of soil to remove/dispose tend to have the higher costs. Alternative 1 does not include construction activities and has the lowest cost. For Alternative 2, an additional cost of 2.1 million (present value or PV) would provide limited excavation of high concentration PCB soils and temporary gravel placement. An increase of $100,000 (PV) for Alternative 3 includes targeted soil removal for the commercial/industrial land use scenario. An increase of approximately $11 million (PV) over Alternative 3 would provide limited soil removal and cap installation (Subalternatives 4A and 4B), with the asphalt cap (4B) costing $2 million less than the clay soil cap (4A). An approximate $30 to $36 million (PV) increase in cost over Subalternatives 4A/4B would add removal of a significantly larger volume of soil (Subalternatives 5A, 5B, and 5C). On-Site treatment and disposal of PCB soils (5C) cost approximately the same as off-Site treatment and disposal (5B).

8. State/Support Agency Acceptance

The EPA has consulted with the State of New Mexico on the Preferred Alternative for the Mill Area and will seek its acceptance after the public comment period ends.

Table 12 – Alternatives Cost Summary for Mill Area

Alternative Description	Cost in Current Dollars ($)			Present Value Cost ($)
	Construction (Capital)	O&M	Total	
1 – No Further Action	0	802,000	802,000	327,000
2 – Limited Action (ICs; Targeted Removal; H&S, Hazard Communication)	2,078,000	923,000	3,001,000	2,451,000
3 – Soil Removal (PCBs >25 mg/kg); Off-Site Treatment/Disposal	2,176,000	923,000	3,099,000	2,549,000
4A – Soil Removal (PCBs >10 mg/kg); Off-Site Treatment/Disposal; Soil Cap	13,064,000	946,000	14,010,000	13,446,000
4B – Soil Removal (PCBs >10 mg/kg); Off-Site Treatment/ Disposal; Asphalt Cap	10,444,000	2,847,000	13,291,000	11,502,000
5A – Soil Removal (PCBs >1 mg/kg); Off-Site Treatment/Disposal	47,269,000	1,206,000	48,475,000	47,746,000
5B – Soil Removal (PCBs >1 mg/kg); Off-Site Treatment/Disposal (PCBs); On-Site Disposal (Molybdenum)	43,190,000	1,206,000	44,396,000	43,667,000
5C – Soil Removal (PCBs >1 mg/kg); On-Site Treatment/Disposal	43,337,000	1,206,000	44,543,000	43,814,000

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends.

Mine Site Area

1. Overall Protection of Human Health and the Environment

Alternative 1 (No Further Action) would not be protective of human health and the environment. Current health and safety programs and LUCs [restricted access and layered ICs would limit exposure to surface water and ground water and prohibit future residential and commercial uses. However, Alternative 1 would not result in ground water being remediated to a level protective of human health. Alternative 2 (Limited Action) is protective through the piping of seepage to the Capulin seepage catchments and pumpback pond and fencing of the area to protect recreational visitors/trespassers from exposure to seepage.

Subalternatives 3A (3H:1V Slope) and 3B (2H:1V Slope) provide additional protection of human health and the environment as compared to Alternative 2. They would provide source containment for the waste rock piles, thereby reducing contamination of ground water by ARD and, as a secondary pathway, to surface water of the Red River at zones of ground-water upwelling. Source containment would be provided through cover placement and revegetation, which performs as a store and release cover system to reduce net percolation into the waste rock and the production of ARD. Appropriate slope gradients provided by Subalternatives 3A and 3B establish the site conditions necessary for placement and retention of cover materials on the waste rock piles which will provide protection of human health and the environment through source containment. Ground water/seepage collection systems from Capulin Canyon and Goathill Gulch (including piping the water to the Mill Area for treatment), and ground-water extraction systems along the base of the Roadside Waste Rock Pile drainages further reduces concentrations of contaminants in ground water and surface water. The combination of source containment and active ground water remediation would protect human receptors that may use ground water drawn from wells as a drinking water supply, as well as aquatic life from exposure to COCs in Red River surface water.

Subalternatives 3A (3H:1V Slope) and 3B (2H:1V Slope) would also provide protection by mitigating instability concerns associated with the steeply graded waste rock piles through regrading to 3H:1V or 2H:1V interbench slopes. CMI has previously conducted interim reclamation of the Goathill North and Sugar Shack West Waste Rock Piles in 2005 and 2008 to address such concerns. It is noted that the partial/complete removal of waste rock would be necessary to achieve the 3H:1V and 2H:1V interbench slopes at some waste rock piles. The removal of waste rock in Subalternative 3A would expose areas of natural scars underlying the piles.

All alternatives and subalternatives are protective, excluding Alternative 1 (No further action).

2. Compliance with ARARs

The alternatives/subalternatives for the Mine Site Area would comply with preliminary chemical-specific, location-specific, and action-specific ARARs, with the possible exception of federal drinking water standards at 40 CFR Part §§141, Subparts B and G (MCLs and MCLGs) and Subpart F (MCLGs), and the New Mexico water quality standards at Water Supply Regulations 20.7.10.100 NMAC (MCLs and MCLGs), and WQCC 20.6.2.3103 NMAC (standards for ground water). These standards may not be met for certain contaminants in ground water at specific locations at the mine site.

Some of the chemical-specific ARARs are currently below preliminary Site-specific cleanup levels that are based on natural background levels (*see also* Table 2, above). It is EPA's policy to generally not clean up to concentrations below natural background levels under CERCLA[21]. It is also not required by New Mexico regulations to achieve the numeric criteria for a specific contaminant, if that contaminant is present in natural

[21] *See* Role of Background in the CERCLA Cleanup Program, USEPA, OSWER 9285.6-07P

background levels above the numeric criteria [20.6.2.4101(B) NMAC]. CMI proposed the natural background levels as Site-specific New Mexico ground-water standards to NMED on October 17, 2008. On May 8, 2009, EPA and NMED accepted the Site background levels as preliminary cleanup levels for the purpose of completing the FS. For the Red River alluvial aquifer, Site background levels were only accepted for the northern edge of the alluvial aquifer. The preliminary cleanup levels for the remaining portion of the Red River alluvial aquifer would be the numeric ground-water criteria set forth in 20.6.2.3103 NMAC.

Since the natural background levels in ground water exceed some existing federal and state standards, the standards would not be met by any of the alternatives. Ground-water modeling and other analyses were performed by CMI to evaluate whether the ground-water and seepage collection systems would meet the proposed Site-specific ground-water standards that are based on natural background levels. For Alternatives 1 (No Further Action) and 2 (Limited Action), the modeling results showed the existing collection systems would not achieve the proposed Site-specific standards. For Subalternatives 3A (3H:1V Slope) and 3B (2H:1V Slope), the results showed that the systems would achieve the standards in the alluvial aquifer, due to source control of the waste rock seepage in the mine site drainages by ground-water extraction and cover and/or removal of waste rock. The modeling effort did not demonstrate that Site-specific ground-water standards would be achieved in colluvium and bedrock for all constituents at all locations on the mine site, in particular under the footprint of the rock piles and adjacent areas of the drainages. However, Site-specific ground-water standards would be met in colluvium and bedrock within Capulin Canyon and Goathill Gulch drainages downgradient of new subsurface seepage interceptor trenches and in the Goathill and Slickline Gulch colluvial fan downgradient of the extraction wells. The modeling results are presented in Appendices E2 and E3 of the Final FS Report, Revision 3.

Although EPA has approved the Final FS Report, Revision 3, there is significant uncertainty with the modeling results performed by CMI and its consultants. Assumptions in the modeling effort included only a 60 percent reduction in net infiltration through the store and release cover system to be constructed on the waste rock piles under Subalternatives 3A (3H:1V Slope) and 3B (2H:1V Slope). The EPA accepted this assumption for FS purposes, but not as a potential performance criterion in design of the cover system. A higher quality cover design would be necessary to satisfy the RAO established by EPA for reducing ARD from the waste rock to a level that would not cause exceedances of ground-water standards. To achieve this RAO, a significantly larger reduction of net percolation through the cover system would be required. This improved reduction of net percolation is considered a feasible undertaking and EPA's expectation is that the water quality standards would be met in all ground waters at the mine site.

3. Long-Term Effectiveness and Permanence

Alternative 1 (No Further Action) and Alternative 2 (Limited Action) would not provide long-term protection and would be only partially effective. Recorded ICs provide legal restrictions on use of contaminated media for the long term. Surface infiltration into, and net percolation through the waste rock would continue. Contaminant concentrations in colluvial and bedrock ground water within the side drainages would therefore not decrease. The ground-water withdrawal well system along the Roadside Waste Rock Piles is somewhat effective at reducing contaminant concentrations in the alluvial aquifer. However, concentrations are not expected to reach preliminary cleanup levels. Some extraction wells and the underground mine dewatering may need to be operated in perpetuity to maintain the cleanup levels in the alluvial aquifer and the water level of the underground mine below the Red River. The Spring 13 and 39 collection systems are effective at reducing contaminant load to the Red River, but will also require long-term management. This alternative does not treat collected water when it is no longer needed for mining operations. Contaminated water from the ground-water collection systems would continue to be pumped to the mill, adjusted for pH, and used for transporting tailing slurry. The conveyance of this water to the tailing facility contributes to the contamination in ground water beneath the impoundments. Long-term effectiveness and permanence increases when water treatment is added to Alternative 2.

Subalternative 3A (3H:1V Slope) and Subalternative 3B (2H:1V Slope) would be effective and permanent. For Subalternative 3A, approximately 122 million yd^3 of the waste rock piles would be removed and transported to an on-Site repository for long-term management. This increases the collateral impact of the remediation through increased truck haulage and other direct and indirect environmental impacts. For Subalternative 3B, a balanced-cut-fill would be achieved within and between waste rock piles and approximately 35 million yd^3 of waste rock would be removed, lessening the collateral impacts from truck haulage. Subalternative 3A would achieve shallower slopes as compared to Subalternative 3B for increasing the rock pile and cover stability, and optimal vegetative growth as a necessary component of evapo-transpiration cover performance. However, Subalternative 3A would also result in the exposure of steep underlying natural grades (steeper than 1.9H:1V) and areas of hydrothermal scars. A permanent store and release/ET cover system would be constructed on regraded waste rock, consisting of a minimum of 3 feet of amended Spring Gulch Waste Rock Pile material and revegetation with grasses, shrubs, forbs and trees. The cover system provides a permanent barrier but requires long-term maintenance and monitoring and storm-water run-on/run-off controls.

The additional water extraction and collection in Subalternatives 3A and 3B would result in additional water treatment, production of treatment-related waste, and long-term management.

Overall, Subalternative 3A would provide the highest level of effectiveness and permanence in the long term, closely followed by Subalternative 3B. The shallower slopes with 3A would be more suitable for promoting successful revegetation and, hence, a more effective store and release/ET cover system, when compared to steeper slopes (3B). Following Subalternatives 3A and 3B would be Alternative 2, and then Alternative 1.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

The type of mining waste and mill waste (source material) that are addressed by the alternatives developed for the Site are high volume, low level threat waste (i.e., waste rock, tailing). The EPA expects to use engineering controls instead of treatment for this type of waste [40 CFR §300.430(a)(1)(iii)(B)]. Therefore, because waste rock is not treated in these alternatives, there is no reduction of toxicity, mobility, or volume of the mining-related source material at the Mine Site Area.

There is reduction of toxicity, mobility, or volume of contamination in surface water and ground water through treatment. Under Alternative 1 (No Further Action) and Alternative 2 (Limited Action), contaminated water collected from the underground mine and the ground-water extraction and seepage interception systems is used for transporting tailing to the tailing facility when the mill is operating. During non-milling periods the collected water is treated with lime for pH adjustment and then discharged to the tailing facility. Although this water is pH adjusted at the mill site, this process does not contribute to the reduction of toxicity, mobility, or volume of contaminants at the tailing facility. When water treatment is added to Alternative 2 and Subalternatives 3A and 3B, there would be further reduction of toxicity, mobility, and volume of contaminants in ground water through treatment.

Overall, Subalternatives 3A and 3B provide greater reduction in toxicity, mobility, and volume through treatment than Alternatives 1 and 2.

5. Short-Term Effectiveness

Alternative 1 (No Further Action) would provide no increase short-term risk because no construction-related actions are proposed that create additional risk to workers, the community, or the environment. Alternative 2 and Subalternatives 3A (3H:1V Slope) and 3B (2H:1V Slope) include actions that would increase potential risk to workers and the environment when water treatment is added because it would require construction of a water treatment plant and conveyance structures. Additional risks to workers and the environment beyond those already described would most likely occur during implementation of Subalternatives 3A and 3B. These activities would require extensive earthmoving activities over large areas and in steep terrain. Additionally, the estimated construction periods required for Subalternatives 3A (25 years) and 3B (28 years) result in greater risk. The movement of rock below the first bench of the Roadside Waste Rock Piles (Subalternatives 3A and 3B) includes greater risk and interruptions to vehicles on State Highway 38. Therefore, the road may need to be temporarily shut down either partially or completely for multiple hours/days throughout this period of time. This could create traffic delays in the town of Red River and other nearby recreational areas. The volume of waste rock requiring removal to an on-Site repository in Subalternative 3A could result in potentially three times as many accidents as Subalternative 3B. All identified short-term risks to workers would be mitigated through legally required worker health and safety training and protection measures.

Overall, the most effective alternative in the short term is Alternative 1, followed by Alternative 2, Subalternative 3B, and then Subalternative 3A.

6. Implementability

Alternative 1 (No Further Action) does not include construction activities and would be the easiest to implement. Alternative 1 also includes ICs (Conservation Easement, Restrictive Covenants) that are in place for the property. Enforcing ICs requires administrative coordination and effort over time. When water treatment is added to Alternative 2 (Limited Action), construction work would be required to build a water treatment plant, sludge repository, and conveyance structures. The water treatment technology is readily available and generally proven. Water treatment equipment can be obtained from multiple suppliers, but long lead times may be required to procure piping and liner material. Large quantities of chemicals would have to be transported and stored on-Site. Labor, materials, and equipment are available to implement Alternative 2.

The earthmoving alternatives are equally implementable, but pose challenges and potential difficulties due to their large scale. Approximately 119 million yd^3 and 33 million yd^3 of waste rock (from multiple waste rock piles) would be relocated with Subalternatives 3A and 3B, respectively. The partial/complete removal or balanced-cut-fill of the Roadside Waste Rock Piles in Subalternatives 3A and 3B would require additional equipment, longer durations, and increased potential construction hazards due to steep underlying slopes. Exposed steep, altered native materials, especially those containing scars, would be difficult to reclaim. Subalternative 3A results in significantly greater areas of scar exposure. Placement of waste rock in an on-Site repository (Subalternative 3A) would require a somewhat longer haul distance compared to regrade within the waste rock pile or balanced-cut-fill within and between other waste rock piles. Assuming that 71-yd^3 capacity haul trucks would be used to transport the waste rock and cover material, the timeframe to complete construction of Subalternatives 3A and 3B are 25 and 28 years, respectively.

Overall, Alternative 1 (No Further Action) does not require construction and would be the easiest to implement, followed by Alternative 2 (Limited Action). Subalternative 3B (2H:1V Slope) would be the next easiest to implement. Subalternative 3A (3H:1V Slope) would involve the largest scale construction activities, including almost complete removal of the Roadside Waste Rock Piles and partial removal of all the other waste rock piles, except Goathill South.

7. Cost

Table 13 presents a quantitative comparison of cost among alternatives for the Mine Site Area. Alternative 1 (No Further Action) would not include construction activities and has the lowest cost. In Alternative 2 (Limited Action), an increase of approximately $250,000 (PV) over Alternative 1 would include piping of seepage to, and fencing around, the Capulin seepage catchment and pumpback pond. For approximately an additional $302 million (PV) over Alternative 2, balanced-cut-fill, partial/complete removal and/or regrade to minimum 3H:1V interbench slopes, cover, and revegetation of waste rock piles would be achieved for Subalternative 3A. A decrease in cost of approximately $196 million (PV) below Subalternative 3A would include balanced-cut-fill, and/or regrade and cover of waste rock piles to minimum 2H:1V interbench slopes for Subalternative 3B, with a significant decrease in exposed scar and steep, potentially altered (contaminated) native material. Additional water collection, extraction and piping to the Mill Area from the toe of Capulin Waste Rock Pile and below the toe of Goathill North Waste Rock Pile, as well as new extraction wells in the Roadside Waste Rock Pile drainages, in lower Capulin Canyon, and lower Goathill Gulch/Slickline Gulch (Subalternatives 3A/3B) add a cost of approximately $600,000 (PV). With water treatment added to the alternatives, overall costs increase approximately $5 to $35 million (PV) depending on whether the year of implementation is Year 0 to Year 30.

Table 13 – Alternatives Cost Summary for Mine Site Area

<table>
<tr><th rowspan="2">Alternative Description</th><th colspan="3">Cost in Current Dollars ($)</th><th rowspan="2">Present Value Cost ($)</th></tr>
<tr><th>Construction (Capital)</th><th>O&M</th><th>Total</th></tr>
<tr><td>1 – No Further Action</td><td>0</td><td>20,198,000</td><td>20,198,000</td><td>8,265,000</td></tr>
<tr><td>2 – Limited Action (ICs; Water Management and Treatment)</td><td>150,000</td><td>20,445,000</td><td>20,595,000</td><td>8,524,000</td></tr>
<tr><td>3A – 3H:1V Balanced-Cut-Fill; Partial/Complete Removal, Regrade and Cover, Water Management; Ground-Water Extraction and Treatment</td><td>600,351,000</td><td>68,772,000</td><td>669,123,000</td><td>309,982,000</td></tr>
<tr><td>3A – 2H:1V Balanced-Cut-Fill, Regrade, and Cover; Water Management; Ground-Water Extraction and Treatment</td><td>231,448,000</td><td>71,720,000</td><td>303,168,000</td><td>114,421,000</td></tr>
<tr><td>Water Treatment for Subalternatives 3A/3B (Year of Construction; Period of Analysis)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Year 0; 30-Year POA</td><td rowspan="4">20,263,000</td><td rowspan="4">41,063,000</td><td rowspan="4">61,326,000</td><td>34,541,000</td></tr>
<tr><td>Year 10; 40-Year POA</td><td>17,559,000</td></tr>
<tr><td>Year 20; 50-Year POA</td><td>8,926,000</td></tr>
<tr><td>Year 30; 60-Year POA</td><td>4,538,000</td></tr>
</table>

8. State/Support Agency Acceptance

The EPA has consulted with the State of New Mexico on the Preferred Alternative for the Mine Site Area and will seek its acceptance after the public comment period ends. The State of New Mexico currently supports the timing of water treatment for the start of the remedial action (i.e., year 0 construction).

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends.

Tailing Facility Area

1. Overall Protection of Human Health and the Environment

All of the alternatives except No Further Action (Alternative 1) would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through engineering controls, layered ICs, and active ground water remediation and treatment. Alternative 1 does not include cover of the tailing impoundments and, therefore, would not prevent the continued migration of tailing seepage to ground water. Alternative 1 also does not reduce dietary exposure of wildlife to molybdenum contamination in tailing and plants that uptake molybdenum.

Recreational visitors and trespassers would be protected from dermal contact and incidental ingestion of tailing by fencing and restricted access to the property. Workers would be protected though health and safety programs and hazard communication. Recorded deed restrictions (Restrictive Covenants) and other layered ICs for restricting residential land use, controlling ground water use, and well drilling prohibitions to be imposed by the State Engineer would increase protection of human health. All of these protections for the tailing facility are conditioned upon post-closure land use being something other than wildlife habitat, such as for nonresidential, light industrial use (e.g., renewable solar energy production)[22]. The level of protection provided by the layered ICs would only be for CMI-owned property and not the surrounding private property.

Placement of a store and release/ET cover over the tailing impoundments after tailing deposition ceases protects wildlife and human receptors from direct contact/ingestion of tailing and reduces infiltration and migration of tailing seepage to ground water. Cover placement would also result in the natural dewatering of the tailing and decreased seepage over time, further protecting human health and the environment by ultimately eliminating tailing-seepage contamination to ground water.

In the near term, livestock and large herbivorous mammals such as mule deer and Rocky Mountain elk are protected from exposure to molybdenum-contaminated soil and vegetation through placement of interim soil covers and fencing which restricts access to the tailing facility.

Various components of the alternatives to mitigate ground-water contamination, including the tailing seepage interception systems, all protect human health. Piping of

[22] CMI has proposed a 5-year solar facility pilot demonstration for the northeastern portion of the tailing facility. The facility would evaluate concentrated photovoltaic (CPV) technology for a 1 megawatt solar facility.

unused irrigation water in the eastern diversion channel would potentially mitigate contamination to ground water southeast of Dam No. 1 that may be sourced from the historic buried tailing northeast of the Change House. Alternative 4 would include extraction of contaminated ground water from wells to be placed southeast of Dam No. 1.

Continued operation of seepage interception systems Alternatives 1 and 2, in combination with the existing extraction wells, facilitates seepage capture and ground-water remediation. However, these existing systems have been unsuccessful in capturing all the tailing seepage migrating from the tailing impoundments. The upgrade to seepage barriers 002 and 003 in Subalternatives 3A and 3B and Alternative 4 would increase the overall protection through additional seepage collection and improved ground-water remediation for the alluvial aquifer.

Extraction of ground water in the basal volcanic aquifer south of Dam No. 4 (Alternative 4) would increase protection of human health. The basal volcanic aquifer is currently being used by the NMDGF as a source of water for the state fish hatchery, including a limited number of residential dwellings for several permanent workers and their families. This ground water has potential for increased future use as a source of domestic/drinking water supply. However, because of the remoteness of the area and rugged terrain, any future increase in use is considered lower than other areas at the tailing facility which have greater potential for future use of the ground water (e.g., valley south and southeast of Dam No. 1).

These ground-water remedial components would take several years of operation to achieve cleanup levels. In the interim, other actions such as providing an alternate water supply to current users of the ground water or placement of point-of-use treatment systems (e.g., filter at the tap) may be necessary to protect human health. Regarding potable water at the Red River State Fish Hatchery, analytical results from tap samples recently collected by NMED show contaminant (molybdenum) levels to be at to slightly above EPA's preliminary cleanup level. Therefore, EPA and NMED plan to continue sampling over the next few months to confirm the results. If the molybdenum levels remain above the preliminary cleanup level, immediate actions would be taken to prevent exposure to the contaminated ground water. For the limited residential area south of the tailing facility with ground-water contamination, EPA is not aware of any use of the contaminated ground water for drinking or other domestic purposes, as most, if not all, of the homes are connected to the village of Questa municipal water supply. However, if there are current users of this contaminated ground water, similar actions being considered for the Red River State Fish Hatchery would be taken to protect human health.

Water treatment in Subalternative 3B and Alternative 4 protects human health and the environment through removal of contaminants from ground water.

All of the alternatives are protective, excluding the No Further Action alternative (Alternative 1).

2. Compliance with ARARs

The No Further Action alternative (Alternative 1) would comply with ARARs, except that federal standards of 40 CFR §§141, Subparts B and G (MCLs) and Subpart F (MCLGs), and state standards of the Water Quality Control Commission (WQCC) 20.6.2.3103 NMAC (standards for ground water) and NM Water Supply Regulations 20.7.10.100 NMAC (MCLs and MCLGs) would not be met for a limited number of constituents. Contaminants that currently exceed ARARs would continue to have the potential for exceedance because infiltration of precipitation and pumpback water would continue to leach contaminants from the tailing material to ground water.

All remaining alternatives and subalternatives would comply with the preliminary federal and state ARARs. A summary of the ARARs as they pertain to these alternatives are presented in Tables G-3, G-7 and G-10 of Appendix G, Final FS Report, Revision 3.

3. Long-Term Effectiveness and Permanence

The No Further Action alternative (Alternative 1) would not be effective in the long term. Fencing and restricted access limit human and livestock contact with tailing and the interim cover limits terrestrial wildlife contact with tailing; however, these actions are not permanent in the long term. Cover placement in Alternative 2, Subalternatives 3A and 3B, and Alternative 4 would provide a permanent and effective long-term remedy. Alternative 4 and Subalternatives 3A and 3B would be more effective than Alternative 2 at collecting seepage and seepage-impacted groundwater, thereby reducing the migration of COCs from tailing to ground water and surface water. Subalternative 3B and Alternative 4 would provide increased long-term effectiveness through treatment.

Overall, the alternative that would be the most effective and permanent in the long-term is Alternative 4, followed by Subalternative 3B, Subalternative 3A, Alternative 2, and then Alternative 1.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

As stated in the evaluation of alternatives for the Mine Site Area, above, EPA expects to use engineering controls instead of treatment for high volume, low-level threat mining waste [40 CFR §300.430(a)(1)(iii)(B)]. Therefore, because tailing is not treated in these alternatives, there is no reduction of toxicity, mobility, or volume of the tailing through treatment. There is a reduction of toxicity, mobility, and volume of contaminants in ground water through water treatment (Subalternative 3B and Alternative 4). The other alternatives have no reduction through treatment.

5. Short-Term Effectiveness

There would be potential risks to workers and the environment during placement of the cover for all the alternatives. The primary risk to workers is the safety risk inherent to large earthmoving activities. Minimal risks to the community would be expected, as the borrow source is located at the tailing facility. However, excavation and hauling alluvial soil for construction of the cover for the tailing impoundments will require large earthmoving activities over an extended period of time that may result in short-term impacts to the environment, including diesel emissions and dust. These potential impacts would be managed through an appropriate air monitoring program. An estimated 5.4 million yd^3 of cover soil would be required, assuming a 3-foot cover depth. The estimated duration for remedy implementation would be approximately 6 years.

Installation of piping in the diversion channel (all alternatives) and upgraded seepage barriers and ground-water extraction wells (Subalternatives 3A and 3B and Alternative 4) also include risks to workers associated with construction activities. Subalternative 3B and Alternative 4 likely include potential risks to workers, community, and the environment with the addition of water treatment, due to construction associated with modifying the existing water treatment plant and installation of conveyance structures. Since Alternative 4 includes larger treatment requirements, more risk may be associated with the additional construction.

Overall, the alternative most effective in the short-term would be Alternative 1, followed by Alternative 2, Subalternatives 3A and 3B, and then Alternative 4.

6. Implementability

The No Further Action alternative (Alternative 1) would not include construction activities and, therefore, would be the easiest to implement. All of the other alternatives are similar in the use of technologies and process options. The alternatives are implementable as the technologies are available and generally proven. The installation of piping in the eastern diversion channel is easily installed; however, piping may require long lead time for procurement. The placement of a cover on the 1,050 acres tailing facility after tailing disposal operations cease is technically implementable. The alluvial soil borrow source is located at the tailing facility and the quantity of material required for cover is available. Standard construction equipment is available from multiple contractors. The construction timeframe for cover place would be six years. Some components are already in place and operable, including seepage interception and pumpback systems, monitoring and dust control. Continued dust control measures require application of emulsion/tackifiers, soil cover, and straw mulch, but these activities are easily implementable. The Restrictive Covenants are in place for the property, but the well drilling restrictions would have to be established by the State Engineers Office.

Alternative 4 includes ground-water extraction from the basal bedrock (volcanic) aquifer south of Dam No. 4, which is highly transmissive and might require pumping several thousand gpm to hydraulically contain and collect contaminated ground water. Additionally, water treatment (Subalternative 3B and Alternative 4) requires modification to the existing IX plant and long-term operations and maintenance of the system. The modified facility may be required to accommodate additional RO treatment and an evaporator to handle reject, if needed. The water treatment equipment is supplied by multiple vendors. Resins are readily available from a limited number of suppliers.

Overall, Alternative 1 is easiest to implement, followed by Alternative 2, and then Subalternatives 3A and 3B. Alternative 4 involves the largest construction and operational effort.

7. Cost

A summary of costs for alternatives at the Tailing Facility Area is presented in Table 14. With the exception of the No Further Action alternative, costs associated with the remaining alternatives (when excluding water treatment) are similar, ranging from approximately $28 - $34 million (Construction) and $32 - $36 million (PV). Most of the construction costs are associated with grading and placement of the 3-foot soil cover over the 1050-acre tailing impoundment (approximately $20 million). Upgrades to the seepage interception systems for Subalternative 3A increases cost approximately $660,000 over Alternative 2. When including water treatment for Subalternative 3B and Alternative 4, costs vary significantly depending on the timing of water treatment. For Subalternative 3B, water treatment of the pumpback seepage (estimated at 400 gpm) increases the cost approximately $7 to $52 million (PV) over Subalternative 3A depending on whether the year of implementation is year zero or year 30. For Alternative 4, the installation of extractions wells and additional collection and treatment of ground water from south of Dam No. 4 and southeast of Dam No. 1 (4,500 gpm) increases the cost approximately $18 to $135 million (PV) over Subalternative 3B.

8. State/Support Agency Acceptance

The EPA has consulted with the State of New Mexico on the Preferred Alternative for the Tailing Facility Area and will seek its acceptance after the public comment period ends. The State of New Mexico currently supports the timing of water treatment for the start of the remedial action (i.e., year 0 construction). The State of New Mexico also believes that additional ground-water characterization on the west side of the tailing facility is necessary.

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends.

Table 14 – Alternatives Cost Summary for Tailing Facility Area

Alternative Description	Cost in Current Dollars ($)			Present Value Cost ($)
	Construction (Capital)	O&M	Total	
1 – No Further Action	0	30,151,000	30,151,000	12,425,000
2 – Limited Action (ICs; Source Containment; Continue Ground Water Withdrawal; Piping Water in Diversion Channel)	28,472,000	16,443,000	44,915,000	32,332,000
3A – Source Containment; Continue Ground-Water Withdrawal with Upgraded Seepage Collection, Piping Water in Diversion Channel	28,878,000	17,592,000	46,470,000	33,018,000
3B – Same as 3A with Water Treatment	29,043,000	18,547,000	47,590,000	33,758,000
3B – Water Treatment (Year of Construction; Period of Analysis)				
Year 0; 30-Year POA	22,076,000	73,027,000	95,103,000	51,989,000
Year 10; 40-Year POA				26,428,000
Year 20; 50-Year POA				13,435,000
Year 30; 60-Year POA				6,830,000
4 – Source Containment; Ground-Water Extraction and Treatment; Piping Water in Diversion Channel	30,442,000	20,876,000	51,318,000	35,939,000
4 – Water Treatment (Year of Construction; Period of Analysis)				
Year 0; 30-Year POA	54,533,000	197,162,000	251,695,000	135,051,000
Year 10; 40-Year POA				68,653,000
Year 20; 50-Year POA				34,899,000
Year 30; 60-Year POA				17,741,000

Red River, Riparian, and South of Tailing Facility Area

1. Overall Protection of Human Health and the Environment

All of the alternatives with the exception of the No Further Action alternative (Alternative 1) would be protective of the environment by eliminating, reducing, or controlling risks through capping or removal of molybdenum-contaminated soil, with either on-Site or off-Site disposal. The No Further Action would allow soil with concentrations of molybdenum above the preliminary cleanup level to remain in place south of the tailing facility and within riparian areas along the river. For the riparian areas, there would be minimal effect on wildlife as approximately 55 percent of the spill deposits have already been cleaned up, and most of the remaining deposits are small in overall size (over half are less than or equal to five yd^3). The capping alternative (Alternative 2) eliminates or reduces direct exposure of ecological receptors to contaminated soil, but the cap will require maintenance. Removal of contaminated soil and tailing spill deposits (Subalternatives 3A and 3B) removes the source and eliminates the direct exposure pathway.

Protection of human health was not evaluated because soil south of the tailing facility and tailing spill deposits do not pose a human health risk. Protection of human health from exposure to ground-water contamination would be dependent on alternatives developed for the Tailing Facility Area. The alternatives that reduce seepage or improve seepage collection would improve ground-water quality in the area south of the tailing facility.

The continued use of copper blocks in pastures south of the tailing facility would provide protection to livestock from molybdenum toxicity.

All of the alternatives and subalternatives are protective, excluding the No Further Action alternative (Alternative 1).

2. Compliance with ARARs

All of the alternatives would meet their respective preliminary ARARs. They are summarized in Tables G-4, G-7, and G-10 of Appendix G, Final FS Report, Revision 3. Compliance of preliminary ground-water ARARs south of the tailing facility would be addressed through alternatives at the Tailing Facility Area.

3. Long-Term Effectiveness and Permanence

The No Further Action alternative would not be effective in the long term and does not provide a permanent solution. Molybdenum concentrations above cleanup levels would remain in soil south of the tailing facility and tailing spill deposits along the Red River riparian zone. A soil cap (Alternative 2) provides a barrier to reduce direct exposure. However, the permanence of the cap would be impacted by soil erosion, run-off and physical activities that could compromise the cap integrity. Routine maintenance would be required for the long term. Erosion mats and/or armoring may increase effectiveness. The long-term effectiveness of the cap south of the tailing facility is also dependent on reductions in tailing seepage by alternatives for the Tailing Facility Area. Removal of the contaminated soil and tailing spill deposits (Subalternatives 3A and 3B) would be the most effective in the long-term and permanent. Disposal of the excavated material at an on-Site facility (3B) would require long-term maintenance and monitoring. Depending on where this material is placed, additional maintenance and monitoring may not be necessary because they would already be performed as part of other source containment alternatives.

Overall, Subalternative 3A would be the most effective and permanent in the long term, followed by Subalternative 3B, Alternative 2, and then Alternative 1.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

There is no reduction in toxicity, mobility, or volume through treatment for any of the alternatives.

5. Short-Term Effectiveness

The No Further Action alternative (Alternative 1) would provide no short-term risks because no construction-related actions are included. Potential short-term risks to workers and the community would occur during capping of contaminated soil and tailing spill deposits (Alternative 2). Additionally, short-term impacts to the riparian ecosystem would likely occur during placement of the cap and erosion controls (erosion mats and/or armoring) from the use of construction equipment. An estimated 17,200 yd^3 would be required for capping. The greatest risk to workers and the community would be expected during the soil removal alternatives (Subalternatives 3A and 3B) because additional earthmoving equipment activities (excavation, hauling, and backfilling). Approximately 29,500 yd^3 of contaminated soil would be excavated, with a similar volume of clean fill to be backfilled. Estimated timeframes for implementation are 1.75 years (Alternative 2) and 2.25 years (Subalternatives 3A and 3B). Impacts of removing material off-Site would include the potential for vehicle accidents and potential to spill material.

Overall, the alternative that is most effective in the short term (i.e., least amount of short term impacts) is Alternative 1, followed by Alternative 2, Subalternative 3B, and then 3A.

6. Implementability

All the alternatives are implementable. The No Action alternative does not include construction activities and is easiest to implement. The other alternatives involve the same level of construction activities and are equally implementable. Capping (Alternative 2) or removal (Subalternatives 3A and 3B) of contaminated soil south of the tailing facility area would require site preparation prior to construction because of the shallow water table and boggy nature of the area. Materials, labor, and equipment are locally available to implement the remedy. For Subalternative 3A, multiple off-Site disposal facilities exist and could accept the excavated soil. On-Site disposal at the tailing facility (Subalternative 3B) is feasible, but placement of soil must occur prior to cover placement at the tailing facility. If the soil is placed at the tailing facility, no additional long-term monitoring and maintenance would be required, as they would already be performed for the tailing facility. Administrative coordination with private landowners would be required to access the area south of the tailing facility, and with federal land-management agencies and landowners along the riparian area.

7. Cost

A summary of costs for alternatives at the Red River, Riparian, and South of Tailing Facility Area is presented in Table 15. The No Further Action alternative (Alternative 1) would not include construction activities and has the lowest cost. An increase in cost of approximately $2.2 million (PV) over Alternative 1 would include capping of soil south of the tailing facility area and tailing spill deposits along the Red River riparian corridor. An additional $1.3 to $3.8 million (PV) over Alternative 2 would provide excavation and disposal of the contaminated soil and tailing spill deposits (Subalternatives 3A and 3B). Off-Site disposal of excavated soil/tailing (3A) would cost approximately $2.5 million (PV) over on-Site disposal (3B).

8. State/Support Agency Acceptance

The EPA has consulted with the State of New Mexico on the Preferred Alternative for the Red River, Riparian, and South of Tailing Facility Area and will seek its acceptance after the public comment period ends.

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends.

Table 15 – Alternatives Cost Summary for Red River, Riparian, South of Tailing Facility Area

Alternative Description	Cost in Current Dollars ($)			Present Value Cost ($)
	Construction (Capital)	O&M	Total	
1 – No Further Action	0	177,000	177,000	65,000
2 – Cap Soil and Tailing Spill Deposits	2,080,000	558,000	2,638,000	2,281,000
3A – Removal of Soil and Tailing Spill Deposits and Off-Site Disposal	5,947,000	412,000	6,359,000	6,096,000
3B – Removal of Soil and Tailing Spill Deposits and On-Site Disposal	3,442,000	412,000	3,854,000	3,591,000

Eagle Rock Lake

1. Overall Protection of Human Health and the Environment

All of the alternatives except the No Action alternative (Alternative 1) would provide adequate protection of the environment after remedial actions are complete and the ecosystem recovers. In the short-term, remedial actions proposed in each of the alternatives (capping, dredging, and lake-backfilling) would result in a loss of the benthic macroinvertebrate ecosystem. The in-lake capping of sediment (Alternative 2) would improve the quality of the benthic zone by providing a barrier to the contaminated sediment and overlaying a suitable 1-foot sediment layer on the lake bottom. However, until a new benthic community is established, the existing community would be smothered. The dredging of contaminated sediment with on-Site or off-Site disposal (Subalternatives 3A and 3B) removes the source of contamination from the lake, but also destroys the existing macroinvertebrate ecosystem. A new macroinvertebrate community would establish itself on the new lake bottom over time. The backfilling of the existing lake (Alternative 5) also destroys the ecosystem, but in the long term the new lake would re-establish a new macroinvertebrate ecosystem. All of the alternatives (excluding No Action) would provide inlet storm-water controls to reduce the volume of contaminated sediment that would enter the lake during rain storms or other high flow events that may entrain sediment into the Red River.

Protection of human health would not be addressed by the alternatives because EPA's HHRA found that the Eagle Rock Lake does not pose a risk to human health.

2. Compliance with ARARs

All of the alternatives would comply with ARARs. The preliminary ARARs identified for these alternatives are summarized in Tables G-5, G-7, and G-12 of Appendix G, Final FS Report, Revision 3.

3. Long-Term Effectiveness and Permanence

Each of the alternatives is effective and permanent in the long-term except for Alternative 1 (No Action). Accumulation of sediment from drainages would continue under Alternative 1 and this would continue to affect the benthic ecosystem. The other alternatives provide a new substrate for the macroinvertebrate ecosystem and controls at the inlet (i.e., headgate) that would minimize sedimentation in the lake. The in-lake cap (Alternative 2) would require long-term maintenance. A headgate is an adequate and reliable control; however uncertainties exist with regard to maintenance of the headgate, which could impact the long-term effectiveness of the alternatives. Long-term management would be required for sediments disposed of on-Site in Subalternative 3B.

Overall, the alternatives that would be the most effective and permanent in the long term are Subalternatives 3A, 3B and Alternative 5, followed by Alternative 2, and then Alternative 1.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

There is no reduction of toxicity, mobility, or volume through treatment for any of the alternatives.

5. Short-Term Effectiveness

For the No Action alternative, there would be no short-term impacts or risks posed to workers, the community, or the environment as no remedial actions would be performed. There would be minimal risk to workers and the community for the in-lake capping, lake dredging, and backfilling/new lake alternatives, but risks to workers would be addressed through the use of personal protective equipment and health and safety programs during construction. There would be risks to the community from hauling sediments to a disposal facility, resulting in increased traffic and potential for local traffic hazards on local roads and highways. In-lake capping would require the excavation and hauling of approximately 4,800 yd^3 of material for the cap. Lake dredging (Subalternatives 3A and 3B) and lake-backfilling with construction of a new lake (Alternative 5) would result in the excavation of similar volumes of material (14,020 yd^3 – 14,500 yd^3) over construction periods between 1.5 and 2.25 years.

Capping or dredging the sediments or backfilling the lake would destroy the existing benthic macroinvertebrate ecosystem. A period of time would be required before a new macroinvertebrate ecosystem is re-established in the existing or new lake. The water quality would be degraded in the short-term during dredging of the lake. Recreational use (fishing) of the lake would be lost during dredging and for a period of time after dredging until clarity of the water improves, suspended sediment settles, and the lake is restocked with rainbow trout. Coordination with the state fish hatchery would be required to temporarily suspend stocking of the lake.

Overall, the alternative that would be the most effective in the short term (i.e., fewest short-term impacts) is Alternative 1, followed by Alternative 5, Alternative 2, and then Subalternatives 3A and 3B.

6. Implementability

Under the No Action alternative (Alternative 1), there would be no activities to implement. For the other alternatives, all the technologies are generally proven and implementable. Installation of storm-water controls at the inlet, including a new motorized headgate and construction of a stilling well to house water quality probes to activate the headgate would not pose any technically difficult. In-lake capping (Alternative 2), which would involve hauling alluvial soil from a local source to the lake and placing the material on the sediment, is not difficult to implement. Lake dredging (Subalternatives 3A and 3B) would involve more complicated construction for dredging activities and subsequent drying and disposal of dredged sediment. Dredging would require specialized equipment that would have to be transported to the site. Construction of a new lake (Alternative 5) would require a change in the point of diversion from the river and may require the addition of water rights. Off-Site disposal (Subalternative 3A) is more implementable because off-Site facilities are readily available, whereas on-Site disposal (Subalternative 3B) would require construction and management of a new on-Site disposal cell. Materials and labor to implement these alternatives are locally available.

Overall, the easiest alternative to implement is Alternative 2, followed by Subalternative 3A, then 3B, and Alternative 5. There are no activities to implement for Alternative 1.

7. Cost

A summary of costs for alternatives at Eagle Rock Lake is presented in Table 16. The No Action alternative (Alternative 1) has the lowest cost. In-lake capping and storm-water inlet controls (Alternative 2) increases cost by approximately $470,000 (PV). An increase of approximately $1 to $2 million (PV) over Alternative 2 includes dredging and disposal of the sediments (Subalternatives 3A and 3B), with off-Site disposal (3A) costing approximately $900,000 (PV) more than on-Site disposal (3B). For approximately $1 million (PV) over Alternative 2, the existing lake would be backfilled and a new lake constructed (Alternative 5). Constructing a new lake and backfilling the existing lake is similar in cost to lake dredging with on-Site or off-Site disposal (Subalternatives 3A and 3B).

8. State/Support Agency Acceptance

The EPA has consulted with the State of New Mexico on the Preferred Alternative for Eagle Rock Lake and will seek its acceptance after the public comment period ends.

Table 16 – Alternatives Cost Summary for Eagle Rock Lake

Alternative Description	Cost in Current Dollars ($)			Present Value Cost ($)
	Construction (Capital)	O&M	Total	
1 – No Action	0	149,000	149,000	54,000
2 – Inlet Storm-Water Controls; In-Lake Capping of Sediment	286,000	495,000	781,000	469,000
3A – Inlet Storm-Water Controls; Dredge Sediments and Off-Site Disposal	2,274,000	495,000	2,769,000	2,457,000
3B – Inlet Storm-Water Controls; Dredge Sediments and On-Site Disposal	1,352,000	504,000	1,856,000	1,538,000
5 – Inlet Storm-Water Controls; Backfill Lake and Construct New Lake	1,299,000	527,000	1,756,000	1,495,000

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends.

SUMMARY OF THE PREFERRED ALTERNATIVE

The Preferred Alternative focuses on engineering controls for source containment at the waste rock piles and tailing impoundments, as sources of the ARD and seepage that contaminates ground water, surface water, and sediment at the Site. The Preferred Alternative also focuses on active ground-water remediation (extraction, seepage interception) and treatment, as well as off-Site treatment and disposal of PCB-contaminated soil as principal threat waste.

The Preferred Alternative takes into account the current and reasonably anticipated future land uses, including the ICs (Conservation Easement and Restrictive Covenants) recorded by CMI in 2009 that restrict residential use and other media uses. The Preferred Alternative takes into account that ICs are used as a supplement to, but not as a substitute for active remediation. It also takes into account the potential beneficial uses for ground water resources, as well as the State of New Mexico's regulations for the abatement and protection of ground water as ARARs.

The Preferred Alternative is consistent with the requirements and conditions for reclamation and ground-water abatement set forth in the New Mexico Mining Permit (TA001RE) and Water Quality Discharge Permits DP-1055 and DP-933 to the extent practicable.

The Preferred Alternative is a combination of the following alternatives and subalternatives from each of the five areas being addressed by this proposed action:

Mill Area

- **Alternative 3** – Soil Removal (High Concentrations of PCBs > 25 mg/kg) and Off-Site Treatment and Disposal (Low Occupancy/Commercial/Industrial)

Mine Site Area

- **Subalternative 3A** – Source Containment (3H:1V: Balanced-Cut-Fill, Partial/Complete Removal, Regrade, and Cover for 3H:1V Slopes); Storm-Water, Surface-Water, and Ground-Water Management, Ground-Water Extraction and Treatment

- **Subalternative 3B** – Source Containment (2H:1V: Balanced-Cut-Fill, Regrade, and Cover for 2H:1V Slopes); Storm-Water, Surface-Water; and Ground-Water Management; Ground-Water Extraction and Treatment

- **Mine Site Water Treatment –** Year 0 Construction

Tailing Facility Area

- **Modified Subalternative 3B** – Source Containment; Continued Ground-Water Withdrawal Operations with Upgraded Seepage Collection, Piping of Water in Eastern Diversion Channel, Ground-Water Extraction Southeast of Dam No. 1 (MW-4 and MW-17 Area) and Treatment

- **Tailing Facility Water Treatment** – Year 0 Construction

Red River, Riparian, and South of Tailing Facility Area

- **Subalternative 3B** – Removal of Soil and Tailing Spill Deposits and On-Site Disposal

Eagle Rock Lake

- **Subalternative 3B** – Inlet Storm Water Controls; Dredge Sediments and On-Site Disposal

A summary of the total costs for the Preferred Alternative is presented in Table 17.

BASIS FOR EPA'S PREFERENCE

Mill Area

The Preferred Alternative is selected over the other soil removal alternatives because it is expected to allow the property to be used for the reasonably anticipated future land use, which is wildlife and/or commercial/industrial. The Preferred Alternative is also expected to achieve long-term risk reduction through removal and off-Site treatment/disposal of PCB contamination. Molybdenum in soil did not pose an unacceptable risk to a future commercial/industrial worker at the Mill Area.

With the approved PMLU of wildlife and water management under Mining Permit TA001RE-96-1 and the establishment of the Conservation Easement and Restrictive Covenants by CMI to restrict future residential uses, EPA considers it reasonable at this time to anticipate wildlife and commercial/industrial uses for the Mill Area. However, if the anticipated future land use should change to residential or another high-occupancy land use, then additional response actions at the Mill Area would be necessary for ensuring protectiveness.

Additionally, the 6-inch cover planned for the Mill Area would be suitable for a commercial/industrial land use. Permit TA001RE-96-1 currently requires 3 feet of cover for the forestry land use. The actual cover depth will be consistent with the permit

Table 17 – Cost Summary for Preferred Alternative

Preferred Alternative Description	Cost in Current Dollars ($)			Present Value Cost ($)
	Construction (Capital)	O&M	Total	
Mill Area – Alternative 3	2,176,000	923,000	3,099,000	2,549,000
Mine Site Area – Subalternatives 3A and 3B	600,351,000 to 231,448,000	68,772,000 to 71,720,000	669,123,000 to 303,168,000	309,982,000 to 114,421,000
Mine Site Area – Water Treatment (Year 0 Construction)	20,263,000	41,063,000	61,326,000	34,541,000
Tailing Facility Area – Modified Subalternative 3B[1]	29,649,000	18,547,000	48,196,000	33,758,000
Tailing Facility Area – Water Treatment (Year 0 Construction)	22,076,000	73,027,000	95,103,000	51,989,000
Red River, Riparian, South of Tailing Facility Area – Subalternative 3B	3,442,000	412,000	3,854,000	3,591,000
Eagle Rock Lake – Subalternative 3B	1,352,000	504,000	1,856,000	1,538,000
Total Cost	679,309,000 to 310,406,000	203,248,000 to 206,196,000	882,557,000 to 516,602,000	437,948,000 To 242,387,000

1. Cost Estimate includes $606,000 (construction cost) for ground-water extraction southeast of Dam No. 1 (from Alternative 4)

requirement and, therefore, may include cover thicknesses up to 3 feet for those areas utilized for forestry.

Mine Site Area

The Preferred Alternative includes the two source containment alternatives, Subalternative 3A and 3B, because they define the range of slope regrades for the waste rock piles that are considered protective. They are also consistent with the Mining Act and Water Quality Act permitting requirements and conditions for reclamation of the waste rock piles. The Preferred Alternative was selected over other alternatives because the others did not include source containment for the acid generating and potentially acid generating waste rock, a critical component for effectively and permanently mitigating ground water, as well as surface water contamination at the mine site.

Combining Subalternative 3A and 3B as the Preferred Alternative is intended to provide EPA with a “tool box” approach for remediating each waste rock pile. It provides EPA some flexibility in determining the appropriate slope regrade and volume of waste rock to be removed on a rock pile by rock pile basis. It is recognized that a 3H:1V interbench slope cannot be achieved for most of the waste rock piles due to steep underlying bedrock slopes. However, slopes of 2H:1V or shallower are achievable. During the remedial design, each waste rock pile will be analyzed independently based on characteristics such as underlying bedrock slope, appropriate gradient, and design for an effective store and release/ET cover (including successful revegetation on steep slopes), stability concerns, factor of safety and whether or not the waste rock pile is considered a critical structure[23]. The volume of waste rock to be removed to achieve minimum interbench slopes and the available capacity of on-Site waste rock repositories will also be included in engineering analysis.

For protectiveness at the Mine Site Area, it is expected that the range of minimum slopes specified in the Preferred Alternative (3H:1V to 2H:1V interbench slopes) will be achieved for the rock piles. However, it is also recognized that regrade to an interbench slope that is steeper than 2H:1V may be appropriate and acceptable from a practical standpoint, if it can be demonstrated to the satisfaction of EPA that such design will be protective of human health and the environment and achieve ARARs.

The Preferred Alternative also includes water treatment to be implemented at the start of construction (Year 0). The timing for water treatment was selected over the other timing options because treatment of seepage and seepage-impacted water to be collected by the interception and ground-water extraction systems at the mine site is needed now. The ongoing practice of allowing seepage from Capulin and Goathill North waste rock piles and storm-water discharge to percolate through the subsidence zone into the underground mine is not an approvable disposal method under the state discharge permits and results in further ground-water contamination. It is also contrary to specific preliminary ARARs identified for this CERCLA response action. This seepage shall be collected and piped to the Mill Area for treatment or use during milling operations. During non-milling times, all the seepage and seepage-impacted ground water collected by the remedial action at the mine site shall be treated. It shall not be indiscriminately discharged at the tailing facility and allowed to migrate through tailing, further contaminating ground water in that area.

Although considerable useful information was derived from the previously unsuccessful revegetation test plots conducted by CMI for the waste rock piles, key cover performance questions remain to be answered and should be resolved by closely targeted test plots. Therefore, the Preferred Alternative will include test plots for the store and release/ET

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[23] Critical structures are those that, because of their location, could result in damage to off-site properties, injury or loss of life, or unacceptable environmental consequences if there was failure. The Roadside Waste Rock Piles are considered critical structures by NMED and MMD.

cover system to demonstrate the anticipated improvement in vegetative productivity with organic amendment application, erosion resistance of amended cover materials, and that moisture holding properties will be sufficient to provide an effective cover system that protects ground water.

Tailing Facility Area

The Preferred Alternative is a modification of Subalternative 3B, as it combines part of Alternative 4 for ground-water extraction in the alluvial aquifer southeast of Dam No. 1. It will also treat all collected seepage and seepage-impacted ground water collected by the remedy, not just the portion which CMI would pump back to the Dam 5A area, as is the current practice (*see* discussion below). The addition of the ground-water extraction system southeast of Dam No. 1 is expected to remediate ground-water contamination that may have a source of eastern tailing impoundment rather than the historic buried tailing north of the Change House. Piping of unused irrigation water in the eastern diversion channel would not mitigate ground-water contamination originating from the impoundment or that currently exists above the preliminary cleanup levels southeast of Dam No. 1.

The Preferred Alternative is selected over other alternatives because it is expected to achieve substantial risk reduction through remediation of contaminated ground water in areas of current and reasonably anticipated future beneficial use. The Preferred Alternative is expected to significantly reduce risk from exposure to contaminated ground water within a reasonable time frame and at significantly less cost (for treatment) than Alternative 4, which would include ground-water remediation in the area south of Dam No. 4. The current limited beneficial use of ground water in the area south of Dam No. 4 and the likelihood of no future increase in such use led EPA to select Subalternative 3B over Alternative 4.

The Preferred Alternative will include provision of an alternate water supply to current users of the ground water or placement of point-of-use treatment systems (e.g., filter at the tap) for those areas of ground water contamination (i.e., Red River State Fish Hatchery, and specific areas south of Dam No. 1) until ground-water cleanup levels are attained. As stated above, EPA and NMED are continuing to sample tap water at the hatchery to confirm the recent analytical results (December 2009).

The Preferred Alternative will include water treatment to be implemented at the start of construction (Year 0). The timing for water treatment was selected over the other timing options to provide treatment for tailing seepage and seepage-impacted ground water to be collected by the remedy. In the Final FS Report, Revision 3, CMI proposes to treat only the collected water which is currently pumped back to the Dam No. 5A impoundment to meet the permitted discharge limit for manganese, while continuing to discharge an untreated portion of collected water to the Red River via NPDES-permitted Outfall 002. Since the preference for treatment to reduce the toxicity, mobility, or volume as a principal element is a statutory requirement of CERCLA, the Preferred Alternative will treat all of the contaminated water collected by the remedial action for the tailing facility prior to discharge to the Red River.

The Preferred Alternative will include performance monitoring downgradient (south and southeast) of Dam No. 1 and downgradient (south and west) of Dam No. 4 to assess the effectiveness of remedial actions on ground-water quality.

The Preferred Alternative will also include ground-water chemistry and other monitoring within the tailing piles to provide early detection of any potential acid generation and metal leaching. Pyrite and other sulfide-bearing minerals are known to be present in the tailing at levels sufficient to generate acid. At this time, the tailing appears to be sufficiently buffered with some carbonates and hydrated lime to preclude acid-generating conditions. However, over a longer time period, should these relatively soluble materials be leached by deep seepage processes or applied process waters then acid producing conditions may prevail. Although soil cover and vegetative canopy should minimize this risk, EPA believes it prudent to include such monitoring.

The Preferred Alternative will include additional ground-water characterization for the Tailing Facility Area. In light of the significant water loss known to be occurring at the tailing impoundments, with approximately seventy-six percent of all the water placed on the western portion of the tailing facility discharging to the basal bedrock (volcanic) aquifer[24], additional ground-water characterization will be performed for the volcanic aquifer beneath and west of the tailing facility. The NMED continues to investigate other seeps and springs west of the Guadalupe Mountains to determine if they are impacted by tailing seepage from the facility. Additionally, further ground-water characterization will be performed in the alluvial and bedrock aquifers downgradient (south) of Dam No. 1.

In November 2009, EPA, NMED and MMD approved a joint proposal by CMI and Chevron Technology Ventures (CTV) for a CPV solar facility and cover depth pilot demonstration at the northeastern corner of the tailing facility. The pilot demonstration will be for a period of five years and include an evaluation of 1-, 2- and 3-foot cover depths. Currently, the Preferred Alternative includes a 3-foot soil cover to be placed on top of the tailing impoundments. In a joint letter from EPA, NMED and MMD, dated November 13, 2009, the agencies agreed that if a 1-foot or 2-foot thick cover is demonstrated to be successful in the five-year pilot, the CERCLA remedy would be modified accordingly and NMED and MMD would support a request to modify permits DP-933 and TA001RE-96-1 as appropriate.

The “definition of success” accepted by EPA, NMED and MMD for the pilot is the following:

- Annual Net Percolation:

  Chevron shall provide a demonstration that the proposed cover depth will be protective of ground water. A successful demonstration will show that the cover

[24] CMI’s 2006 Water Balance Calculation, Final RI Report

system has the capacity to limit net percolation by storing precipitation within the cover system for a period long enough for water to be removed by evaporation and transpiration and that any net percolation will not cause an exceedance of ground water standards.

- Molybdenum Uptake in Vegetation:

  No significant difference, as determined by an analysis of variance (ANOVA) test with a p-value of 0.05, between molybdenum concentrations measured in above-ground foliage collected from three or more locations from the 1-, 2-, and 3-foot cover test plots. T-tests shall show no significant differences between 1 and 3 feet of cover and between 2 and 3 feet of cover to demonstrate the adequacy of the 1- and 2-foot covers.

- COPC Concentrations in Soil:

  No significant difference, as determined by an analysis of variance (ANOVA) test with a p-value of 0.05, in COPC concentrations in composite soil samples collected from three or more locations in the 1- and 2-foot cover test plots and composite samples collected from the 3-foot cover test plot. The composite samples shall be taken from 0 to 3 inches beneath the ground surface. T-tests shall show no significant differences between 1 and 3 feet of cover and between 2 and 3 feet of cover to demonstrate the adequacy of the 1- and 2-foot covers.

Red River, Riparian, and South of Tailing Facility Area

The Preferred Alternative for removing contaminated soil/tailing with on-Site disposal is selected over the other alternatives because it is expected to achieve long-term risk reduction through removal of the source and direct exposure pathway. It is also expected to reduce the risk within a reasonable timeframe and at less cost than the off-Site disposal alternative.

Eagle Rock Lake

The Preferred Alternative for dredging the lake and disposing of contaminated sediments on-Site is selected over the other alternatives because it is equally as effective and permanent at reducing long term risk, but slightly less costly than the off-Site disposal alternative. The Preferred Alternative is also supported by the USFS who currently manages the lake.

Statutory Requirements of CERCLA

Based on the information currently available, EPA, the lead agency, believes that the Preferred Alternative meets the threshold criteria [40 CFR §300.430(f)(1)(i)(A)] and provides the best balance of tradeoffs among the other alternatives with respect to the balancing criteria [40 CFR §300.430(f)(1)(i)(B)]. The EPA expects the Preferred

Alternative to satisfy the following statutory requirements of CERCLA Section 121(b), 42 U.S.C. §9621(b):

- Be protective of human health and the environment;
- Comply with ARARs;
- Be cost effective;
- Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable; and
- Satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element or provide an explanation in the ROD as to why it does not.

Because the Preferred Alternative will treat the source materials constituting principal threats, the remedy will meet the statutory preference for the selection of a remedy that involves treatment as a principal element.

The Preferred Alternative can change in response to public comment or new information.

APPENDIX A
WHAT IS RISK AND HOW IS IT CALCULATED

A Superfund human health risk assessment estimates the “baseline risk.” This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. To estimate the baseline risk at a Superfund site, EPA undertakes a four-step process:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, EPA looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help EPA to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, EPA considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, EPA calculates a “reasonable maximum exposure” (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur.

In Step 3, EPA uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. EPA considers two types of risk: cancer risk and non-cancer risk. The likelihood of any kind of cancer resulting from a Superfund site is generally expressed as an upper bound probability; for example, a “1 in 10,000 chance.” In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, EPA calculates a “hazard index.” The key concept here is that a “threshold level” (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted.

In Step 4, EPA determines whether site risks are great enough to cause health problems for people at or near the Superfund site. The results of the three previous steps are combined, evaluated and summarized. EPA adds up the potential risks from the individual contaminants and exposure pathways and calculates a total site risk.

GLOSSARY

Acid Rock Drainage (ARD): The result of a reaction between rocks containing sulfide minerals (such as pyrite), air and water. The reaction forms sulfuric acid, which dissolves metals from the rock into the water.

Administrative Record: The collection of information about a Superfund site used by EPA to select a preferred cleanup alternative.

Alluvium: Silt, sand, clay and gravel deposited by rivers.

Applicable or Relevant and Appropriate Requirement (ARAR): Federal and state environmental laws and regulations that must be met after cleanup or in the process of cleanup at a Superfund site.

Aquifer: A layer of porous soil or rock that contains water and transmits it from one point to another in quantities sufficient to permit economic development.

Colluvium: Soil and rock debris that accumulates at the base of a cliff or steep slope by mass wasting or erosion. Colluvium forms humps or fan-shaped deposits at the base of mountains.

Contaminant of Potential Concern (COPC): Those chemicals that are identified as a potential threat to human health or the environment and are evaluated further in the baseline risk assessment.

Contaminant of Concern (COC): A subset of the COPCs that are identified in the RI/FS as needing to be addressed by the response action selected in the Record of Decision. At the Molycorp Inc. Site, this means inorganic chemicals (primarily metals such as molybdenum), and polychlorinated bi-phenyls (PCBs).

Debris Fan: Fan shaped deposits of debris which form as a result of rain water washing debris down steep slopes along canyon rivers or streams.

Ecological Risk Assessment (ERA): A study that estimates the possible effects of contamination on plants and animals if no cleanup is done at a Superfund site.

Engineering Controls: Ways to prevent contact with contamination that involve construction, such as a soil cover or a water treatment plant.

Feasibility Study (FS): The detailed study at a Superfund site that develops and evaluates cleanup alternatives.

Ground Water: Underground water that fills pores in soils or openings in rocks to the point of saturation. Ground water is often used for drinking water via municipal or private wells.

Human Health Risk Assessment (HHRA): A study that estimates the likelihood of health problems occurring if no cleanup is done at a Superfund site.

Institutional Controls: Ways to reduce risks from contamination at a Superfund site using legal processes. Institutional controls can include zoning, deed notices, leases and other mechanisms.

Monitoring: Testing of soil, sediment, air, water, plants, or animals to detect changing conditions at a site.

Present Value: An evaluation of expenditures that occur over different time periods. By discounting all costs to a common base year, the costs for different remedial alternatives can be compared on the basis of a single figure for each alternative. When calculating present value cost for a Superfund site, total operations and maintenance costs are to be included.

Proposed Plan: A summary of site cleanup alternatives and other key information, including EPA's preferred alternative, presented to the public for comment.

Record of Decision: The document that describes EPA's cleanup plan for a site, explains EPA's decision, and provides a response to public comments on the proposed plan.

Remedial Investigation (RI): An in-depth study to determine the nature and extent of contamination and any threat to public health, welfare or the environment caused by the release or threatened release of hazardous substances, pollutants, or contaminants at or from the site.

Revegetate: To plant grasses, shrubs, or trees in an area, often to prevent wind and water erosion or for use as part of the store and release/evapo-transpiration (ET) cover systems, where the vegetation takes up the moisture in the cover.

Riparian Area: Green, vegetated areas on each side of streams and rivers.

Toxic metals: Metallic elements and compounds that can affect the health of living things. Examples are arsenic, molybdenum, aluminum, manganese, and zinc. Some are necessary in small amounts but become unhealthy at higher levels. Some accumulate in the body, foods, or in plants.

Transpiration: Process by which moisture is carried through plants from roots and evaporates into the atmosphere.

LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ARD	Acid rock drainage
AST	Aboveground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
BERA	Baseline Ecological Risk Assessment
BLM	Bureau of Land Management of the U.S. Department of the Interior
BMP	Best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended
CFR	Code of the Federal Register
CMI	Chevron Mining, Inc.
CNS	Central nervous system
COC	Contaminant of concern
COPC	Contaminant of potential concern
^{o}F	Degrees Fahrenheit
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
ESI	Expanded Site Investigation
ET	Evapo-transpiration
F	Fahrenheit
FS	Feasibility Study
GI	Gastro-intestinal
GIS	Geographic information system
Gpm	Gallons per minute
HDPE	High-density polyethylene
HDS	High density sludge
HHRA	Human health risk assessment
HI	Hazard index
HQ	Hazard quotient
IC	Institutional Control
IX	Ion Exchange
IRIS	Integrated Risk Information System
LUC	Land use control
MCL	Maximum concentration level
mg/kg	Milligrams per kilogram
MMD	Mining and Minerals Division of the New Mexico Department of Energy, Minerals, and Natural Resources
mg/L	Milligrams per liter
MSHA	Mine Safety Health Administration
MW	Monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	Not detected

NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMDGF	New Mexico Department of Game and Fish
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
ONRL	New Mexico Office of Natural Resource Trustees
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
pH	Measure of the acidity or basicity of a solution
PMLU	Post-mining land use
$PM_{2.5}$	Particulate matter greater than 2.5 microns in size
PM_{10}	Particulate matter greater than 10 microns in size
PRG	Preliminary Remediation Goal
RAO	Remedial action objective
RCRC	Rio Colorado Reclamation Committee
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RfD	Reference dose
RME	Reasonable maximum exposure
RO	Reverse Osmosis
ROD	Record of Decision
R3G	Red River Reclamation Group
SLERA	Screening level ecological risk assessment
SMCL	Secondary maximum concentration level
SPLC	Synthetic Precipitate Leaching Protocol
TMDL	Total maximum daily load
TRV	Toxicity reference value
TSCA	Toxic Substances Control Act
TSD	Treatment, storage, and disposal facility
UNOCAL	Union Oil Company of California
USFS	U.S. Forest Service of the U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service of the U.S. Department of Agriculture
USGS	U.S. Geological Survey of the U.S. Department of Agriculture
UST	Underground storage tank
VOC	Volatile organic chemical
Yds^3	Cubic yards

ATTACHMENT 1
COMMENT SHEET

Your comments on the Proposed Plan for the Molycorp Site are important to the EPA and will help us select a cleanup remedy for the Site. You may use the space below to write your comments and then mail the form to:

June Hoey (Community Involvement Coordinator)
U.S. Environmental Protection Agency, Superfund Division (6SF-VO)
1445 Ross Avenue, Suite 1200, Dallas, TX 75202-2733

Use additional sheets if necessary. Your comments must be postmarked on or before January 30, 2010, the end of the 30-day public comment period. You may also provide oral or written comments during the scheduled public meeting (see Highlight 1 of this Proposed Plan). If you have any questions about the comment period or the Site, please contact June Hoey at (214) 665-8522 or through the EPA's toll-free number at 1-800-533-3508. Those with computer communications capabilities may submit their comments to the EPA via the Internet at the following e-mail address: hoey.phyllis@epa.gov. The EPA will respond to all significant comments in a Responsiveness Summary that is included with the Record of Decision for the Site.