Climax Molybdenum
A Freeport-McMoRan Company

CLIMAX MINE
RECLAMATION PERMIT M-1977-493

TECHNICAL REVISION TR-24
ENVIRONMENTAL PROTECTION PLAN

CLIMAX MOLYBDENUM COMPANY

Submitted to the
Colorado Division of
Reclamation Mining and Safety

Version: R3
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Climax Molybdenum Company
Permit M-1977-493
Environmental Protection Plan

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T-1 Introduction

T-1.1 Purpose and Objectives

In April 1994, the Colorado Mined Land Reclamation Board (Board) approved and promulgated amendments to the Mineral Rules and Regulations for Hard Rock, Metal, and Designated Mining Operations (Rules) under the Colorado Mined Land Reclamation Act (Act). The most important of these changes was the classification and definition of a "Designated Mining Operation" and the addition of Section 6.4.20 Exhibit T - Designated Mining Operation Environmental Protection Plan in Rule 6 (the current amended version of the Rules, effective September 30, 2010, now address Environmental Protection Plan requirements in Section 6.4.21 – Exhibit U).

A "Designated Mining Operation" (DMO) is defined as a mining operation where:

- designated chemicals used in metallurgical processing are present on-site; or
- toxic or acid-forming materials will be exposed or disturbed as a result of mining operations; or
- acid mine drainage occurs or has the potential to occur due to mining or reclamation activities.

The Colorado Division of Reclamation, Mining and Safety (DRMS – formerly “Division of Minerals and Geology” or DMG), the agency that administers the Mineral Rules and Regulations, formally notified the Climax Mine that it was a DMO on August 3, 1994 (letter to Mr. Frank Zancanella). The Climax Mine concurred with the designation on August 31, 1994 (letter to Mr. Bruce Humphries, DRMS).

Briefly, the purpose of the Environmental Protection Plan (EPP) is to define how the DMO operator will protect those areas that potentially could be affected or impacted by "designated chemicals, toxic or acid-forming materials or acid mine drainage." "Designated Chemicals" are defined in Rule 1, Section 1.1 (13) as "toxic or acidic chemicals used within the permit area in extractive metallurgical processing, the use of which, at certain concentrations, represents a potential threat to human health, property or the environment." DRMS has jurisdiction over the designated chemicals used in mineral production processes.

Climax Molybdenum Company - Climax Mine (Climax) originally submitted the Climax Mine EPP as Technical Revision (TR) 7 to its existing Regular 112(d) Mining and Reclamation Permit (Number M-1977-493; “Permit”) on August 11, 1995. The EPP was updated in December 2011 as TR-18 to reflect the restart of mining and milling operations at Climax. The objective of this EPP update, submitted as TR-24, is to reflect current conditions of a fully operational mining and milling facility.

For purposes of the record, the Climax Mine is wholly owned and operated by the Climax Molybdenum Company (CMC), a wholly owned subsidiary of Freeport-McMoRan Inc. with headquarters in Phoenix, Arizona.

T-1.1.1 Reference and Indexing

Since the Climax Mine was continuously considered by DRMS to be an active operation with an approved life-of-mine Permit, much of the information and data required for the EPP has been developed previously. The most recent version of the EPP (R2) was submitted and approved by DRMS in December 2011 as Technical Revision 18 (TR-18) to the Climax Reclamation Permit. EPP R2 was designed to supersede all previous EPP amendments and revisions. The EPP R2 was approved prior to Climax resuming full-scale mining and milling operations in 2012. This EPP version (R3) reflects current mining and milling conditions and is intended as an update to EPP R2. Where applicable, EPP R2 Appendices that have not changed are incorporated into this version with their original EPP R2 footer. Also, as stated in EPP R2, previously submitted information regarding design details or construction certification of EPFs are not included in this EPP, and may not be specifically referenced but remain part of the public record and official Permit files.

T-1.1.2 Changes in Referenced Information and Documents

Changes in the reclamation plan can trigger the need for submittal of a formal Amendment, Technical Revision, or Modification depending upon the type of change as defined in the Rules. Because the EPP references numerous public record documents and information on file with the DRMS and other state regulatory agencies, notification relative to changes, particularly minor ones, can rapidly become unwieldy for both Climax and the DRMS. Therefore, Climax proposes to handle minor changes in referenced documents and information by establishing a central file for the reclamation plan and associated EPP information and documents at the Climax Mine environmental office. Climax will conduct periodic reviews of the EPP to identify where changes have occurred and where changes may occur during subsequent years. Significant changes to EPP R2 are reflected in this EPP version R3 and submitted to DRMS as TR-24.

T-1.1.3 Emergency Response Plan for Designated Chemicals

An Emergency Response Plan for designated chemicals is required as a component of the EPP to comply with Sections 34-32-103 (4.9) and 34-32-116.5(5), C.R.S 1984 and Section 8.3 of the Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for Hard Rock, Metal and Designated Mining Operations (Rules). An Emergency Response Plan for Designated Chemicals at Climax is included as Appendix T-A. Climax also maintains a required Spill Prevention Control and Countermeasures (SPCC) Plan and a Materials Containment Plan (MCP). These documents describe procedures to prevent, control, and mitigate releases of chemicals to the environment and provide supplemental information pertaining to emergency response for designated chemicals. Copies of the SPCC/MCP are kept at the Climax Mine environmental office.

T-1.2 Description of Site

The Climax Mine is an open pit and former underground mining operation that extracts, crushes, and processes molybdenite ore from the base of Bartlett Mountain and produces concentrate at the adjacent mill site. The final product is molybdenum disulfide (MoS_2) concentrate that is transported off site for final processing.

The Climax Mine, mill, and ancillary facilities are located near the summit of Fremont Pass (elevation 11,318 feet) where Colorado State Highway 91 crosses the Continental Divide. The mine is located approximately 12 miles south of I-70 at Copper Mountain, Colorado and 13 miles north of Leadville, Colorado. The site is located within the headwaters of three drainages on both sides of the Continental Divide and encompasses the upper reaches of the Arkansas River, East Fork of the Eagle River, and Tenmile Creek. Acreage affected by mine and mill operations lie within a contiguous 14,300 acre land block owned by the Climax Molybdenum Company. Site maps and maps of affected acreages are located in Exhibit C of Permit Amendment Application AM-06. The Climax boundary and affected areas also are included on Figure AM-06-T-01.

The Climax Mine began underground operations in 1917 and operated intermittently until the 1920s when continuous mining and milling commenced. When Climax was originally permitted under the Colorado Mined Land Reclamation Act in 1977, production from the mine was approximately 50,000 tons per day from both underground and open pit operations. The estimated mine life at that time anticipated exhaustion of ore reserves in the year 2015. However, when the world market for molybdenum declined dramatically in the early to mid-1980s, economics forced Climax to curtail mineral production and development substantially.

In 1989, the reclamation permit was amended (AM-03) to better reflect the realities of long-term limited production at that time. This amendment addressed the role of Climax as a “swing producer" with limited and declining underground production and the ability to produce from the open pit in the future. Amendment AM-05 (July 2005) briefly discussed business plans for the Climax Molybdenum Company, recognized that the concept of “swing-producer” had become obsolete, and confirmed the active status of the operation. In 2007, Climax Molybdenum Company announced its intent to return Climax to production in 2010. Production would come from the open pit and processing would occur in a new, modern mill facility located adjacent to the pit. Old and obsolete infrastructure would be removed from

the site. Demolition of unneeded site structures began in 2006 and continued through 2008.

Climax initiated construction of new processing facilities in April 2008. In 2008, due to economic considerations, Climax temporarily slowed these construction activities associated with the restart of mineral extraction and production at the Climax Mine. Climax restarted production of MoS_2 concentrate in May 2012.

Since the 1989 amendment, and continuing to date, a significant number of closure and reclamation activities have occurred at the site. Portions of the Mayflower Tailing Storage Facility (TSF) and 5 Dam were capped and vegetated. Except for 5-Shaft, the underground support facilities in the Storke Yard have been dismantled and the Storke Yard area has been reclaimed. The Oxide Pond (TSF) area (Eagle Park Reservoir; aka: 4 Dam Reservoir) has been reclaimed as a fresh water storage reservoir and sold to outside interests. 1 Dam has been resloped and capped, and seeded in some areas. The Robinson TSF has been capped with a rock cover and most of the surface reclaimed using biosolids. The 2 Dam Spillway and a portion of the East Side Channel (ESC) have been constructed and are operational. Portions of the E and F Dumps have been recontoured and seeded. The E and F Dumps are located within the footprint of the overburden storage facility (OSF) now termed the North 40 OSF (TR-22). The water treatment system has been upgraded with the installation of an on-line lime slaking facility and Sludge Densification Plant (SDP), and with construction of the Property Discharge Water Treatment Plant (PDWTP). A high capacity pump station was installed at the base of 3 Dam as part of the water treatment system upgrades. Numerous historical mine sites have been remediated and reclaimed. Finally, as previously mentioned, numerous unneeded buildings and structures in the mine and mill area have been dismantled and demolished.

Infrastructure upgrades and system improvement projects previously approved under TR-14 and TR-17 include the rehabilitation of Tenmile Tunnel, a new Tailing Delivery Line (TDL), the Robinson Lake Pump Station and Pipeline and the new mill building. TR-19 consisted of the Property Discharge Water Treatment Plant (PDWTP) that is part of the Climax water treatment system for stage 2 metals removal that began operating in July 2014, and TR-21 describes the Mayflower Flood Bypass Tunnel (for emergency water release) and Reclaim Water System (including a new barge and pipeline system).

Major components and facilities at Climax include the open pit and underground mine, overburden storage facilities, or OSFs (McNulty and North 40) that were approved under TR-22, crusher and mill complex, the process water reservoir (Robinson Lake; aka: Robinson Reservoir) and its circuit, fresh water reservoirs (Chalk Mountain Reservoir and Buffehrs Lake) and their circuits, the SDP (providing stage 1 metals removal) and PDWTP (providing stage 2 metals removal), the Robinson TSF (undergoing final reclamation), Tenmile TSF (approved under TR-20, the Mayflower TSF (approved under TR-23) that began operating in August 2014, and the clear water Interceptor System. Since the Climax Mine dates to 1917, some of these components or their predecessors are historic, pre-dating the Colorado Mined Land Reclamation Act by decades.

Ancillary fresh water facilities not owned by CMC, including Clinton Reservoir and Eagle Park Reservoir, are important site features and although not managed by Climax do interact with Climax's water management system. The East Interceptor in the Tenmile Creek Watershed feeds fresh water into Clinton Reservoir and the reservoir provides flood control to protect the Mayflower TSF. The Chalk Mountain Interceptor in the Eagle River Watershed feeds fresh water into Eagle Park Reservoir and Climax operates a seepage collection and return system from the toe of 4 Dam, the dam containing Eagle Park Reservoir.

Detailed locations, descriptions, and map references of specific environmental protection facilities are in Section T-5 and in the attached appendices as referenced throughout. Figures AM-06-T-01 and AM-06-T-02 illustrate the locations of major components and facilities. Detailed physical and environmental descriptions of the site also are in various permitting documents submitted to DRMS including the 1977 Climax Mining and Reclamation Permit, Reclamation Permit Amendments, and Technical Revisions.

T-2 Other Agency Environmental Protection Measures

T-2.1 General Information

The Climax Mine is regulated at various levels by the DRMS, the Colorado Air Pollution Control Division (APCD), and the Colorado Water Quality Control Division (WQCD). The latter two divisions are within the Colorado Department of Public Health and Environment (CDPHE). The WQCD administers Climax's Colorado Pollutant Discharge System (CPDS) permit and a storm water permit. As part of the storm water permit, Climax maintains a Storm Water Management Plan (SWMP). The SWMP addresses the handling of water that is outside of the water treatment system at Climax.

Other state and federal agencies that regulate or oversee activities at the Climax Mine include the Colorado State Engineer (dam safety and water rights), Colorado Hazardous Materials and Waste Management Division (within CDPHE), Mine Safety and Health Administration (MSHA), U.S. Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers (ACOE). Since lands within the DRMS permit areas are privately owned, there is no federal land management agency regulation of the site. The singular exception to this private land ownership is the Humbug extension of Supply Canal No. 1, which is located on U.S. Forest Service (USFS) land and permitted with a Special Use Permit from the USFS. The USFS administers lands surrounding Climax.

Specifics of environmental protection measures and monitoring as required by Rule 6.4.21(3) are discussed in Section T-2.2 and in Sections T-5, T-6, and T-7 herein.

T-2.2 Specific Permits and Authorizations

The Climax Mine operates under numerous specific regulatory permits and authorizations. Permits pertaining to environmental controls are regulated by the State of Colorado and some federal agencies and are public information. Copies of these permits and authorizations are available at the agencies listed and at the Climax Mine environmental office. Table T-1, below, lists the permits and authorizations for the Climax Mine related to this EPP as of the date of this plan revision.

Table T-1: Climax Mine Permits and Authorizations

Agency/Organization	Applicable Permit or Authorization	Description
Colorado Department of Public Health and Environment – Air Pollution Control Division	Construction Permit Initial Approval No. 04LK0977	Facility-wide air emissions permit covering all equipment/activities associated with the mine and mill
Colorado Department of Public Health and Environment – Water Quality Control Division	Colorado Discharge Permit System (CDPS) Individual Permit No. CO-0000248	Permit for mine drainage treatment system discharges to Tenmile Creek
Colorado Department of Public Health and Environment – Water Quality Control Division	CDPS General Permit No. COR-040178	Permit for storm water discharges associated with metal mining operations and mine-waste remediation
US EPA and Colorado Department of Public Health and Environment – Water Quality Control Division	General Permit No. COG-650110	Permit to generate and apply composted biosolids for reclamation purposes
Colorado Division of Reclamation, Mining and Safety	Reclamation Permit No. M-1977-493	Reclamation Permit for Climax Mine
Colorado Division of Reclamation, Mining and Safety	DRMS Permit No. M-1977-493 - Technical Revisions	Technical Revisions to Reclamation Permit for Climax Mine
United States Department of Transportation	Hazardous Materials Certificate of Registration	Registration with US DOT as required for shipping hazardous materials

Agency/Organization	Applicable Permit or Authorization	Description
Colorado Department of Public Health and Environment - Hazardous Materials and Waste Management Division	Hazardous Waste EPID No. COD - 0730407421	Registration with CDPHE as Small Quantity Hazardous Waste Generator
Eagle County Planning Department	Resolution 2008-081 - 1041 Permit Approval	Land use permit for Robinson Pump Station project
Summit County Planning Department	1041 Permit Approval PLN12-014	Land use permit for Property Discharge Water Treatment Plant
US Department of Agriculture	Forest Service Special Use Permit #2720	Permit for Supply Canal No. 1

T-3 Designated Chemicals

The chemicals listed and discussed herein are those used specifically in: 1) the extractive metallurgical processing of molybdenite ore to produce MoS_2 concentrate; and 2) the wastewater treatment system at Climax. The Climax Mine is in operation and producing molybdenum concentrates, thus most of the designated chemicals associated with metallurgical processing are currently present on site. The rates of chemical usage are variable, depending on properties of the ore and other process considerations. Records of chemical usage are maintained by Climax. Information relative to water treatment chemicals used at the site is also provided, however, these are not identified as designated chemicals.

The information provided regarding designated chemicals is presented as the best information available. These chemicals, quantities, and concentrations may vary based upon production needs and processes. For example, brand name chemicals may be changed out for different brands of similar chemicals based on factors such as cost, effectiveness, material handling requirements related to safety, or environmental reasons. Changes in brand and reagent usage are a part of the production process and are not considered to be grounds for notification to the DRMS.

Climax also will periodically conduct both bench-scale and pilot-scale reagent testing of new reagents to improve processing and economic efficiencies, and reducing safety and/or environmental impacts. Bench-scale testing will adhere to standard industry practices for handling and disposal of reagents. Climax will provide information electronically or in writing to DRMS for pilot-scale testing, whereby new chemicals are temporarily introduced into the process. This information will include rationale for testing the new reagent, MSDS information, expected quantities to be used during the test, and anticipated duration of the test.

Notification to the DRMS also will be made per the review/reporting discussed in Section T-1.1.2 in the event that: 1) new types of chemicals, not discussed herein, are added to the process; 2) the storage location of a designated chemical is changed; or 3) the specific containment facility for a designated chemical must be modified.

TR-14 described the new mill and ancillary buildings for use during resumed production; however the final design and layout of the mill and accessory buildings had not been fully developed at that time. TR-14 designated the mill building as a location for several Environmental Protection Facilities (EPFs) associated with designated chemicals. Details of the mill facility are provided in general arrangement drawings (Figures AM-06-T-06 and AM-06-T-07).

T-3.1 List of Chemicals and Specific Locations

Designated chemicals that may be used at Climax during periods of production and for on-going water treatment are listed in Table T-2. The table includes the list of designated chemicals used in the froth flotation metallurgical process for concentrating MoS_2, and for informational purposes, also lists water treatment chemicals. Not all chemicals in Table T-2 may be present on site. For example, Climax has no immediate plans for using sodium cyanide, and this chemical is not being stored on site. It remains in the list of designated chemicals in the event it is ever used at Climax.

The individual reagent tank volumes are presented in Table T-2 and their locations are illustrated on Figure AM-06-T-06. There are two enclosed reagent storage rooms within the mill building. There are three tanks in one room; the collector, frother and iron depressant tanks. The largest of these tanks is 13,500 gallons, or approximately 1,800 ft^3. The total maximum volume of reagents stored in this room is 32,800 gallons, or approximately 4,400 ft^3. As illustrated on Figure AM-06-T-06, this room has a total spill containment capacity of approximately 44,000 gallons, or 5,900 ft^3. The other room contains one tank, the liquid Nokes (iron/lead/copper depressant) tank, whose size is 18,000 gallons, or approximately 2,400 ft^3 with a spill containment capacity of approximately 29,000 gallons, or 4,000 ft^3. All of the reagent storage tanks within the reagent storage rooms (Area 450) are vented to atmosphere. Climax also stores containers (totes and/or drums) of designated chemicals on the floor of the mill building (Area 430), and may temporarily store containers in the Climax warehouse.

Secondary containment for designated and other chemicals is achieved by use of containment structures (Area 450), spill pallets (warehouse and Area 430), concrete floors/sumps (Area 430). Building perimeter infrastructure/ditches/berms also provide tertiary containment. Specific containment details for the reagent storage rooms (Area 450) are shown on Figure AM-06-T-07.

Table T-2: Designated and Other Chemicals at the Climax Mine

Chemical Type & Use	Product Name	Storage Location	Storage Container Type	Tank Storage Capacity	Secondary Containment
Designated Chemicals					
Collector	Nalco 9866 or similar	Reagent Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	13,500 gallons	Yes
Collector Dispersant	Tergitol NP-4 Surfactant or similar	Floatation Area 430	300 gallon totes	5 totes, ~ 1500 gallons	Yes
Primary Frother	Nalco 8836 Plus or similar	Reagent Area of Mill – Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	9,300 gallons	Yes
Cleaner Frother	CorsiTech FrothPro 327 or similar	Reagent Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	600 gallons	Yes
Iron Depressant	Orfom D8 or similar	Reagent Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	10,000 gallons	Yes
Lead and Copper Depressant	Nokes	Reagent Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	18,000 gallons	Yes
CaF2 Depressant	Citric Acid	Floatation Area 430	300 gallon totes	Up to5 totes, ~ 1500 gallons	Yes

Chemical Type & Use	Product Name	Storage Location	Storage Container Type	Tank Storage Capacity	Secondary Containment
Froth Modifier	Calumet Hydrocal 60, PPG-2000/4000, Nalco 7561, or similar	Floatation Area 430	300 gallon totes	~ 10 totes, ~ 3000 gallons	Yes
Flocculent	Polymer Ventures DAF-30 or similar	Floatation Area 430	Dry bulk bags, one mix tank and one storage tank	8250 lbs.	Yes
pH Modifier	Calcium Oxide (CaO, Lime, quicklime)	Lime mix area and silo	1 silo at the mill	225 tons	Yes
Iron and Copper Depressant	Sodium Cyanide (NaCN)	Reagent Area of Mill	NA	Not currently in use	NA
Water Treatment Chemicals					
Flocculent	GreatFloc 5500, DAF10 or similar	SDP and PDWTP	3,500 and 3,000 gallon	5,500 gallons	Yes
pH Adjustment, Hydroxide precipitation of metal ions	Calcium Oxide (CaO, Lime, quicklime)	Lime Station, SDP, 3 Dam Pump Station, PDWTP	Lime silos		Yes
pH adjustment to meet discharge standards	Sulfuric Acid (H_2SO_4)	Mayflower/5 Dam Pump Station, PDWTP	Tanks at 5 Dam Pump Station and PDWTP	7,000 and 4,300 gallons	Yes

Detailed information regarding effects on human health and the environment is found in the MSDS data in Appendix T-B.

T-3.2 Designated Chemicals Information

T-3.2.1 Collector

A collector reagent 'collects' the molybdenum in a froth flotation extraction process allowing the molybdenum to float to the surface of the floatation cells. Nalco TX 9866 (or similar) is used as a collector reagent in the milling process. Nalco TX 9866 is a combustible petroleum distillate. Aside from being combustible, this product is a skin and eye irritant.

In the environment, the collector reacts similar to other petroleum distillates and can cause short-term damage to terrestrial and aquatic ecosystems. Spills should be contained with inert absorbents, and contaminated soils should be removed.

The collector is stored in one tank with a capacity of 13,500 gallons, located in the reagent storage area of the mill building (see Mill Building Detail - Area 450 on the south side of the mill building on Figure AM-06-T-06). Secondary containment with a volume greater than that of the tank is provided in the reagent

storage area (see Reagent Storage Area Detail Figure AM-06-T-07). Tank level indication is available locally as well as through the control system. The control system will alarm for a given tank low and high level. Both a horn and beacon are provided at the unloading point to indicate a tank high level.

In the event of a storage tank failure, the collector will be contained in the reagent storage area via secondary containment. The secondary containment area is equipped with a sump but no sump pump. In the event of a release in this area, a pump will be placed in the secondary containment sump and the collector will be routed back into the process circuit or pumped into a suitable container for proper disposal through direction from the environmental department. A spill that occurs during offloading into the storage tank will be handled similarly using a sump located in the offloading area.

When needed, collector may be stored as totes in Area 430 (floatation). Area 430 has a concrete floor that is sloped to a sump so that material can be placed back in the mill circuit or sent to tailing. In the event of a collector distribution system failure, the collector will be contained within the mill building.

T-3.2.2 Collector Dispersant

Tergitol NP-4 Surfactant (or similar) is used in the flotation circuit as a collector dispersant, mixing with the primary collector Nalco 9866 at a small proportion of 1 liter per 300 gallons. This is essentially a dispersant for petroleum oil which, by mixing with the collector, disperses it into smaller droplets to increase the collection efficiency of molybdenite particles. The product is 4-mole Ethylene Oxide adduct of Nonyl Phenol. It contains less than 3% Dinonylphenyl Polyoxyethylene and Polyethylene Glycol.

Direct contact with this product will cause eye burns and skin irritation. Aspiration may cause lung damage. The product is water insoluble but completely soluble in oil. It is considered as low HLB emulsifier with flash point 425°F.

It may be stored as totes within Area 430 (floatation) with the same spill prevention and containment protocol as other reagents stored in the area (e.g., cleaner frother).

T-3.2.3 Primary Frother

A frother reagent creates froth in the agitated slurry and assists in holding the froth intact at the surface of the floatation cell. Nalco 8836 Plus (or similar) is utilized in the mill circuit as the primary flotation frother. Nalco 8836 Plus contains aliphatic alcohol and is combustible. Primary exposure pathways include eye contact, skin contact and inhalation.

The frother is stored in one tank with a capacity of 9,300 gallons. The frother is stored in the reagent storage area of the mill building (see Mill Building Detail - Area 450 on the south side of the mill building on Figure AM-06-T-06). Secondary containment with a volume greater than that of the tank is provided in the reagent storage area (see Reagent Storage Area Detail Figure AM-06-T-07). Tank level indication is available locally as well as through the control system. The control system will alarm for a given tank low and high level. Both a horn and beacon are provided at the unloading point to indicate a tank high level.

In the event of a storage tank failure, the frother will be contained in the reagent storage area via secondary containment. The secondary containment area is equipped with a sump but no sump pump. In the event of a release in this area, a pump will be placed in the secondary containment sump and the frother will be routed back into the process circuit or pumped into a suitable container for proper disposal through direction from the environmental department. A spill that occurs during offloading into the storage tank will be handled similarly using a sump located in the offloading area.

When needed, frother may be stored as totes in Area 430 (floatation). Area 430 has a concrete floor that is sloped to a sump so that material can be placed back in the mill circuit or sent to tailing. In the event of a frother distribution system failure, the frother will be contained within the mill building.

T-3.2.4 Cleaner Frother

CorsiTech FrothPro 327 (or similar) is used in the secondary mill regrind circuit as a flotation frother. It is comprised of polypropylene glycol butyl ether. Direct contact with this material may cause mild eye and

skin irritation.

CorsiTech FrothPro 327 is a stable product that is completely soluble in water. CorsiTech FrothPro 327 has a National Fire Protection Agency rating of2 for health and for fire, meaning the material can cause significant irritation and that the material must be preheated before ignition can occur.

The Cleaner Frother reagent is delivered in 300 gallon totes, which may be stored in the curbed area identified to the north of the iron depressant storage tank (see Reagent Storage Area Detail Figure AM-06-T-07). This containment area connects to the one described above for the collector, therefore excess containment capacity is provided for the Cleaner Frother totes. In the event of a release in this area, a pump will be placed in the secondary containment sump and the cleaner frother will be routed back into the process circuit or pumped into a suitable container for proper disposal through direction from the Environmental Department. The totes will be transferred into a cleaner frother storage tank (600 gallons). The cleaner frother storage tank is located in the regrind/cleaner area of the mill building (area 430 on the Mill Building Detail drawing on Figure AM-06-T-06). Cleaner frother storage tank releases will be contained inside of the mill building and will pump to the rougher concentrate thickener.

Tank level indication will be available locally as well as through the control system. The control system will alarm for a given tank low and high level.

When needed, frother may be stored as totes in other locations within Area 430 (floatation). Area 430 has a concrete floor that is sloped to a sump so that material can be placed back in the mill circuit or sent to tailing. In the event of a frother distribution system failure, the frother will be contained within the mill building.

T-3.2.5 Pyrite (Iron) Depressant

Orfom D8 Depressant (or similar) is a mineral processing aid is used in the mill circuit to maintain separation and suppress pyritic minerals in the flotation process. This is a corrosive material that causes irreversible eye and skin damage. The vapor is combustible, and may cause respiratory tract irritation if inhaled. The material can be harmful or fatal if swallowed.

The D-8 is stored in one tank with a capacity of 10,000 gallons. This tank is in the reagent storage area of the mill building (see Mill Building Detail - Area 450 on the south side of the mill building on Figures AM-06-T-06 and AM-06-T-07).

Secondary containment with a volume greater than that of the tank is provided in the reagent storage area (see Reagent Storage Area Detail Figure AM-06-T-07). Tank level indication is available locally as well as through the control system. The control system will alarm for a given tank low and high level. Both a horn and beacon are provided at the unloading point to indicate a tank high level.

In the event of a storage tank failure, the D-8 will be contained in the reagent storage area via secondary containment. The secondary containment area is equipped with a sump but no sump pump. In the event of a release in this area, a pump will be placed in the secondary containment sump and the D-8 will be routed back into the process circuit or pumped into a suitable container for proper disposal through direction from the environmental department. A spill that occurs during offloading into the storage tank will be handled similarly using a sump located in the offloading area.

When needed, iron depressant may be stored as totes in other locations within Area 430 (floatation). Area 430 has a concrete floor that is sloped to a sump so that material can be placed back in the mill circuit or sent to tailing. In the event of an iron depressant distribution system failure, the iron depressant will be contained within the mill building.

T-3.2.6 Galena and Chalcopyrite (Lead and Copper) Depressant

Liquid Nokes reagent is incorporated into the mill circuit as a galena and chalcopyrite depressant. Nokes reagent is the reacted product of caustic soda and phosphorous pentasulfide in solution with water. The addition of NaOH to the solution maintains a pH greater than 11 which prevents the release of hydrogen sulfide gas (H_2S). Climax uses only liquid nokes which has been reacted prior to delivery. Liquid nokes is stored in the Reagent Area of the Mill Building.

Phosphorous pentasulfide is a reactive and ignitable greenish-yellow solid with a "rotten egg" smell which can affect the human body through inhalation, ingestion, and dermal contact. While solid phosphorous pentasulfide can cause dermal irritation, the primary health hazard associated with this material is the release of hydrogen sulfide gas upon contact with water. Hydrogen sulfide can be a primary health hazard which acts as an irritant to mucus membranes and can produce severe breathing difficulties. High concentrations can stop breathing immediately. Phosphorous pentasulfide can be neutralized with an alkaline substance such as lime, NaOH, or soda ash.

The use of liquid pre-mixed Nokes significantly reduces the risk of H_2S generation since the potential for gas generation is greatest during the reaction phase. Nevertheless, H_2S monitoring is provided at two locations. One is the truck unloading point where the solution is transferred from a bulk tanker to our storage system. The other is in the liquid Nokes storage tank area. Both monitors are located at low points to quickly detect any H_2S that might be generated.

Nokes is stored in one tank with a capacity of 18,000 gallons. The Nokes is stored in the reagent storage area of the mill building (see Mill Building Detail - Area 450 on the south side of the mill building on Figure AM-06-T-06).

Secondary containment with a volume greater than that of the tank is provided in the reagent storage area (see Reagent Storage Area Detail Figure AM-06-T-07). Tank level indication is available locally as well as through the control system. The control system will alarm for a given tank low and high level. Both a horn and beacon are provided at the unloading point to indicate a tank high level.

In the event of a storage tank failure, Nokes will be contained in the reagent storage area via secondary containment. The secondary containment area is equipped with a sump but no sump pump. In the event of a release in this area, a pump will be placed in the secondary containment sump and the Nokes will be routed back into the process circuit or pumped into a suitable container for proper disposal through direction from the environmental department. A spill that occurs during offloading into the storage tank will be handled similarly using a sump located in the offloading area.

When needed, Nokes may be stored as totes in Area 430 (floatation). Area 430 has a concrete floor that is sloped to a sump so that material can be placed back in the mill circuit or sent to tailing. In the event of a Nokes distribution system failure, the Nokes will be contained within the mill building.

T-3.2.7 CaF2 Depressant

Climax may use diluted citric acid with the First Cleaner Feed to depress calcium fluoride at the first stage and have it rejected through the Cleaner Scavenger. Citric acid is corrosive and harmful to the eyes and skin if direct contact is made. This material will be stored in Area 430 in approximate 300-gallon totes with the same containment as the other reagents in this area.

T-3.2.8 Froth Modifier

Hydrocal 60 (or similar) is used in the flotation circuit as a froth modifier. Like the collector, Hydrocal 60 is a petroleum distillate and is combustible. It is a skin and eye irritant.

Hydrocal 60 is stored in totes in the rougher flotation area of the mill (Area 430). In the event of a release in this area, the froth modifier will be routed back into the process circuit or pumped into a suitable container for proper disposal through direction from the Environmental Department. In the event of a froth modifier distribution system failure, the froth modifier will be contained within the mill building.

PPG 4000 is added to the cleaner circuit as an anti-foam reagent. This reagent has the capability of froth modification by enhancing froth drainage and, as such is used an alternate to Hydrocal 60. The product is mostly (90-100%) comprised of Poly-Propylene Glycol (PPG). The base structure is similar to the cleaner frother which is comprised of Poly-Propylene Glycol as well. The only structural difference is the higher molecular weight (Mn ~ 4000 compared to Mn ~ 100-500 in the case of the frother). As per the MSDS, this is not a hazardous substance or mixture. This product is water insoluble.

This product is being added to the circuit either by using 5 gallons buckets and pumping to the launder or pumping directly from the tote to the launder at a specified dosage. PPG 4000 may be stored as totes within Area 430. Containment during spill or system failure will be same as mentioned previously for the cleaner frother.

Like PPG 4000, Polyglycol P 2000 is a polypropylene glycol. The only difference between the two is that P 2000 has a lighter molecular weight. Both are water insoluble and have similar hazard characteristics. P 2000 may be used in place of the other froth modifiers.

Nalco 7561 is a similar product to the others described above, and may be used as a replacement of PPG 4000. The MSDS mentions that the VOC content is 0%, contains no hazardous air pollutant (HAP), and no toxic release inventory (TRI) chemical. Prolonged contact on eye and skin may cause irritation. Fire hazard associated with this product is considered low. Storage and containment during spill will be same as PPG 4000.

T-3.2.9 Flocculent

Polymer Ventures DAF-30 Flocculent (or similar) is used in the thickeners to facilitate nucleation and settling of light particles. DAF-30 is a non-hazardous, common commercial flocculent. It is a polymer that may irritate the skin or eyes. Impermeable gloves and chemical splash goggles should be utilized when working with the chemical to prevent exposure. If the product is released to the environment, it should be contained with absorbent and removed. It is stored in the mix area on the west end of the mill (Area 430). In the event of a flocculent distribution system failure, the flocculent will be contained within the mill building.

T-3.2.10 pH Modifier

Calcium Oxide (CaO), also known as lime or quicklime, is used in the flotation circuit at Climax to modify the pH and act as a pyrite depressant. Quicklime is stored in a 225 ton capacity dry silo located on the north side of the mill building (Area 430). Lime is a common, but strong caustic alkali. In high concentrations, lime can cause caustic irritation, inflammation, and burns through inhalation and dermal contact.

Quicklime is slaked in the mill and used as a milk of lime slurry. In the event of a lime distribution system failure, the lime will be contained within the mill building.

T-3.2.11 Pyrite and Chalcopyrite (Iron and Copper) Depressant

Additional depressant products may be utilized at the site in the mill circuit. Sodium cyanide remains a potentially important reagent that may be utilized in low doses in liquid form in the flotation mill circuit to depress pyrite, chalcopyrite, iron, and copper. Although sodium cyanide (cyanide) is not currently utilized at the site, it has been used in the past and may be used in the future. If used, it would be delivered and stored in solid briquettes then mixed with water and caustic soda beads (NaOH) to maintain pH 11 for safety.

Sodium cyanide is a white solid with a faint almond odor that can affect the human body through inhalation, ingestion, and dermal contact. Cyanide can rapidly cut the flow of oxygen from the blood stream to body tissues. At lower levels of exposure, early symptoms include weakness, headache, confusion, nausea, and vomiting. These symptoms may be followed by unconsciousness and death. Cyanide is rapidly removed from the body by the liver and is neither bioaccumulative nor carcinogenic. Strong solutions of cyanide salts are corrosive and may produce ulcers.

Currently, sodium cyanide is not used in the Climax reagent scheme. It has been maintained as a possible depressant if other reagents do not perform adequately. If inclusion of sodium cyanide in the milling process enters further planning stages, Climax will notify the Division with additional information regarding the expected concentration, process solution volumes, storage location, fate of designated chemicals, measures taken to prevent and monitor for a release, and measures taken in the event of a release.

T-3.3 Water Treatment Chemicals Information

T-3.3.1 Flocculent

Climax uses GreatFloc 5500, DAF10 or other chemical equivalents as a flocculent at the SDP and PDWTP to facilitate nucleation and settling of hydroxide precipitates. The flocculants are non-hazardous, common commercial flocculants. The flocculent is an acrylamide polymer that may irritate the skin or eyes. Impermeable gloves and chemical splash goggles should be utilized when working with the chemical to prevent exposure. If the product is released to the environment, it should be contained with absorbent and removed.

T-3.3.2 pH Adjustment (Lime)

Calcium Oxide (CaO), also known as lime or quicklime, is used in the water treatment circuit at Climax to raise the pH and lower metal levels through precipitation. Lime also is used in reclamation operations and at the mill to adjust the pH of process water. Lime is stored at the Lime Station, PDWTP and in small stockpiles associated with current reclamation. Lime is a common, but strong caustic alkali. In high concentrations, lime can cause caustic irritation, inflammation, and burns through inhalation and dermal contact.

Excessive amounts of lime in the environment can raise alkalinity to damaging levels. In aquatic systems, excessive lime also can cause potentially damaging precipitation/sedimentation.

T-3.3.3 pH Adjustment (Sulfuric Acid)

Sulfuric acid (H_2SO_4) is used to adjust the pH of treated water at the PDWTP to within the permit stipulated range of pH 6.5 - 9.0 prior to discharge to Tenmile Creek. Sulfuric acid is a corrosive that can affect the human body through inhalation, ingestion, and dermal contact. Effects can vary from mild irritations to severe burns (internally or externally) depending upon the type, degree, and length of exposure. Repeated chronic exposure to dilute solutions may cause dermal irritations, whereas similar exposure to vapors or mists may cause erosion of teeth and inflammation of the eyes and mucus membranes of the nose, throat, and lungs.

In the environment, sulfuric acid can be directly toxic through its corrosive nature or by lowering pH levels to the point of toxicity. In addition, even in very dilute forms, which may not be injurious to human health, chronic releases of sulfuric acid can dissolve metals from rocks which, in turn, can damage aquatic and, in some instances, terrestrial ecosystems. Sulfuric acid is readily neutralized by the addition of alkaline substances such as NaOH, CaO, or limestone.

T-3.4 Material Safety Data Sheets for Designated Chemicals

Material Safety Data Sheets (MSDS) are attached in Appendix T-B. Updated MSDSs are maintained at the site. These data sheets list permissible exposure limits, monitoring and measurement procedures, health hazard information and exposure effects, recommended medical procedures for human exposure, emergency first aid procedures, personal protection, leak and spill procedures, and waste disposal methods.

T-3.5 Disposal, Decommissioning, Detoxification or Stabilization

Procedures for the disposal, decommissioning, detoxification or stabilization of designated chemicals during temporary cessation or final closure are discussed in the following sections.

T-3.5.1 Temporary Cessation/Prolonged Lack of Mineral Production

Under the scenario of formal temporary cessation or periods of prolonged lack of mineral extraction and production, designated chemicals at Climax would be used or removed from the site. Mixed chemicals such as Nokes Reagent and NaCN in solution would be used in the milling process until depletion of the supplies. The distributor would be contacted to assume possession of unmixed and uncontaminated

chemicals, and the material would be transported off-site in the same manner that it was received at the site. Those designated chemicals used in the water treatment system at Climax would remain at the site and would continue to be used. Water treatment and discharge would not cease under these scenarios. If unmixed chemicals were contaminated or the distributors were to decline possession, then detoxification or stabilization and disposal would be managed pursuant to solid and hazardous waste regulations.

T-3.5.2 Final Closure

Upon final closure at the conclusion of operations at Climax, designated chemicals will be handled in similar fashion as under the scenario described above. The exception is that lime, sulfuric acid, and flocculent used in the water treatment process will remain at the site until no longer required in the water treatment process. Removal and disposal of water treatment chemicals will occur as discussed for mill process chemicals during periods of temporary cessation or prolonged lack of mineral production.

T-4 Acid-Forming Materials and Acid Mine Drainage

The Climax ore body beneath Bartlett Mountain contains unoxidized sulfides that, in the presence of oxygen, water, and bacteria, have the potential to become an acid-forming material as defined in Rule 1, Section 1.1(1). Likewise, waste rock materials deposited in McNulty OSF, North 40 OSF, and tailing material deposited in the TSFs also contain material with acid-forming potential. Climax concurred with this fact in its response to the DRMS (August 31, 1994) when it accepted the DRMS determination that Climax was a DMO under the amended rules. In addition, water that percolates through the open pit area and accumulates in the pit or closed underground workings contacts sulfide bearing material and, in turn, has the potential to become acidified, thus, meeting the definition of "Acid Mine Drainage" in Rule 1, Section 1.1(2).

Overburden material will be handled during operations, to the extent practicable, to minimize the generation and impact of acid drainage as well as the volume of water requiring treatment during and after mining. As overburden material is placed as part of ongoing operations, Climax will continually look for and identify opportunities to manage overburden materials to minimize acid rock drainage and the volume of water requiring treatment. Techniques will include, but may not be limited to, material segregation (based on acid generating potential), upgradient diversion of unimpacted water, and Climax's election to implement concurrent reclamation to minimize future acid drainage and the quantity of water requiring treatment. Concurrent reclamation of OSFs is described in Exhibit E of AM-06. As required under Rule 6.4.21(6), appropriate EPFs have been identified to minimize, capture and treat acid mine drainage (see Section T-5.3).

The locations of OSFs have been developed with consideration of existing conditions as well as overall technical and economic feasibility. As described in Exhibit D of AM-06, overburden placement will consist of additional placement in the area of existing E and F dumps as well as the existing McNulty OSF. TR-22 includes OSF design, stability analyses, and an operations and monitoring plan. TR-22 also includes conceptual seepage collection and run-on and run-off control facilities to minimize the impact of potential acid drainage associated with these facilities. Final designs for seepage collection EPFs will be submitted prior to the initiation of construction in accordance with Rule 7.3.

The acid-forming materials will remain in-situ at the Climax site following final termination of mining and processing activities. As discussed herein, as long as acidic drainage with the potential to affect the environment is released from these sources, such drainage will be managed according to the stipulations and requirements of the appropriate regulatory permits in place at the time.

The geochemical processes at the site are well understood to ensure the effectiveness of the water management and treatment system. Table T-E-6, included in Appendix T-E (Geochemical Data) is from EPP R2 (TR-18) and presents a summary of water quality data from impacted sources, including seepage from the OSFs, TSFs and other sources from around the site that are collected and treated. Samples of impacted water sources will continue to be collected by Climax on an as needed basis.

T-4.1 Temporary Cessation/Prolonged Lack of Mineral Production

Surface water discharge at Climax is regulated under the CDPS Permit as discussed in Section T-2.2. Under temporary cessation or a prolonged lack of mineral production scenario, mine waters, storm water, and seepage waters would continue to be managed, treated and discharged according to the conditions of this permit.

T-4.2 Final Closure

Upon final closure and reclamation of Climax Mine as described in the Reclamation Permit, Technical Revisions and Amendments, impacted waters from the mine, ponded water on the TSFs, seepwater from TSFs and OSFs, and storm water will be managed according to conditions of the CDPS Permit. This permit acknowledges that surface water from Climax must meet effluent limitations prior to discharge.

As described in Exhibit E – Reclamation Plan to AM-06, both Tenmile and Mayflower TSFs will be reclaimed with a combination of dry and wet covers. Due to concerns regarding water treatment, flood control, constructability, and dam safety, a wet cap is needed for the Climax Mine site. Climax manages water to reduce the volume and flow rate of water requiring treatment. This management includes the use of interceptor canals, diversion ditches, surface treatments, and reclamation of formerly impacted land. The seepage from TSF dams and water pumped from the open pit or underground mine workings, however, will continue to require treatment well into the future. These future sources of impacted water are expected to follow a similar pattern of significant seasonal variability. The use of a wet cap reclamation scenario provides detention storage capacity that allows for seasonal attenuation during the peak flow periods and promotes a more constant flow rate for water treatment. This detention storage dampens the peaks of the impacted water hydrograph and reduces the required capacity of the treatment system. In addition, an active reservoir to store impacted water provides flexibility in the timing and rate of water treatment and therefore reduces the risk of releasing impacted water during an upset scenario in the water treatment system or under unusual hydrologic conditions.

Hydrologic flood studies indicate that peak flow rates onto the TSFs are generally in the thousands of cfs during a PMP event. If there is no detention storage capacity within the TSF to attenuate these flows, which would be the case in a dry cover scenario, then very large and heavily armored channels would be required to convey the flood flows safely beyond the site. The detention storage capacity provided by the wet cover configuration allows for much lower capacity flood conveyance facilities. The detention concept is less sensitive to peak flood flow estimation and results in lower risk from erosion, channel failure, and potential dam breach.

The wet cap configuration also is consistent with that presented to DRMS and approved in Technical Revision TR-13. The wet covers are anticipated to develop into a sustainable mosaic of mesic, wet meadow, and emergent marsh habitats that will support a variety of wildlife and waterfowl species. In addition, the infrastructure at the TSFs, will allow the ponds to be utilized for detention storage capacity at closure.

Final reclamation of the OSFs, also described in AM-06 Exhibit E – Reclamation Plan, will involve regrading of the overburden material to the final closure grades as determined through the ongoing geotechnical stability evaluations and placement of a soil cover and revegetation.

T-5 Climax Mine Environmental Protection Facilities

An "Environmental Protection Facility" (EPF) is defined in Section 1.1(15) of the Rules as "...a structure which is identified in the “Environmental Protection Plan” as designed, constructed and operated for control or containment of designated chemicals…, acid mine drainage, or toxic or acid-forming materials that will be exposed or disturbed as a result of mining or reclamation operations." Except where noted, the EPFs as defined are present and operational at Climax. Because of Climax's unique geographic position affecting both sides of the Continental Divide and three distinct and major watersheds (Arkansas River, Eagle River, and Tenmile Creek), the following discussion of EPFs and controls is organized by watershed. Within the three watersheds, defined EPFs involve (in no particular order):

- Control of run-off that contacts potentially contaminated material;

- The process water circuit, which includes process water reclaimed from the TSFs for use in the mill process, the TSFs and seepwater control systems;
- Mine water drainage and control systems;
- Storage and containment facilities for designated chemicals used in the milling process; and
- Facilities associated with the water management and treatment system.

The EPFs discussed throughout this EPP are shown on Figures AM-06-T-01 through AM-06-T-07. In addition to these EPFs, a number of internal systems also exist to provide additional control. The internal systems are classified separately to identify those systems that while serving an important function at the Site, are not absolutely necessary for the control, and prevention of a release, of acid mine drainage, or toxic or acid-forming materials. The EPFs and internal controls are listed in Table T-3 and detailed descriptions of all systems are provided in subsequent subsections, organized by watershed.

An extensive clean water interceptor system has been established at the Climax Mine to convey un-impacted storm water around the process facilities and TSFs and to limit the amount of water to be treated and discharged. These systems, constructed primarily in the 1970s prior to the enactment of the DMO regulations, do not have specific, approved designs associated with them. Climax recognizes their importance to the overall water management system, but notes that the clean water interceptors do not appear to meet the definition of an EPF since they carry only un-impacted water around the Site and do not contain or control designated chemicals or process solutions. As agreed upon with DRMS, although these systems are considered to be pre-EPF systems and do not contain or control designated chemicals or process solutions, they will be managed by Climax as internal EPFs. The interceptor systems are closely monitored, inspected and maintained as part of routine site monitoring activities. Other than repair and maintenance, any future expansion or modifications of the interceptors will be subject to review by DRMS, consistent with Section 6.4.21(10)(a)(ii) of the Rules.

Table T-3: Potential Contaminant Sources and Environmental Protection Facilities at the Climax Mine

Potential Area of Impacts	Potential Contaminant Sources	Direct (Governing) EPF/Control	Internal Controls
Upper Arkansas River Watershed	Impacted water from the flooded underground workings	5-Shaft Pump Station	
	Run-off and seepage from the Storke Yard	Storke Wastewater Pump Station	
	Run-off from road cuts and overburden on Ceresco Ridge above the Storke Yard	Storke Wastewater Pump Station, Ceresco runoff collection system	
Upper Eagle River Watershed	4 Dam Seepage	4 Dam Pump Station	
	Robinson Lake and Dam - process water, seepage, sediments	Robinson Lake Seepwater Pump System, Robinson Dam	
	Robinson TSF and 1 Dam - tailing, seepwater, toe drain discharge, Tenmile Tunnel drainage	Robinson Lake Pump Station, 1 Dam (Robinson TSF),	Tim's Pond, Warren's Pump System, Chalk Mountain Interceptor
Upper Tenmile Creek Watershed	Designated chemicals for concentrate production and water treatment chemicals	EPFs for designated chemicals and water treatment chemicals,	

Potential Area of Impacts	Potential Contaminant Sources	Direct (Governing) EPF/Control	Internal Controls
	Impacted water including: process water, seepage, run-off, underground mine water, and water from TSFs	5 Dam Seepwater Pump System, ETDL, Tenmile TSF, Mayflower TSF	Mill Process Water Tank, Tenmile Tunnel, 2 Dam Spillway, East Side Channel, Tenmile Decant, Sludge Densification Plant (SDP), 3 Dam Pump Station, Property Discharge Water Treatment Plant (PDWTP), East Interceptor, West Interceptor, Pit Dewatering System
	Tailing stored in TSFs	TDL, 2 Dam, 3 Dam, 5 Dam	
	Acid-generating overburden materials	Diversion structures to prevent runon and to direct impacted runoff to treatment facilities, collection drains beneath and adjacent to OSFs	Material segregation, concurrent reclamation

T-5.1 Arkansas River Watershed

T-5.1.1 Potential Sources of Contamination

The upper Arkansas River Watershed contains portions of the Climax site that supported the historic underground mining operations. Prior to closure of the underground mine, the entrance to the underground operation at Climax was through 5-Shaft and the Storke Portal at the Storke Yard just east of the hairpin turn on Highway 91, in the upper Arkansas River Watershed.

When the underground operation was terminated in December 1994, equipment was salvaged and pumping was curtailed allowing the deeper workings to be inundated. Water in contact with sulfide mineralization underground meets the definition of “Acid Mine Drainage” in Rule 1.1 (2), and thus, is a potential source of contamination to the upper Arkansas River Watershed should water levels rise uncontrolled. Storm water becomes impacted as it passes through the open pit area and collects in the underground mine workings. Former underground workings and the open pit are connected to the 5-Shaft located in the Storke Yard area and, as described below, a pumping station installed in 5-Shaft maintains the water level by pumping water through the Storke Pipeline to the ETDL and water treatment/process water circuit in the Tenmile Creek Watershed.

The Storke Yard historically incorporated some mine waste rock material for construction fill. The areas of the mine in the upper Arkansas River Watershed have been the focus of major reclamation activities since the late 1980s. Equipment was removed and buildings were demolished in preparation for final reclamation of the Storke Yard in 1995 and beyond. Impacted water from the Storke Yard area is directed to the Storke Wastewater Pump Station, described below. In addition to historic Climax

operations, there are other non-Climax, abandoned mined land (AML) features present in the upper Arkansas River Watershed. As part of previous reclamation activities in this area, some impacted water from these AML features is directed to the Storke Wastewater Pump Station.

A project to restore a buried segment of the East Fork Arkansas River running along the south side of the Storke Yard was completed in 2008. The area of the Arkansas River to the south-southwest of the Storke Yard was reclaimed in the late 1980s into the early 1990s. This area terminates in the gravel pit at the Climax property line. The East Fork Arkansas River runs through this reclaimed gravel pit before leaving the property and groundwater under the direct influence of surface water in this area is the source of domestic water for the mill as described in AM-06 Exhibit G – Water Information.

Mine development work includes improvements to an existing haul road along Ceresco Ridge (TR-22). Storm water runoff from this area is managed to prevent impacts to the Arkansas River.

As described above, and as listed in Table T-3, the sources of potential contamination in the Arkansas River watershed include:

- Impacted water from the flooded underground workings;
- Run-off and seepage from the Storke Yard; and
- Run-off and seepage from road cuts and overburden fill placement for road construction on Ceresco Ridge above the Storke Yard.

With the reclamation completed at present, issues related to run-off and seepage have been significantly reduced. There are no designated chemicals stored or utilized within the Arkansas River watershed.

T-5.1.2 Environmental Protection Facilities

The following controls are designated EPFs to prevent potential impacts to the Arkansas River Watershed from Climax operations:

- 5-Shaft Pump Station (and associated Storke Pipeline);
- Storke Wastewater Pump Station; and
- Ceresco Ridge Haul Road Fill Area Runoff Collection System.

5-Shaft Pump Station and Storke Pipeline: A pumping station installed in 5-Shaft maintains the water level at an elevation that does not threaten the flow of impacted water to the Arkansas River Valley. Storm water becomes impacted as it passes through the open pit area and collects in the underground mine workings. The quantity of water entering the shaft fluctuates seasonally based on the amount of runoff into the open pit area. Generally, minimum flows occur in the late fall through winter, increase as early as April or May, and peak from mid-June through early August. The level of water in 5-Shaft must be kept below the apex of the Mosquito Fault to prevent mine water from potentially impacting the Arkansas River. The water level is maintained by pumping water through the Storke Pipeline to the ETDL and the water treatment/process water circuit in the Tenmile Creek Watershed. As the mining of the open pit advances in depth, the 5-Shaft Pump Station may become obsolete and pit water levels will be controlled through other means.

Storke Wastewater Pump Station: The Storke Wastewater Pump Station is located just below the Storke Yard and acts as a seepage and storm water collection and return system where collected impacted water is pumped to the water treatment/process water circuit in the Tenmile Creek drainage. Two concrete lined ponds at this EPF serve to collect seepage and storm water/snowmelt run-off from the yard area and it is pumped to the ETDL where it mixes with other mine water prior to treatment.

Ceresco Ridge Haul Road Fill Area Runoff Collection System: Runoff from new fill material used to improve the existing Ceresco ridge haul road remains within the 5-Shaft/Storke Wastewater capture area. As indicated in TR-22, Climax will construct an additional runoff collection ditch below the fill placement areas on Ceresco Ridge. The collection ditch will intercept and route potentially impacted runoff to the

camp drainage system that reports to water treatment.

T-5.2 Eagle River Watershed

T-5.2.1 Potential Sources of Contamination

As listed in Table T-3, the sources of potential contamination in the upper watershed of the East Fork of the Eagle River within the Climax property include:

- 4 Dam seepage;
- Robinson Dam seepage;
- Tenmile Tunnel and 1 Dam seepage;
- Robinson Lake (aka: Robinson Reservoir); and
- A portion of the Robinson TSF (1 Dam).

The Oxide Pond (Eagle Park Reservoir) was first constructed in the early 1960s to impound tailing material from the oxide ore processing facility at Climax. Oxide ore processing was discontinued in 1968. The tailing material and sediments in this TSF were acidic and contained elevated levels of metals. Seepwater emanating from the toe of the dam (4 Dam) likewise was acidic (Appendix G, original 1995 EPP).

In 1993, a project was initiated to convert Eagle Park Reservoir to a fresh water impoundment to allow Climax to sell the storage facility. Such a conversion of this impoundment required draining of impacted water, removal of tailing material and contaminated sediments, and prevention of Robinson Lake seepage from entering the impoundment. This project was completed in 1997. Impacted media (water, tailing, sediment, and soils) were removed to the Tenmile TSF and 2 Dam during the course of this project. Eagle Park Reservoir was released from DRMS financial warranty and was sold to a private consortium of downstream users in 1998. Eagle Park Reservoir is no longer within the affected lands boundary of the Climax site. It is not considered an EPF nor is it ever to be used as an EPF or for secondary containment by Climax. The Climax EPFs in place in the upper Eagle River watershed are in fact designed and operated to preclude discharge of impacted water from mine facilities to Eagle Park Reservoir.

Robinson Lake is an EPF and functions as the primary process water storage facility in the system. The reservoir stores process water that is collected from the Tenmile and Mayflower TSFs and delivered through the Tenmile Tunnel. Water collected from the Tenmile TSF is decanted through the Tenmile Decant to the Tenmile Tunnel and water collected from the Mayflower TSF is pumped by the Mayflower barge system (during Phase II Deposition) to the Tenmile Tunnel. Robinson Lake also collects seepwater and toe drain discharge from 1 Dam as well as seepwater pumped from the Robinson Dam and 4 Dam seepage collection systems. The reservoir primarily contains industrial process water, TSF seepwater and 4 Dam seepwater, along with unintercepted storm water from the surrounding area and overflow from Chalk Mountain Reservoir.

The Robinson TSF is an EPF and was originally constructed in 1936 straddling the uppermost watersheds of Tenmile Creek to the north-northeast and the Eagle River to the west-southwest (Figure AM-06-T-01). The largest dam, the 240 foot high 1 Dam, contains the TSF upstream of Robinson Lake in the Eagle River drainage. 2 Dam is partially inundated by the upstream portion of the Tenmile TSF in the Tenmile Creek drainage. While the tailing material contained within the Robinson TSF consists primarily of quartz silica and orthoclase feldspar, it also contains enough sulfur to be acknowledged by Climax as acid producing.

In addition to tailing material, seepage from the Robinson TSF and water discharging from the toe drain system beneath 1 Dam are potential sources of contamination. Tim's Pond and Warren's Pump Station serves as the primary collection system for seepwater from 1 Dam and the Tenmile Tunnel and returns collected water to the SDP via the 2 Dam Pipeline. Robinson Lake acts as a secondary collection system

for these co-mingled waters, and the Robinson Lake Pump Station will serve to return this water to the industrial process water circuit for reuse as needed.

There are no designated chemicals stored or utilized in the Eagle River watershed.

T-5.2.2 Environmental Protection Facilities

The following controls are designated EPFs to prevent potential impacts to Eagle Park Reservoir and the East Fork of Eagle Creek from Climax operations:

- Robinson TSF and 1 Dam;
- Robinson Lake and Dam;
- Warren's Pump System;
- Robinson Lake Seepage Pump System;
- 4 Dam Seepage Collection and Pump System;
- Chalk Mountain Interceptor; and
- Robinson Lake Pumping System.

Climax EPFs in the upper Eagle River Watershed are described in detail below. Where appropriate, the descriptions include the rationale for each EPF, the level of protection afforded Eagle Park Reservoir and East Fork Eagle River, and the contingencies for worst-case storm or other events to preclude discharge of impacted water.

Robinson TSF and 1 Dam: 1 Dam, along with 2 Dam, contain tailing material and an approximate 60 acre water pool within the Robinson TSF. The Robinson TSF is also discussed in the Tenmile Creek watershed section. 1 Dam forms the divide between the Tenmile Creek and Eagle River basins.

1 Dam was upgraded and reconfigured in a project that was initiated in 1989 and completed in 1992. Briefly, this project entailed construction of a large diameter toe drain collection and discharge system, flattening of the slope of the dam from approximately 2H:1V to approximately 4H:1V, and armoring the face of the dam with rock cover material. The dam was revegetated at the end of this project.

Prior to 2005, drainage that collected on the surface of Robinson TSF was conveyed to the Eagle River basin through the West Gravity Line. As part of a reclamation project in 2005, the East Side Channel and a spillway for the TSF through 2 Dam were constructed and now convey Robinson TSF drainage north down the Tenmile Creek basin. The West Gravity Line was subsequently abandoned and plugged with concrete. This project eliminated a significant source of impacted water inflow to the Eagle River basin.

A collection system along the toe of 1 Dam collects seepage from 1 Dam and routes it to Warren's Pump Station (within the Robinson Lake footprint) for delivery to the water treatment system in the Tenmile Creek basin. Warren's Pump Station is itself considered an EPF during periods when the Robinson Lake Pump Station is not in operation and is discussed further in following sections.

Another component of the 1 Dam/Robinson TSF EPF is the capping and reclamation program. As discussed earlier, 1 Dam was graded and capped in the early 1990s. Portions of 1 Dam were covered with topsoil and revegetated successfully from 2004 to 2009. The majority of the remainder of the TSF was capped with rock material from a portion of the E and F Dumps, the open pit cirque area, and other areas. This cap reduces infiltration of surface water into the tailing material and reduces available oxygen (particularly during the winter months) necessary for acid production. The vegetation also consumes water that would otherwise infiltrate into the tailing material and become impacted. Revegetation work began in 1997 and is ongoing.

The size of the water pool on the TSF is maintained as small as practical to reduce infiltration into and through the tailing material. This is expected to reduce the volume of seepage emanating from the toe of 1 Dam.

Climax also has developed a comprehensive water quality monitoring plan (Section T-8) to detect potential changes in water quality downgradient of mine facilities such as Robinson TSF and 1 Dam to enable implementation of measures that may be needed to protect off site water resources such as Eagle Park Reservoir and East Fork Eagle River, including the addition of new EPFs if necessary. The water quality monitoring plan is included as Appendix T-C.

Robinson Lake and Dam: The Robinson Lake system including the reservoir proper and Robinson Dam is considered an EPF. Robinson Lake is designed and operated as a zero discharge facility to preclude overflow to Eagle Park Reservoir and East Fork of Eagle River. The Robinson Lake Pump Station located directly below the dam, Warren's Pump Station, and the seepage collection and return system are each considered EPFs and are discussed individually. The purpose of Robinson Lake is to store process water, which is routed into Robinson Lake through the Tenmile Tunnel and delivered by the Robinson Lake Pump Station back to the mill facilities. Robinson Lake also receives seepwater pumped from the Robinson Dam and 4 Dam seepwater collection systems.

Robinson Dam and its appurtenances are under the jurisdiction of the Colorado State Engineer's Office (SEO). The dam is required by the SEO to include an overflow emergency spillway to safely pass the inflow design flood. The spillway and outlet works for Robinson Dam are in compliance with the SEO rules and regulations.

In 2008, in accordance with information provided in TR-15, Climax conducted a sludge removal project in the east end of Robinson Lake to optimize the capacity of the facility for future production. Sludge and sediment removal was again conducted in 2010 and early 2011 and approximately one million cubic yards of material were removed. This work significantly reduced the amount of material that could potentially leach contaminants.

An operating plan for Robinson Lake has been implemented to prevent process water from entering Eagle Park Reservoir from Robinson Lake under the following set of extreme conditions:

- Surcharge storage capacity throughout the year to store, without release, the full rainfall amount of the site-specific probable maximum precipitation (PMP) event plus five days of seepwater inflow from the 1 Dam, Robinson Dam, and 4 Dam seepage collection systems, plus two days of diverted inflow from the Tenmile Tunnel;
- Additional surcharge storage capacity from April 15th through June 30th, which corresponds to the time frame when high snowmelt can occur, to store five days of the 100-year snowmelt runoff from the entire Robinson Lake drainage basin including the area above the Chalk Mountain Interceptor;

Specific safeguards in the plan include:

- Water level indicators in Robinson Lake with automated alarms to warn of high water levels;
- Frequent inspections by Climax personnel and as required by the SEO;
- Compliance with SEO requirements for dam safety and inspection;
- A seepwater collection system with a backup pump and generator to collect and pump embankment seepage back into the reservoir;
- Piezometers for monitoring phreatic water levels in the embankment;
- Toe drains for monitoring seepage;
- Structural monuments for monitoring for ground movement; and
- A contingency plan for implementing temporary backup pumps and power to dewater Robinson Lake if needed during an upset condition.

The Robinson Lake Operating Plan is included in Appendix T-D. The management plan will be adhered to as a component of this EPP as Climax's commitment not to allow Robinson Lake to overflow.

Warren's Pump System:

Prior to the installation of this EPF in 1997, 1 Dam seepage would flow into Robinson Lake. This water would then be delivered to the treatment system in the Tenmile Creek basin using the former Robinson Lake Pump Station. Warren's Pump System, including Tim's Pond and Warren's Pump Station, operates as an internal EPF to reduce the flow of impacted 1 Dam seepage into Robinson Lake. Tim's Pond consists of a cut-off wall and collection pond designed to capture and contain 1 Dam seepage, which is then piped to Warren's Pump Station. Warren's Pump Station serves to pump waters collected below 1 Dam back to the water treatment system in the Tenmile Creek basin via the 2 Dam Pipeline. In a non-operating mine scenario, water that collects in Robinson Lake can be pumped directly to the Warren's Pump Station pond for return to the treatment system.

This EPF is considered an internal EPF, since a failure or upset of this EPF does not directly result in an environmental impact. Warren's Pump System is contained within the footprint of Robinson Lake, near the northwest edge of the lake such that any spill or overflow from this EPF would report directly into Robinson Lake, which is also an EPF as described above.

The floor elevation of Warren's Pump Station is at a level just above the flood level in Robinson Lake. The pump station design allows for the withdrawal of the top 11 feet of water stored in Robinson Lake using the Warren's pumps. This provides a backup or redundant pumping system for Robinson Lake to ensure the lake maintains sufficient freeboard to prevent overflows.

The pump station consists of three vertical turbine pumps. With two pumps running, the discharge capacity of the system ranges from 3,800 to 4,500 gpm, depending on the condition of the discharge pipeline. The third pump is generally considered an installed spare, but can provide additional pumping capacity if necessary.

Robinson Lake Seepage Pump System: The purpose of the Robinson Lake Seepage Pump System is to contain and collect impacted seepage from the downstream toe of Robinson Dam and convey this water back into Robinson Lake. This EPF became necessary when Eagle Park Reservoir was converted to a clean water reservoir in 1997. This EPF was constructed in 1997 and significant modifications were made in 2001. The system has been in continuous operation since 1997.

The primary means of containment consists of a concrete cut-off wall below the Robinson Dam outlet area that is keyed into bedrock on the bottom and sides. A collection pond located on the upstream side of the cutoff wall provides detention storage and emergency storage capacity in the system. The collection pond provides an operational capacity of approximately 400,000 gallons. Captured seepage and runoff from the downstream face of Robinson Dam is pumped back into Robinson Lake. This cutoff and containment component restricts groundwater seepage from entering Eagle Park Reservoir.

The Robinson Lake Seepage Pump System includes a pump station that houses two submersible pumps that each have a capacity of approximately 480 gpm operating individually and approximately 750 gpm operating in parallel. The second pump functions primarily as an installed spare. The operation of the pumps is automatic based on the water level in the collection pond. There are two discharge pipelines, one operating and one backup that convey the water from the pump station to Robinson Lake.

The pumping system is electrically powered. Additional backup systems include a diesel generator installed at the site that can be activated in the event of a sustained loss of power. There are also diesel powered pumps on site that can be used in an upset condition to pump water from the collection pond into Robinson Lake. The system also includes instrumentation and telemetry that will activate alarms at the mill facilities in the event of a high water level in the collection pond. The system is inspected by Climax personnel daily.

Typical seepage rates from Robinson Dam are in the range of 20 to 50 gpm, which is much less than the pumping capacity of the system. This is the normal inflow rate to the system. However, since the system collects surface runoff from the small tributary basin above the cutoff wall, the design capacity of the system is controlled by hydrologic events such as rainfall or snowmelt. The hydrologic design basis of this system is the 100-year 24-hour precipitation event or the 100-year snowmelt event occurring within

the basin that is tributary to the seepage collection system.

4 Dam Seepage Collection and Pump System: The lowermost EPF downgradient of Climax facilities that protects the East Fork of the Eagle River beyond and below the Climax property boundary is the 4 Dam Seepage Collection and Pump System. This EPF is located just below the Eagle Park Dam (a.k.a. 4 Dam) and consists of a seepwater collection pond and two pumps in the adjoining enclosed pump house to return seepage to the upstream Robinson Lake. Located directly below the pump-house is a second, smaller seepage collection pond that acts as secondary containment of the seepage. This second pond supports a small pump that returns seepage back to the first collection pond. The discharge pipeline for the system extends from the pump station along the south side of Eagle Park Reservoir to the discharge point at Robinson Lake.

The intent of the collection system configuration is to minimize the collection of surface runoff from the downstream face of the dam. This surface runoff is not impacted by mine materials and can be routed to the stream system. Seepage from the dam toe is contained and routed into the collection pond.

Backup systems in place at this EPF to prevent discharge of impacted water to the East Fork of Eagle River include an installed backup pump and a diesel generator for use in the event of an extended loss of power. Instrumentation and telemetry equipment is in place to trigger an alarm at the mill facilities in the event of a high water level in the collection pond.

Robinson Lake Pump System: The location of the Robinson Lake Pump Station is just below Robinson Dam. A former pump station facility in this location has been decommissioned. The new Robinson Lake Pump Station and reclaim water pipeline are part of the process water reclaim system allowing for the recycling and re-use of water from the TSFs. Water is pumped to the mill water storage tank through a 21,000 foot buried steel pipeline for use as process water in the milling circuit. As described above, recharge to Robinson Lake will be accomplished by transferring water from Tenmile TSF and Mayflower TSF via the Tenmile Tunnel. The new pump station has a nominal operating capacity of 10,000 gpm. The Robinson Lake Pump Station and pipeline design was submitted to, and approved by, DRMS in 2008 under TR-14 and later in 2011 under TR-17 due to a change in pipeline size and alignment.

The design of the Robinson Lake reclaim water pump system is based on using the existing outlet pipe from Robinson Lake. A new hydraulically actuated outlet works valve was installed in 2008 along with new piping at the downstream toe of the embankment. In 2011, as part of construction of the new Robinson Lake Pump Station, new piping connects the outlet works piping into the pump station.

The Robinson Lake Pump Station building is a pre-engineered metal building. No potable water or sanitary sewer systems are included in the building. The building is configured so that all spills and leaks inside the building are captured by a sump and pumped to Robinson Lake by a dedicated sump pump.

The pump station and pipeline are designed to preclude accidental discharge to Eagle Park Reservoir and East Fork Eagle River. If a leak were to occur in the pipeline, water would either flow into one of the surface containments on site such as Robinson Lake or Robinson TSF or the Robinson Dam seepwater collection ponds. As with other EPFs, Climax conducts daily visual inspections of all active pipelines during each shift, including the entire reclaim system. These frequent visual inspections provide for immediate detection and response should a leak occur and are a key component to a comprehensive monitoring/mitigation system to prevent potential environmental impacts. Additional information regarding system alarms at the Robinson Lake Pump Station is in Section T-5.4.2.

Chalk Mountain Interceptor: An extensive clean water interceptor system has been established by Climax around the affected areas of the Eagle River Watershed. The Chalk Mountain Interceptor conveys storm water around the process facility and TSFs, which limits the amount of impacted waters to be treated and discharged. As agreed upon with DRMS, although this interceptor is considered to be a pre-EPF system and does not contain or control designated chemicals or process solutions, it will be managed as an internal EPF. The interceptor is closely monitored, inspected and maintained as part of routine site monitoring activities. Other than normal repair and maintenance, any future expansion or modifications of the interceptors will be subject to review by DRMS, consistent with Section 6.4.21(10)(a)(ii) of the Rules.

This Chalk Mountain Interceptor starts near the top of Fremont Pass and collects runoff primarily from the

north slope of Chalk Mountain. The system discharges the collected water either into Eagle Park Reservoir or into the East Fork Eagle River. Except for a few culvert sections, the interceptor consists of an unlined ditch that is cut into the hillside. The ditch is paralleled by an access and maintenance road.

T-5.3 Tenmile Creek Watershed

T-5.3.1 Potential Sources of Contamination

The open pit mine, mill facilities, overburden storage facilities (OSFs), and the Robinson, Tenmile and Mayflower TSFs are all located within the Tenmile Creek Watershed (Figure AM-06-T-01). Most of the mine's water treatment/management activity occurs within the Tenmile Creek drainage area and must address: (1) a component of water that is pumped from the Eagle and Arkansas River drainages to the Tenmile drainage; (2) a large component of minimally impacted runoff from areas above the interceptor channels within the Tenmile drainage; and (3) wastewater from the mill circuit and water which has had direct contact with mine tailing, overburden, or other disturbed areas.

Water from the Arkansas River drainage introduced to the Tenmile drainage includes water from the underground mine workings (5-Shaft) and water from the Arkansas Well used for domestic supply at the mill. Water introduced from the Eagle River drainage includes dam seepage (1 and 4 Dam), and runoff collected in Robinson Lake that may enter the Tenmile drainage area as makeup to the mill water circuit. All other waters managed by Climax originate as snow or rainfall within the Tenmile Creek drainage on the mine site or on land above the interceptor canals.

The upper Tenmile Creek Watershed, including its tributary drainages of McNulty Gulch, Kokomo Gulch, Searle Gulch, Rose Gulch, Tucker Gulch, Humbug Creek, Mayflower Creek, and Clinton Creek, has been subject to extensive placer and lode mining, milling, and smelting operations since the discovery of placer gold in the 1860s (reference for historic information: Dempsey, S. and J.E. Fell, Jr. 1986; Mining the Summit. University of Oklahoma Press). At one time, the Tenmile Creek Valley within the present boundaries of Climax supported four incorporated towns: Carbonateville, Robinson, Kokomo, and Recen. At the peak of historic mining development in the 1880s, more than 10,000 people resided in the valley during the snow-free period. A number of mills and several smelters processed lead/silver, gold, copper, and (later) zinc ores extracted from the numerous mines in the area. Thus, Tenmile Creek Watershed from the top of Fremont Pass to well downstream of the Climax property line was impacted prior to the discovery and development of the Climax molybdenum ore body. Operations at Climax since the early 1970s have stabilized and dramatically improved environmental conditions in the watershed downstream of the property. Such improvements are evidenced by the documented recovery of the aquatic ecosystem in Tenmile Creek from its virtually sterile condition prior to 1970.

Within the Tenmile Creek Watershed certain impacted waters are collected and routed to the SDP, for first stage metals treatment and discharged to the Tenmile TSF. The SDP was incorporated into the mine's water treatment/management system in 2007 (AM-05) to improve both water treatment efficiency and sludge management and has a capacity of approximately 6,900 gpm. Employing lime neutralization, precipitation/settling, and sludge thickening steps, the SDP significantly reduces the water content of solids placed in the Tenmile TSF, thereby making more efficient use of the facility's solids storage capacity. The SDP produces a sludge that is deposited in a constructed cell on Tenmile TSF. Evaporation and freeze/thaw cycles increase sludge density.

Water treatment, following the SDP, is accomplished using the water pool of the Tenmile TSF and the Property Discharge Water Treatment Plant (PDWTP) for first and second stage treatment, respectively. In the first stage treatment, discharges from the SDP and impacted waters that exceed the SDP's treatment capacity of 6,900 gpm are treated by lime addition and settling in the water pool of the Tenmile TSF. In the second stage, treated water is decanted from the Tenmile TSF and flows by gravity into the Mayflower TSF where it is pumped by barge to the PDWTP (TR-19). At the PDWTP pH is again adjusted upward with lime addition to further precipitate metals. The stage two treated water at the PDWTP is neutralized with sulfuric acid before being discharged at CDPS Permit Outfall 002A to merge with flow from the Interceptor System before it is discharged at CDPS Permit Outfall 001A. Prior to construction and operation of the PDWTP, stage two treatment was accomplished by diverting stage one treated water

from Tenmile TSF to a lime addition facility on 3 Dam and then allowing treatment to occur in the Mayflower TSF water pool.

Phase 1 tailing Deposition began at Climax with the restart of operations in 2012. In Phase I Deposition, tailing slurry is deposited in the Tenmile TSF, and excess water is reclaimed for use in the mill via the Tenmile Decant and Tenmile Tunnel. Phase I Deposition will cease when the Tenmile TSF reaches capacity as described in TR-20.

Phase II Deposition began in August 2014 when Climax began delivering tailing to the Mayflower TSF (5 Dam) through a combination of new and rehabilitated tailing delivery pipelines (TDLs). Like the Tenmile TSF, the tailing slurry is being deposited in the Mayflower TSF utilizing the upstream deposition method by operation of a header and spigot system along the crest of 5 Dam.

The mill water reclaim system from Tenmile TSF will continue to operate as previously described. Phase II Deposition in Mayflower TSF will use the Mayflower Barge and reclaim water pipeline (TR-23). This process water barge is located in the Mayflower TSF water pool and delivers water from the pool to the north portal of the Tenmile Tunnel where it is directed to Robinson Lake.

During Phase II Deposition, first stage treatment of impacted water will take place in the SDP and Mayflower TSF water pool. The discharge of circumneutral tailing slurry into the Mayflower water pool will be consistent with first stage treatment. Excess water requiring off site discharge from the Mayflower TSF will be pumped from the water pool by a second barge (described in TR-19) and delivered to the PDWTP.

In conjunction with these operations, potential sources of contamination in the Tenmile Creek watershed include:

- Designated chemicals (stored and used) for production of molybdenum disulfide concentrate;
- Mill water reclaim circuit (including storage tanks and supply system);
- Process facility/mine yard (a.k.a: Camp Area) run-off and seepage;
- Underground mine and open pit water;
- OSF seepage (North 40 and McNulty);
- Tailing and process water delivery systems (TDL and ETDL);
- Water treatment chemicals (stored and used) for treatment of mine water (including the Lime Station, SDP and PDWTP);
- Robinson TSF;
- Tenmile TSF and 3 Dam seepage; and
- Mayflower TSF and 5 Dam seepage.

These potential sources of contamination are also listed in Table T-3 and are shown on Figure AM-06-T-01.

Climax has developed a comprehensive water quality monitoring plan to detect potential changes in water quality downgradient of mine facilities. The monitoring is designed so that changes are detected early to enable implementation of measures that may be needed to protect off site water resources such as Clinton Reservoir and Tenmile Creek, including the addition of new EPFs if necessary. The water quality monitoring plan is included as Appendix T -C.

T-5.3.2 Environmental Protection Facilities

The Climax water management and treatment system, which terminates at the base of 5 Dam and the PDWTP, contains the principal EPFs in the Tenmile Creek Drainage. This system discharges treated water meeting the conditions and standards of the CDPS Permit at Outfall 001A located near the property boundary. Under the CDPS permit discussed in Section T-2.2, discharge of water from the site, including process water and impacted waters are required to meet discharge water quality limits. Contaminants that might be released from the potential sources discussed in Section T-5.3.1 would be captured within the

Tenmile Creek watershed above or at the Mayflower TSF where water is sent to stage 2 treatment at the PDWTP prior to discharge. Individual EPFs, which are part of the water treatment system, are discussed in subsequent sections along with EPFs that are present in other areas of potential contamination above the water discharge outfall.

The following controls are designated EPFs to prevent potential impacts to Tenmile Creek and Clinton Reservoir from Climax operations:

- TDL;
- ETDL;
- East Side Channel;
- Robinson TSF and 2 Dam;
- Tenmile TSF and 3 Dam;
- Mayflower TSF and 5 Dam;
- 5 Dam Seepwater Collection and Return System;
- Containment for Designated Chemicals for Concentrate Production;
- OSF Water Management Controls;
- SDP and PDWTP;
- Containment for Water Treatment Chemicals
- East and West Interceptor Systems; and
- Pit Dewatering System

TDL: Tailing delivery and deposition for mine production will utilize the Tenmile and Mayflower TSFs. As presented in TR-14, a 36-inch diameter high-density polyethylene (HDPE) TDL was placed from the mill discharge sump to the Tenmile TSF. The TDL generally follows the alignment of the existing ETDL. The existing 42-inch diameter reinforced concrete pipe (RCP) TDL from the SDP to the Mayflower TSF was rehabilitated, and portions of the TDL were replaced with HDPE to convey tailing beyond the Tenmile TSF to the Mayflower TSF. The TDL is further described in TR-20 and TR-23. TR-23 also describes containment measures included in the design of the TDL in the event of releases from the pipeline and associated drop structures.

ETDL: The ETDL conveys impacted water sources to the SDP and serves as an emergency tailing conveyance line should the main delivery line from the Mill to the first discharge point have to be taken out of service for a short period. This line is constructed of 36-inch and 42-inch RCP that isolates the impacted water from the environment until it is delivered to the SDP or deposited in one of the TSFs.

East Side Channel: As described in Exhibit G of AM-06, the Robinson Section of the East Side Channel conveys water from the Robinson Pond water pool and areas tributary to the Robinson Pond through the 2 Dam Spillway to Tenmile TSF. Further upstream, the unimproved portions of the East Side Channel extend along the eastern boundary of Robinson TSF, under the multi-plate culvert beneath Highway 91, and up into the area which borders the North 40 OSF. The unimproved portion parallels the ETDL/TDL and terminates in the vicinity of the sanitary wastewater treatment building. This channel collects seepage and run-off from the Camp/Mill area and serves as a secondary containment for potential releases from the TDL and ETDL pipelines.

Robinson TSF and 2 Dam: As discussed in Section T-5.2.1, the Robinson TSF encompasses approximately 650 acres. 1 Dam and a small portion of the southern part of this TSF are located in the upper Eagle River Watershed and are discussed in Section T-5.2. The remainder of the TSF and 2 Dam are within the Tenmile Creek Watershed.

The Robinson TSF contains mill tailing material. As discussed in Section T-5.2.1, tailing material from the

Climax mill circuit is recognized as potentially acid producing.

The Robinson TSF has been decommissioned and, as noted previously, is in the final stages of reclamation. However, even when reclaimed, Robinson TSF remains both a potential source of contamination and an important EPF.

Tenmile TSF and 3 Dam: The Tenmile TSF, including 3 Dam, currently encompasses approximately 620 acres and is located adjacent to and just downstream of the Robinson TSF. Once Tenmile TSF has reached its planned capacity of tailing material, it will encompass approximately 650 acres.

The Tenmile TSF was constructed in the 1950s and contains tailing material that, as discussed previously, is considered acid producing. Future operations at Climax will first utilize the Tenmile TSF for tailing disposal. Approximately 29 million tons of additional tailing may be deposited in the Tenmile TSF.

Mill tailing in slurry form is delivered to the TSF by the TDL. Clarified water is removed from the TSF through a decant system at Tenmile Decant via the Tenmile Tunnel (to the Robinson Lake or Mayflower TSF as discussed in Section T-5.2.1). A water pool is maintained at the upstream end of the Tenmile TSF for process water storage, storm water management, and as the first stage in the water treatment system.

The Tenmile TSF is considered both a source of potential contamination and an EPF. The integrity of the TSF and 3 Dam provides containment of the tailing material. The Tenmile TSF also provides control for contaminants that might be released from upgradient sources.

Mayflower TSF and 5 Dam: The last TSF downstream in the Tenmile Creek Watershed is the Mayflower TSF. This TSF and its dam (5 Dam), along with the 5 Dam Seepwater Collection and Pump System is the final water management control (excluding the PDWTP) on Tenmile Creek within the Climax property boundary. At the end of mining, the projected size of Mayflower TSF is approximately 900 acres.

The Mayflower TSF was constructed in the mid-1970s. It was utilized for tailing deposition until Climax ceased mill operations. In the early 1990s, the beach areas of the TSF and 5 Dam were capped with rock and soil material excavated from the eastern edge of the TSF. A portion of this capping had been removed prior to the resumption of tailing deposition in mid-2014. To prevent dam failure, the Mayflower TSF also includes an emergency flood bypass tunnel (described in TR-21).

As with the Robinson and Tenmile TSFs, the Mayflower TSF is both a potential source of contamination and a critical EPF. As a potential source, the Mayflower TSF contains tailing material that is considered potentially acid producing. It should be noted, however, that the historical use of this TSF strictly as a water treatment facility has served to add significant amounts of lime to the impoundment. Another source of potential contamination is seepage emanating from the toe of 5 Dam. This seepwater is slightly acidic with elevated sulfate and metals.

As an EPF, the Mayflower TSF, including 5 Dam, is crucial. Mayflower TSF (as well as Tenmile TSF) also provides containment of contaminated materials or designated chemicals if they are accidentally released up-gradient of the TSF. In addition, the Mayflower TSF contains, mixes, and treats impacted waters from several historic mines and smelter sites as well as non-point run-off waters which contact mine wastes within a large portion of the historic Consolidated Tenmile Mining District.

5 Dam Seepwater Collection and Return System: The seepwater collection and return system below 5 Dam (Mayflower TSF) is an important EPF at the Climax Mine. Although it is component of the Climax water treatment and discharge system EPF, it is discussed again here as a specific EPF. Seepage from the dam is routed to concrete ponds. Collected seepage is pumped back by vertical turbine pumps to the 3 Dam Pump Station or the water pool on the Mayflower TSF. This pump system is located within the Mayflower Pump Station below the TSF. During upset conditions, seepage can be temporarily contained within the 5 million gallon concrete pond system.

Containment for Designated Chemicals for Concentrate Production: The EPFs for the designated chemicals used for milling and production of concentrate at Climax include containment provided by enclosed buildings, tanks, bins, and sumps, singly or in combination. However, additional containment EPFs for designated chemicals include the Tenmile and Mayflower TSFs and the associated water treatment system. As stated previously, the mill site and its ancillary facilities are located within the upper

Tenmile Creek watershed. Therefore, a release of a designated chemical or process waters not contained at the release site ultimately would be contained at the TSFs.

TR-14 described the new mill and accessory buildings for use during resumed production, however the final design and layout of the mill and accessory buildings had not been fully developed at that time. TR-14 designated the mill building as a location for several Environmental Protection Facilities (EPFs) associated with designated chemicals. Additional details of the mill facility have since been developed and general arrangement drawings of the mill and reagent storage and containment areas are provided as Figures AM-06-T-06 and AM-06-T-07. The list of designated chemicals, their storage location, storage capacity and the presence of secondary containment is provided in Table T-2 in Section T-3.1.

OSF Water Management Controls: As described in Section T-4, Climax will use best management practices to reduce the amount of impacted water requiring treatment. Climax will segregate materials when feasible and has developed construction design and monitoring plans with guidelines for overburden placement to reduce infiltration within exposed OSF surfaces to the extent practicable by promoting drainage off of OSF surfaces and performing concurrent reclamation.

The OSF EPFs will consist of water management controls for the McNulty and North 40 OSFs. Specific EPFs are identified in TR-22 and include the following:

- Upgradient diversions to prevent storm water runon from coming into contact with OSF material;
- Run-off control features to contain and direct impacted storm water to the water management and treatment system;
- Underdrains to eliminate contact between shallow groundwater and OSF materials;
- Underdrains beneath OSF toe areas to collect and route seepage to the water management and treatment system.

Climax will provide final as-built drawings of the system and the EPF certification to DRMS upon completion of the system.

SDP and PDWTP: The SDP and PDWTP provide first and second stage treatment, respectively, of impacted waters to comply with discharge permit requirements. The plants utilize the high density sludge (HDS) process, which re-circulates sludge to maximize the neutralization potential of the added lime and improve coagulation and settling. Lime is added to the incoming water in the metals reactors. The resulting precipitate is thickened and the thickener overflow flows into the Tenmile TSF at SDP and, for stage 2 at PDWTP, is filtered by sand filters in the metals filter building to remove any remaining precipitate solids. At the PDWTP sulfuric acid is added to provide a final pH adjustment, and the filtrate is discharged at CDPS Outfall 002A to the natural channel above CDPS Outfall 001A in Tenmile Creek. To ensure effluent limits are met for all constituents, the PDWTP is designed to treat flows up to 14,000 gpm.

Any spills at SDP are contained by floor drains, all of which are within the drainage area of the Tenmile TSF. At the PDWTP, the metals reactor building has dedicated sumps to catch overflows and spills and return the water to the treatment system. Water also can be routed to Mayflower return pump station that can convey up to 7,000 gpm back to the Mayflower TSF. The concrete-lined, events pond at the PDWTP provides additional containment of approximately five million gallons to safely accommodate the full volume from failure of the largest single vessel (thickener) or the combined capacity of the influent line and feed tank. Water from the events pond will be pumped back to the Mayflower Return Sump. Technical Revision TR-19 provides a detailed description of the PDWTP and general arrangement drawings.

Containment for Water Treatment Chemicals: As discussed, various source waters are treated by lime neutralization to raise the pH and precipitate metal hydroxides. Precipitates (treatment sludge) are contained within the sludge cells on within the Tenmile TSF and Mayflower TSF footprints. Additional precipitation and settling occurs in the Tenmile and Mayflower TSFs. Prior to discharge to Tenmile Creek, sulfuric acid is used at the PDWTP to reduce the final pH into the range stipulated by the CDPS Permit.

Lime: Slaked lime is currently produced at the SDP and PDWTP Lime Stations. The lime stations

includes conventional silos for storage of lime and lime slakers. Slaked lime is produced by mixing lime from the silos with fresh water.

Sulfuric Acid: Sulfuric acid is incorporated into the water treatment system at the PDWTP to lower the pH of discharged water to within the range of pH 6.5 to 9.0. Sulfuric acid is stored in an approximate 4,300 gallon carbon steel tank located within an enclosed room with epoxy-coated concrete floor inside the PDWTP filter building..

Flocculent: Flocculent is received in bags and put into solution onsite at the SDP and PDWTP. At the SDP, the liquid solution is stored in a 2,000 gallon mix tank and a 3,500 gallon feed/storage tank. At the PDWTP, the flocculent is mixed and stored in two approximately 3,000 gallon tanks. The mixing tanks are located within secondary containment inside the SDP and PDWTP buildings.

East and West Interceptor Systems: An extensive clean water interceptor system has been established by Climax around the affected areas of the upper Tenmile Creek Watershed. The interceptor canal system conveys storm water around the process facility and TSFs, which limits the amount of impacted waters to be treated and discharged. As agreed upon with DRMS, although these interceptors are considered to be pre-EPF systems and do not contain or control designated chemicals or process solutions, they will be managed as internal EPFs. The interceptor system is closely monitored, inspected and maintained as part of routine site monitoring activities. Other than repair and maintenance, any future expansion or modification of the interceptors will be subject to review by DRMS, consistent with Section 6.4.21(10)(a)(ii) of the Rules.

The interceptors total approximately 13 miles in length and are labeled as the West Interceptor and the East Interceptor (Figure AM-06-T-01). These interceptors were constructed in the 1970s during construction of the Mayflower TSF to intercept and convey snowmelt and storm water around the three TSFs in the Tenmile Creek Watershed. The West Interceptor begins along the west side of the Tenmile TSF and drains directly into Tenmile Creek within the Climax property line downstream of the Mayflower TSF. The east interceptor begins at the edge of the McNulty OSF and terminates at the Clinton Gulch Reservoir. The Clinton Canal begins at Clinton Reservoir and terminates at Mayflower Creek. The total Interceptor System handles approximately 14,500 acre-feet of water annually. Clinton Reservoir offers flood protection for Mayflower TSF.

Pit Dewatering System

As described in Section T-5.1.2, the 5-Shaft Pump Station and Storke Pipeline are used to convey impacted storm water that passes through the open pit area and collects in the underground mine workings. The current Climax mine plan will result in deepening the open pit to below the elevation of the 5-Shaft pumps. When this occurs, Climax will need to transition from the current 5-Shaft Pump Station to an in-pit dewatering system to convey impacted storm water to the SDP for treatment. The pit dewatering system will consist of a pumping station located at the bottom of the open pit that will convey water to one or more booster stations up to the rim of the open pit. This water will then be piped through the Camp area to the ETDL or other pipeline that will transmit the mine drainage by gravity flow to the SDP for stage one metals treatment. The pump station and boosters will be powered by an electrical transmission line with emergency generators available in the event of power outages. Preliminary designs of the pit dewatering system were included in the submittal of this Technical Revision 24. Climax will provide final as-built drawings of the system and the EPF certification to DRMS upon completion of the system. Construction of the pit dewatering system could begin as early at 2015, depending on the timing of mine development.

Protection of Clinton Reservoir: As the McNulty OSF is expanded, it will become necessary to truncate the upper end of the East Interceptor Canal to direct runoff from the OSF to the water management and treatment system instead of allowing this water to enter the interceptor and Clinton Reservoir. The design of this modification of the East Interceptor will be developed to ensure that impacted water will not enter the East Interceptor, and to maximize the amount of clean water intercepted. The tributary area to the East Interceptor is currently estimated at 832 acres. When the East Interceptor is truncated, Climax estimates that the tributary area will be reduced by approximately 240 acres, although the final change will depend on the location and design details associated with the modification to the East Interceptor.

Although not considered EPFs, Climax will conduct visual inspections and implement other Storm Water

Management Plan best management practices (BMPs) in association with its general storm water permit to manage disturbances associated with the open pit, including road construction and pit development activities near the summit of Bartlett Mountain, to prevent water quality impacts to the Clinton Gulch watershed and Clinton Reservoir from erosion and sediment. As part of its storm water management program, Climax also will utilize BMPs for blasting activities to prevent water quality impacts from flyrock entering the Clinton Gulch watershed, and will grade disturbances, including the Bartlett Mountain access road so that storm water runoff will report to the open pit or McNulty Gulch collection area for eventual treatment rather than allow runoff to the Clinton drainage.

T-5.4 Environmental Protection Facility Effectiveness Evaluation

The EPFs described and discussed for the three watersheds at the Climax Mine site have been very effective in preventing releases of potential contaminants to the environment, as documented by water quality monitoring and compliance with discharge standards.

T-5.4.1 Arkansas River Watershed

The mining related activities that occurred in the Storke Yard area in the past have ceased as the scope and size of operations at Climax have been reduced to mining from the open pit. Closure and reclamation tasks have been completed in the upper Arkansas River Watershed contributing to improved water quality conditions in the Arkansas River.

The two pumping stations in the Arkansas Watershed are the critical EPFs in the watershed. Both are active, as they directly contain and control impacted waters. The Storke Wastewater Pump Station has been operational for approximately 30 years without major problems or releases. The 5-Shaft Pump Station, although only operational since 1996, has performed as expected without release of impacted mine water. Prior to startup of the 5-Shaft Pump Station, the underground mine workings were dewatered by other pump systems, thereby establishing a long history of environmental protection in the Arkansas River Watershed. The Ceresco Ridge Haul Road Fill Area Runoff Collection System will provide containment and control of any impacted run-off from newer fill areas.

Demonstration of the Mosquito Fault as a hydraulic barrier to potential process water impacts to the Arkansas was discussed with DRMS during a site inspection and in verbal and written correspondence in the fall of 1994. Subsequent geophysical evaluations were performed to establish the criteria to maintain water levels 19 feet below the apex of the Mosquito Fault. The Mosquito Fault is located approximately 350 ft west of the 5-Shaft. A pumping station installed in 5-Shaft maintains the water level at a target elevation of 11,080 feet that does not allow the flow of impacted water to the Arkansas River Valley. The level of water in 5-Shaft is kept below the apex of the Mosquito Fault to prevent mine water from potentially impacting the Arkansas River. Climax also monitors a piezometer located approximately 60 feet from the 5-shaft for changes in water level, on the same side of the Mosquito Fault as the 5-Shaft. The effectiveness of 5 Shaft pumping is verified by the water level in the piezometer adjacent to the shaft that shows a hydraulic gradient towards the shaft.

As the mining of the open pit advances in depth, the 5 Shaft Pump Station may become obsolete during operations, and pit and underground water levels will then be controlled by an in-pit dewatering system. The long-term operation of the 5 Shaft Pump Station, Storke Wastewater Pump Station and the Ceresco Ridge collection system will be dependent upon final reclamation activities in the area, but will continue indefinitely until water quality conditions are demonstrated to no longer require collection.

T-5.4.2 Eagle River Watershed

As with the EPFs throughout the Climax Mine site, those in the upper Eagle River Watershed have been effective in containing and controlling the release of potential contaminants during the recent history of the mine. The primary EPFs in the watershed are Robinson Lake (and dam), the Robinson Lake Pump Station, and the associated seep collection and return systems below Robinson Lake. As described in Section T-5.2.2, the capacities of the collection and pumping systems in-place are adequate to provide protection of water resources in the Eagle River Watershed.

Multiple improvements to the EPFs in the Eagle River Watershed have been made over the last 15 to 20

years, and include: The installation of Tim's Pond and improvements to Warren's Pump Station to capture the majority of seepage from 1 Dam and Tenmile Tunnel and pumping this water to the SDP before it enters Robinson Lake; Upgrading the Robinson Lake Seepage Collection System including the application of an impermeable coating on the upstream side of the cut-off wall and construction of a collection pond upgradient of the wall to provide increased storage capacity. The long-term effectiveness of the system of EPFs in-place in the Eagle River Watershed is demonstrated by water quality observed at water quality monitoring locations described in the Water Quality Monitoring Plan (Appendix T-C) and in water quality within Eagle Park Reservoir.

Robinson Lake functions as a process water and seepage containment, storage and return system. The Robinson Lake Pump Station returns process waters directly to the process water tank for the mill. Because the integrity of this collection and return system is essential to production of molybdenum concentrates, close observation of its operation and maintenance of the systems is a priority. The development of the Robinson Lake Operating Plan (Appendix T-D) provides additional operational safeguards to prevent an overflow condition from Robinson Lake.

The 4 Dam and Robinson Dam seepage collection and pump systems will remain in place and fully functional until such time as seepage from the dam meets water quality standards for this segment of the Eagle River. The seepage collected in the 4 Dam Seepage Collection System averages only approximately 10 gallons per minute, and the system has a redundant design to provide secondary containment, as described in Section T-5.2.2. The effectiveness of this system has been provided through monitoring water quality in the East Fork Eagle River at sites described in the Water Quality Monitoring Plan (Appendix T-C).

The 1 Dam EPF has been effective in controlling the release of tailing material from the TSF. The regrading, capping, and reclamation of this dam (Section T-5.2.2) have increased its present and future effectiveness.

T-5.4.3 Tenmile Creek Watershed

EPFs in the critical Tenmile Creek Watershed have been, and continue to be, extremely effective in containing and controlling contaminants and preventing contaminant release into the environment. As the EPFs essentially function in series from the top of the watershed, the effectiveness of the system is increased through the redundancy or secondary containment afforded by this arrangement. Each EPF serves as a protective layer for up-gradient EPFs. However, it must again be emphasized that the upper Tenmile Creek Watershed has been significantly impacted by historic placer and lode mining, milling and smelting activities, which peaked in the 1880s. Prior to construction of the Mayflower TSF and the Interceptor System, impacted waters and significant loads of contaminated sediments from these non-Climax historic operations entered Tenmile Creek and were transported downstream.

The Climax water treatment and discharge system, which treats large volumes of water, has an exemplary track record. The treated discharge at Outfall 001A has met effluent limitations contained in the permit and has passed Whole Effluent Toxicity (WET) tests. Utilizing the first and second stage treatment processes of the SDP and PDWTP (second stage formally accomplished at the Mayflower TSF) with lime addition for pH adjustment is an effective and time-proven means of treatment.

The EPFs that control and contain the water treatment chemicals, as with the process water and tailing circuit, have a proven track record for effectiveness at the Climax Mine. As discussed in Section T-5.3.2, water treatment chemicals have primary and secondary containment.

The ETDL and TDL generally have good records for effectiveness. However, leaks/spillage can and have occurred in the past. As described in TR-20 and TR-23, there is containment in the designs and, if leaks occur, any needed repairs to the line will be made promptly. As stated previously, other EPFs (TSFs) downgradient of the ETDL and TDL also provide containment, preventing a release outside of the water management and treatment system.

The effectiveness of the Robinson, Tenmile (TR-20), and Mayflower TSFs (TR-23) is self-evident. The Robinson TSF has been used since the mid-1930s, the Tenmile TSF since the mid-1950s, and the Mayflower TSF since the mid-1970s without failure. Each TSF will contain any major point and non-point

source releases of potential contaminants from upstream areas including impacted seepages from the McNulty and North 40 OSFs, spillage/leaks from the ETDL and TDL, and potentially contaminated surficial run-off from haul roads, the pit area, and the yard areas around the mill facilities. The effectiveness of the Mayflower TSF (including the 5 Dam Seepwater Collection and Return System) in the Climax water treatment and discharge system has been discussed at length.

Designated chemical storage EPFs within the mill all include secondary containment as described in Section T-3.

T-5.5 Specific Environmental Protection Facility Monitoring/Alarms

The critical EPFs at Climax are regularly checked, inspected, or monitored either visually, analytically, or both by security and water treatment personnel that are on-site at all times. Occasional inclement weather can restrict access to some facilities for short periods of time. In the case of pump stations, mechanical and telemetric alarms also are operational should failures occur. These monitoring systems are discussed herein by EPF and watershed. System alarms for the critical EPFs are discussed in subsequent sections. Facility monitoring/alarms details are not included for potential future EPFs that have not been designed.

T-5.5.1 Arkansas River Watershed

5-Shaft Pump Station: The 5-Shaft Pump Station is equipped with monitoring and alarm systems. In addition to these systems, the station is visually checked regularly. A groundwater piezometer (5-Shaft Monitoring Well) has been installed adjacent to the pump station to monitor groundwater levels adjacent to 5-Shaft. The water levels in this piezometer are recorded on a monthly basis.

Storke Wastewater Pump Station: The Storke Wastewater Pump Station is equipped with monitoring and alarm systems. As with the 5-Shaft Pump Station, the Storke Wastewater Pump Station is checked visually by designated employees.

T-5.5.2 Eagle River Watershed

Robinson TSF and 1 Dam: As discussed previously, 1 Dam has been reconfigured, stabilized, and reseeded. Monitoring of this EPF is conducted visually by various mine personnel. Piezometers are utilized to monitor water levels in the dam.

Robinson Lake and Dam: Visual monitoring of Robinson Lake is performed routinely by Climax personnel. The Robinson Lake Pump Station operates as the main level control for Robinson Lake. A water level indicator continuously monitors the water level within Robinson Lake and is connected telemetrically to the mill control room to provide immediate notification should water levels exceed set points for high water action levels.

Robinson Dam is considered to be a jurisdictional dam by the Dam Safety Branch of the Colorado State Engineer's Office (SEO) and must therefore meet the dam safety and inspection requirements of the SEO's "Rules and Regulations for Dam Safety and Dam Construction." The Dam is inspected regularly by Climax personnel and generally once per year by SEO personnel.

A total of nine piezometers are located in the Robinson Dam embankment. Climax personnel routinely monitor the piezometers and maintain a database of phreatic water levels.

A foundation drain system is located on the right downstream abutment of the dam. The flow rate from the drain is monitored regularly by Climax personnel and recorded during the SEO's Dam Safety Engineer's inspections. A small collection pond near the toe of the dam also collects dam seepage. This system is monitored regularly by Climax personnel; however, this system also collects some surface runoff and shallow subsurface flows from the area to the left of the dam embankment.

Six structural monuments are located along the crest of the dam for monitoring for ground movement. These monuments are surveyed once per year, or more frequently if requested by the SEO, to monitor for indications of settlement, sliding, or dam instability.

Warren's Pump System: Warren's Pump Station is checked regularly by mine personnel and contains appropriate alarms to provide immediate notification should pump failure occur.

Robinson Lake Seepage Pump Station: Water level readings from a level probe in the wet well control the on/off operation of the pumps. A backup generator, which is located in the Robinson Lake Pump Station, provides backup power to the seepwater system in the event of a power failure. This system is monitored regularly by Climax personnel.

4 Dam Seepage Collection and Pump Station: This seepage return station is checked regularly by mine personnel. Water level readings from a level probe control the on/off operation of the pumps. In addition, a beacon alarm is situated atop the dam to alert personnel in the case of pump failure. A back-up pump is situated at the station as well as a back-up generator set to run the seep pump in case of power failure.

The channel immediately below the 4 Dam seepage collection system primarily conveys only water released from the Eagle Park Reservoir (EPR) and localized run-off from precipitation or snowmelt events. As part of its EPF monitoring program, Climax will visually inspect the stream channel below the seepage collection system and EPR outlet works during periods of no natural flow or discharge from the reservoir.

Robinson Lake Pump System: The pump station is designed for normal operation with two pumps running. A third pump is installed as a backup during normal operating conditions and could be used to evacuate additional water from Robinson Lake if needed. Pressure indicators on the intake and discharge sides of the pumps control operation of the pumps and also are tied to automated alarms to warn of upset conditions. As with the other pump stations at Climax, the pump station pressure alarms are connected telemetrically to the mill control room to provide immediate notification should intake or discharge pressures exceed certain set points or pump upsets occur.

The pump station is also equipped with instrumentation to monitor pump operating status, temperature, and vibration as well as discharge flow rate. These parameters will be relayed to and monitored at the mill control room.

T-5.5.3 Tenmile Creek Watershed

Monitoring of the water treatment and discharge system, which verifies the effectiveness of the various EPFs associated with the water treatment system at Climax, is extensive and intensive. The CDPS Permit requires daily, monthly, and quarterly sampling and monitoring with reporting on a monthly basis. In addition, Climax conducts quarterly WET tests on discharged waters. Detailed information regarding the types of monitoring, parameters, frequency, reporting requirements, methods and analyses is found in the CDPS Permit (CO0000248).

Water Treatment Chemicals: The chemicals used in the water treatment process are flocculent, lime and sulfuric acid. Lime and sulfuric acid are stored in steel silos and a 4,300 gallon tank, respectively. The acid station at 5 Dam is being phased out since commissioning of the PDWTP. As described previously, flocculent is stored in mix tanks and feed/storage tanks. The mixing in the mix tanks is done in batch operations and is monitored. The feed/storage tanks are equipped with level controls to regulate tank levels. The lime silos are monitored visually. The PDWTP sulfuric acid tank is monitored with level indicators. The acid metering system also contains an alarm.

Designated Chemicals for Concentrate Production: Monitoring of the integrity of the designated chemical EPFs is a standard operating procedure at the Climax Mine during periods of operation when chemicals are maintained at the site. Each storage facility is visually checked by mill personnel. Leaks, spills, or other accidental or unauthorized releases are immediately reported.

TDL and ETDL: Regular checks of the TDL and the ETDL are conducted. While the TDL is used to transport tailing from the mill to the TSFs, they are also important links in the water treatment system at Climax. Specific monitoring procedures and a description of instrumentation installed within the tailing

delivery system are described in the TSF Operations and Maintenance Manuals submitted as TR-20 and TR-23. These manuals, incorporated by reference, will be maintained and updated separate from the EPP.

Robinson TSF and 2 Dam: Monitoring of 1 Dam was discussed in Section T-5.5.2. Robinson TSF and 2 Dam are monitored visually by Climax personnel. As with all the TSFs, its location, size, and function allow for extensive observations.

Tenmile TSF and 3 Dam: The Tenmile TSF, 3 Dam, and ancillary facilities such as Tenmile Decant and Tenmile Tunnel are monitored by Climax personnel in accordance with TR-20. Piezometers are utilized to monitor water levels in the dam. Piezometric water levels are recorded and reviewed by Climax and a third-party engineering consultant. Periodic inspections of the TSF include monitoring seepage to detect unusual flow quantity or clarity changes, monitoring spigot discharge and tailing deposition patterns, periodic evaluation of tailing characteristics, observations of pond level and tailing beach width, inspection for signs of erosion, displacement or cracking, and general observations of the dam and appurtenances.

Operational plans for the Tenmile (3 Dam) TSF dam are in TR-20. A third-party engineering consultant will evaluate and provide an annual summary report on TSF operation and monitoring results.

Mayflower TSF and 5 Dam: The Mayflower TSF, 5 Dam, and ancillary facilities are monitored by Climax personnel in accordance with TR-23. Piezometers are utilized to monitor water levels in the dam. Piezometric water levels are recorded and reviewed by Climax and a third-party engineering consultant. Periodic inspections of the TSF include monitoring seepage to detect unusual flow quantity or clarity changes, monitoring spigot discharge and tailing deposition patterns, periodic evaluation of tailing characteristics, observations of pond level and tailing beach width, inspection for signs of erosion, displacement or cracking, and general observations of the dam and appurtenances.

Operational plans for the Mayflower (5 Dam) TSF dam are in TR-23. A third-party engineering consultant will evaluate and provide an annual summary report on TSF operation and monitoring results. The 5 Dam seepwater collection and return system at the Mayflower pump station also is monitored. The pump station contains both stand-by pumps and a stand-by generator set should mechanical or power failures occur. Telemetry to the mill is used to monitor the Mayflower Pump Station remotely.

SDP and PDWTP: The SDP has been successfully operated since 2007. The PDWTP began operation in 2014. Both plants have been designed with the level of control and redundancy needed to achieve compliance with the Climax mine CDPS permit requirements and environmental protection of Tenmile Creek. This includes extensive automatic control of systems based on installed instrumentation, while providing operators with alarms and the ability to run systems manually, if required. The PDWTP is fully integrated into the current site-wide SCADA and human-machine interface (HMI) monitoring and control systems via fiber optics. The control strategy is designed for automatic and controlled shutdown in the event of system failures or power outages, and will provide for automatic collection and recycle of off specification water.

T-6 Groundwater

Groundwater at hardrock mine sites in Colorado is regulated through the DRMS. Climax monitors groundwater in each of the three drainage basins surrounding the site (East Fork Arkansas River, East Fork Eagle River and Tenmile Creek). The groundwater program at the Climax Mine is described in the WQMP (Appendix T-C).

Per Rule 3.1.7(2)(a), the Water Quality Monitoring Plan (Appendix T-C) presents a discussion of the hydrogeologic conditions specific to each of the three drainages at the Climax mine site.

T-7 Surface Water

In addition to the water information provided in Exhibit G of AM-06, information relative to surface water containment and control facilities, surface water quality, the Climax treatment and discharge permit, and surface water monitoring and sampling programs have been discussed in Section T-5.0 and in Appendix T-C. Maps showing water related features are found in the Figures AM-06-T-01 and AM-06-T-02.

As discussed previously, the Climax Mine site lies within the headwater areas of three watersheds – the East Fork of the Arkansas River, the East Fork of the Eagle River, and Tenmile Creek, with most of the mine's water treatment/management activity occurring within the Tenmile Creek drainage area. Discharge to Tenmile Creek occurs in accordance with CDPS Permit No. CO0000248. Water Quality Standards for each of these stream segments are in CDPHE-Water Quality Control Division regulations approved by the Water Quality Control Commission (WQCC Regulations 32 and 33). Before Climax implemented its current water treatment/management system, there was a near complete absence of stream life in Tenmile Creek upstream of its confluence with West Fork Tenmile Creek near Copper Mountain. These conditions were attributable primarily to acid mine drainage from historic mining activity within the headwaters area of Tenmile Creek. Over the past 40 years, Climax has implemented a water treatment/management system in the Tenmile headwaters area, which has included reclamation of many historic mining sites, and capture and treatment of impacted waters from many inactive mines in the drainage area. Since Climax has implemented its water treatment/management scheme, Tenmile Creek has recovered to support a viable and reproducing fishery downstream from the point of the Climax outfall. The complete responsibility accepted by Climax for water treatment/management within the headwaters area of Tenmile Creek is reflected in the Water Quality Control Commission's 1987 rulemaking regarding the Climax outfall, in which the Commission stated:

> *The evidence in these proceedings on Ten Mile Creek have shown that Ten Mile Creek for all intents and purposes begins at the Climax property boundary at a place designated as the "Parshall Flume." It is at this point that the natural flows that are intercepted by Climax in the Ten Mile Creek Basin are channeled together and form the source of Ten Mile Creek. Hence the Commission believes Parshall Flume to be the source of the mainstem of Ten Mile Creek. Also included in this segment are all tributaries to Ten Mile Creek including those natural tributaries intercepted by Climax. (5 CCR 1002-33.11 & 33.16)*

Storm water management information for the Climax Mine site is discussed throughout this EPP. Storm water is managed in accordance with Storm Water Permit COR-040178.

T-8 Water Quality Monitoring Plan

A Groundwater Monitoring Plan for the Climax Mine was previously submitted to DRMS as TR-08 in September 1995 and TR-18 in December 2011. An updated Water Quality Monitoring Plan is included in this Environmental Protection Plan as Appendix T-C. The WQMP includes points of compliance, identifies appropriate standards, and includes internal monitoring locations upgradient of Clinton Reservoir and Eagle Park Reservoir.

This monitoring program is intended to provide data for: (1) demonstrating that EPP requirements are being met; and (2) evaluating changes in water quality that may be related to mining and milling operations at the site. It also provides a process for identifying when changes may be occurring so that appropriate actions can be taken to prevent adverse off-site impacts.

T-9 Climate and Air Quality

Information regarding climate as required in the EPP Rules is in AM-06 Exhibit K – Climate Information. In addition, details regarding air emissions and the fugitive dust control plan are found in the Construction permit issued by the Air Pollution Control Division of the CDPHE.

T-10 Geochemical Information

Geochemical data, including acid/base accounting, pH data and metals data (both SPLP and total metals), have been summarized for TR-18 and are included as Appendix T-E. Data were collected from overburden material, road fill material, tailing material, and material from each of the TSFs. Soil samples were analyzed, as well as water samples from waste rock reactors constructed on McNulty OSF. The data are summarized in several tables identified as Tables T-E-1 through T-E-5.

T-11 Construction Information

Construction schedule information will be provided as new EPFs are proposed and designed. Design submittals for new EPFs will also describe the quality assurance (QA) and quality control (QC) program and measures to be employed during their construction. In general, the QA/QC program will consist of construction observation, inspection of materials for use in construction, survey control and field measurements, and appropriate field testing during construction to ensure that work is conducted and completed in accordance with the project-specific design and technical specifications.

T-12 Plant Growth Media and Revegetation

The Climax Mine site closure and reclamation plan is detailed in AM-06, Exhibit E. Detailed soils information and maps are found in AM-06, Exhibit I.

T-13 Wildlife Protection

Since the initial planning process for the Climax Mine Mining and Reclamation Permit in the early 1970s, wildlife resources have been important to, and recognized by, Climax. The Colorado Division of Wildlife (now the Division of Parks and Wildlife - CDPW) personnel have been involved in the review of permit applications and in planning assistance with various mitigation projects such as in stream habitat improvement in the upper Arkansas River.

Information and data developed during permit planning are included in AM-06, Exhibit H – Wildlife Information. Although wildlife issues at Climax have not been significant, Climax has maintained excellent communications throughout the years with both the regional CDPW office personnel and the local District Wildlife Manager. As described to DRMS in previous correspondence, Climax has implemented a program to report wildlife related problems or concerns. Employees undergo annual refresher training which discuss promptly reporting wildlife concerns if observed. This program has been in place for many years and will continue. As needed, Climax works with local CDPW personnel.

All designated chemicals will be properly stored inside of structures to eliminate exposure to wildlife. Climax process water with high or low pH or elevated metals has not been identified as a problem for wildlife. Wildlife species, including large mammals, waterfowl, and shorebirds are commonly observed throughout the property without apparent harm from operations. Ongoing reclamation activities also decrease the area of process water that wildlife may access, and staged water treatment between the SDP and PDWTP improve water quality in downstream areas, further minimizing potential impacts. Reclamation and reduction of those areas where wildlife may contact process water are continuing activities that serve to minimize potential impacts.

Information regarding threatened or endangered species is in AM-06 Exhibit H.

FIGURES

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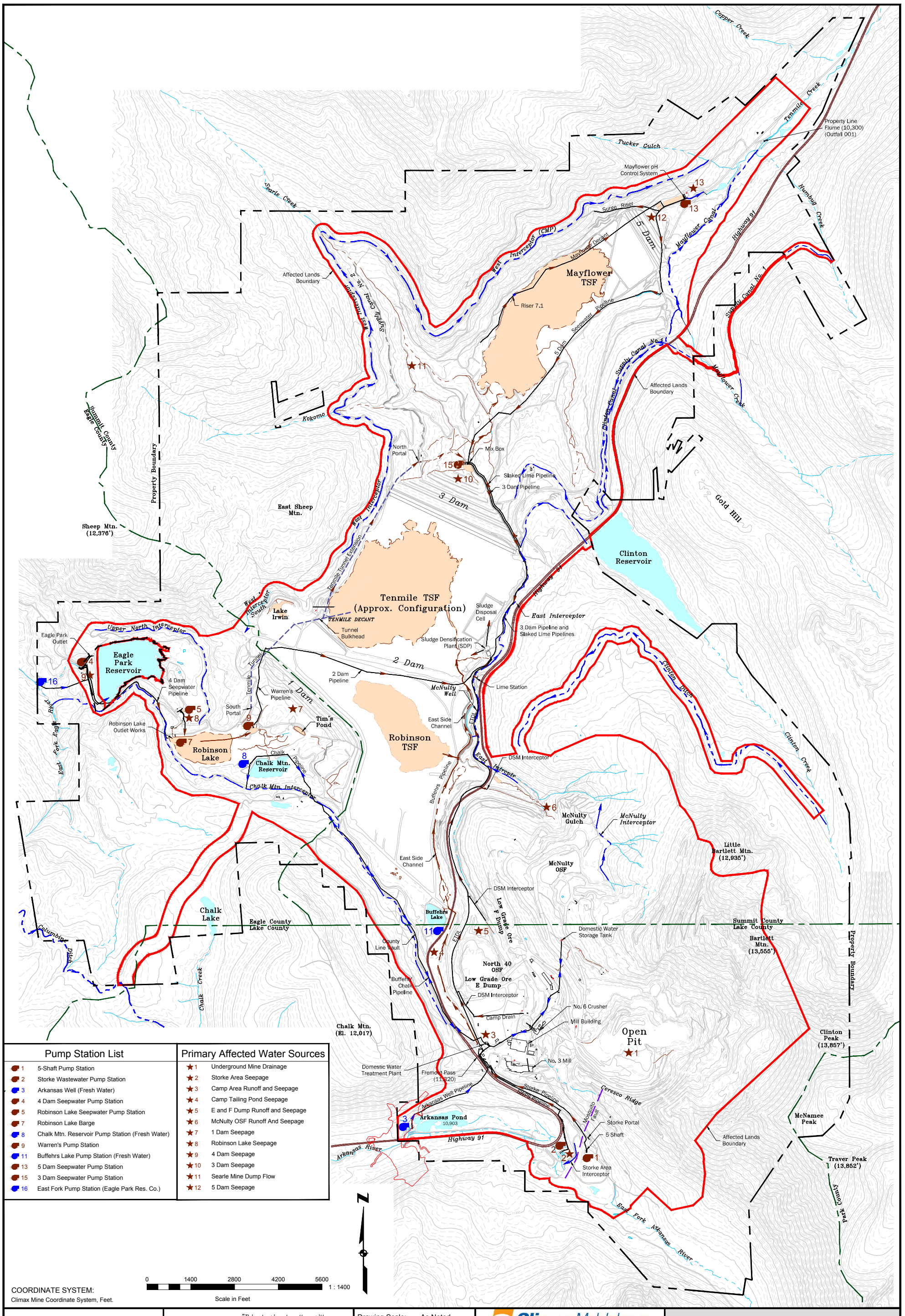

Pump Station List

1	5-Shaft Pump Station
2	Storke Wastewater Pump Station
3	Arkansas Well (Fresh Water)
4	4 Dam Seepwater Pump Station
5	Robinson Lake Seepwater Pump Station
7	Robinson Lake Barge
8	Chalk Mtn. Reservoir Pump Station (Fresh Water)
9	Warren's Pump Station
11	Buffehrs Lake Pump Station (Fresh Water)
13	5 Dam Seepwater Pump Station
15	3 Dam Seepwater Pump Station
16	East Fork Pump Station (Eagle Park Res. Co.)

Primary Affected Water Sources

★1	Underground Mine Drainage
★2	Storke Area Seepage
★3	Camp Area Runoff and Seepage
★4	Camp Tailing Pond Seepage
★5	E and F Dump Runoff and Seepage
★6	McNulty OSF Runoff And Seepage
★7	1 Dam Seepage
★8	Robinson Lake Seepage
★9	4 Dam Seepage
★10	3 Dam Seepage
★11	Searle Mine Dump Flow
★12	5 Dam Seepage

COORDINATE SYSTEM:
Climax Mine Coordinate System, Feet.

W. W. Wheeler and Associates, Inc.
Water Resources Engineers
3700 S. Inca Street, Englewood, CO 80110
Phone: 303-761-4130 Fax: 303-761-2802

FOR PERMITTING ONLY
NOT FOR CONSTRUCTION

Drawing Scale:	As Noted
Drawn By:	SMM
Checked By:	MDS
Approved By:	BR
Date:	March 2010

Climax Molybdenum
A Freeport-McMoRan Company

REVISIONS

DATE	BY	DATE	BY
2-28-2012	SMM		

CLIMAX MINE

FIGURE AM-06-T-01
WATER MANAGEMENT SYSTEM MAP
SITEWIDE EXISTING (2010) WATER SYSTEM

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Copper Creek
Tenmile Creek
Property Discharge Water Treatment Plant
Property Line Flume (10,300) (Outfall 001)
Tucker Gulch
Mayflower Spillway Tunnel
Searle Creek
Surge Riser
3 Dam Tailing Distribution System
5 Dam
Mayflower Decant (Decommissioned)
West Interceptor (CMP)
Mayflower Canal
Highway 91
Humbug Creek
PDWTP Return Pipeline
Affected Lands Boundary
Mayflower TSF
West Interceptor No. 2
Supply Canal No. 2
5 Dam Seepwater Pipeline Extension
Supply Canal No. 1
Mayflower TDL
Chicken Gulch
Mayflower Creek
PDWTP Barge Pumping System
Millwater Barge Pumping System
Affected Lands Boundary
Kokomo
Summit County
Eagle County
Property Boundary
North Portal
Slaked Lime Pipeline
3 Dam Pipeline
East Sheep Mtn.
3 Dam
3 Dam Crest Berm
3 Dam Tailing Distribution System
West Interceptor
Tenmile Tunnel Extension
Gold Hill
Sheep Mtn. (12,376')
Clinton Reservoir
Tenmile TSF (Approx. Configuration)
Lake Irwin
West Interceptor South
TENMILE DECANT
Tunnel Bulkhead
Sludge Densification Plant (SDP)
East Interceptor
3 Dam Pipeline and Slaked Lime Pipelines
Upper North Interceptor
Eagle Park Outlet
Eagle Park Reservoir
2 Dam
TDL
2 Dam Pipeline
Lime Station
Tunnel
Tenmile
1 Dam
4 Dam Seepwater Pipeline
Warren's Pipeline
South Portal
McNulty Well
Clinton Ditch
Robinson Lake Outlet Works
Tim's Pond
Robinson TSF
East Side Channel
ETDL
Robinson Lake
Chalk Mtn. Reservoir
Chalk Pipeline
Chalk Mtn. Interceptor
East Fork
DSM Interceptor
Buffehrs Pipeline
East Interceptor
Clinton Creek
Robinson Lake Reclaim Pipeline
McNulty Gulch
Little Bartlett Mtn. (12,935')
East Side Channel
TDL
McNulty OSF
Columbine Pipeline
Chalk Lake
Eagle County
Lake County
Buffehrs Lake
DSM Interceptor
Final Dump Contours
Summit County
Lake County
Bartlett Mtn. (13,555')
Property Boundary
County Line Vault
ETDL
Domestic Water Storage Tank
Columbine Ditch
Chalk Creek
North 40 OSF
Buffehrs Chalk Pipeline
Mill Water Storage Tank
DSM Interceptor
Final Pit Contours
No. 6 Crusher
Camp Drain
Mill Building
Chalk Mtn. (El. 12,017)
Open Pit
Clinton Peak (13,857')
Sanitary Wastewater Treatment Plant
No. 3 Mill
Domestic Water Treatment Plant
Fremont Pass (11,320)
Arkansas Well Pipeline
Storke Pipeline
Ceresco Ridge
McNamee Peak
Arkansas Pond 10,903
Mosquito Fault
Storke Portal
5 Shaft
Highway 91
Affected Lands Boundary
Arkansas River
Storke Area Interceptor
Traver Peak (13,852')
Park County
Base Fork Arkansas River

Pump Station List

1	5-Shaft Pump Station
2	Storke Wastewater Pump Station
3	Arkansas Well (Fresh Water)
4	4 Dam Seepwater Pump Station
5	Robinson Lake Seepwater Pump Station
6	Robinson Lake Pump Station
8	Chalk Mtn. Reservoir Pump Station (Fresh Water)
9	Warren's Pump Station
11	Buffehrs Lake Pump Station (Fresh Water)
13	5 Dam Seepwater Pump Station
15	3 Dam Seepwater Pump Station
16	East Fork Pump Station (Eagle Park Res. Co.)
17	Millwater Barge Pump System
18	PDWTP Barge Pump System

Primary Affected Water Sources

1	Underground Mine Drainage
2	Storke Area Seepage
3	Camp Area Runoff and Seepage
4	Camp Tailing Pond Seepage
5	E and F Dump Runoff and Seepage
6	McNulty Dump Runoff And Seepage
7	1 Dam Seepage
8	Robinson Lake Seepage
9	4 Dam Seepage
10	3 Dam Seepage
11	Searle Mine Dump Flow
12	5 Dam Seepage
13	Tunnel Seepage

COORDINATE SYSTEM:
Climax Mine Coordinate System, Feet.

0 1400 2800 4200 5600
1 : 1400
Scale in Feet

W. W. Wheeler and Associates, Inc.
Water Resources Engineers
3700 S. Inca Street, Englewood, CO 80110
Phone: 303-761-4130 Fax: 303-761-2809

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NOT FOR CONSTRUCTION

Drawing Scale:	As Noted
Drawn By:	SMM
Checked By:	MDS
Approved By:	BR
Date:	March 2010

Climax Molybdenum
A Freeport-McMoRan Company

REVISIONS

DATE	BY	DATE	BY
2-28-2012	SMM		

CLIMAX MINE

FIGURE AM-06-T-02
WATER MANAGEMENT SYSTEM MAP
SITEWIDE PHASE I AND II DEPOSITION
WATER SYSTEM

Storke Wastewater Pump Station
Storke Yard Drainage
Arkansas Well
Arkansas River Basin
Eagle River Basin
Chalk Mtn. Pump Station
Chalk Mtn. Reservoir
Columbine Pipeline
Spillway
Runoff
Robinson Seepwater Pump Station
Robinson Lake (Reclaim Water)
Seepage
Spillway
Eagle Park Reservoir
4 Dam Seepwater Pump Station
Fresh Water Release to Eagle River
Tenmile Creek Basin
5 Shaft Pump System
Arkansas River Basin
Tenmile Creek Basin
Open Pit Drainage
Continental Divide
Runoff
Camp Drainage
Ore Dump Drainage
East Side Channel
Robinson Pond (Reclaimed)
1 Dam
Seepage
Robinson Lake Pump Station
Warren's Pump Station
Robinson Lake Barge
Mill Water
Mill Water Tank
Domestic Water Tank
Mill Domestic Water
Buffehrs Lake
Buffehrs Pump Station
Domestic Water Treatment Plant
Camp Drainage
TDH
2 Dam
NO
NC
Eagle River Basin
Tenmile Creek Basin
Bulkhead
2 Dam Pipeline
WWTP
Ore Dump Drainage
McNulty Gulch Drainage
ETDL
Mill Facility
Mill Tailing
Runoff
Tenmile Decant
Tenmile TSF (Stage 1 Treatment)
{Deposition}
Tailing Delivery
Overflow
Collection Chamber
Lime Station
Sludge Densification Plant (Stage 1)
Effluent
Dense Sludge
McNulty Well
3 Dam
Tenmile Tunnel
Supply Canal No. 2
Seepage
3 Dam Pump Station
Sump Pond
Runoff
Searle Mine Drainage
Mayflower pH Control System
Sulfuric Acid
Property Line Flume (Outfall 001)
Tenmile Creek
Slaked Lime
Overflow
Risers
Decant
Mix Box
Mayflower TSF (Stage 2 Treatment)
5 Dam
Seepage
5 Dam Seepwater Pump Station
3/4 Cutout
NC
NC
Halfway Cutout

NOTE:
For clarity, the fresh water interceptor system is not shown on this figure.

Legend

- Existing Pipeline or Structure
- Proposed Pipeline or Structure
- Facility in Standby Mode or Decommissioned
- NO — Normally Open Valve
- NC — Normally Closed Valve

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Approved By:	BR
Date:	March 2010

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CLIMAX MINE

FIGURE AM-06-T-04
WATER MANAGEMENT SYSTEM SCHEMATIC
PHASE I DEPOSITION FLOW

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Storke Wastewater Pump Station
Storke Yard Drainage
Arkansas Well
Arkansas River Basin
Eagle River Basin
Chalk Mtn. Pump Station
Chalk Mtn. Reservoir
Columbine Pipeline
Spillway
Runoff
Robinson Seepwater Pump Station
Robinson Lake (Reclaim Water)
Seepage
Spillway
Eagle Park Reservoir
4 Dam Seepwater Pump Station
Fresh Water Release to Eagle River
Tenmile Creek Basin
Open Pit Drainage
Open Pit Pump System (5-Shaft or Pit Pump Station)
Arkansas River Basin
Tenmile Creek Basin
Continental Divide
Runoff
Camp Drainage
Ore Dump Drainage
East Side Channel
Robinson Pond (Reclaimed)
Seepage
Robinson Lake Pump Station
Warren's Pump Station
Robinson Lake Barge
Eagle River Basin
Tenmile Creek Basin
Mill Water
Mill Water Tank
Domestic Water Tank
Mill Domestic Water
Buffehrs Lake
Buffehrs Pump Station
Domestic Water Treatment Plant
Camp Drainage
TDH
2 Dam
NO
NC
Bulkhead
2 Dam Pipeline
WWTP
Ore Dump Drainage
McNulty Gulch Drainage
Mill Tailing
ETDL
Mill Facility
Runoff
Tenmile Decant
Tenmile TSF (Stage 1 Treatment)
Tailing Delivery Overflow
Tenmile Tunnel
Tenmile Creek
Collection Chamber
NC
3 Dam
Supply Canal No. 2
Lime Station
McNulty Well
Sludge Densification Plant (Stage 1)
Effluent
Seepage
Runoff
Dense Sludge
3 Dam Pump Station
Searle Mine Drainage
Property Discharge Water Treatment Plant (Stage 2)
Property Line Flume (Outfall 001)
Sump Pond
Risers
Decant
Seepage
Mayflower TSF (Stage 1 Treatment) {Deposition}
Mix Box
3/4 Cutout
Halfway Cutout
NC
NC
5 Dam Seepwater Pump Station
Effluent
Sludge
Mayflower Pump Barge
Slaked Lime
Mayflower Tailing Delivery Line

NOTE:
For clarity, the fresh water interceptor system is not shown on this figure.

Legend

- Existing Pipeline or Structure
- Proposed Pipeline or Structure
- Facility in Standby Mode or Decommissioned
- NO — Normally Open Valve
- NC — Normally Closed Valve

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Approved By:	BR
Date:	March 2010

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CLIMAX MINE

FIGURE AM-06-T-05
WATER MANAGEMENT SYSTEM SCHEMATIC
PHASE II DEPOSITION FLOW

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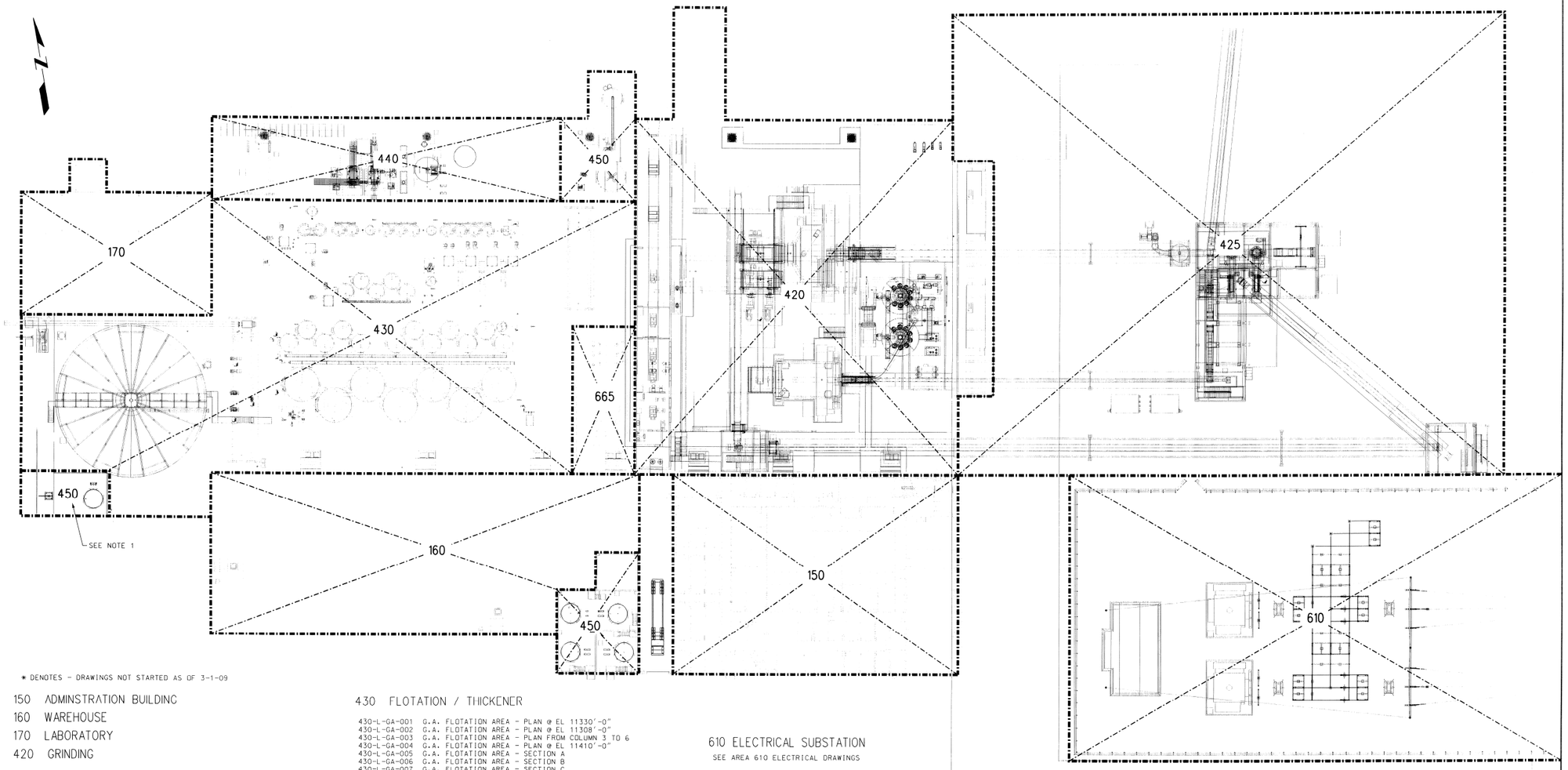

* DENOTES - DRAWINGS NOT STARTED AS OF 3-1-09

150 ADMINSTRATION BUILDING

160 WAREHOUSE

170 LABORATORY

420 GRINDING

420-L-GA-001 G.A. GRINDING AREA - PLAN @ EL 11330'-0"
420-L-GA-002 G.A. GRINDING AREA - PLAN @ EL 11370'-0"
420-L-GA-003 G.A. GRINDING AREA - PLAN @ EL 11400'-0"
420-L-GA-004 G.A. GRINDING AREA - PLAN @ EL 11420'-0"
420-L-GA-005 G.A. GRINDING AREA - SECTIONS A & B
420-L-GA-006 G.A. GRINDING AREA - SECTIONS C & D
420-L-GA-007 G.A. GRINDING AREA - SECTIONS E & F
420-L-GA-008 G.A. GRINDING AREA - SECTIONS G & H
420-L-GA-009 G.A. GRINDING AREA - SECTIONS I & J

425 PEBBLE CRUSHER

425-L-GA-001 G.A. PEBBLE CRUSHING AREA - PLAN @ 11375'-0"
425-L-GA-002 G.A. PEBBLE CRUSHING AREA - PLAN @ 11345'-0"
425-L-GA-003 G.A. PEBBLE CRUSHING AREA - PLAN @ 11392'-9"
425-L-GA-004 G.A. PEBBLE CRUSHING AREA - PLAN @ 11408'-2"
* 425-L-GA-005 G.A. PEBBLE CRUSHING AREA - PLAN @ 11448'-0" & 11464'-2"
425-L-GA-006 G.A. PEBBLE CRUSHING AREA - SECTION A
425-L-GA-007 G.A. PEBBLE CRUSHING AREA - SECTION B
425-L-GA-008 G.A. PEBBLE CRUSHING AREA - SECTION C
425-L-GA-009 G.A. PEBBLE CRUSHING AREA - SECTION D

430 FLOTATION / THICKENER

430-L-GA-001 G.A. FLOTATION AREA - PLAN @ EL 11330'-0"
430-L-GA-002 G.A. FLOTATION AREA - PLAN @ EL 11308'-0"
430-L-GA-003 G.A. FLOTATION AREA - PLAN FROM COLUMN 3 TO 6
430-L-GA-004 G.A. FLOTATION AREA - PLAN @ EL 11410'-0"
430-L-GA-005 G.A. FLOTATION AREA - SECTION A
430-L-GA-006 G.A. FLOTATION AREA - SECTION B
430-L-GA-007 G.A. FLOTATION AREA - SECTION C
430-L-GA-008 G.A. FLOTATION AREA - SECTION D
430-L-GA-009 G.A. FLOTATION AREA - SECTION E
430-L-GA-010 G.A. THICKENER AREA - PLAN @ 11309'-0"
430-L-GA-011 G.A. THICKENER AREA - PLAN @ 11318'-6"
430-L-GA-012 G.A. THICKENER AREA - SECTION A & B
430-L-GA-013 G.A. THICKENER AREA - SECTION C & D

440 FILTERING / DRYING / PACKAGING

440-L-GA-001 G.A. FILTRATION/DRYING/PRODUCT HANDLING - PLAN @ 11338'0"
440-L-GA-002 G.A. FILTRATION/DRYING/PRODUCT HANDLING - PLAN @ 11360'0"
* 440-L-GA-003 G.A. FILTRATION/DRYING/PRODUCT HANDLING - PLAN @ 11386'0"
440-L-GA-004 G.A. FILTRATION/DRYING/PRODUCT HANDLING - PLAN @ 11397'0"
440-L-GA-005 G.A. FILTRATION/DRYING/PRODUCT HANDLING - SECTION A
440-L-GA-006 G.A. FILTRATION/DRYING/PRODUCT HANDLING - SECTION B & C

450 REAGENT

450-L-GA-001 G.A. LIME SYSTEM - PLAN @ 11340'0"
* 450-L-GA-002 G.A. LIME SYSTEM - PLAN @ 11354'0"
450-L-GA-003 G.A. LIME SYSTEM - SECTIONS A & B
450-L-GA-004 G.A. REAGENT AREA - PLAN & SECTIONS

610 ELECTRICAL SUBSTATION

SEE AREA 610 ELECTRICAL DRAWINGS

665 COMPRESSED AIR

HOLD FOR EQUIPMENT INFORMATION
(DRAWINGS NOT STARTED)

NOTES:

1. FLOCCULANT SYSTEM GA'S ARE INCLUDED IN 430 AREA GA DRAWINGS 430-L-GA-010 THRU 013

DOCUMENT APPROVAL
☐ Approved
☐ Not approved - resubmit
Date _____ Approved by _____

REFERENCE DRAWINGS

REV	DESCRIPTION	BY	CHECKED	APPROVED
A	ISSUED FOR REVIEW	LDA	LP 1-22-09	
B	ISSUED FOR APPROVAL	LDA	LP 2-11-09	
C	ISSUED FOR APPROVAL		2/11/09	

REV	DESCRIPTION	BY	CHECKED	APPROVED

NOT APPROVED FOR CONSTRUCTION UNLESS SIGNED AND DATED BELOW ALL PAGES OF DRAWING NO

PROJECT APPROVAL					
ISSUED	REV	PROJ	DATE	CLIENT	DATE
PRELIMINARY	A	BD	1-26-09		
ISSUED FOR APPROVAL	C		2/11/09		
ISSUED FOR CONSTRUCTION					
REVISED ISSUED FOR CONSTRUCTION					

Climax Molybdenum A Freeport-McMoRan Company

JACOBS

CLIMAX 2010
GENERAL ARRANGEMENT
MILL AREA
KEY PLAN

PROJECT NO	SCALE	DWG NO	REV
09KU6600	1" = 30'	410-L-GA-001	C

2/13/2009 4:04:38 PM examples q:\cmh02\09KU66\engr\mech\Drawings\410L0A001.dgn

TETRA TECH

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DATE	BY	DATE	BY

Drawing Scale:	NA
Drawn By:	NA
Checked By:	NA
Approved By:	NA
Date:	FEB 2011

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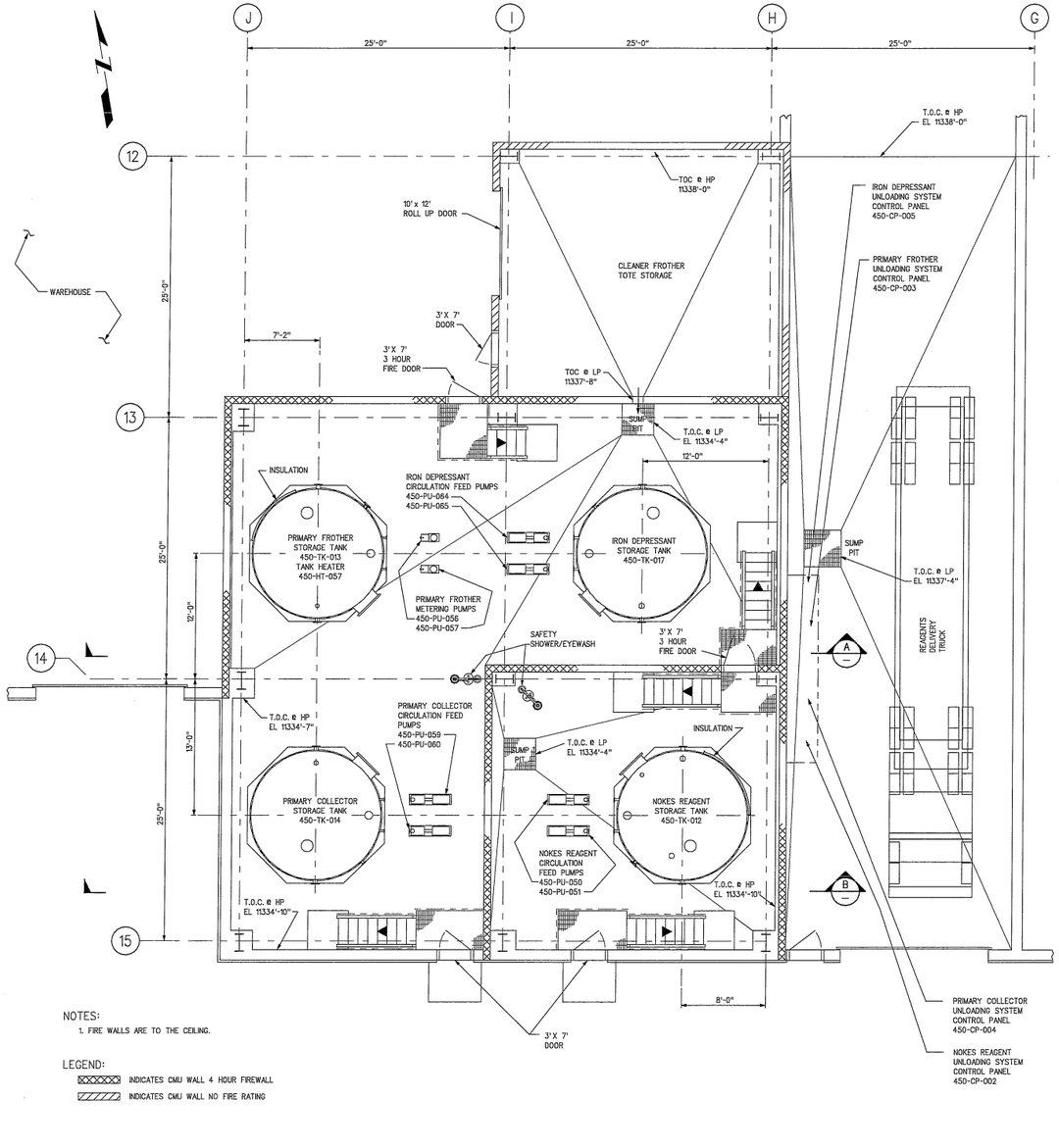
CLIMAX MINE

FIGURE AM-06-T-06
GENERAL ARRANGEMENT
MILL AREA
KEY PLAN

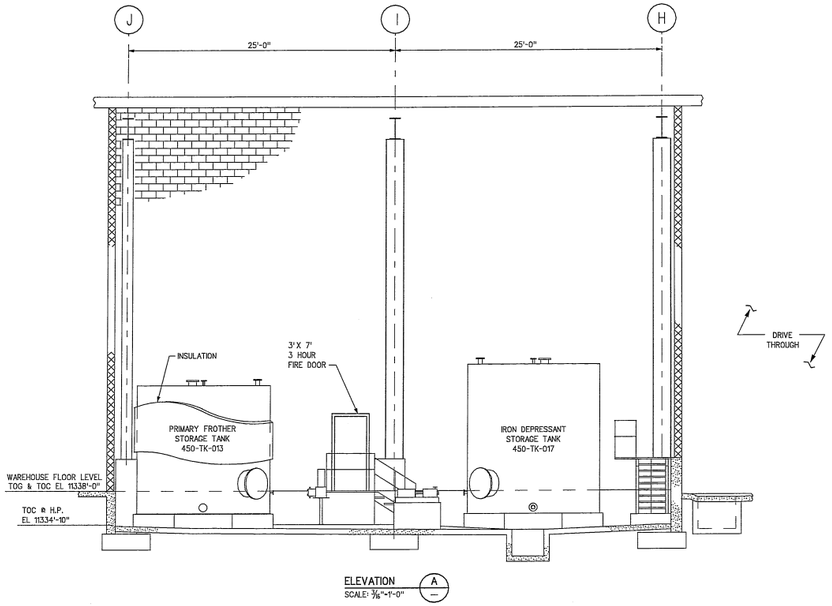


NOTES:

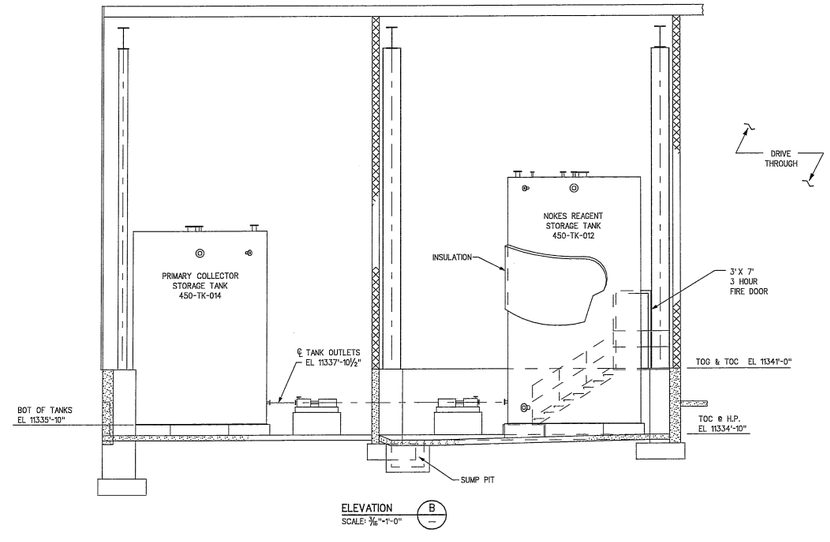
1. FIRE WALLS ARE TO THE CEILING.

LEGEND:

- INDICATES CMU WALL 4 HOUR FIREWALL
- INDICATES CMU WALL NO FIRE RATING



ELEVATION A
SCALE: 3/16"=1'-0"



ELEVATION B
SCALE: 3/16"=1'-0"

REFERENCE DRAWINGS

REV	DESCRIPTION	BY	CHECKED	APPROVED
A	ISSUED FOR REVIEW	LDA	DP 1-16-09	
B	ISSUED FOR APPROVAL	LDA	DP 2-2-09	DP 2-2-09
C	ISSUED FOR APPROVAL			

REV	DESCRIPTION	BY	CHECKED	APPROVED

PROJECT APPROVAL					
ISSUED	REV	PROJ	DATE	CLIENT	DATE
PRELIMINARY	A	BD	1-19-09		
ISSUED FOR APPROVAL	C	BD			
ISSUED FOR CONSTRUCTION					
REVISED ISSUED FOR CONSTRUCTION					

Climax Molybdenum — A Freeport-McMoRan Company

JACOBS

CLIMAX 2010
GENERAL ARRANGEMENT
REAGENT STORAGE & HANDLING
PLAN & SECTIONS

PROJECT NO	SCALE	DWG NO	REV
09KU6600	3/16" = 1'-0"	450-M-GA-004	C

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Drawing Scale:	NA
Drawn By:	NA
Checked By:	NA
Approved By:	NA
Date:	FEB 2011

Climax Molybdenum
A Freeport-McMoRan Company

CLIMAX MINE

FIGURE AM-06-T-07
GENERAL ARRANGEMENT
REAGENT STORAGE & HANDLING
PLAN & SECTIONS

APPENDIX T-A
DESIGNATED CHEMICALS EMERGENCY RESPONSE PLAN

EPP – Appendix A – Designated Chemicals Emergency Response Plan

Table of Contents

Tables

T-A-1 Introduction

T-A-1.1 Purpose and Objectives

This Appendix to the Environmental Protection Plan contains information found in the Climax Mine site-wide Emergency Response Action Plan (ERAP). The ERAP was developed to provide a formal emergency preparedness program that protects human health and property in the event of an emergency such as fire, explosion, etc. The ERAP also formalizes the arrangements with local police, fire departments, and hospitals in case of an emergency. Employees have access to the ERAP via the company intranet and are trained on its contents. The ERAP is maintained onsite to reflect current site conditions. This Emergency Response Plan for Designated Chemicals has been prepared in accordance with Rule 8.3 of the MLRB Hard Rock/Metal Mining Rules, and provides information specific to designated chemicals only.

This Appendix indicates the designated chemicals onsite at Climax during periods of production, outlines emergency response procedures for designated chemicals, identifies contact people associated with responding to emergencies, and contains a brief discussion of the location of the designated chemicals and associated controls. The location of the reagent storage area within the mill facility is indicated on EPP Figure AM-06-T-06. The general arrangement and containment details of the reagent storage area are presented on EPP Figure AM-06-T-07.

T-A-2 Designated Chemicals

The chemicals listed and discussed herein are those used specifically in the extractive metallurgical processing of molybdenite ore to produce molybdenum disulfide (MoS_2) concentrate. The information provided regarding designated chemicals is presented as the best information currently available. These chemicals, quantities, and concentrations may vary based upon production needs and processes. For example, brand name chemicals such as (but not limited to) Nalco may be changed out for different brands of similar chemicals based on factors such as cost, effectiveness, or handling considerations. Changes in brand and reagent usage are a part of the production process and are not considered to be grounds for significantly altering this Appendix. However, updates will be made in the event that: 1) new types of chemicals, not discussed herein, are added to the process; 2) the storage location of a designated chemical is changed; or 3) the specific containment facility for a designated chemical must be enlarged. Updates may also be made to acknowledge changes in site emergency contacts.

Designated chemicals are stored in the reagent area of the mill, as indicated on EPP Figures AM-06-T-06 and AM-06-T-07.

T-A-2.1 List of Chemicals and Specific Locations

Designated chemicals used at Climax during periods of production are listed in Table T-A-1. The table includes the list of designated chemicals used in the froth flotation metallurgical process for concentrating MoS_2. This list includes the storage location, the type and capacity of the storage container and identifies the presence of secondary containment associated with the design of the reagent storage area.

Table T-A-1: Designated Chemicals at the Climax Mine

Chemical Type & Use	Product Name	Storage Location	Storage Container Type	Tank Storage Capacity	Secondary Containment
Collector	Nalco 9866 or similar	Reagent Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	13,500 gallons	Yes
Collector Dispersant	Tergitol NP-4 Surfactant or similar	Floatation Area 430	300 gallon totes	5 totes, ~ 1500 gallons	Yes
Frother	Nalco 8836 Plus or similar	Reagent Area of Mill – Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	9,300 gallons	Yes
Cleaner Frother	CorsiTech FrothPro 327 or similar	Reagent Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	600 gallons	Yes
Iron Depressant	Orfom D8 or similar	Reagent Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	10,000 gallons	Yes
Iron and Copper Depressant	Sodium Cyanide (NaCN)	Reagent Area of Mill	NA	Not currently in use	NA
Lead and Copper Depressant	Nokes	Reagent Area 450 and Floatation Area 430 (when totes used)	One tank (and 300 gallon totes when needed)	18,000 gallons	Yes
pH adjustment	Lime	Lime mix area and silo	1 silo at the mill	225 tons	Yes
Flocculent	Polymer Ventures DAF-30 or similar	Floatation Area 430	Dry bulk bags, one mix tank and one storage tank	8250 lbs.	Yes
CaF2 Depressant	Citric Acid	Floatation Area 430	300 gallon totes	Up to5 totes, ~ 1500 gallons	Yes
Froth Modifier	Calumet Hydrocal 60, PPG-2000/4000, Nalco 7561, or similar	Floatation Area 430	300 gallon totes	~ 10 totes, ~ 3000 gallons	Yes

T-A-3 Containment and Control Activities

The operation of the facility is designed to minimize potential hazards to facility personnel, general public, facility property, and the environment. As indicated in Table T-A-1, the designated chemical (reagent) storage area provides secondary containment for each of the storage vessels and each system will be equipped with appropriate level control systems and system alarms.

T-A-3.1 Personnel Response Activities

Containment and control activities are coordinated with the Emergency Coordinator, who will supervise the incident according to the procedures contained in the ERAP. Containment and control activities may run concurrent to other activities, such as rescue and recovery operations.

T-A-3.2 Response Procedures

The health and safety of people is paramount and will not be compromised for containment and control activities.

Containment and Control activities will be initiated for, but not limited to, the following events:

- Fire;
- Explosion;
- Natural Disaster; and
- Environmental Release.

T-A-3.3 Basic Response Guidelines

The standard response procedures outlined in this plan are needed to respond to situations developing at the facility/office location. The attached site specific plans for multiple types of emergencies detail response activities as required in order to preserve health, life, and property.

- Immediate evacuation of the personnel endangered within the area and call for back-up support;
- All trained response personnel will don appropriate protective clothing and SCBA depending upon the source and nature of the incident (minimum four responding personnel required to be set in two, 2-person teams); and
- Active working areas have ABC-type fire extinguishers available for fighting small fires (site personnel will not fight explosive fires).

Table T-A-2 Emergency Response Procedures summarizes the procedures that are followed in response to an injury, fire, explosion, spill or other environmental release.

Table T-A-2: Emergency Response Procedures

1	Identification	Identify the character, source, amount and extent of the spill or incident. ▪ DO NOT ENTER a hazardous area until hazards have been assessed and controlled. ▪ STAY UPWIND/UPHILL of chemical spills or releases.
2	Internal Notification	Immediately notify Area Supervisor and Climax Administration Dial 7568 Climax Administration If by radio, call "**May Day", "May Day", "May Day"**
3	Assessment	Identify the exact source, amount, and real extent of the incident and assess the possible direct and indirect hazardous to human health or the environment that may result from a release, fire, or explosion.

Table T-A-2: Emergency Response Procedures

4	Evacuation	Call for evacuation of all non-essential personnel from areas impacted or having potential to be impacted by the incident.
5	Request Help and Complete External Notification	If there is imminent danger or injured personnel, the Emergency Coordinator or their designee should ensure Administration has summoned the appropriate internal/external emergency response services (e.g. site responders, fire, police, etc.). Additionally, contact should be made with the site environmental department as appropriate to ensure government agency notifications are made as required.
6	Mitigation	If safe to do so and individuals are properly trained: ▪ Attempt to extinguish incipient stage fires; ▪ Shut off pumps, close valves, etc. if material is still being released; ▪ Shut off motors and electrical circuits, and extinguish ignition sources in the area impacted by the incident; and ▪ In case of injury, begin first aid up to the level of individual training.
7	Containment	Develop a security perimeter around the area(s) impacted by the incident. For spills or other releases, contain released materials with absorbents, booms, drain covers, or earthen material, if safe to do so.
8	Cleanup and outside assistance	Characterize and provide for disposal of all wastes resulting from the incident. The phone numbers of outside resources, which may be needed to assist in cleaning up significant incidences, are provided in this plan.
9	Follow-up	Ensure all emergency equipment is returned to service; make necessary notifications prior to restarting operations, review the incident and determine root causes; provide written follow-up to agencies, if necessary.

T-A-4 Available Emergency Equipment

The office/facility/project maintains communications systems for emergency notification. A variety of on-site equipment suitable for emergency response and accessibility to off-site resources are maintained.

T-A-4.1 On-Site Response Equipment

A wide variety of primary emergency response equipment is maintained at the facility in a state of operational readiness in close proximity to areas that have an increased possibility for potentially harmful releases and incidents. Employees are responsible for knowing the location and use of this emergency response equipment. Table T-A-3 – On-Site Response Equipment provides a summary of available primary response equipment. Response equipment and materials, appropriate for the designated chemicals stored and used, are located in the Mill area.

Table T-A-3: On-Site Response Equipment

Equipment	Location	Capabilities
Fire Truck	Mill	Deliver water where needed for fire control activities
Ambulance	Mill	Provide emergency transport
Water Trucks	3 Mill and Open Pit	Deliver water where needed for fire control activities and

		decontamination
Fire Extinguishers	Various	Extinguishment of small incipient stage fires
Heavy Equipment	Various	Constructing containment around large spills and incident sites, removing operational risks, assisting with rescue activities
Spill Kits (include absorbent materials)	Various locations within Mill and maintenance shops	Containment of small/medium chemical releases, including acids
Shower & Eyewash Units	Various	Decontamination of employees, contractors and visitors
Personal Protective Equipment	Various	Protection of employees, contractors, visitors, and responders prior to an emergency and throughout the response and recovery period.
SCBA/Other Protective Clothing	Safety Department in Administration Building	Protection for on-site emergency responders

Response equipment is to be tested and inspected by qualified personnel periodically.

Other non-specific response equipment is available depending on the emergency. Examples may include:

- Earth moving equipment for containment of berms; and
- Bucket trucks for rescue

T-A-5 Emergency Contacts and Communication

T-A-5.1 Off-Site Notifications

In the event of an emergency condition, the following off-site organizations shall be notified as appropriate:

Lake County

Agency	1st Choice	Alternate #1	Alternate #2
Fire Department	9, then 9-1-1*	(719) 486-1249	(719) 486-2990
Sheriff	9, then 9-1-1	(719) 486-1249	n/a
St. Vincent's Hospital	9, then 9-1-1	(719) 486-0230	(719) 486-7144
Ambulance	9, then 9-1-1	(719) 486-7144	n/a
Leadville Medical Center	9, then 9-1-1	(719) 485-1264	n/a

* "9" is dialed to obtain an outside line from the site

Summit County

Agency	1st Choice	Alternate #1	Alternate #2
Sheriff	9, then 9-1-1	(970) 668-8600	(970) 453-2232
Ambulance	9, then 9-1-1	(970) 668-5777	n/a
Copper Mtn.Fire Dept.	9, then 9-1-1	(970) 968-2911	n/a
Summit Medical Center	(970) 668-3300	n/a	n/a

Eagle County

Agency	1st Choice	Alternate #1	Alternate #2
Sheriff	9, then 9-1-1	(970) 328-8500	(970) 949-7729

MSHA

1-800-746-1553

For all Immediately Reportable Accidents, MSHA must be contacted within 15 minutes so Mine Operators are aware of accident.

Air Ambulance

Flight for Life	1-800-332-3123
Air Life	1-800-247-5433

Other Federal Agencies

Centers for Disease Control & Prevention	1-404-639-3311	or	1-800-232-4636
Disasters/Emergencies (US Geological Survey)	1-888-275-8747		

State Agencies

Air Pollution Control Division	(303) 692-3100
Division of Reclamation Mining and Safety	(303) 866-3567
Hazardous Material & Waste Management	1-877-518-5608
Water Quality Control Division	(303) 692-3500
US EPA National Response Center	1-800-424-8802

Other

Chemtrec	1-800-424-9300
Poison Control Center	1-800-332-3073
3E MSDS	1-800-451-8346
XCEL High Pressure Gas Load Center	1-800-698-7811
St. Anthony's Hospital ER	1-303-629-3721

T-A-5.2 On-Site Notifications

In the event of an emergency condition, the following Climax Mine Contact List is provided for notifications, as necessary

Climax Mine Contact List (Also See Climax Phone and Manager on Duty Lists)
Updated: 09/16/14

Company Agents	Home	Office	Cell
Matt Main Health & Safety Mgr	(719) 486-0325	(719) 486-7719	(719) 293-5052 (719) 271-8162
Gordon Stinnett Superintendent – Site Services	(719) 395-6081	(719) 486-7616	(719) 839-1013
Raymond Lazuk Environmental Mgr		(719) 486-7584	(719) 201-1282
Brian McGill Chief Environmental Engineer		(719) 486-7718	(719) 271-3394
Erich Bower General Manager		(719) 486-7555	(970) 389-2104
Ron Valentine Chief Engineer	(719) 486-1801	(719) 486-7565	(970) 481-2947 (719) 321-8028
Sludge Densification Plant		(719) 486-7631	
PDWTP		(719) 486-7581	
Climax Security		(719) 486-7583	
Water Tech (Radio) Water Tech Office		(719) 486-7572	

APPENDIX T-B
MATERIAL SAFETY DATA SHEETS

SAFETY DATA SHEET

NALCO® 9866

Section: 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	NALCO® 9866
Other means of identification	:	Not applicable.
Recommended use	:	COLLECTOR FOR MINERAL FLOTATION
Restrictions on use	:	Refer to available product literature or ask your local Sales Representative for restrictions on use and dose limits.
Company	:	Nalco Company 1601 W. Diehl Road Naperville, Illinois 60563-1198 USA TEL: (630)305-1000
Emergency telephone number	:	(800) 424-9300 (24 Hours) CHEMTREC
Issuing date	:	11/20/2013

Section: 2. HAZARDS IDENTIFICATION

Emergency Overview

CAUTION
May cause irritation with prolonged contact.
Keep away from heat. Keep away from sources of ignition - No smoking. Keep container tightly closed. Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Avoid breathing vapor. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water. Use a mild soap if available.
Wear suitable protective clothing and gloves.
Low Fire Hazard; liquids may burn upon heating to temperatures at or above the flash point. May evolve oxides of carbon (COx) under fire conditions.

Potential Health Effects

Eyes	:	Health injuries are not known or expected under normal use.
Skin	:	Health injuries are not known or expected under normal use.
Ingestion	:	Health injuries are not known or expected under normal use.
Inhalation	:	Health injuries are not known or expected under normal use.

Section: 3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No.	Concentration: (%)
Severely Hydrotreated Heavy Naphthenic Distillate	64742-52-5	60.0 - 100.0

Section: 4. FIRST AID MEASURES

In case of eye contact	:	Immediately flush with plenty of water for at least 15 minutes. If symptoms develop, seek medical advice.
In case of skin contact	:	Flush with large amounts of water. Use soap if available. If symptoms develop, seek medical advice.
If swallowed	:	If conscious, washout mouth and give water to drink. Get medical attention.
If inhaled	:	Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.
Protection of first-aiders	:	In event of emergency assess the danger before taking action. Do not put yourself at risk of injury. If in doubt, contact emergency responders.Use personal protective equipment as required.

See toxicological information (Section 11)

Section: 5. FIREFIGHTING MEASURES

Specific hazards during firefighting.	:	Low Fire Hazard; liquids may burn upon heating to temperatures at or above the flash point. May evolve oxides of carbon (COx) under fire conditions.
Special protective equipment for firefighters	:	In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

Section: 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Keep people away from and upwind of spill/leak. Ventilate spill area if possible. Notify appropriate government, occupational health and safety and environmental authorities.
Environmental precautions	:	Prevent material from entering sewers or waterways.

Section: 7. HANDLING AND STORAGE

Advice on safe handling	:	Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Do not breathe vapors/gases/dust. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled.
Conditions for safe storage	:	Store in suitable labeled containers. Store the containers tightly closed.

Section: 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Exposure guidelines have not been established for this product. Available exposure limits for the

substance(s) are shown below.

Components	CAS-No.	Form of exposure	Permissible concentration	Basis
Oil Mist (Mineral)	Proprietary	TWA	5 mg/m3	OSHA Z1
		TWA (Inhalable fraction)	5 mg/m3	ACGIH
		TWA (Mist)	5 mg/m3	NIOSH REL
		STEL (Mist)	10 mg/m3	NIOSH REL

Engineering measures : General ventilation is recommended. Use local exhaust ventilation if necessary to control airborne mist and vapor.

Personal protective equipment

Eye protection : Safety glasses

Hand protection : Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Skin protection : Wear suitable protective clothing.

Respiratory protection : No personal respiratory protective equipment normally required.

Hygiene measures : Wash hands before breaks and immediately after handling the product.

Section: 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Liquid

Colour : Amber Clear

Odour : Characteristic

Flash point : 138.0 °C
Method: Pensky-Martens closed cup

pH : no data available

Odour Threshold : no data available

Melting point/freezing point : no data available

Initial boiling point and boiling range : no data available

Evaporation rate : no data available

Flammability (solid, gas) : no data available

Upper explosion limit : no data available

Lower explosion limit : no data available

Vapour pressure : no data available

Relative vapour density : no data available

Relative density : 0.89 (25.0 °C)

Density : no data available

Water solubility	:	no data available
Solubility in other solvents	:	no data available
Partition coefficient: n-octanol/water	:	no data available
Auto-ignition temperature	:	no data available
Thermal decomposition	:	no data available
Viscosity, dynamic	:	no data available
Viscosity, kinematic	:	no data available
VOC	:	28.5 %

Section: 10. STABILITY AND REACTIVITY

Conditions to avoid	:	Avoid extremes of temperature.
Incompatible materials	:	Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.
Hazardous decomposition products	:	Oxides of carbon

Section: 11. TOXICOLOGICAL INFORMATION

Potential Health Effects

Eyes	:	Health injuries are not known or expected under normal use.
Skin	:	Health injuries are not known or expected under normal use.
Ingestion	:	Health injuries are not known or expected under normal use.
Inhalation	:	Health injuries are not known or expected under normal use.

Experience with human exposure

Toxicity

Product

Acute oral toxicity	:	no data available
Acute inhalation toxicity	:	no data available
Acute dermal toxicity	:	no data available
Skin corrosion/irritation	:	no data available
Serious eye damage/eye irritation	:	no data available
Respiratory or skin sensitization	:	no data available

Carcinogenicity	:	no data available
Reproductive effects	:	no data available
Germ cell mutagenicity	:	no data available
Teratogenicity	:	no data available
STOT - single exposure	:	no data available
STOT - repeated exposure	:	no data available
Aspiration toxicity	:	no data available

Section: 12. ECOLOGICAL INFORMATION

Ecotoxicity

Toxicity to fish	:	no data available
Toxicity to daphnia and other aquatic invertebrates.	:	no data available
Toxicity to algae	:	no data available

Persistence and degradability

The organic portion of this preparation is expected to be inherently biodegradable.

Mobility

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	:	<5%
Water	:	50 - 70%
Soil	:	30 - 50%

The portion in water is expected to float on the surface.

Bioaccumulative potential

This preparation or material is not expected to bioaccumulate.

Other information

no data available

Section: 13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

Disposal methods : As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility.

Section: 14. TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Land transport (DOT)

Proper shipping name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Air transport (IATA)

Proper shipping name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Sea transport (IMDG/IMO)

Proper shipping name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Section: 15. REGULATORY INFORMATION

California Prop 65 : This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

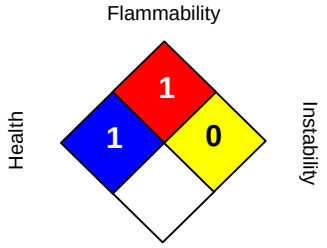
INTERNATIONAL CHEMICAL CONTROL LAWS :

TOXIC SUBSTANCES CONTROL ACT (TSCA)
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

Section: 16. OTHER INFORMATION

NALCO® 9866

NFPA:



HMIS III:

HEALTH	1
FLAMMABILITY	1
PHYSICAL HAZARD	

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Revision Date	:	11/20/2013
Version Number	:	1.1
Prepared By	:	Regulatory Affairs

REVISED INFORMATION: Significant changes to regulatory or health information for this revision is indicated by a bar in the left-hand margin of the SDS.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

For additional copies of an MSDS visit www.nalco.com and request access.

Dow (hereinafter, and for purposes of this MSDS only, refers to The Dow Chemical Company and to Dow Chemical Canada Inc.) encourages and expects you to read and understand the entire MSDS, as there is important information throughout the document. Dow expects you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 IDENTIFICATION

Product Name TERGITOL(TM) NP-4 SURFACTANT

1.2 COMPANY IDENTIFICATION

The Dow Chemical Company
Midland, MI 48674

1.3 EMERGENCY TELEPHONE NUMBER

24-HOUR EMERGENCY TELEPHONE NUMBER: (989)636-4400.
Customer Information Number: 1-800-258-2436.

2. COMPOSITION INFORMATION

Component	CAS #	Amount (%W/W)
Poly(oxy-1,2-ethanediyl), alpha-(4-nonylphenyl)-omega-hydroxy-, branched	127087-87-0	> 97 %
Dinonylphenyl polyoxyethylene	9014-93-1	< 3%
Polyethylene glycol	25322-68-3	< 3%

3. HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Appearance Transparent colorless

Physical State Liquid

Odor Mild

Hazards of product

DANGER!
CAUSES EYE BURNS.
CAUSES SKIN IRRITATION.

ASPIRATION MAY CAUSE LUNG DAMAGE.

3.2 POTENTIAL HEALTH EFFECTS

Effects of Single Acute Overexposure

Inhalation Mist may cause irritation of the respiratory tract, experienced as nasal discomfort and discharge, with chest pain and coughing.

Eye Contact Causes severe irritation, experienced as discomfort or pain, excess blinking and tear production, marked excess redness and swelling of the conjunctiva, and chemical burns of the eye.

Skin Contact Brief contact is not irritating. Prolonged or repeated contact may cause discomfort and local redness.

Skin Absorption Prolonged or widespread contact may result in the absorption of potentially harmful amounts of material.

Swallowing May cause abdominal discomfort, nausea, vomiting and diarrhea. Aspiration into the lungs may occur during ingestion or vomiting, resulting in lung injury.

Chronic, Prolonged or Repeated Overexposure

Effects of Repeated Overexposure Repeated skin contact may cause a dermatitis.
Other Effects of Overexposure None currently known.

Medical Conditions Aggravated by Exposure

A knowledge of the available toxicology information and of the physical and chemical properties of the material suggests that overexposure is unlikely to aggravate existing medical conditions.

See Section 11 for toxicological information and additional information about potential health effects.

3.3 POTENTIAL ENVIRONMENTAL EFFECTS

Toxic to aquatic organisms.

4. FIRST AID PROCEDURES

4.1 INHALATION

Remove to fresh air. Obtain medical attention if symptoms persist.

4.2 EYE CONTACT

Immediately flush eyes with water and continue washing for at least 15 minutes. DO NOT remove contact lenses, if worn. Obtain medical attention without delay, preferably from an ophthalmologist.

4.3 SKIN CONTACT

Remove contaminated clothing. Wash skin with soap and water. Obtain medical attention if irritation persists. Wash clothing before reuse.

4.4 SWALLOWING

If patient is fully conscious, give two glasses of water. DO NOT INDUCE VOMITING. Obtain medical attention.

4.5 NOTES TO PHYSICIAN

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Any material aspirated during vomiting may cause lung injury. Therefore, emesis should not be induced mechanically or pharmacologically. If it is considered necessary to evacuate the stomach contents, this should be done by means least likely to cause aspiration (e.g. gastric lavage after endotracheal intubation).

5. FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES - REFER TO SECTION 9, PHYSICAL AND CHEMICAL PROPERTIES

5.2 EXTINGUISHING MEDIA

Extinguish fires with water spray or apply alcohol-type or all-purpose-type foam by manufacturer's recommended techniques for large fires. Use carbon dioxide or dry chemical media for small fires.

5.3 FIRE FIGHTING PROCEDURES

Do not direct a solid stream of water or foam into hot, burning pools; this may cause frothing and increase fire intensity.

5.4 SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Use self-contained breathing apparatus and protective clothing.

5.5 UNUSUAL FIRE AND EXPLOSION HAZARDS

Avoid accumulation of water. Product may be carried across water surface spreading fire or contacting an ignition source.

5.6 HAZARDOUS COMBUSTION PRODUCTS

Burning can produce the following products: Carbon monoxide and/or carbon dioxide. Carbon monoxide is highly toxic if inhaled; carbon dioxide in sufficient concentrations can act as an asphyxiant.

6. ACCIDENTAL RELEASE MEASURES

Steps to be Taken if Material is Released or Spilled:
Contain spills immediately with inert materials (e.g., sand, earth). Transfer liquids and solid diking material to suitable containers for recovery or disposal. To avoid gelling and foaming problems, do not use water to flush away spills.

Personal Precautions: Wear suitable protective equipment. Floor may be slippery. Use care to avoid falling. See Section 8.2 - Personal Protection.

Environmental Precautions: Avoid discharge to natural waters.

7. HANDLING AND STORAGE

7.1 HANDLING

General Handling
Do not get in eyes.
Avoid contact with skin and clothing.
Do not swallow.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

FOR INDUSTRY USE ONLY.

Ventilation
Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

Other Precautions
Surfactants can cause foaming problems in biological wastewater treatment plants and other high shear operations.

7.2 STORAGE

Store in accordance with good industrial practices. Storage information may be obtained from product-specific Storage and Handling Guides, or by calling Dow's Customer Information Group at 1-800-258-2436 (U.S.) or 1-800-331-6451 (Canada).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 EXPOSURE LIMITS

Component	Exposure Limits	Skin	Form
Polyethylene glycol	10 mg/m3 TWA8 AIHA WEEL		Aerosol

In the Exposure Limits Chart above, if there is no specific qualifier (i.e., Aerosol) listed in the Form Column for a particular limit, the listed limit includes all airborne forms of the substance that can be inhaled.

A "Yes" in the Skin Column indicates a potential significant contribution to overall exposure by the cutaneous (skin) route, including mucous membranes and the eyes, either by contact with vapors or by direct skin contact with the substance. A "Blank" in the Skin Column indicates that exposure by the cutaneous (skin) route is not a potential significant contributor to overall exposure.

8.2 PERSONAL PROTECTION

Respiratory Protection: Atmospheric levels should be maintained below the exposure guideline.
When airborne exposure guidelines and/or comfort levels may be exceeded, use an approved air-purifying respirator.
For emergency response or for situations where the atmospheric level is unknown, use an approved positive-pressure self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply.

Ventilation: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

Eye Protection: Monogoggles

Protective Gloves: Polyvinyl chloride coated

Other Protective Equipment: Eye Bath, Safety Shower

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid

Appearance: Transparent colorless

Odor: Mild

Flash Point - Closed Cup: **218 °C 425 °F** *Pensky-Martens Closed Cup ASTM D 93*

Flash Point - Open Cup: **263 °C 505 °F** *Cleveland Open Cup ASTM D 92*

Flammable Limits In Air:
Lower *Not determined.*
Upper *Not determined.*

Autoignition Temperature: *Not currently available.*

Vapor Pressure: **< 0.01 mmHg** *20 °C*

Boiling Point (760 mmHg): **> 200 °C > 392 °F**

Vapor Density (air = 1): **> 10**

Specific Gravity (H2O = 1): **1.029** *20 °C / 20 °C*

Freezing Point: *Pour point* **-33 °C -27 °F**

Melting Point: Not applicable.

Solubility in Water (by weight): **< 0.5 %** With slight haze

pH: *Not currently available.*

Molecular Weight: **396 g/mol** (Average)

Evaporation Rate (Butyl Acetate = 1): **< 0.01**

Percent Volatiles: **0.19 Wt%**

10. STABILITY AND REACTIVITY

10.1 STABILITY/INSTABILITY Stable

Conditions to Avoid: Prolonged excessive heat may cause product decomposition.

Incompatible Materials: Normally unreactive; however, avoid strong bases at high temperatures, strong acids, strong oxidizing agents and materials reactive with hydroxyl compounds.

10.2 HAZARDOUS POLYMERIZATION Will not occur.

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Peroral

Rat; male; LD50 = 4.29 (3.07 - 5.98) ml/kg; slope not available

Major Signs: lethargy, slow breathing, tremors, narcosis, prostration

Percutaneous

Rabbit; male; LD50 = 2.52 (0.96 - 6.59) ml/kg; slope not available; 24 hr occluded contact.

Irritation: erythema, necrosis

Gross Pathology: hemorrhages, congestion of lungs

Gross Pathology - Decedents: mottling of liver

Inhalation

Aerosol Studies Rat; male; 8 hour; LC50 = 0.0213 ml/l; 1% dispersion in water

Mortality: 0/6

IRRITATION

Skin: Rabbit; unoccluded contact; 0.01
Results: minimal capillary dilatation at 24 hr

Eye: Rabbit; 0.005 ml; undiluted
Results: severe corneal injury (chemical burns) within 24 hr, healing by 7 days

Eye: Rabbit; 0.5 ml; 15% in water
Results: moderate corneal injury (chemical burns)

Eye: Rabbit; 0.5 ml; 40% in water
Results: severe corneal injury (chemical burns) within 24 hr, healing by 7 days

SIGNIFICANT DATA WITH POSSIBLE RELEVANCE TO HUMANS

In two-year feeding studies, the 4-mole ethoxylate of nonylphenol (NPE4) at doses of 200 mg/kg/day or 40 mg/kg/day in rats and dogs, respectively, produced no significant effects. The 9-mole ethoxylate (NPE9) at doses of 140 or 30 mg/kg/day in the diet of rats or dogs, respectively, produced no adverse effects. Parameters evaluated included body and organ weights and histopathology of 28 tissues. A dose of 1000 mg/kg/day of NPE9 resulted in reduced body weights and enlarged livers in rats and reduced weight, emesis, and minimal blood changes in dogs. A dose of 88 mg/kg/day NPE9 produced increased liver to body weight ratios in dogs which was attributed to decreased food consumption. Rats fed dietary concentrations of a related alkylphenol ethoxylate, the 40-mole ethoxylate of octylphenol (OPE40), up to 14000 ppm (700 mg/kg/day) for two years showed no adverse effects on growth or survival, feed consumption, hematologic values, urine measurements, organ weights or histopathologic lesions.
Alkylphenol Ethoxylate Toxicity: In studies with rabbits, sustained occluded skin contact of some undiluted surfactants caused inflammatory changes in the lung. This material can cause lung injury if deposited as a liquid directly into the lung. Some deaths have occurred in rats exposed to high aerosol concentrations of this material for 4 hours. However, there were no histopathological findings in the lungs of rats that died, suggesting that the deaths were not caused by chemical toxicity, but likely related to some non-specific physical cause such as suffocation. Developmental effects including extra ribs and other skeletal variations were observed in the fetuses of rats treated with maternally toxic levels of a 9-mole ethoxylate of octylphenol, or a 4-mole or 9-mole ethoxylate of nonylphenol. The significance of these findings to humans is unclear as several human studies did not show any association of congenital effects in children and maternal exposure to spermicides containing octyl or nonylphenol ethoxylates. Alkylphenol Toxicity: Several studies with nonylphenol have resulted in slightly increased kidney weights in male rats continuously exposed to dietary concentrations of 200 ppm or greater (approximately >10 mg/kg/body weight/day). No histological lesions of the kidney were observed in one study but histopathological lesions, primarily tubule mineralization, were observed at 2000 ppm in one study and in a dose-related manner at concentrations >=200 ppm in a third study. These results indicate that continuous exposure to high concentrations of nonylphenol may be toxic to the kidney. While nonylphenol has been shown to bind to the estrogen receptor and to have weak estrogen mimetic activity in several in vitro and in vivo screening assays, treatment of rats at dietary concentrations of nonylphenol up to 2000 ppm in

their diet for 90 days did not result in alterations in estrous cycles, sperm measurements, or endocrine organ weights or histopathology. In addition, a three generation (F0 through F3 weaning) study conducted by the NIEHS indicated that nonylphenol did not affect reproductive parameters at dietary concentrations up to 2000 ppm in any generation. Effects in juvenile females consistent with those seen in screening assays (e.g., premature vaginal opening) were observed following high level exposure post-weaning (F1, F2, and F3) at 650 and 2000 ppm. Sperm counts were reduced at 650 and 2000 ppm in the F2 adults compared to controls from the same generation. These results and other inconsistent or potentially body weight related findings are considered of questionable significance. The No Observed Adverse Effect Level (NOAEL) for reproduction was 2000 ppm and for all effects was 200 ppm (except as noted for kidneys above). Considering the high doses (e.g., 100-350 mg/kg/day for females in the 2000 ppm group; the higher doses occurring post-weaning), the lack of permanent/prolonged effects is considered significant. Based on the results of these studies, exposure to low doses of nonylphenol, such as from workplace or environmental exposure, would not be expected to result in effects on mammalian reproduction. In a 2-generation reproduction study with octylphenol at dietary concentrations of 0.2 to 2000 ppm, treatment-related effects in adult F0, F1, and F2 animals were limited to reduced body weights and feed consumption at 2000 ppm. No effects on any reproductive parameters were observed in either generation. No effects on sperm measurements, estrous cyclicity, or reproductive organs were observed in adult animals. Pup body weights during lactation were reduced at 2000 ppm. The NOAEL for systemic and postnatal toxicity was 200 ppm (approximately 15 mg/kg/day) and for reproductive toxicity was >2000 ppm (approximately 150 mg/kg/day). Although octylphenol has weak estrogen mimetic activity in some screening assays, no estrogenic or reproductive effects occurred from dietary exposure to rats for two generations over a 10,000 fold dose range.

12. ECOLOGICAL INFORMATION

12.1 ENVIRONMENTAL FATE

BOD (% Oxygen consumption)

	Day 5	Day 10	Day 15	Day 20	Day 28/30
Acclimated	4 %	28 %		31 %	

BOD (% Oxygen consumption)

	Day 5	Day 10	Day 15	Day 20	Day 28/30
	< 1 %	1 %	2 %	4 %	

Modified Sturm Test (OECD 301B)(% CO2 evolved)

	Day 5	Day 10	Day 15	Day 28
				12.4 %

Modified Sturm Test (OECD 301B)(% CO2 evolved)

	Day 5	Day 10	Day 15	Day 28
		15.9 %		55 %

12.2 ECOTOXICITY

Toxicity to Micro-organisms
Bacterial/NA; 16 h; NOEC
Result value: 625 mg/l

Toxicity to Micro-organisms
Bacterial/NA; 16 h; IC50
Result value: 2400 mg/l

Toxicity to Aquatic Invertebrates
Daphnia; 48 h; NOEC
Result value: 0.75 mg/l

Toxicity to Aquatic Invertebrates
Daphnia; 48 h; EC50
Result value: 1.6 (1.5 - 1.8) mg/l

Toxicity to Fish
Fathead Minnow; 96 h; NOEC
Result value: 0.6 mg/l

Toxicity to Fish
Fathead Minnow; 96 h; LC50
Result value: 1.2 (1.1 - 1.3) mg/l

12.3 FURTHER INFORMATION

Appropriate treatment of effluents will reduce levels of nonylphenol ethoxylate (NPE) residues to concentrations that should pose no harm to the environment, including protection for weak estrogen-mimetic activity observed for some degradation intermediates.
Chemical Oxygen Demand (COD) - measured: 2.5 mg/mg

Chemical Oxygen Demand (COD) - calculated:: 2.45 mg/mg

13. DISPOSAL CONSIDERATIONS

13.1 DISPOSAL

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. DOW HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION 2 (Composition/ Information on Ingredients). FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: incinerator or other thermal destruction device. waste water treatment system. As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customer Information Group at 1-800-258-2436 or 1-989-832-1556 (U.S.), or 1-800-331-6451 (Canada) for further details .

14. TRANSPORT INFORMATION

14.1 U.S. D.O.T.

NON-BULK
Proper Shipping Name : NOT REGULATED

BULK
Proper Shipping Name : ENVIRONMENTALLY HAZARDOUS SUBSTANCES LIQUID, NOS
Technical Name : CONTAINS ALCOHOL C13-C15 POLY(1-6) ETHOXYLATE
Hazard Class : 9
ID Number : UN3082
Packing Group : PG III

Other Information : MARINE POLLUTANT (ALCOHOL C13-C15 POLY (1-6) ETHOXYLATE)

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

15.1 FEDERAL/NATIONAL

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (CERCLA) SECTION 103

This product contains the following substances subject to CERCLA Section 103 reporting requirements and are listed in 40 CFR Part 302.4.

Component	CAS #	Amount
Glycol Ethers	Not available	<= 35.8000%
Ethylene oxide	75-21-8	<= 0.0020%
1,4-Dioxane	123-91-1	<= 0.0015%
Acetaldehyde	75-07-0	<= 0.0006%
Formaldehyde	50-00-0	<= 0.0004%

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EMERGENCY PLANNING AND COMMUNITY RIGHT TO KNOW ACT) SECTION 302

This product contains the following substances subject to SARA Section 302 reporting requirements and are listed in 40 CFR Part 302.4.

None.

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EMERGENCY PLANNING AND COMMUNITY RIGHT TO KNOW ACT) SECTION 313

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act 1986 and 40 CFR Part 372.

Component	CAS #	Amount
Glycol Ethers	Not available	<= 35.8000%

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EMERGENCY PLANNING AND COMMUNITY RIGHT TO KNOW ACT)SECTIONS 311 AND 312

Delayed (Chronic) Health Hazard : Yes
Fire Hazard : No
Immediate (Acute) Health Hazard : Yes
Reactive Hazard : No
Sudden Release of Pressure Hazard : No

TOXIC SUBSTANCES CONTROL ACT (TSCA)

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements.

EUROPEAN INVENTORY OF EXISTING COMMERCIAL CHEMICAL SUBSTANCES (EINECS)

All components in this product are in compliance with EINECS.

CEPA - DOMESTIC SUBSTANCES LIST (DSL)

All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

15.2 STATE/LOCAL

PENNSYLVANIA (WORKER AND COMMUNITY RIGHT-TO-KNOW ACT)

The following product components are cited in the Pennsylvania Hazardous Substances List, the Pennsylvania Special Hazardous Substance List, and/or the Pennsylvania Environmental Hazardous Substance list, and are present at levels which require reporting.

Component	CAS #	Amount
Glycol Ethers	Not available	<= 35.8000%

MASSACHUSETTS (HAZARDOUS SUBSTANCES DISCLOSURE BY EMPLOYERS)

The following components of this product appear on the Massachusetts Substance List and are present at levels which could require identification in the MSDS:

Component	CAS #	Amount
Ethylene oxide	75-21-8	<= 0.0020%
1,4-Dioxane	123-91-1	<= 0.0015%
Acetaldehyde	75-07-0	<= 0.0006%
Formaldehyde	50-00-0	<= 0.0004%

CALIFORNIA PROPOSITION 65 (SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986)

This product contains the following chemical(s) known to the State of California to cause cancer:

Component	CAS #	Amount
1,4-Dioxane	123-91-1	<= 0.0015%
Acetaldehyde	75-07-0	<= 0.0006%
Formaldehyde	50-00-0	<= 0.0004%

CALIFORNIA PROPOSITION 65 (SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986)

This product contains the following chemical(s) known to the State of California to cause cancer and birth defects or other reproductive harm.

Component	CAS #	Amount
Ethylene oxide	75-21-8	<= 0.0020%

CALIFORNIA SCAQMD RULE 443.1 (SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT RULE 443.1, LABELING OF MATERIALS CONTAINING ORGANIC SOLVENTS)

VOC: Vapor pressure <0.01 mmHg at 20°C
0 g/L

This section provides selected regulatory information on this product including its components. This is not intended to include all regulations. It is the responsibility of the user to know and comply with all applicable rules, regulations and laws relating to the product being used.

16. OTHER INFORMATION

16.1 ADDITIONAL INFORMATION

ADDITIONAL INFORMATION: Additional product safety information on this product may be obtained by calling Dow's Customer Information Group at 1-800-258-2436 (U.S.) or 1-800-331-6451 (Canada).

16.2 HAZARD RATING SYSTEM

NFPA ratings for this product are: H - 2 **F -** 1 **R -** 0

These ratings are part of a specific hazard communication program and should be disregarded where individuals are not trained in the use of this hazard rating system. You should be familiar with the hazard communication programs applicable to your workplace.

16.3 RECOMMENDED USES AND RESTRICTIONS

FOR INDUSTRY USE ONLY

16.4 REVISION

Version: 5.0
Revision: 02/10/2003
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

16.5 LEGEND

Bacterial/NA	Non Acclimated Bacteria
F	Fire
H	Health
IHG	Industrial Hygiene Guideline
N/A	Not available
NFPA	National Fire Protection Association
O	Oxidizer
R	Reactivity
TS	Trade secret
VOL/VOL	Volume/Volume
W	Water Reactive
W/W	Weight/Weight

NOTICE: Dow urges each customer or recipient of this MSDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this MSDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given., Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that its activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of Dow, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product., Due to the proliferation of sources for information such as manufacturer-specific MSDSs, Dow is not and cannot be responsible for MSDSs obtained from any source other than Dow. If you have obtained a Dow MSDS from a non-Dow source or if you are not sure that a Dow MSDS is current, please contact Dow for the most current version.

SAFETY DATA SHEET

PRODUCT

NALCO® 8836 PLUS

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **NALCO® 8836 PLUS**

APPLICATION : FLOTATION REAGENT

COMPANY IDENTIFICATION : Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 2 / 2 FLAMMABILITY : 2 / 2 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Aliphatic alcohol	Proprietary	60.0 - 100.0

3. HAZARDS IDENTIFICATION

****EMERGENCY OVERVIEW****

WARNING
Combustible. Irritating to eyes and skin.
Keep away from heat. Keep away from sources of ignition - No smoking. Keep container tightly closed. Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Avoid breathing vapor. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water. Use a mild soap if available.
Wear suitable protective clothing and gloves. Wear chemical splash goggles.
Combustible Liquid; may form combustible mixtures at or above the flash point. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition.
May evolve oxides of carbon (COx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin, Inhalation

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
Can cause mild to moderate irritation.

SKIN CONTACT :
Can cause moderate irritation.

INGESTION :
Not a likely route of exposure. There may be irritation to the gastro-intestinal tract with nausea and vomiting. Can cause central nervous system depression.

INHALATION :
Repeated or prolonged exposure may irritate the respiratory tract.

AGGRAVATION OF EXISTING CONDITIONS :
Skin contact may aggravate an existing dermatitis condition.

HUMAN HEALTH HAZARDS - CHRONIC :
No adverse effects expected other than those mentioned above.

4. FIRST AID MEASURES

EYE CONTACT :
Immediately flush eye with water for at least 15 minutes while holding eyelids open. Get medical attention.

SKIN CONTACT :
Immediately flush with plenty of water for at least 15 minutes. If symptoms develop, seek medical advice.

INGESTION :
Do not induce vomiting: contains petroleum distillates and/or aromatic solvents. If conscious, washout mouth and give water to drink. Get medical attention.

INHALATION :
Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.

NOTE TO PHYSICIAN :
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : 185 °F / 85 °C

EXTINGUISHING MEDIA :
Foam, Carbon dioxide, Dry powder, Other extinguishing agent suitable for Class B fires, For large fires, use water spray or fog, thoroughly drenching the burning material.
Water mist may be used to cool closed containers.

UNSUITABLE EXTINGUISHING MEDIA :
Do not use water unless flooding amounts are available.

FIRE AND EXPLOSION HAZARD :
Combustible Liquid; may form combustible mixtures at or above the flash point. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. May evolve oxides of carbon (COx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Keep people away from and upwind of spill/leak. Ventilate spill area if possible. Remove sources of ignition. Ensure clean-up is conducted by trained personnel only. Do not touch spilled material. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Clean contaminated surfaces with water or aqueous cleaning agents. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment., Prevent material from entering sewers or waterways., If drains, streams, soil or sewers become contaminated, notify local authority.

7. HANDLING AND STORAGE

HANDLING :
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Do not breathe vapors/gases/dust. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled. Do not use, store, spill or pour near heat, sparks or open flame.

STORAGE CONDITIONS :
Store in suitable labeled containers. Store the containers tightly closed. Store away from heat and sources of ignition. Have appropriate fire extinguishers available in and near the storage area. Connections must be grounded to avoid electrical charges. Store separately from oxidizers.

SUITABLE CONSTRUCTION MATERIAL :
Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
This product does not contain any substance that has an established exposure limit.

ENGINEERING MEASURES :
General ventilation is recommended. Use local exhaust ventilation if necessary to control airborne mist and vapor.

RESPIRATORY PROTECTION :
Where concentrations in air may exceed the limits given in this section or when significant mists, vapors, aerosols, or dusts are generated, an approved air purifying respirator equipped with suitable filter cartridges is recommended. Consult the respirator / cartridge manufacturer data to verify the suitability of specific devices. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
When handling this product, the use of chemical gauntlets is recommended. The choice of work glove depends on work conditions and what chemicals are handled, but we have positive experience under light handling conditions using gloves made from PVC Gloves should be replaced immediately if signs of degradation are observed. Breakthrough time not determined as preparation, consult PPE manufacturers.

SKIN PROTECTION :
Wear standard protective clothing.

EYE PROTECTION :
Wear chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Amber
ODOR	Hydrocarbon

SPECIFIC GRAVITY	0.877 @ 77 °F / 25 °C
DENSITY	7.29 lb/gal
SOLUBILITY IN WATER	Partial
pH (100 %)	6.8

VAPOR PRESSURE 26.8 mm Hg @ 100 °F / 37.8 °C

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Extremes of temperature Heat and sources of ignition including static discharges.

MATERIALS TO AVOID :
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Oxides of carbon

11. TOXICOLOGICAL INFORMATION

No toxicity studies have been conducted on this product.

SENSITIZATION :
This product is not expected to be a sensitizer.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: Low

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

No toxicity studies have been conducted on this product.

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is

intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	10 - 30%	50 - 70%

The portion in water is expected to float on the surface.

BIOACCUMULATION POTENTIAL
Component substances have a potential to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Moderate

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

For Packages Less Than Or Equal To 119 Gallons:

Proper Shipping Name :	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

For Packages Greater Than 119 Gallons:

Proper Shipping Name :	COMBUSTIBLE LIQUID, N.O.S.
Technical Name(s) :	PETROLEUM HYDROCARBON
UN/ID No :	NA 1993
Hazard Class - Primary :	COMBUSTIBLE
Packing Group :	III
Flash Point :	85 °C / 185 °F

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name :	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name :	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Aliphatic alcohol : Combustible., Irritant

CERCLA/SUPERFUND, 40 CFR 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
-	Delayed (Chronic) Health Hazard
X	Fire Hazard
-	Sudden Release of Pressure Hazard
-	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CLEAN AIR ACT, Sec. 112 (Hazardous Air Pollutants, as amended by 40 CFR 63), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CALIFORNIA PROPOSITION 65 :
Substances listed under California Proposition 65 are not intentionally added or expected to be present in this product.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

STATE RIGHT TO KNOW LAWS :
The following substances are disclosed for compliance with State Right to Know Laws:

2-Ethylhexanol	104-76-7
2-ethylhex-2-enal	645-62-5

INTERNATIONAL CHEMICAL CONTROL LAWS :

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
This product contains substance(s) which are not in compliance with the Law Regulating the Manufacture and Importation Of Chemical Substances and are not listed on the Existing and New Chemical Substances list (ENCS).

KOREA
This product contains substance(s) which are not in compliance with the Toxic Chemical Control Law (TCCL) and may require additional review.

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 12/27/2010
Version Number : 1.3

Material Safety Data Sheet

Froth Pro 327

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	Froth Pro 327
Product use	Foamer
Manufacturer	CorsiTech P.O. Box 27727 Houston, TX 77227-7727 USA
Telephone	1-800-477-5353 (CorsiTech)
In case of emergency	1-800-424-9300 (CHEMTREC) 1-703-527-3887 (CHEMTREC - International)

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Signal Word	**Danger**
Hazard Summary	Combustible liquid. Harmful. Causes serious eye damage. Irritant.
Physical state	liquid
Color	brown
Odor	slight pleasant
Primary Routes of Entry	Inhalation. Skin.

Potential Health Effects

Inhalation	May cause respiratory tract irritation.
Skin	Causes skin irritation.
Eyes	Causes serious eye damage.
Ingestion	Harmful if swallowed. Causes digestive tract burns.
Chronic Exposure	May cause damage to organs through prolonged or repeated exposure.
Medical conditions aggravated by over-exposure	Asthma Skin disorders

Environmental hazards

Environmental effects	No known significant effects or critical hazards.

See toxicological information (section 11)

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous ingredients

Name	CAS no.	Weight %
Distillation residues	Proprietary	60 - 100
Polypropylene glycol butyl ether	9003-13-8	30 - 60

SECTION 4. FIRST AID MEASURES

General advice	If you feel unwell, seek medical advice (show the label when possible). No action shall be taken involving any personal risk or without suitable training.
Inhalation	Move exposed person to fresh air. If symptoms persist, call a physician.
Skin contact	Take off contaminated clothing and shoes immediately. In case of contact, immediately flush skin with soap and plenty of water. If symptoms persist, call a physician.
Eye contact	In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Remove contact lenses. Continue rinsing eyes during transport to hospital. Keep eye wide open while rinsing. Protect unharmed eye. If eye irritation persists, consult a specialist.
Ingestion	Rinse mouth with water. Drink plenty of water. Obtain medical attention. Never give anything by mouth to an unconscious person.
Notes to physician	No information available.

SECTION 5. FIRE-FIGHTING MEASURES

Fire Hazard	Flammable or combustible, may be ignited by heat, sparks or flames. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.
Flash point	145 °F (62.8 °C) Pensky-Martens. closed cup
Autoignition temperature	Not available.
Flammable limits	Lower: Not available. Upper: Not available.
Extinguishing media	
Suitable	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Hazardous combustion products	Carbon oxides.
Special protective equipment for fire-fighters	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.
Further information	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Explosion hazard	Risk of explosion of the product in the presence of mechanical impact: Not available. Risk of explosion of the product in the presence of static discharge: Not available.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Shut off all ignition sources. Ensure adequate ventilation. Avoid breathing vapor or mist. Do not touch or walk through spilled material. Keep people away from and upwind of spill/leak. Material can create slippery conditions. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).
Environmental precautions	Avoid contact of spilled material with soil and prevent runoff entering surface waterways.
Methods for cleaning up	For large spills, dike spilled material or otherwise contain it to ensure runoff does not reach a waterway. Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a

container for disposal according to local / national regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

SECTION 7. HANDLING AND STORAGE

Handling Eliminate all ignition sources. Use only with adequate ventilation. Put on appropriate personal protective equipment (see section 8). Do not get in eyes or on skin or clothing. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Open drum carefully as content may be under pressure. Do not enter storage areas and confined spaces unless adequately ventilated. Workers should wash hands and face before eating, drinking and smoking.

Storage Keep container closed when not in use. Keep container in a well-ventilated area. Separate from oxidizing materials.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Personal Protection

Hand protection Impervious butyl rubber gloves. Nitrile rubber. Neoprene gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Eye protection Safety goggles.

Skin and body protection Wear as appropriate: Chemical-resistant apron. Long sleeved clothing. Footwear protecting against chemicals.

Respiratory protection In the case of vapor formation use a respirator with an approved filter.

Occupational Exposure Limits

Not established

Engineering measures Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures Handle in accordance with good industrial hygiene and safety practice. Use only with adequate ventilation. Avoid contact with skin, eyes and clothing. Remove contaminated clothing and protective equipment before entering eating areas. Wash hands before breaks and immediately after handling the product.

Protective measures Emergency baths, showers, or other equipment appropriate for the potential level of exposure should be located close to the workstation location. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state liquid

Color brown

Odor slight pleasant

Odor Threshold Not available.

Melting/freezing point Not available.

Pour point Not available.

Boiling/condensation point Not available.

Flash point	145 °F (62.8 °C) Pensky-Martens. closed cup
pH	not applicable
Solubility	oil
Relative density	0.9717 at 20 °C (68 °F)
Vapor pressure	Not available.
Evaporation rate	Not available.
Viscosity	100 cPs at 75 °F (23.9 °C)
Partition coefficient: n-octanol/water	Not available.

Note: Typical values only - not to be interpreted as sales specifications

SECTION 10. STABILITY AND REACTIVITY

Chemical stability	Stable under normal conditions.
Conditions to avoid	Heat, flames and sparks.
Materials to avoid	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.
Hazardous reactions	No dangerous reaction known under conditions of normal use.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

No data is available on the product itself.

Irritation/Corrosion

No data is available on the product itself.

Sensitization

No data is available on the product itself.

Chronic toxicity

No data is available on the product itself.

Target organ effects

Distillation residues: Inhalation of high concentrations of vapor may affect the central nervous system.

Carcinogenicity

No data is available on the product itself.

None of the components are listed.

Mutagenicity

No data is available on the product itself.

Teratogenicity

No data is available on the product itself.

Reproductive toxicity

No data is available on the product itself.

SECTION 12. ECOLOGICAL INFORMATION

Environmental effects No known significant effects or critical hazards.

Aquatic ecotoxicity

No data is available on the product itself.

Biodegradation

No data is available on the product itself.

Bioaccumulation

No data is available on the product itself.

Octanol/water partition coefficient (LogPow) Not available.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste disposal Dispose of wastes in an approved waste disposal facility. Empty containers or liners may retain some product residues. If recycling is not practicable, dispose of in compliance with local regulations.

Contaminated packaging Dispose of as unused product.

Disposal should be in accordance with applicable regional, national and local laws and regulations. Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

SECTION 14. TRANSPORT INFORMATION

DOT

NA Number:	1993
Description of the goods	Combustible liquid, n.o.s.(Distillation residues)
Class	CBL
Packing group	III
Emergency Response Guidebook Number	128
Environmentally hazardous	no

Note: Product is not classified as a dangerous good in non-bulk packaging (<= 450 liters/119 US gallons).

TDG
Not dangerous goods

IATA
Not dangerous goods

IMDG
Not dangerous goods

SECTION 15. REGULATORY INFORMATION

U.S. Federal regulations

CERCLA: Hazardous substances - Reportable quantity:
None of the components are listed.

SARA 311/312 MSDS distribution - chemical inventory - hazard identification:
Fire Hazard
Acute Health Hazard

SARA 313 - Supplier notification
None of the components are listed.

Clean Water Act (CWA) 307: None of the components are listed.

Clean Water Act (CWA) 311: None of the components are listed.

Clean Air Act (CAA) 112 accidental release prevention: None of the components are listed.

State regulations

Massachusetts Substances: None of the components are listed.

Pennsylvania RTK Hazardous Substances: None of the components are listed.

New Jersey Hazardous Substances: None of the components are listed.

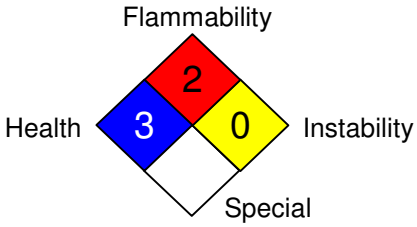
California Prop. 65:
This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

International regulations

United States inventory (TSCA 8b):	On TSCA Inventory
Canada inventory (DSL):	All components of this product are on the Canadian DSL list.
Australia inventory (AICS)	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

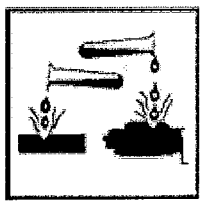
National Fire Protection Association (U.S.A.):



Prepared by	Product Stewardship (1-281-431-2561)
Date of issue	02/12/2013
Date of previous issue	00/00/0000
Version	1.0

Disclaimer
To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet



SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Orfom® D8 Depressant

Product Use: Mineral Processing Aide
Product Number(s): 0001016856, 0001016855, 0001095798
Synonyms: None Established
Product CAS No.: 86932-91-4

Company Identification:
Chevron Phillips Chemical Company LP
Mining Chemicals
10001 Six Pines Drive
The WoodlandsTX 77380

Product Information:
MSDS Requests: (800) 852-5530
Technical Information: (832) 813-4862
Responsible Party: Product Safety Group
Email:msds@cpchem.com

Chevron Phillips Chemicals International N.V.
Brusselsesteenweg 355
B-3090 Overijse
Belgium

24-Hour Emergency Telephone Numbers
HEALTH:Chevron Phillips Emergency Information Center 866.442.9628 (North America) and 1.832.813.4984 (International)
TRANSPORTATION: North America: CHEMTREC 800.424.9300 or 703.527.3887
ASIA: +1.703.527.3887
EUROPE: BIG .32.14.584545 (phone) or .32.14.583516 (telefax)
SOUTH AMERICA SOS-Cotec Inside Brazil: 0800.111.767
Outside Brazil: 55.19.3467.1600

SECTION 2 HAZARDS IDENTIFICATION

****

EMERGENCY OVERVIEW
Clear orange-red liquid with mild odor.
NFPA RATINGS: **Health:** 3 **Flammability:** 2 **Reactivity:** 0

3E Company
1905 Aston Avenue, 100
Carlsbad, CA 92008
U.S. Toll Free: 1-800-451-8346 or 1-760-602-8703
North America: 1-800-931-0537/Mexico 00-1-800-931-0537 or 1-760-602-8822
Fax: 1-760-602-8888
Email: msds@3ecompany.com

Material Safety Data Sheet Transmittal Form

December 10, 2008

Request #: **156844**
Processed By: **Poliana McPheeters**

Recipient:

PAT WADSWORTH

Email: patricia_wadsworth@fmi.com

Requester:

PAT WADSWORTH

Email: patricia_wadsworth@fmi.com
Phone: 719-486-7568

Thank you for using 3E's MSDS Paperless Compliance™ service. This service may eliminate the requirement to maintain MSDS on site. Below is a list of the MSDS you requested. Please verify that the MSDS sheet(s) enclosed/attached match what you have ordered.

PID	Manufacturer ORDERED/Actual	Product Name ORDERED/Actual	UPC	Item
1882816	CHEVRON PHILLIPS/Chevron Phillips Chemical Company LP	ORFOM D8/Orfom D8 Depressant		

END OF ORDER DETAIL - Request# 156844

Signal Word:
Danger

Risk Phrases:
R65: Harmful: may cause lung damage if swallowed.
R34: Causes burns.
R41: Risk of serious damage to eyes.

Safety Phrases:
S39: Wear eye/face protection.
S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S2: Keep out of the reach of children.
S28: After contact with skin, wash immediately with soap and water.
S62: If swallowed do not induce vomiting: seek medical advice immediately and show this container or label.
S36/37/39: Wear suitable protective clothing, gloves and eye/face protection.
S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

****

IMMEDIATE HEALTH EFFECTS:
Eye: Contact with the eyes causes permanent damage, including blindness. Symptoms may include pain, tearing, reddening, swelling and impaired vision. Not expected to cause prolonged or significant eye irritation.
Skin: Contact with the skin causes permanent damage, including burns and scarring. Symptoms may include pain, itching, discoloration, swelling, and blistering.
Ingestion: This material can directly enter the lungs, if swallowed, or if subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death. May be severely irritating and cause permanent damage to the mouth, throat, and stomach. Symptoms of severe irritation or ulceration of the digestive tract may include nausea, vomiting, diarrhea, and, in severe cases, collapse, shock, and death.
Inhalation: Breathing of high vapor concentrations may cause dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness. The vapor or fumes from this material may cause respiratory irritation. Mists of this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty in breathing.

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENT	CAS NUMBER	AMOUNT	EINECS / ELINCS	SYM	R-PHRASES
Disodium Carboxymethyltrithiocarbonate	86932-91-4	35 - 45 % weight	NA	NA	NA
Sodium Hydroxide	1310-73-2	5 % weight	215-185-5	C	R35
Water	7732-18-5	45 - 55 % weight	2317-91-2	NA	NA
Impurities	Various	< 5 % weight	NA	NA	NA

Occupational Exposure Limits:

Component	Limit	TWA	STEL	Ceiling / Peak	Notation
Disodium Carboxymethyltrithiocarbonate	ACGIH	Not Established	NA	NA	NA
Sodium Hydroxide	ACGIH	Not Established	NA	2 mg/m3	NA
Sodium Hydroxide	CPCHEM	2 mg/m3	NA	NA	NA
Sodium Hydroxide	German MAK	2 mg/m3	NA	1	NA

SECTION 4 FIRST AID MEASURES

Eye: Flush eyes with running water immediately while holding the eyelids open. Remove contact lenses, if worn, after initial flushing, and continue flushing for at least 15 minutes. Get immediate medical attention.
Skin: To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse. Get medical attention if any symptoms develop.
Ingestion: If swallowed, do not induce vomiting. Give the person a glass of water or milk to drink and get immediate medical attention. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.

Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis. Probable mucosal damage may contraindicate the use of gastric lavage.

SECTION 5 FIRE FIGHTING MEASURES

See Section 7 for proper handling and storage.

NFPA RATINGS: **Health:** 3 **Flammability:** 2 **Reactivity:** 0
FLAMMABLE PROPERTIES:
Flashpoint: 74°C (165.2°F)
Autoignition: NDA
Flammability (Explosive) Limits (% by volume in air): **Lower:** NDA **Upper:** NDA

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion. Combustion may form: Sulfur Oxides, Carbon Oxides

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator. Wear appropriate personal protective equipment when cleaning up spills. Refer to Section 8. Eliminate potential sources of ignition. Handling equipment must be bonded and grounded to prevent sparking.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible sorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: U.S.A. regulations may require reporting spills of this material that could reach any surface waters. Report spills to local authorities and/or the National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL . REFER TO PRODUCT LABEL OR MANUFACTURERS TECHNICAL BULLETINS FOR THE PROPER USE AND HANDLING OF THIS MATERIAL .

Precautionary Measures: Liquid evaporates and forms vapor (fumes) that can catch fire and burn with explosive force. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Fire hazard is greater as liquid temperature rises above 85F. Do not get in eyes, on skin, or on clothing. Do not breathe vapor or fumes. Do not breathe mist. Wash thoroughly after handling.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations, which have the potential of generating an accumulation of electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids, National Fire Protection Association (NFPA 77), Recommended Practice on Static Electricity' (liquids, powders and dusts), and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents' (liquids).
General Storage Information: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner, or disposed of properly. DO NOT USE OR STORE near heat, sparks or open flames. USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
If user operations generate airborne material, use process enclosures, local exhaust ventilation, or other engineering controls to control exposure.

PERSONAL PROTECTIVE EQUIPMENT:
Eye/Face Protection: Wear chemical goggles AND a face shield! Wear eye protection such as safety glasses, chemical goggles, or faceshields if engineering controls or work practices are not adequate to prevent eye contact.
Skin Protection: Wear impervious protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted. Users should determine acceptable performance characteristics of protective clothing. Consider physical requirements and other substances present when selecting protective clothing. Suggested materials for protective gloves include: Nitrile, or Neoprene
Respiratory Protection: Wear a NIOSH approved respirator that provides protection when working with this material if exposure to harmful levels of airborne material may occur, such as: Air-Purifying Respirator for Organic Vapors, Dusts and Mists
Use a positive pressure, air-supplying respirator if there is potential for uncontrolled release, exposure levels are not known, or other circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Limit	TWA	STEL	Ceiling / Peak	Notation
Disodium Carboxymethyltrithiocarbonate	ACGIH	Not Established	NA	NA	NA
Sodium Hydroxide	ACGIH	Not Established	NA	2 mg/m3	NA
Sodium Hydroxide	CPCHEM	2 mg/m3	NA	NA	NA
Sodium Hydroxide	German MAK	2 mg/m3	NA	1	NA

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Clear orange-red liquid with mild odor.
Autoignition: NDA
Boiling Point: >100°C (212°F)
Evaporation Rate: <1
Flammability (Explosive) Limits (% by volume in air): **Lower:** NDA **Upper:** NDA
Flashpoint: 74°C (165.2°F)
Molecular Formula: Mixture
Molecular Weight: NA
Melting Point: NDA
Octanol / Water Partition Coefficient: log-Kow: NDA
pH: NA
Pour Point : -1°C (30.2°F)
Solubility (in water): Completely Soluble
Specific Gravity: 1.3106 @ 16 °C (60°F)
Vapor Pressure: NDA
Vapor Density (AIR=1): >1
Viscosity: 5.44 cSt @ 21.1 °C (70°F)
Percent Volatile: 60 % volume

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Conditions to Avoid: heat, sparks, fire, and oxidizing agents.
Incompatibility With Other Materials: Corrosive to copper and copper bearing alloys.
Hazardous Decomposition Products: Sulfur Oxides. Carbon Oxides.
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE HEALTH EFFECTS:

Acute Oral Toxicity: / unknown
Acute Dermal Toxicity: / unknown
Acute Inhalation Toxicity: LC50 / not known

Eye Irritation: Sodium Hydroxide: This material is corrosive to the eyes.
Skin Irritation: Sodium Hydroxide: This material is corrosive to the skin.
Respiratory Tract Irritation: This material maybe irritating to the respiratory tract.

ADDITIONAL TOXICOLOGY INFORMATION:
The toxicological properties of this product have not been tested or have not been tested completely and its handling or use may be hazardous. EXERCISE DUE CARE.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY:
The toxicity of this material to aquatic organisms has not been evaluated. Consequently, this material should be kept out of sewage and drainage systems and all bodies of water.

ENVIRONMENTAL FATE:
The environmental fate of this material is not available.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

SECTION 14 TRANSPORT INFORMATION

The shipping descriptions shown here are for bulk shipments only, and may not apply to shipments in non-bulk packages (see regulatory definition). Consult the appropriate domestic or international mode- specific and quantity- specific Dangerous Goods Regulations for additional shipping description requirements (e.g., technical name or names, etc.) Therefore, the information shown here, may not always agree with the bill of lading shipping description for the material. Flashpoints for the material may vary slightly between the MSDS and the bill of lading.

Shipping Descriptions per regulatory authority.

US DOT
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S. , 8, II

ICAO / IATA
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S. , 8, II

IMO / IMDG
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., 8, II

RID / ADR
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., 8, II, ADR

SECTION 15 REGULATORY INFORMATION

SARA 311/312 CATEGORIES:

1.	Immediate (Acute) Health Effects:	YES
2.	Delayed (Chronic) Health Effects:	NO
3.	Fire Hazard:	NO
4.	Sudden Release of Pressure Hazard:	NO

5. Reactivity Hazard: NO

REGULATORY LISTS SEARCHED:

01= CA Prop 65	17 = FDA 178	33 = RCRA Waste Appendix VIII
02 = LA RTK	18 = FDA 179	34 = RCRA Waste D-List
03 = MA RTK	19 = FDA 180	35 = RCRA Waste P-List
04 =MN Hazardous Substance	20 = FDA 181	36 = RCRA Waste U-List
05 =NJ RTK	21 = FDA 182	37 = SARA Section 302
06 = PA RTK	22 = FDA 184	38 = SARA Section 313
07 = CAA Section 112 HAPs	23 = FDA 186	39 = TSCA 12 (b)
08 = CWA Section 307	24 = FDA 189	40 = TSCA Section 4
09 = CWA Section 311	25 = IARC Group 1	41 = TSCA Section 5(a)
10 =DOT Marine Pollutant	26 = IARC Group 2A	42 = TSCA Section 8(a) CAIR
11 = FDA 172	27 = IARC Group 2B	43 = TSCA Section 8(a) PAIR
12 = FDA 173	28 = IARC Group 3	44 = TSCA Section 8(d)
13 = FDA 174	29 = IARC Group 4	45 = WHIMS - IDL
14 = FDA 175	30 = NTP Carcinogen	46 = Germany D TAL
15 = FDA 176	31 = OSHA Carcinogen	47 = Germany WKG
16 = FDA 177	32 = OSHA Highly Hazardous	48 = DEA List 1
		49 = DEA List 2

The following components of this material are found on the regulatory lists indicated.
Sodium Hydroxide 3, 4, 5, 6, 9, 45

CERCLA REPORTABLE QUANTITIES(RQ)/SARA 302 THRESHOLD PLANNING QUANTITIES(TPQ):

Component	Component RQ	Component TPQ	Product RQ
Sodium Hydroxide	1000 lbs	None	20000 lbs

WHMIS CLASSIFICATION:
Class B, Division 3: Combustible Liquids
Class E: Corrosive Material

CHEMICAL INVENTORY LISTINGS:

AUSTRALIA	YES (AUS)
CANADA	YES (DSL)
CHINA	NO (IECSC)
EUROPEAN UNION	YES (EINECS)
JAPAN	NO (ENCS)
KOREA	NO (ECL)
PHILIPPINES	NO (PICCS)
UNITED STATES	YES (TSCA)

EU LABELING:
Signal Word:
Danger

Symbols:
C - Corrosive

Risk and Safety Phrases:
R65: Harmful: may cause lung damage if swallowed.
R34: Causes burns.
R41: Risk of serious damage to eyes.
S39: Wear eye/face protection.
S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S2: Keep out of the reach of children.
S28: After contact with skin, wash immediately with soap and water.
S62: If swallowed do not induce vomiting: seek medical advice immediately and show this container or label.
S36/37/39: Wear suitable protective clothing, gloves and eye/face protection.
S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 3 Flammability: 2 Reactivity: 0 Special: NA

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA).

REVISION STATEMENT: This revision updates all sections of the MSDS please review.

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV	- Threshold Limit Value	TWA	- Time Weighted Average
STEL	- Short-term Exposure Limit	PEL	- Permissible Exposure Limit
ACGIH	- American Conference ofGovernment Industrial Hygienists	OSHA	- Occupational Safety & Health Administration
NIOSH	- National Institute for Occupational Safety & Health	NFPA	- National Fire Protection Agency
WHMIS	- Workplace Hazardous Materials Information System	IARC	- Intl. Agency for Research on Cancer
EINECS	- European Inventory ofexisting Commercial Chemical Substances	RCRA	- Resource Conservation Recovery Act
SARA	- Superfund Amendments and Reauthorization Act.	TSCA	- Toxic Substance Control Act
EC50	- Effective Concentration	LC50	- Lethal Concentration
LD50	- Lethal Dose	CAS	- Chemical Abstract Service
NDA	- No Data Available	NA	- Not Applicable
<=	- Less Than or Equal To	>=	- Greater Than or Equal To
CNS	- Central Nervous System	MAK	- Germany Maximum Concentration Values

This data sheet is prepared according to the latest adaptation of the EEC Guideline 67/548.
This data sheet is prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200).
This data sheet is prepared according to the ANSI MSDS Standard (Z400.1).
This data sheet was prepared by EHS Product Stewardship Group, Chevron Phillips Chemical Company LP, 10001 Six Pines Drive, The Woodlands, TX 77380.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

ALKEMIN
Alkemin,S.de R.L.de C.V.

Material Safety Data Sheet

Liquid Nokes Reagent

MSDS Number: LNR1 DATE: 4/08/01 6 Pages

Section 1: CHEMICAL PRODUCT and COMPANY IDENTIFICATION

1.1 Product Name ..... **Liquid Nokes Reagent**
Chemical Family ..... Sodium Thiophosphates
Synonyms ..... Nokes Reagent
Formula ..... NA - blend

1.2 Manufacturer .....ALKEMIN, S. de R.L. de C.V.
2480 W. Twin Buttes Road
Sahuarita, Arizona

Information .....(520) 791-2940

1.3 Emergency Contact ..... **800 424-9300 (CHEMTREC)**

Section 2: COMPOSITION, INFORMATION ON HAZARDOUS INGREDIENTS

2.1 Chemical Ingredients (% by wt.)

Sodium Thiophosphates CAS #:10101-88-9 18 - 25%

Section 3: HAZARDS IDENTIFICATION

NFPA: Health - 3 Flammability - 0 Reactivity - 1

EMERGENCY OVERVIEW

Warning: Solution is very alkaline

Eye contact will cause marked eye irritation and possibly severe corneal damage. Skin contact will result in irritation and possible corrosion of the skin tissue. Ingestion will irritate/burn mouth, throat and gastrointestinal tract. Contact with stomach acid will cause hydrogen sulfide vapors to be released. Heating or contact with acids or acidic materials will cause hydrogen sulfide gas to be evolved.

Section 3: HAZARDS IDENTIFICATION (Cont.)

3.1 POTENTIAL HEALTH EFFECTS

EYE: Causes irritation, burns, tissue destruction, possible permanent damage to the cornea.

SKIN CONTACT: Severe irritant. Can cause inflammation, redness, swelling, burns.

INGESTION: Ingestion will result in severe burning and corrosion of mouth, throat and the gastrointestinal tract. If the ingested material contacts stomach acid, highly toxic hydrogen sulfide gas will be evolved.

INHALATION: Inhalation not likely. Mists may cause upper respiratory tract irritation, lung irritation.

CHRONIC EFFECTS/CARCINOGENICITY: Not listed as a carcinogen by NTP, IARC or OSHA..

Section 4: FIRST AID MEASURES

4.1 EYES: Immediately flush with large quantities of water for 15 minutes. Hold eyelids apart during irrigation to insure thorough flushing of the entire area of the eye. Obtain immediate medical attention.

4.2 SKIN: Immediately flush with large quantities of soap and water, for at least 5 minutes. Remove contaminated clothing under a safety shower. Obtain medical attention if any irritation occurs.

4.3 INGESTION: If victim is conscious and alert, give 2-3 glasses of water to drink and **do not induce vomiting**. Seek immediate medical attention. Do not leave victim unattended. To prevent aspiration of swallowed product, lay victim on side with head lower than waist. Vomiting may occur spontaneously. If vomiting occurs and the victim is conscious, give water to further dilute the chemical.

4.4 INHALATION: Remove victim from contaminated atmosphere. If breathing is labored, administer oxygen. If breathing has ceased, clear airway and start mouth to mouth resuscitation. If heart has stopped beating, external heart massage should be applied. Obtain medical attention.

NOTES TO PHYSICIAN: All treatment should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

Section 5: FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

FLASH POINT: Not applicable.

5.2 EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, foam, dry sand or as appropriate for combustibles involved in fire.

Section 5: FIRE FIGHTING MEASURES (Cont.)

5.4 FIRE & EXPLOSIVE HAZARDS: Under fire conditions and at high temperatures, as water evaporates, the residue can decompose and support combustion. Fumes which may be emitted are hydrogen sulfide, a highly toxic and flammable gas. Dilution of the product resulting in a high dithiophosphate ratio will also evolve hydrogen sulfide vapors.

5.5 FIRE FIGHTING EQUIPMENT: As in any fire, wear self-contained breathing apparatus, positive pressure, MSHA/NIOSH (approved or equivalent) and full protective gear. Dike area to prevent runoff and contamination of water sources. Persons who may have been exposed to contaminated smoke should be immediately examined by a physician and checked for symptoms of poisoning.

Section 6: ACCIDENTAL RELEASE MEASURES

6.1 Small releases: Ventilate closed spaces before entering. Personnel should be thoroughly trained to handle spills and releases. Wear protective gear (See Section 8). Stop leak if can be done without risk. Dike spill using absorbent or impervious materials such earth, sand or clay. Clean up residual material with water. Collect washing for disposal. Do not flush to drain.

6.2 Large releases: Wear proper protective equipment. Confine area to qualified personnel. Shut off release if safe to do so. Dike spill area to prevent runoff into sewers, drains (potential explosive mixtures of hydrogen sulfide in confined spaces) or surface waterways (potential aquatic toxicity). Recover as much of the solution as possible. Treat remaining material as a small release (above).

Section 7: HANDLING and STORAGE

7.1 Handling: Wear proper protective equipment (See Section 8). Avoid contact with eyes and skin. Do not ingest. Do not breathe vapors and mists. Use only in well ventilated areas.

7.2 Storage: Store in cool, dry, well ventilated areas. Do not store combustibles in the area of storage vessels. Keep away from any sources of heat or flame.

Section 8: EXPOSURE CONTROLS, PERSONAL PROTECTION

8.1 RESPIRATORY PROTECTION: When respirators are required, select NIOSH/MSHA approved equipment. Under normal conditions, without any other contaminant, and air-purifying respirator with cartridges/canister approved for acid gases, dusts, mists and fumes, should provide protection. For abnormal conditions or unknown concentrations, use a full-face positive pressure air-supplied respirator, or a self contained breathing apparatus.

8.2 SKIN PROTECTION: Neoprene rubber gloves, apron and boots (as appropriate) should be worn to prevent repeated or prolonged contact with the product. Wash any contaminated clothing prior to reuse. Food, beverage and tobacco products should not be carried or consumed where this chemical is in use. Before eating, drinking or smoking wash face and hands with soap and water.

Section 8: EXPOSURE CONTROLS, PERSONAL PROTECTION (Cont.)

8.3 EYE PROTECTION: Chemical goggles and preferably a full face shield. Requirements will vary dependent upon work environment conditions and material handling practices.

Maintain an eyewash/safety shower in immediate work areas.

8.4 EXPOSURE GUIDELINES:

	OSHA		ACGIH	
	TWA	STEL	TLV	STEL
SODIUM HYDROXIDE	2 mg/m^3 (ceiling)		2 mg/m^3	
HYDROGEN SULFIDE	20 ppm (ceiling)		10 ppm (ceiling)	

8.5 ENGINEERING CONTROLS: Engineering control methods to reduce hazardous vapor exposure are preferred. Methods include mechanical ventilation (dilution and local exhaust) and process control.

Section 9: PHYSICAL and CHEMICAL PROPERTIES

9.1 APPEARANCE:	Tan slurry liquid
9.2 ODOR:	Slight pungent odor
9.3 BOILING POINT:	Not determined
9.4 VAPOR PRESSURE:	Not determined
9.5 VAPOR DENSITY:	Not determined
9.6 SOLUBILITY IN WATER:	Soluble
9.7 DENSITY:	1.22 to 1.52 g/ml (10.16 – 12.66 lb/gal) at 25ºC (77ºF)
9.8 FREEZING POINT:	Not determined
9.9 pH:	13.5
9.10 VOLATILE:	Not determined

Section 10: STABILITY and REACTIVITY

10.1 STABILITY: Stable material under normal handling and storage conditions.

10.2 HAZARDOUS POLYMERIZATION: Will not occur.

10.3 HAZARDOUS DECOMPOSITION PRODUCTS: (Thermal decomposition) Heating product will evolve H_2S gas. Decomposition will evolve hydrogen sulfide, phosphine, oxides of sulfur. Decomposition temperature range is 300 to 305ºC (572 to 581ºF).

10.4 INCOMPATIBILITY: Acids will cause the release of highly toxic hydrogen sulfide gas. Product solution is not compatible with copper, zinc, aluminum or their alloys (i.e. bronze, brass, galvanized metals, etc.) . Avoid elevated temperatures and heat.

Section 11: TOXICOLOGICAL INFORMATION

11.1 ORAL: INT-RAT LD_{50}: 100 mg/kg (sodium thiophosphate)

11.2 DERMAL: Data not available

11.3 INHALATION: INH-RAT LC_{50}: 444 ppm (hydrogen sulfide)

11.4 CHRONIC/CARCINOGENICITY: No evidence available

11.5 TERATOLOGY: Data not available

11.6 REPRODUCTION: Data not available

11.7 MUTAGENICITY: Data not available

Section 12: ECOLOGICAL INFORMATION

Data not available.

Section 13: DISPOSAL CONSIDERATIONS

If released to the environment for other than its intended purpose the released product would be classed as a D002. corrosive waste. Consult state and local regulations regarding the proper disposal of this material. Rinse containers before disposal. EPA hazardous waste.

Section 14: TRANSPORT INFORMATION

14.1 DOT Shipping Name:	Corrosive liquid, basic, inorganic, n.o.s.
14.2 DOT Hazard Class:	8
14.3 UN/NA Number:	UN3266
14.4 Packing Group:	II
14.5 DOT Placard:	Corrosive
14.6 DOT Label(s):	Corrosive
14.7 IMO Shipping Name:	Corrosive liquid, basic, inorganic, n.o.s.
14.8 Reportable Quantity:	NA
14.9 RR STCC Number:	NA

Section 15: REGULATORY INFORMATION

15.1 OSHA: This product is listed as a hazardous material under criteria of the Federal OSHA Hazard Communication Standard, 29 CFR 1910.1200

15.2 **SARA TITLE III**

a. **EHS** (Extremely Hazardous Substance) List: No

b. Section 311/312, (Tier I,II) Categories:

Immediate (acute)	Yes
Fire	No
Sudden release	No
Reactivity	Yes
Delayed (chronic)	No

c. Section 313 (Toxic Release Reporting-Form R): No

Chemical Name	CAS Number	Concentration
NA		

d. **TPQ** (Threshold Planning Quantity): No

15.3 CERCLA/SUPERFUND:

RQ (Reportable Quantity) Sodium Hydroxide 1000 lbs.

15.4 TSCA (Toxic Substance Control Act) Inventory List: Yes

Section 16: OTHER INFORMATION

REVISIONS: The entire MSDS was formatted to comply to ANSI Standard Z400.1-1993.

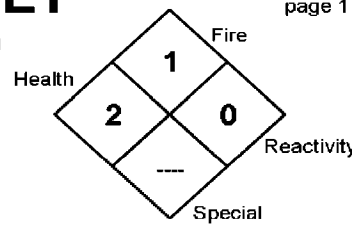
MATERIAL SAFETY DATA SHEET

BRENNTAG

Brenntag MSDS #:	**BPI-00180**
MSDS Revision/Issue Date:	**12/06/13**
Supercedes Revision Date:	**04/12/13**

NFPA 704 DESIGNATION
HAZARD RATING

4=Extreme
3=High
2=Moderate
1=Slight
0=Insignificant



1. CHEMICAL PRODUCT IDENTIFICATION & COMPANY IDENTIFICATION

PRODUCT IDENTIFIER: **Citric Acid 50% Solution (All Grades)**

GENERAL USE: Used as an acidulant in beverages, to adjust the pH of foods, as synergistic antioxidant in processing cheese, as a foam inhibitor, and as a sequestering agent to remove trace metals.

PRODUCT DESCRIPTION: An aqueous solution of an aliphatic acid. Synonyms include: beta-hydroxytricarboxylic acid, and 2-hydroxy-1,2,3-propanetricarboxylic acid.

INFORMATION PROVIDED BY:
Brenntag Pacific, Inc.
10747 Patterson Place
Santa Fe Springs, CA 90670

For MSDS call: **PHONE: 562-903-9626**

EMERGENCY PHONE NUMBERS

CHEMTREC: **800-424-9300**

2. COMPOSITION & INFORMATION ON INGREDIENTS

COMPONENT	CAS #	OSHA HAZARD	WT %	ACGIH TLV$_{(TWA)}$	ACGIH STEL	OSHA PEL$_{(TWA)}$	OSHA STEL
Citric Acid	77-92-9	Severe Eye Irritant; Skin & Respiratory Irritant	50 ± 2	None	None	None	None

NDA = No Data Available N/A = Not Applicable

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: A clear, colorless to light yellow, strongly acidic liquid having no characteristic odor. This product can cause severe irritation or burns to the eyes. It may cause moderate to severe irritation to the skin and respiratory tract.

POTENTIAL HEALTH EFFECTS

INHALATION: Inhalation of mists or aerosols may cause moderate to severe irritation to the nose, mouth, throat, mucous membranes and lungs. Symptoms of exposure may include sneezing, coughing, chest discomfort or pain and shortness of breath. Inhalation of high mist concentrations may result in possible permanent lung damage.

EYE CONTACT: Exposure to the mists or liquid can cause severe eye irritation. Symptoms of exposure may include tearing, redness, swelling and a painful burning sensation. Corneal damage with impairment of vision may result from direct contact with the liquid or mists, unless promptly treated.

SKIN CONTACT: Exposure to the mists or liquid may cause moderate to severe skin irritation. Symptoms of exposure may include redness, swelling, a stinging sensation and/or pain. No published reports indicate this product is absorbed through the intact skin.

INGESTION: Ingestion may cause moderate to severe irritation to the mouth, throat and the entire gastrointestinal tract, including the stomach and intestines, characterized by nausea, vomiting, diarrhea, abdominal pain, with possible bleeding and/or tissue ulceration.

CHRONIC: The chronic health effects of exposure to this product are expected to be the same as for acute exposure.

4. FIRST AID MEASURES

INHALATION: If inhaled, immediately move to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; use the Holger Nielsen method (back pressure-arm lift) or proper respiratory device. If breathing is difficult, give oxygen. Call a physician.

EYE CONTACT: In case of contact, immediately flush eyes with plenty of clean running water for at least 15 minutes, lifting the upper and lower lids occasionally. Remove contact lenses, if worn. Get medical attention immediately.

SKIN CONTACT: In case of contact, immediately flush skin with plenty of clean running water for at least 15 minutes, while removing contaminated clothing and shoes. Then wash with soap and water. If burn or irritation occurs, call a physician.

INGESTION: If swallowed, DO NOT induce vomiting. Get medical attention immediately. If victim is fully conscious, give plenty of water to drink. Never give anything by mouth to an unconscious person.

NOTE TO PHYSICIANS: Treat exposure symptomatically.

5. FIRE FIGHTING MEASURES

Flashpoint and Method: This product does not flash.

Flammable Limits (in air, % by volume) **Lower:** Not applicable **Upper:** Not applicable

Autoignition Temperature: Not applicable

GENERAL HAZARD: This product is an aqueous solution of a non-volatile organic acid having no characteristic odor. The Uniform Fire Code health hazard classification for this product is: **Irritant**. When in contact with some soft metals (i.e. *Aluminum*), this product can corrode the metal, liberating flammable / explosive Hydrogen gas. This product may produce hazardous mists and/or hazardous decomposition products.

FIRE FIGHTING INSTRUCTIONS: **EXTINGUISHING MEDIA:** Water fog or spray, CO_2, foam or dry chemicals. Use the extinguishing media that is appropriate to the surrounding fire.

FIRE FIGHTING EQUIPMENT: Fire fighters should wear full protective equipment, including self-contained breathing apparatus.

HAZARDOUS COMBUSTION PRODUCTS: When heated to dryness and decomposition, it can emit toxic carbon monoxide and carbon dioxide plus dense, irritating smoke.

6. ACCIDENTAL RELEASE MEASURES

LAND SPILL: Wearing recommended protective equipment and clothing, dike spill using soil, sand or compatible commercial absorbent. Pick up bulk of liquid using pumps or vacuum truck or absorb liquid in sand or commercial absorbent. Place in approved containers for recovery, disposal or satellite accumulation. Neutralize the acidity using soda ash, slaked lime or a suitable agent appropriate for neutralizing acidic liquids. Flush the spill area with water; collect rinsates for disposal or sewer, as appropriate.

WATER SPILL: Wear recommended protective equipment and clothing if contact with hazardous material can occur. Stop or divert water flow. Dike contaminated water and remove for disposal and/or treatment. As appropriate, notify all downstream users of possible contamination.

7. HANDLING AND STORAGE

STORAGE TEMPERATURE: Ambient **STORAGE PRESSURE:** Ambient

GENERAL: Store in a cool, dry, well-ventilated area away from incompatible materials and products. Avoid getting this product in eyes, on skin or on clothing. Wear the recommended personnel protective equipment. Avoid breathing mists or aerosols. Use with adequate ventilation. Keep the container tightly closed when not in use. Wash thoroughly after handling this product.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

CONTROL MEASURES: Use a local or general, mechanical exhaust ventilation system capable of maintaining mist levels, in the work area, below any level, which may be irritating.

RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

RESPIRATOR: If use causes an irritating mist, wear a NIOSH-approved full facepiece or half mask respirator equipped with a good mist / particulate cartridge or supplied air.

EYES: Wear chemical goggles (recommended by ANSI Z87.1-1979).

GLOVES: Wear Nitrile, Neoprene, Butyl Rubber, Viton or Natural Rubber gloves.

CLOTHING & EQUIPMENT: Wear a Nitrile, Neoprene, Butyl Rubber or Natural Rubber apron when handling this product. An eye wash station and safety shower should be available in the work area.

FOOTWEAR: Wear Nitrile, Neoprene, Butyl Rubber or Natural Rubber boots, if contact is likely.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear, colorless to light yellow	**Bulk Density (pounds/ft^3):**	Not applicable
Physical State:	Liquid	**Vapor Pressure:**	No data available
Odor:	No characteristic	**Vapor Density (air=1):**	No data available
Odor Threshold:	No data available	**Evaporation Rate (n-Butyl Acetate=1):**	No data available
Molecular Formula:	$C_6H_8O_7$ (in water)	**VOC Content:**	Not applicable
Molecular Weight:	192.14 (in water)	**% Volatile:**	Approximately 50
Boiling Point:	Approximately 104° C. (219° F.)	**Solubility in H_2O:**	Complete
Freezing/Melting Point:	Less than 0° C. (32° F.)	**Octanol/Water Partition Coefficient:**	No data available
Specific Gravity:	Approximately 1.22 @ 20° C.	**pH (as is):**	1.5 – 2.0
Density (pounds/gallon):	Approximately 10.2	**pH (1% solution):**	2.0 – 2.5

10. STABILITY AND REACTIVITY

GENERAL: This product is stable and hazardous polymerization will not occur.

CONDITIONS TO AVOID: Hot storage.

INCOMPATIBLE MATERIAL: Strong oxidizers, caustics & alkali, chlorine releasers, sulfides, sulfites, cyanides, Aluminum, Magnesium, Zinc and alloys of these metals.

HAZARDOUS DECOMPOSITION PRODUCTS: When heated to dryness and decomposition, it emits toxic oxides of carbon plus dense, irritating smoke.

SENSITIVITY TO MECHANICAL IMPACT: This product is not sensitive to mechanical impact.

SENSITIVITY TO STATIC DISCHARGE: This product is not sensitive to static discharge.

11. TOXICOLOGICAL INFORMATION

Components:	**Citric Acid**
Eye Contact:	Rabbit: 750 ug/24 Hours; Severe
Skin Contact:	Rabbit: 500 mg/24 Hours; Moderate
Oral Rat LD_{50}:	3 gm/kg
Dermal Rabbit LD_{50}:	No data available
Inhalation Rat LC_{50}:	No data available
Human Data:	No data available
Other Toxicological Data:	Intravenous Mouse LD_{50}: 42 mg/kg
Carcinogenicity:	No data available
Teratogenicity:	No data available
Mutagenicity:	No data available
Synergistic Products:	None reported
Target Organs:	Eyes, Skin, Mucous membranes, Lungs & Teeth
Medical Conditions Aggravated By Exposure:	Skin or Respiratory disorders

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE:

The environmental fate of this product is expected to be: **Land**: biodegradation with some leaching into the groundwater. **Water**: biodegradation. **Air**: not expected to volatilize due to low vapor pressure. This product is not expected to bioaccumulate.

ENVIRONMENTAL CONSIDERATIONS:

The aquatic toxicity of this product has not been determined. However the aquatic toxicity of pure Citric Acid is: Goldfish LD_0: 625 mg/liter, longtime exposure in hard water. Goldfish LD_{100}: 894 mg/liter, longtime exposure in hard water.

13. DISPOSAL CONSIDERATIONS

RCRA 40 CFR 261 CLASSIFICATON: Corrosive Waste

U.S. EPA WASTE NUMBER/DESCRIPTION: D002

If this product is disposed of as shipped, it meets the criteria of a hazardous waste as defined under 40 CFR 261 due to its corrosivity. If this product becomes a waste, it will be a hazardous waste which is subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly. As a hazardous liquid waste, it must be disposed of in accordance with local, state and federal regulations in a permitted hazardous waste treatment, storage and disposal facility.

14. TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME: **Not Restricted (See Other Shipping Information) (If shipped as a hazardous material use TDG directions)**

Hazard Class: Not applicable **UN Number:** Not applicable **Packing Group:** Not applicable

Primary Label: None Required **Subsidiary Label(s):** None Required

Primary/Subsidiary Placards: None Required

DOT Reportable Quantity (RQ): Not Listed **RQ for Product:** Not applicable

Marine Pollutant: No

2008 North American Emergency Response Guidebook No.: **Not applicable (in U.S.); 153 (Outside U.S.)**

TDG PROPER SHIPPING NAME: **CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.** (Contains Citric Acid)

Hazard Class: 8 **UN Number:** UN3265 **Packing Group:** III

Primary Label: Corrosive **Subsidiary Label(s):** None Required

Primary/Subsidiary Placards: Corrosive

TDG Reportable Quantity (RQ): # At least 5 kg or 5 liters.

TDG Schedule XII: Not listed

Regulated Limit (RL): ## Not listed **RL for Product:** Not applicable

Other Shipping Information: DOT exception taken for materials only corrosive to Aluminum and mild steel; 49 CFR 173.154 (d) (1) and (2), when shipped by ground, in the U.S. only For all air, water and international shipments, use the TDG shipping description.

Canadian Transportation of Dangerous Goods Regulations (TDGR), Part IX, Table I, Quantities or levels for Immediate Reporting: releases of reportable quantities, RQ, that meet the definition of a "dangerous occurrence" (a threat to life, health, property, or the environment) must be reported to the appropriate authorities as outlined in TDGR 9.13(1) and 9.14(1).

Reporting to Environment Canada is required for any releases exceeding the regulated limits, RL, of 9.2 materials (primary or secondary). The regulated limits are found in Schedule XIII of the TDGR.

15. REGULATORY INFORMATION

COMPONENTS:	**Citric Acid**
OSHA Target Organs:	Eyes, Skin, Mucous membranes, Lungs & Teeth

Carcinogenic Potential:

Regulated by OSHA:	No
Listed on NTP Report:	No
Listed by IARC:	No
IARC Group:	Not applicable
ACGIH Appendix A:	Not listed
A1 Confirmed Human:	Not applicable
A2 Suspected Human:	Not applicable

U.S. EPA Requirements

Release Reporting

CERCLA (40 CFR 302)

Listed Substance:	Not listed
Reportable Quantity:	Not applicable
Category:	Not applicable
RCRA Waste No.:	Not applicable
Unlisted Substance:	Yes
Reportable Quantity:	100 pounds
Characteristic:	Corrosivity
RCRA Waste No..	D002

SARA TITLE III

Section 302 & 303 (40 CFR 355):

Listed Substance:	Not listed
Reportable Quantity:	Not applicable
Planning Threshold:	Not applicable

Section 311 & 312 (40 CFR 370):

Hazard Categories (**product**): **Fire: N** **Sudden Release of Pressure: N** **Reactive: N** **Acute Health: Y** **Chronic Health: N**

Planning threshold: 10,000 pounds

Section 313 (40 CFR 372).

Listed Toxic Chemical:	Not listed
Reporting Threshold:	Not applicable

U.S. TSCA Status

Listed (40 CFR 710): Yes

State Regulations

State of California: Safe Drinking Water and Toxins Enforcement Act, 1986 (Proposition 65):

Carcinogen:	No
Reproductive Toxin:	No

Other Regulations

State Right To Know Laws: None known

Canadian Regulations

Product Information:

Controlled Product:	**Yes**
WHMIS Hazard Symbols:	**Corrosive Material**
WHMIS Class & Division:	**E**

Ingredient Information:

IDL Substance:	Yes
DSL or NDSL Lists:	DSL

16. OTHER INFORMATION

EPA Registration number: Not applicable

Approved Product Uses: Not applicable

Special Notes:

This product is not formulated or manufactured to contain any material, which the State of California has found to cause cancer and/or birth defects or other reproductive harm.

Special Instructions:

When making solutions, always add this product to water with adequate mixing to ensure a uniform solution.

Do not mix this product with strong caustic or alkaline solutions as violent boiling or spattering may result.

Do not add Citric Acid 50% Solution to hypochlorite bleaches, chlorine sanitizers or chlorinated cleaners as this will liberate toxic, corrosive Chlorine gas.

MSDS Revision Information: Information Revised This Issue Date: **Updated contact information and language through out the MSDS.**

Form Revision made 2/19/09

MSDS Distributed by: Brenntag Pacific, Inc.

Prepared By:	Edward Doheny	Date Prepared:	December 6, 2013

MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name	**Hydrocal 60**
Version #	07
Revision date	01-20-2012
CAS #	64742-53-6
Manufacturer information	Calumet Specialty Products Partners, L.P. 2780 Waterfront Pkwy E. Dr. Suite 200 Indianapolis, IN 46214 United States www.calumetlubricants.com Technical Services 317-328-5660 CHEMTREC International 703-527-3887

2. Hazards Identification

Potential health effects

Eyes	Health injuries are not known or expected under normal use.
Skin	Health injuries are not known or expected under normal use.
Inhalation	Health injuries are not known or expected under normal use.
Ingestion	Minute amounts aspirated into the lungs during ingestion or vomiting may cause mild to severe pulmonary injury and possibly death.
Potential environmental effects	Ecological injuries are not known or expected under normal use.

3. Composition / Information on Ingredients

Non-hazardous components	CAS #	Percent
Light Naphthenic Hydrotreated Distillates (petroleum)	64742-53-6	100

4. First Aid Measures

First aid procedures

Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Skin contact	Rinse skin with water/shower. Get medical attention if irritation develops and persists.
Inhalation	If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Call a physician if symptoms develop or persist.
Ingestion	Rinse mouth. If ingestion of a large amount does occur, call a poison control center immediately.

5. Fire Fighting Measures

Flammable properties	Not flammable by OSHA criteria. Not combustible by OSHA criteria.
Extinguishing media	
Suitable extinguishing media	Water fog.
Unsuitable extinguishing media	Water. Do not use water jet as an extinguisher, as this will spread the fire.
Protection of firefighters	
Protective equipment and precautions for firefighters	Wear suitable protective equipment.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.

6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Keep people away from and upwind of spill/leak. Keep upwind. Keep out of low areas.

Methods for containment	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Prevent entry into waterways, sewer, basements or confined areas.
Methods for cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills in original containers for re-use. For waste disposal, see section 13 of the MSDS.

7. Handling and Storage

Handling	DO NOT handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. Avoid prolonged exposure.
Storage	Keep away from heat, sparks and open flame.

8. Exposure Controls / Personal Protection

Engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Personal protective equipment	
Eye / face protection	Eye wash fountain is recommended.
Skin protection	Normal work clothing (long sleeved shirts and long pants) is recommended.
Respiratory protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
General hygiene considerations	Handle in accordance with good industrial hygiene and safety practice.

9. Physical & Chemical Properties

Appearance	Product is water-white to pale straw liquid.
Physical state	Liquid.
Form	Liquid.
Color	L0.5 ASTM D1500
Odor	Faint
Boiling point	Not available.
Melting point/Freezing point	Not available.
Specific gravity	> 0.895
Relative density	Not available.
Flash point	> 280 °F (> 137.8 °C) Cleveland Open Cup
Auto-ignition temperature	> 578 °F (> 303.3 °C) estimated
Viscosity	> 60 SUS
Viscosity temperature	100 °F (37.8 °C)
Pour point	< -70 °F (< -56.7 °C) ASTM D97
Other data	
Density	> 0.8945 g/cm3
Flammability class	Combustible IIIB

10. Chemical Stability & Reactivity Information

Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Heat, flames and sparks. Avoid temperatures exceeding the flash point.
Incompatible materials	Not available.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological Information

Toxicological data

Product	Test Results
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT NAPHTHENIC□ (64742-53-6)	Acute Dermal LD50 Rabbit: 2000 mg/kg estimated Acute Inhalation LC50 Rat: 2.18 mg/l estimated Acute Oral LD50 Rat: 5000 mg/kg estimated

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

12. Ecological Information

Ecotoxicological data

Product	Test Results
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT NAPHTHENIC□ (64742-53-6)	EC50 Daphnia: 1000 mg/l 48 hours estimated

* Estimates for product may be based on additional component data not shown.

Ecotoxicity This product has no known eco-toxicological effects.

Persistence and degradability Not available.

13. Disposal Considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste. Dispose in accordance with all applicable regulations.

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport Information

DOT

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2)

Not regulated

DEA Essential Chemical Code Number

Not regulated

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

Not regulated

DEA Exempt Chemical Mixtures Code Number

Not regulated

CERCLA (Superfund) reportable quantity

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical	No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

Further information HMIS® is a registered trade and service mark of the NPCA.

HMIS® ratings
Health: 1
Flammability: 1
Physical hazard: 0

NFPA ratings
Health: 1
Flammability: 1
Instability: 0

Disclaimer The information in the sheet was written based on the best knowledge and experience currently available.

Issue date 01-20-2012

This data sheet contains changes from the previous version in section(s): This document has undergone significant changes and should be reviewed in its entirety.

Material Safety Data Sheet
The Dow Chemical Company

Product Name: POLYGLYCOL P 2000

Issue Date: 11/15/2012
Print Date: 12 Jun 2014

The Dow Chemical Company encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. Product and Company Identification

Product Name
POLYGLYCOL P 2000

COMPANY IDENTIFICATION
The Dow Chemical Company
2030 Willard H. Dow Center
Midland, MI 48674
United States

Customer Information Number: 800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: 989-636-4400
Local Emergency Contact: 989-636-4400

2. Hazards Identification

Emergency Overview
Color: Colorless
Physical State: Liquid.
Odor: Sweet
Hazards of product:

No significant immediate hazards for emergency response are known.

OSHA Hazard Communication Standard
This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Potential Health Effects
Eye Contact: May cause slight temporary eye irritation. Corneal injury is unlikely.
Skin Contact: Essentially nonirritating to skin. Material may be handled at elevated temperatures; contact with heated material may cause thermal burns.
Skin Absorption: Prolonged skin contact is unlikely to result in absorption of harmful amounts.
Inhalation: At room temperature, exposure to vapor is minimal due to low volatility; single exposure is not likely to be hazardous. Vapor from heated material or mist may cause respiratory irritation.

Ingestion: Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.
Aspiration hazard: Based on physical properties, not likely to be an aspiration hazard.

3. Composition Information

Component	CAS #	Amount
Polyproplylene glycol	25322-69-4	> 99.0 %

4. First-aid measures

Description of first aid measures

General advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.
Inhalation: Move person to fresh air; if effects occur, consult a physician.
Skin Contact: Wash skin with plenty of water. Suitable emergency safety shower facility should be immediately available.
Eye Contact: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.
Ingestion: No emergency medical treatment necessary.

Most important symptoms and effects, both acute and delayed

Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), no additional symptoms and effects are anticipated.

Indication of immediate medical attention and special treatment needed

If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. Fire Fighting Measures

Suitable extinguishing media

Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.
Extinguishing Media to Avoid: Do not use direct water stream. May spread fire.

Special hazards arising from the substance or mixture

Hazardous Combustion Products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.
Unusual Fire and Explosion Hazards: Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage. Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage. Review the "Accidental Release Measures" and the "Ecological Information" sections of this (M)SDS.

Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, change to full chemical resistant fire fighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures: Isolate area. Refer to Section 7, Handling, for additional precautionary measures. Keep unnecessary and unprotected personnel from entering the area. Spilled material may cause a slipping hazard. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.
Methods and materials for containment and cleaning up: Contain spilled material if possible. Absorb with materials such as: Dirt. Sand. Sawdust. Collect in suitable and properly labeled containers. Wash the spill site with water. See Section 13, Disposal Considerations, for additional information.

7. Handling and Storage

Handling
General Handling: Avoid contact with eyes. Wash thoroughly after handling. Use with adequate ventilation. Keep container closed. Product shipped/handled hot can cause thermal burns. This material is hygroscopic in nature. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.
Other Precautions: Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion.

Storage
Protect from atmospheric moisture. Store in a dry place. Avoid prolonged exposure to heat and air. Store in the following material(s): Carbon steel. Stainless steel. Polypropylene. Polyethylene-lined container. Teflon. Glass-lined container. Aluminum. Plasite 3066 lined container. Plasite 3070 lined container. 316 stainless steel. See Section 10 for more specific information.

Shelf life: Use within
24 Months

8. Exposure Controls / Personal Protection

Exposure Limits

Component	List	Type	Value
Polyproplylene glycol	WEEL	TWA Aerosol.	10 mg/m3

Personal Protection

Eye/Face Protection: Use safety glasses (with side shields). When handling hot material: Use chemical goggles. Wear a face-shield which allows use of chemical goggles, or wear a full-face respirator, to protect face and eyes when there is any likelihood of splashes.
Skin Protection: No precautions other than clean body-covering clothing should be needed. When handling hot material, protect skin from thermal burns. Selection of specific items will depend on the operation.

Hand protection: Chemical protective gloves should not be needed when handling this material. Consistent with general hygienic practice for any material, skin contact should be minimized. Use gloves with insulation for thermal protection, when needed.

Respiratory Protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. For most conditions, no respiratory protection should be needed; however, if material is heated or sprayed, use an approved air-purifying respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.
Ingestion: Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls

Ventilation: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

9. Physical and Chemical Properties

Appearance	
Physical State	Liquid.
Color	Colorless
Odor	Sweet
Odor Threshold	No test data available
pH	7.7 - 8.8 *DOWM 101495-TE94A*
Melting Point	No test data available
Freezing Point	Not applicable
Boiling Point (760 mmHg)	decomposes prior to boiling.
Flash Point - Closed Cup	> 185 °C (> 365 °F) *ASTM D93*
Evaporation Rate (Butyl Acetate = 1)	No test data available
Flammability (solid, gas)	No
Flammable Limits In Air	**Lower**: No test data available **Upper**: No test data available
Vapor Pressure	negligible at ambient temperature
Vapor Density (air = 1)	>1 *Literature*
Specific Gravity (H2O = 1)	> 1.00 25 °C/25 °C *Literature*
Solubility in water (by weight)	Insoluble
Partition coefficient, n-octanol/water (log Pow)	No data available for this product.
Autoignition Temperature	No test data available
Decomposition Temperature	No test data available
Kinematic Viscosity	300 cSt @ 25 °C *Literature*
Explosive properties	Not explosive
Oxidizing properties	No
Liquid Density	8.340 g/cm3 *ASTM D4669*

10. Stability and Reactivity

Reactivity
No dangerous reaction known under conditions of normal use.
Chemical stability
Stable under recommended storage conditions. See Storage, Section 7.

Possibility of hazardous reactions
Polymerization will not occur by itself.
Conditions to Avoid: Product can oxidize at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems.

Incompatible Materials: Avoid contact with oxidizing materials. Avoid contact with: Strong acids. Strong bases. Avoid unintended contact with isocyanates. The reaction of polyols and isocyanates generates heat.
Hazardous decomposition products
Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Carbon dioxide. Alcohols. Ethers. Hydrocarbons. Ketones. Polymer fragments.

11. Toxicological Information

Acute Toxicity
Ingestion
Typical for this family of materials. Estimated. LD50, rat > 10,000 mg/kg
Dermal
Typical for this family of materials. Estimated. LD50, rabbit > 10,000 mg/kg
Inhalation
As product: The LC50 has not been determined.
Eye damage/eye irritation
May cause slight temporary eye irritation. Corneal injury is unlikely.
Skin corrosion/irritation
Essentially nonirritating to skin. Material may be handled at elevated temperatures; contact with heated material may cause thermal burns.
Sensitization
Skin
For this family of materials: Did not cause allergic skin reactions when tested in humans.
Respiratory
No relevant data found.
Repeated Dose Toxicity
Based on available data, repeated exposures are not anticipated to cause significant adverse effects.
Chronic Toxicity and Carcinogenicity
No relevant data found.
Developmental Toxicity
No relevant data found.
Reproductive Toxicity
No relevant data found.
Genetic Toxicology
No relevant data found.

12. Ecological Information

Toxicity
For this family of materials: Material is practically non-toxic to fish on an acute basis (LC50 > 100 mg/L).

Persistence and Degradability

For this family of materials: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Biodegradation may occur under anaerobic conditions (in the absence of oxygen).

Bioaccumulative potential

Bioaccumulation: No bioconcentration is expected because of the relatively high molecular weight (MW greater than 1000).

Mobility in soil

Mobility in soil: No data available.

13. Disposal Considerations

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Recycler. Reclaimer. Incinerator or other thermal destruction device. For additional information, refer to: Handling & Storage Information, MSDS Section 7 Stability & Reactivity Information, MSDS Section 10 Regulatory Information, MSDS Section 15

14. Transport Information

DOT Non-Bulk
NOT REGULATED

DOT Bulk
NOT REGULATED

IMDG
NOT REGULATED

ICAO/IATA
NOT REGULATED

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. Regulatory Information

OSHA Hazard Communication Standard

This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	No
Delayed (Chronic) Health Hazard	No
Fire Hazard	No
Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 103
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)
This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

CEPA - Domestic Substances List (DSL)
All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

US. Toxic Substances Control Act
All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30

16. Other Information

Product Literature
Additional information on this product may be obtained by calling your sales or customer service contact.

Recommended Uses and Restrictions
Identified uses
Component(s) for the manufacture of urethane polymers. We recommend that you use this product in a manner consistent with the listed use. If your intended use is not consistent with the stated use, please contact your sales or technical service representative.

Revision
Identification Number: 81512 / 1001 / Issue Date 11/15/2012 / Version: 5.0
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

N/A	Not available
W/W	Weight/Weight

OEL	Occupational Exposure Limit
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
ACGIH	American Conference of Governmental Industrial Hygienists, Inc.
DOW IHG	Dow Industrial Hygiene Guideline
WEEL	Workplace Environmental Exposure Level
HAZ_DES	Hazard Designation
Action Level	A value set by OSHA that is lower than the PEL which will trigger the need for activities such as exposure monitoring and medical surveillance if exceeded.

The Dow Chemical Company urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

BASF

The Chemical Company

Safety Data Sheet
Pluriol® P 4000

1. Product and Company Identification

Use: Raw material for the chemical-technical industry

Company
BASF CORPORATION
100 Campus Drive
Florham Park, NJ 07932, USA

24 Hour Emergency Response Information
CHEMTREC: 1-800-424-9300
BASF HOTLINE: 1-800-832-HELP

Synonyms: Pluracol P 4000

2. Hazards Identification

Emergency overview

NO PARTICULAR HAZARDS KNOWN.
Do not get in eyes, on skin, or on clothing.
Avoid inhalation of mists/vapours.
Provide local exhaust ventilation to control vapours/mists.
Wear NIOSH-certified chemical goggles.
Wear chemical resistant protective gloves.
Wear protective clothing.
Eye wash fountains and safety showers must be easily accessible.

State of matter: liquid
Colour: colourless to yellowish
Odour: product specific

Potential health effects

Primary routes of exposure:
Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Signs and symptoms of overexposure:
No significant symptoms are expected due to the non-classification of the product.

3. Composition / Information on Ingredients

CAS Number	Content (W/W)	Chemical name
25322-69-4	80.0 - 100.0 %	polypropylenglycol

4. First-Aid Measures

General advice:
Remove contaminated clothing.

If inhaled:
Keep patient calm, remove to fresh air, seek medical attention. Assist in breathing if necessary.

If on skin:
Wash thoroughly with soap and water.

If irritation develops, seek medical attention.

If in eyes:
Wash affected eyes for at least 15 minutes under running water with eyelids held open.

Seek medical attention.

If swallowed:
Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required.

Note to physician

Treatment:	Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

Flash point:	> 100 °C	(DIN 51758)
Autoignition:	> 200 °C	(DIN 51794)
Self-ignition temperature:		not self-igniting

Suitable extinguishing media:
water spray, dry powder, foam

Protective equipment for fire-fighting:
Firefighters should be equipped with self-contained breathing apparatus and turn-out gear.

Further information:
Contaminated extinguishing water must be disposed of in accordance with official regulations.

6. Accidental release measures

Personal precautions:
Use personal protective clothing. Information regarding personal protective measures see, chapter 8.

Environmental precautions:
Do not discharge into drains/surface waters/groundwater.

Cleanup:
For small amounts: Pick up with absorbent material (e.g. sand, sawdust, general-purpose binder). Dispose of absorbed material in accordance with regulations.
For large amounts: Pump off product.

Further information:
High risk of slipping due to leakage/spillage of product.

7. Handling and Storage

Handling

General advice:
No special measures necessary provided product is used correctly.

Protection against fire and explosion:
No special precautions necessary.

Storage

General advice:
Keep container tightly closed and in a cool place.

Temperature tolerance
The product is not damaged by low temperatures or by frost.
Protect from temperatures above: 70 °C
Properties of the product change irreversibly on exceeding the limit temperature.

8. Exposure Controls and Personal Protection

Personal protective equipment

Respiratory protection:
Respiratory protection not required.

Hand protection:
Chemical resistant protective gloves

Consult with glove manufacturer for testing data.

Eye protection:
Safety glasses with side-shields.

General safety and hygiene measures:
Wear protective clothing as necessary to minimize contact. Handle in accordance with good industrial hygiene and safety practice. Do not eat, drink or use tobacco while working. Wash contaminated clothing before reuse.

9. Physical and Chemical Properties

Form:	liquid		
Odour:	product specific		
Colour:	colourless to yellowish		
pH value:	5	(50 g/l)	
solidification temperature:	approx. -35 °C	(DIN 51583)	
Boiling point:	approx. 200 °C		
Density:	approx. 1.0 g/cm3	(23 °C)	(DIN 51757)
Viscosity, kinematic:	approx. 1,050 mm2/s	(20 °C)	(DIN 51562)
Solubility in water:		insoluble	
Solubility (qualitative):	soluble solvent(s): non-polar solvents,		

10. Stability and Reactivity

Hazardous reactions:
No hazardous reactions when stored and handled according to instructions.
The product is chemically stable.

Decomposition products:
Hazardous decomposition products: No hazardous decomposition products if stored and handled as prescribed/indicated.

Corrosion to metals:
Corrosive effects to metal are not anticipated.

11. Toxicological information

Acute toxicity

Oral:
Type of value: LD50
Species: rat
Value: > 2,000 mg/kg

Irritation / corrosion

Skin:
Species: rabbit
Result: non-irritant
Method: Draize test

Eye:
Species: rabbit
Result: non-irritant
Method: Draize test

Other Information:

The product has not been tested. The statement has been derived from products of a similar structure or composition.

12. Ecological Information

Fish

Acute:
Oncorhynchus mykiss/LC50 (96 h): > 100 mg/l

Microorganisms

Toxicity to microorganisms:
DEV-L2 : > 1,000 mg/l

Inhibition of degradation activity in activated sludge is not to be anticipated during correct introduction of low concentrations.

Degradability / Persistence
Biological / Abiological Degradation

Test method:	mod. OECD 303A
Method of analysis:	Bismuth-active substance
Degree of elimination:	20 - 70 % (56 d)
Evaluation:	Moderately/partially eliminated from water.

Other adverse effects:

The product has not been tested. The statement has been derived from products of a similar structure or composition.

13. Disposal considerations

Waste disposal of substance:
Dispose of in accordance with national, state and local regulations. It is the waste generator's responsibility to determine if a particular waste is hazardous under RCRA.

Container disposal:
Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

14. Transport Information

Land transport
USDOT

Not classified as a dangerous good under transport regulations

Sea transport
IMDG

Not classified as a dangerous good under transport regulations

Air transport
IATA/ICAO

Not classified as a dangerous good under transport regulations

15. Regulatory Information

Federal Regulations

Registration status:
Chemical TSCA, US released / listed

OSHA hazard category: Not hazardous;

EPCRA 311/312 (Hazard categories): Not hazardous;

State regulations

CA Prop. 65:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

16. Other Information

NFPA Hazard codes:
Health : 0 Fire: 1 Reactivity: 0 Special:

HMIS III rating
Health: 0 Flammability: 1 Physical hazard: 0

NFPA and HMIS use a numbering scale ranging from 0 to 4 to indicate the degree of hazard. A value of zero means that the substance possesses essentially no hazard; a rating of four indicates extreme danger. Although similar, the two rating systems are intended for different purposes, and use different criteria. The NFPA system was developed to provide an on-the-spot alert to the hazards of a material, and their severity, to emergency responders. The HMIS system was designed to communicate workplace hazard information to employees who handle hazardous chemicals.

We support worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

MSDS Prepared by:
BASF NA Product Regulations
msds@basf.com

MSDS Prepared on: 2011/08/04

END OF DATA SHEET

Technical Bulletin

Pluriol® P 4000 Polypropylene Glycol

Helping Make Products Better™

BASF
The Chemical Company

Pluriol P 4000 is a 100% active, polypropylene glycol surfactant with an average molecular weight of 4000. It is produced by reaction of dipropylene glycol and propylene oxide in controlled proportions.

Solubility and Compatibility:
The Pluriol P 4000 is compatible with a wide range of other liquids, and, at 77°F, is miscible in all proportions with most organic aromatic compounds, halogenated hydrocarbons, alcohols, aldehydes and acids. In addition, it shows good solubility with some animal and vegetable oils, and modified alkyd resins.

Applications:
Brake Fluid formulations
Lubricating-oil and grease-compounding
Rubber processing
Air-filter dust trapping
Foam inhibiting

Shelf Life:
BASF will endorse the results on the certificate of analysis for a period of up to two years from the date of manufacture for material in original, unopened, properly stored containers. Beyond two years, we recommend the quality of the material be confirmed prior to use, by retesting the certificate of analysis parameters.
Please refer to the Material Safety Data Sheet (MSDS) for this product for instructions on safe and proper handling and disposal.

Specifications	
Hydroxyl no., mg. KOH/g	26.0 – 29.5
Water, wt. %	0.08 max.
Acid no., mg. KOH/g	0.08 max.
Color, APHA	25 max.
Viscosity, 100°F, cSt	410 – 500
Appearance	Clear Liquid
pH, apparent (1:1 IPA/water, 3%)	5.0 – 8.0
Molecular Weight (calculated)	3800 – 4300

Typical physical properties	
Appearance	Clear, colorless liquid
Specific gravity at 20/20°C	1.0041
Density, lb/gal at 25°C	8.34
Refractive index at 25°C	1.45
Flash point, °F	401 – 470
Fire point, °F	515
Viscosity at 25°C, cps	790
Pour point, °F	–21
Solubility in H2O, wt. % at 25°C	0.005

For More Information:
Order Placement
To place orders for delivery in the United States or Canada, please call our toll free number (800) 443-6460.

For Other Information
Including product literature and Material Safety Data Sheets please call (734) 324-6101.

Or Visit Our Website At:
www.performance.basf-corp.com

BASF Corporation
100 Campus Drive
Florham Park, New Jersey 07932
800-443-6460

Care Chemicals

SAFETY DATA SHEET

PRODUCT

NALCO® 7561

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **NALCO® 7561**

APPLICATION : FOAM CONTROL CHEMICAL

COMPANY IDENTIFICATION : Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 0 / 1 FLAMMABILITY : 1 / 1 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Based on our hazard evaluation, none of the substances in this product are hazardous.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

CAUTION
May cause irritation with prolonged contact.
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of soap and water.
Wear suitable protective clothing.
Low Fire Hazard; liquids may burn upon heating to temperatures at or above the flash point. May evolve oxides of carbon (COx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
May cause irritation with prolonged contact.

SKIN CONTACT :
May cause irritation with prolonged contact.

INGESTION :
Not a likely route of exposure. May cause diarrhea.

INHALATION :
Not a likely route of exposure. No adverse effects expected.

SYMPTOMS OF EXPOSURE :
Acute :
A review of available data does not identify any symptoms from exposure not previously mentioned.
Chronic :
A review of available data does not identify any symptoms from exposure not previously mentioned.

AGGRAVATION OF EXISTING CONDITIONS :
Skin contact may aggravate an existing dermatitis condition.

4. FIRST AID MEASURES

EYE CONTACT :
Flush affected area with water. If symptoms develop, seek medical advice.

SKIN CONTACT :
Immediately wash with plenty of soap and water. If symptoms develop, seek medical advice.

INGESTION :
Do not induce vomiting without medical advice. If conscious, washout mouth and give water to drink. Get medical attention.

INHALATION :
Remove to fresh air, treat symptomatically. Get medical attention.

NOTE TO PHYSICIAN :
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : 350 °F / 176.7 °C (PMCC)

EXTINGUISHING MEDIA :
Alcohol foam, Carbon dioxide, Foam, Dry powder, Other extinguishing agent suitable for Class B fires, For large fires, use water spray or fog, thoroughly drenching the burning material.
Water mist may be used to cool closed containers.

UNSUITABLE EXTINGUISHING MEDIA :
Do not use water unless flooding amounts are available.

FIRE AND EXPLOSION HAZARD :
Low Fire Hazard; liquids may burn upon heating to temperatures at or above the flash point. May evolve oxides of carbon (COx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Stop or reduce any leaks if it is safe to do so. Ventilate spill area if possible. Do not touch spilled material. Remove sources of ignition. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Ensure clean-up is conducted by trained personnel only. Notify appropriate government, occupational health and safety and environmental authorities. Do not touch spilled material. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Restrict access to area as appropriate until clean-up operations are complete. Ventilate spill area if possible. Stop or reduce any leaks if it is safe to do so.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Clean contaminated surfaces with water or aqueous cleaning agents. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
Do not contaminate surface water.

7. HANDLING AND STORAGE

HANDLING :
Use with adequate ventilation. Keep the containers closed when not in use. Do not take internally. Do not get in eyes, on skin, on clothing.

STORAGE CONDITIONS :
Protect product from freezing. Store away from heat and sources of ignition. Store separately from oxidizers. Store the containers tightly closed.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
This product does not contain any substance that has an established exposure limit.

ENGINEERING MEASURES :
General ventilation is recommended.

RESPIRATORY PROTECTION :
Respiratory protection is not normally needed.

HAND PROTECTION :
Nitrile gloves PVC gloves Neoprene gloves Butyl gloves

SKIN PROTECTION :
Wear standard protective clothing.

EYE PROTECTION :
Wear chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

HUMAN EXPOSURE CHARACTERIZATION :
Based on our recommended product application and personal protective equipment, the potential human exposure is:
Low

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Clear Amber
ODOR	Organic

SPECIFIC GRAVITY	0.97 - 1.00
DENSITY	8.06 lb/gal
SOLUBILITY IN WATER	Dispersible
VISCOSITY	90 cps
VOC CONTENT	0 % EPA Method 24

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
None known

MATERIALS TO AVOID :
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Oxides of carbon

11. TOXICOLOGICAL INFORMATION

The following results are for the product.

PRIMARY SKIN IRRITATION :
Species: Rabbit
Draize Score: 1.4 /8.0
Test Descriptor: Product

PRIMARY EYE IRRITATION :
Species: Rabbit
Draize Score: 5.7 /110.0
Test Descriptor: Product

SENSITIZATION :
This product is not expected to be a sensitizer.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: Low

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product.

Acute Fish Results :

Species	Exposure	Test Type	Value	Test Descriptor
Fathead Minnow	96 hrs	LC50	199 mg/l	Product
Rainbow Trout	96 hrs	LC50	235 mg/l	Product

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Daphnia magna	48 hrs	LC50	289 mg/l	Product

PERSISTENCY AND DEGRADATION :

Chemical Oxygen Demand (COD) : 2,200,000 mg/l

Biological Oxygen Demand (BOD) :

Incubation Period	Value	Test Descriptor
5 d	700,000 mg/l	

The organic portion of this preparation is expected to be poorly biodegradable.

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	< 5%	> 90%

The portion in water is expected to float on the surface.

BIOACCUMULATION POTENTIAL
Component substances have a low potential to bioconcentrate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low
Based on our recommended product application and the product's characteristics, the potential environmental exposure is: Low

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, none of the substances in this product are hazardous.

CERCLA/SUPERFUND, 40 CFR 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act :
When use situations necessitate compliance with FDA regulations, this product is acceptable under : 21 CFR 176.210 Defoaming agents used in the manufacture of paper and paperboard, 21 CFR 176.200 Defoaming Agents used in coatings, 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods.

Limitations: no more than required to produce intended technical effect.

FEDERAL INSTITUTE FOR RISK ASSESSMENT (BfR) RECOMMENDATION :
This product is In compliance with recommendation BfR XXXVI

Dosage Limit (%)	Dosage Limit (mg/dm2)	Limitation Qualifier
		no dosage limit

This product has been certified as KOSHER/PAREVE by the CHICAGO RABBINICAL COUNCIL.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
This product may contain trace levels (<0.1% for carcinogens, <1% all other substances) of the following substance(s) listed under the regulation. Additional components may be unintentionally present at trace levels.

Substance(s)	Citations
• Sulfuric Acid	Sec. 311

CLEAN AIR ACT, Sec. 112 (Hazardous Air Pollutants, as amended by 40 CFR 63), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CALIFORNIA PROPOSITION 65 :
Substances listed under California Proposition 65 are not intentionally added or expected to be present in this product.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

STATE RIGHT TO KNOW LAWS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

INTERNATIONAL CHEMICAL CONTROL LAWS :

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

NEW ZEALAND
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Low

* The environmental risk is: Low

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 08/14/2013
Version Number : 1.12

MATERIAL SAFETY DATA SHEET

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Product Name	DAF-30		
Product Code	PVDAF30		
Company Name	Polymer Ventures, Inc.	HMIS Codes*	
Company Address	1612 Harbor View Road, Charleston, SC 29412	Health	1
Company Website	www.polymerventures.com	Flammability	0
Emergency Phone (24 Hrs)	800-424-9300	Reactivity	0
Information Phone	843-853-8817	Protection	B
Sheet Revised	1/1/2006		

PolymerVentures®

SECTION 2 - HAZARDOUS INGREDIENTS / SARA TITLE III INFORMATION

COMPONENTS	CAS #	% BY WT	OSHA PEL	ACGIH TWA	SARA TITLE III	RPT QTY
None						

SECTION 3 - HAZARDS IDENTIFICATION

Inhalation	Inhalation may cause inflammation of mucous membranes and irritation.					
Eyes	Causes pain, reddening, and swelling of the conjunctiva.					
Skin	May cause irritation similar to a rash with localized edema, reddening, and raised lesions.					
Ingestion	There is no direct data available pertaining to the hazards associated with ingestion of this product. As with most chemicals, ingestion may cause					
	gastrointestinal irritation accompanied by nausea, vomiting, and diarrhea.					
Carcinogenicity	NTP?	No	IARC MONOGRAPHS?	No	OSHA REGULATED?	No

SECTION 4 - FIRST AID MEASURES

Inhalation	Immediately remove individual to fresh air. If individual has stopped breathing, give artificial respiration. Get immediate medical attention.
Eyes	Immediately flush eyes with plenty of cool, clean water for at least 15 minutes. Keep eyelids apart to maintain maximum contact with water.
	Do not allow the individual to rub their eyes. Get immediate medical attention.
Skin	Remove contaminated clothing and footwear. Wash thoroughly with water, and do not reuse clothing until properly cleaned.
	Discard footwear. If a rash should develop, get medical attention.
Ingestion	If victim is conscious and able to swallow, quickly have them drink water or milk to dilute. Do not give anything by mouth if victim is unconscious or having
	convulsions. Induce vomiting only if advised by a physician or poison control center. Contact a physician or Poison Control Center immediately.

SECTION 5 - FIRE AND EXPLOSION HAZARD DATA

Flash Point	>212 Degrees F	Flammable Limits	LOWER	N/A		
Method Used	Tag Closed Cup		UPPER	N/A		
Extinguishing Media	Use water spray, dry chemicals, foam, or carbon dioxide. Use water spray to keep fire exposed containers cool. If a spill has ignited, use water spray to disperse					
	the vapors. Water spray may be used to flush spills away from a fire and to dilute spills to non-flammable mixtures. Do not flush into a storm drain or public sewer.					
Special Firefighting	Do not direct a solid stream of water or foam into hot, burning pools; this may cause frothing and increase fire intensity. Use self-contained breathing apparatus					
Procedures	(SCBA) and proper personal protection clothing.					
Unusual Fire and	There are no known unusual fire and explosion hazards associated with this material in its virgin form. However, in a fire-fighting scenario involving multiple chemicals,					
Explosion Hazards	fire fighters should be aware of possible synergistic effects and attack the fire accordingly.					

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Land Release	This material may cause groundwater contamination. Contain as much material as possible. Begin a containerization process as soon as practical. Rinse spill area
	with water after cleanup is complete and containerize all rinse water.
Water Release	This material is soluble/dispersible in water. Stop source of spill if safe to do so. Divert all flow and contain. Remove and containerize or neutralize in place,
	then remove for proper disposal.
Air Release	Vapors may be suppressed by the use of a water fog. Contain all run-off water for proper disposal.

SECTION 7 - HANDLING AND STORAGE

Storage	This material is safe to store in well ventilated areas at ambient temperatures. Keep containers closed when not in use to prevent
	evaporative losses and possible contamination. Protect product from freezing.
Other Precautions	Eyewash and safety showers are recommended in the immediate work area. Check with you state OSHA to determine the need and maximum distance for
	stations to be placed in regards to possible chemical exposure.

SECTION 8 - CONTROL MEASURES

Respiratory Protection	If air contaminants exceed a TLV, PEL, or STEL, use a NIOSH-MSHA approved full-face , air purifying respirator with appropriate cartridge or SCBA. Respirators and
	cartridges should be selected based upon the form and concentration of the contaminants in accordance with applicable regulations.
Ventilation	Normal ventilation has been found to be generally adequate. The end-user must determine if the process or methods involved with the use of this material
	requires any additional or special ventilation.
Protective Gloves	Rubber, butyl, neoprene, or plastic gloves should be worn when using this material to avoid skin contact.
Eye Protection	Safety glasses with side shields are recommended.
Other Protective Equipment	Not generally required under normal working conditions. The end user must determine if the process or methods involved require other
	personal protection clothing or equipment.
Hygienic Practices	Do not eat, drink, or smoke in areas where chemicals are being stored or handled. Wash thoroughly before handling food or drink.

SECTION 9 - PHYSICAL/CHEMICAL CHARACTERISTICS

Appearance and Odor	White granular powder	pH	4.0 - 9.0 typical
Boiling Point	N/D	Specific Gravity	N/D
Vapor Density	N/D	Evaporation Rate	N/D
Solubility in Water	Completely soluble	Percent Volatiles	N/D

MATERIAL SAFETY DATA SHEET

SECTION 10 - REACTIVITY DATA

Stability	Stable
Conditions to Avoid	None known or noted
Materials to Avoid	Strong oxidizing agents
Hazardous Byproducts	Oxides of carbon and nitrogen
Hazardous Polymerization	Will not occur

PolymerVentures®

SECTION 11 - TOXICOLOGICAL INFORMATION

Toxicity Test Results	No information is available.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Impact	No information is available.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste disposal methods	Dispose of material in an approved chemical waste landfill or incinerate in accordance with applicable federal, state, and local regulations.
	Since empty containers retain material residues, all labeled hazard precautions must be observed.

SECTION 14 - TRANSPORTATION INFORMATION

This material is regulated by the DOT?	No
DOT Description from Hazardous Materials Table 49 CFR 172.101	Not regulated
Reportable Quantity if Applicable	No reportable materials

SECTION 15 -REGULATORY INFORMATION

REGULATION	REPORTABLE COMPONENTS
CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act)	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 302 and 304	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 311 and 312	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 313	Refer to Section 2 of the MSDS.
Clean Air Act, Section 111, Volatile Organic Compounds (VOC)	None
Clean Air Act, Section 112, Hazardous Air Pollutants	None
Clean Water Act, Section 307, Priority Pollutants List	None

SECTION 16 -ADDITIONAL INFORMATION

ABBREVIATION	DEFINITION	ABBREVIATION	DEFINITION
N/A	Not Applicable	TLV	Threshold Limit Value
N/E	Not Established	PEL	Personal Exposure Limit
N/D	Not Determined	STEL	Short Term Exposure Limit
UNK	Unknown	<	Less Than
EHS	Environmental, Health, and Safety Department	>	Greater Than
OSHA	Occupational Safety and Health Administration	PNOR	Particulates Not Otherwise Regulated
ACGIH	American Conference of Governmental Industrial Hygienists	PNOC	Particulates Not Otherwise Classified

*Please Note: The Hazardous Material Information System (HMIS) is a voluntary, subjective alpha-numeric symbolic system for recommending hazard risk and personal protection equipment information. It is a subjective rating system based on the evaluator's understanding of the chemical associated risks. The end-user must determine if the code is appropriate for their use.

The regulatory listings provided herein are not all inclusive of possible regulations affecting this material. It is the end-user's responsibility to determine all local, state, federal, or international regulations/restrictions that may apply.

SECTION 17 - DISCLAIMER

This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty, or guarantee is made as to its accuracy, reliability, or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use. We do not accept liability for any loss or damage that may occur from the use of this information nor do we offer warranty against patent infringement.

END MSDS

GRAYMONT

MATERIAL SAFETY DATA SHEET

------SECTION I - CHEMICAL PRODUCT AND COMPANY INFORMATION ------

PRODUCT NAME: HIGH CALCIUM QUICKLIME

WHMIS - CLASSIFICATION:
D2A / D2B: MATERIALS CAUSING OTHER TOXIC EFFECTS
E: CORROSIVE MATERIAL

MANUFACTURER'S AND SUPPLIER'S NAME:
GRAYMONT (NB) INC
4634, ROUTE 880
HAVELOCK, NEW BRUNSWICK, E4Z 5K8.

GRAYMONT (QC) INC
25-206, RUE DE LAUZON
BOUCHERVILLE (QUEBEC), J4B 1E7.

GRAYMONT (PA) INC.
965, EAST COLLEGE AVENUE
PLEASANT GAP, PA 16823

GRAYMONT (WESTERN CANADA) INC.
190 - 3025, 12TH STREET N.E.
CALGARY, ALBERTA, T2E 7J2

GRAYMONT (WESTERN US) INC.
3950 SOUTH, 700 EAST
SUITE 301
SALT LAKE CITY, UTAH 84107

GRAYMONT (WI) INC.
FOOT OF HILL AVENUE
SUPERIOR, WISCONSIN 54880

EMERGENCY TEL. NO.:
(613) 996-6666 CANUTEC (CANADA)
(800) 424-9300 CHEMTREC (US)

CHEMICAL NAME: CALCIUM OXIDE

CHEMICAL FAMILY: ALKALINE EARTH OXIDE

CHEMICAL FORMULA: COMPLEX MIXTURE - MOSTLY CaO

MOLECULAR WEIGHT:
CaO: 56.08

TRADE NAME AND SYNONYMS:
HIGH CALCIUM QUICKLIME, LIME, QUICKLIME, CALCIUM OXIDE, BURNT LIME, UNSLAKED LIME, FLUXING LIME.

MATERIAL USE:
NEUTRALIZATION, FLOCCULATION, FLUX (NET.), CAUSTIC AGENT, ABSORPTION

------SECTION II - COMPOSITION AND INFORMATION ON INGREDIENTS ------

HAZARDOUS INGREDIENTS APPROXIMATE CONCENTRATION C.A.S.

(COMPLEX MIXTURE)	(% BY WEIGHT)	NUMBER
CALCIUM OXIDE	90 TO 100	1305-78-8
CRYSTALLINE SILICA, QUARTZ	0.1 TO 1	14808-60-7
CRYSTALLINE SILICA, QUARTZ	0 TO 0.1 (NOTE 1)	14808-60-7

HAZARDOUS INGREDIENTS (COMPLEX MIXTURE)	EXPOSURE LIMITS (MG/M3) OSHA PEL (TWA) 8/40H	ACGIH TLV (TWA) 8/40H	RSST VEMP (TWA) 8/40H	MSHA PEL (TWA) 8/40H	NIOSH REL (TWA) 10/40H	NIOSH IDLH
CALCIUM OXIDE	5	2	2	5	2	25
CRYSTALLINE SILICA, QUARTZ	10/(%SiO2) +2 RESPIRABLE SILICA DUST	0.025 RESPIRABLE SILICA DUST	0.1 RESPIRABLE SILICA DUST	10/(%SiO2) +2 RESPIRABLE SILICA DUST	0.05 RESPIRABLE SILICA DUST	50
CRYSTALLINE SILICA, QUARTZ	10/(%SiO2) +2 RESPIRABLE SILICA DUST	0.025 RESPIRABLE SILICA DUST	0.1 RESPIRABLE SILICA DUST	10/(%SiO2) +2 RESPIRABLE SILICA DUST	0.05 RESPIRABLE SILICA DUST	50

(NOTE 1):
CONCENTRATION OF CRYSTALLINE SILICA IN A SERIES OF LIME PRODUCTS WILL VARY FROM SOURCE TO SOURCE. IT WAS NOT DETECTED ON SOME SAMPLES (<0.1% W/W). THEREFORE TWO RANGES ARE BEING DISCLOSED.

(NOTE 2):
ACGIH TLV VERSION 1973 HAS BEEN ADOPTED BY THE MINE SAFETY HEALTH ADMINISTRATION (MSHA) AS THE REGULATORY EXPOSURE STANDARD.

------SECTION III - PHYSICAL AND CHEMICAL DATA ------

PHYSICAL STATE:
GAS ( )
LIQUID ( )
SOLID (X)

ODOR AND APPEARANCE: SLIGHT EARTHY ODOR - WHITE CRYSTALLINE SUBSTANCE

ODOR THRESHOLD (P.P.M.): NOT APPLICABLE

SPECIFIC GRAVITY: 3.25 - 3.38

VAPOR PRESSURE (MM): NOT APPLICABLE

VAPOR DENSITY (AIR=1): NOT APPLICABLE

EVAPORATION RATE: NOT APPLICABLE

BOILING POINT (DEG. C): 2850

MELTING POINT (DEG. C): 2570 - 2625

SOLUBILITY IN WATER (20 DEG. C): 0.125G/100G SOLUTION

VOLATILES (% BY VOLUME): NOT APPLICABLE

pH (25 DEG. C): SAT. SOLN CaO 12.45

BULK DENSITY (KG/M3): 720 - 1200

COEFFICIENT OF WATER/OIL DISTRIBUTION: NOT APPLICABLE

------SECTION IV - FIRE OR EXPLOSION HAZARD DATA ------

FLAMMABILITY:
YES ( )
NO (X)
IF YES, UNDER WHICH CONDITIONS?:

EXTINGUISHING MEDIA:
QUICKLIME DOES NOT BURN. USE EXTINGUISHER APPROPRIATE FOR MATERIAL BURNING.

SPECIAL FIRE FIGHTING PROCEDURES:
AVOID USING WATER UNLESS NECESSARY FOR OTHER MATERIALS, IN WHICH CASE, FLOOD TO ABSORB HEAT GENERATED. (CONTACT WITH WATER WILL EVOLVE HEAT AND COULD CAUSE IGNITION OF PAPER, CARDBOARD, ETC.). WEAR SELF-CONTAINED BREATHING EQUIPMENT APPROVED BY NIOSH.

FLASH POINT (DEG. C) AND METHOD: NOT APPLICABLE

UPPER FLAMMABLE LIMIT (% BY VOLUME): NOT APPLICABLE
LOWER FLAMMABLE LIMIT (% BY VOLUME): NOT APPLICABLE

AUTO IGNITION TEMPERATURE (DEG. C): NOT APPLICABLE

TDG FLAMMABILITY CLASSIFICATION: NON-FLAMMABLE

HAZARDOUS COMBUSTION PRODUCTS: NONE

DANGEROUS COMBUSTION PRODUCTS: NONE

EXPLOSION DATA:

SENSITIVITY TO CHEMICAL IMPACT: NOT APPLICABLE

RATE OF BURNING: NOT APPLICABLE

EXPLOSIVE POWER: NOT APPLICABLE

SENSITIVITY TO STATIC DISCHARGE: NOT APPLICABLE

------SECTION V - REACTIVITY DATA ------

CHEMICAL STABILITY:
YES ( )
NO (X)

IF NO, UNDER WHICH CONDITIONS?:
ABSORBS MOISTURE AND CARBON DIOXIDE IN THE AIR TO FORM CALCIUM HYDROXIDE AND CALCIUM CARBONATE.

INCOMPATIBILITY TO OTHER SUBSTANCES:
YES (X)
NO ( )

IF SO, WHICH ONES?:
BORON TRI-FLUORIDE, CHLORINE TRI-FLUORIDE, ETHANOL, FLUORINE, HYDROGEN FLUORIDE, PHOSPHORUS PENTOXIDE; WATER AND ACIDS (VIOLENT REACTION WITH GENERATING HEAT AND POSSIBLE EXPLOSION IN CONFINED AREA).

REACTIVITY:
YES (X)
NO ( )

IF SO, UNDER WHICH CONDITIONS?:
REACTS VIOLENTLY WITH STRONG ACIDS. REACTS WITH WATER TO FORM CALCIUM HYDROXIDE. THE HEAT GENERATED WHEN MIXED WITH WATER OR MOIST AIR IS SUFFICIENT ENOUGH TO IGNITE SURROUNDING MATERIALS SUCH AS PAPER, WOOD OR CLOTH.

HAZARDOUS DECOMPOSITION PRODUCTS: NONE.

HAZARDOUS POLYMERIZATION PRODUCTS: WILL NOT OCCUR.

------SECTION VI - TOXICOLOGICAL PROPERTIES ------

ROUTE OF ENTRY:
(X) SKIN CONTACT
( ) SKIN ABSORPTION
(X) EYE CONTACT
(X) ACUTE INHALATION
( ) CHRONIC INHALATION
(X) INGESTION

EFFECTS OF ACUTE EXPOSURE TO PRODUCT:

SKIN:
SEVERE IRRITATION OR BURNING OF MUCOUS AND SKIN. DEHYDRATION OF TISSUES.

EYES:
SEVERE EYE IRRITATION AND BURNING, INTENSE WATERING OF THE EYES, POSSIBLE LESIONS, POSSIBLE BLINDNESS WHEN EXPOSED FOR PROLONGED PERIOD. (DRAIZE >80).

INHALATION:
IF INHALED IN FORM OF DUST:
NOSE, ORAL CAVITY AND THROAT IRRITATION, COUGH, SNEEZING, INFLAMMATION OF BREATHING PASSAGES, ULCERATION AND PERFORATION OF NASAL SEPTUM, BRONCHITIS, POSSIBLE PNEUMONIA.

INGESTION:
IF INGESTED, BURNING AND EDEMA OF DIGESTIVE TRACTS, ABUNDANT SALIVATION, DIFFICULTIES IN SWALLOWING AND BREATHING, VOMITING BLOOD, DROP IN BLOOD

PRESSURE (INDICATES PERFORATION OF ESOPHAGUS OR STOMACH).

EFFECTS OF CHRONIC EXPOSURE TO PRODUCT:
CONTACT DERMATITIS. FOLLOWING REPEATED OR PROLONGED CONTACT, THIS PRODUCT CAN CAUSE REDNESS, DESQUAMATION AND FISSURES. THIS PRODUCT MAY CONTAIN TRACE AMOUNTS OF CRYSTALLINE SILICA. EXCESSIVE INHALATION OF RESPIRABLS CRYSTALLINE SILICA DUST MAY RESULT IN RESPIRATORY DISEASE, INCLUDING SILICOSIS, PNEUMOCONIOSIS AND PULMONARY FIBROSIS.

LD50 OF PRODUCT (SPECIFY SPECIES AND ROUTE):
3059 MG/KG (MOUSE/INTRAPERITONEAL)

IRRITANCY OF PRODUCT: SEVERE TO MOIST TISSUES

EXPOSURE LIMITS OF PRODUCT: UNAVAILABLE

LC50 OF PRODUCT (SPECIFY SPECIES): UNAVAILABLE

SENSITIZATION TO PRODUCT: NONE

SYNERGISTIC MATERIALS: NONE REPORTED

(X) CARCINOGENICITY
( ) REPRODUCTIVE EFFECTS
( ) TERATOGENICITY
( ) MUTAGENICITY

QUICKLIME IS NOT LISTED AS A CARCINOGEN BY ACGIH, MSHA, OSHA, NTP, DFG, RSST OR IARC. IT MAY, HOWEVER, CONTAIN TRACE AMOUNTS OF CRYSTALLINE SILICA LISTED CARCINOGENS BY THESE ORGANIZATIONS.

CRYSTALLINE SILICA, WHICH INHALED IN THE FORM OF QUARTZ OR CRYSTOBALITE FROM OCCUPATIONAL SOURCES, IS CLASSIFIED BY IARC AS CARCINOGENIC TO HUMANS. (GROUP 1)

SILICA, CRYSTALLINE (AIRBORNE PARTICLES OF RESPIRABLE SIZE) IS REGULATED UNDER CALIFORNIA'S SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65). CRYSTALLINE SILICA IS LISTED AS A CHEMICAL KNOWN TO THE STATE TO CAUSE CANCER.

NIOSH CONSIDERS CRYSTALLINE SILICA TO BE POTENTIAL OCCUPATIONAL CARCINOGEN AS DEFINED BY THE OSHA CARCINOGEN POLICY (29 CFR 1990). (Ca).

NTP LISTS RESPIRABLE CRYSTALLINE SILICA AS KNOWN TO BE HUMAN CARCINOGENS BASED ON SUFFICIENT EVIDENCE OF CARCINOGENICITY IN HUMANS. (K).

ACGIH LISTS RESPIRABLE CRYSTALLINE SILICA (QUARTZ) AS SUSPECTED HUMAN CARCINOGEN. (A2).

DFG LISTS RESPIRABLE CRYSTALLINE SILICA AS A SUBSTANCE THAT CAUSES CANCER IN MAN (1)

RSST LISTS RESPIRABLE CRYSTALLINE SILICA (QUARTZ) AS SUSPECTED HUMAN CARCINOGEN.

------SECTION VII - PREVENTIVE MEASURES ------

PERSONAL PROTECTIVE EQUIPMENT (PPE):
WEAR CLEAN, DRY GLOVES, FULL LENGTH PANTS OVER BOOTS, LONG SLEEVED SHIRT BUTTONED AT THE NECK, HEAD PROTECTION AND APPROVED EYE PROTECTION SELECTED FOR THE WORKING CONDITIONS.

GLOVES (SPECIFY): GAUNTLETS CUFF STYLE.

RESPIRATORY (SPECIFY):
NIOSH APPROVED RESPIRATOR.

UP TO 10 MG/M3:
(APF = 5): ANY QUARTER-MASK RESPIRATOR.

UP TO 20 MG/M3:
(APF = 10):
ANY PARTICULATE RESPIRATOR EQUIPPED WITH AN N95, R95 OR P95 FILTER EXCEPT QUARTER-MASK RESPIRATOR. ANY SUPPLIED-AIR RESPIRATOR.

UP TO 25 MG/M3:
(APF = 25):
ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS-FLOW MODE. ANY POWERED, AIR PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.

FOR RESPIRABLE QUARTZ LEVELS THAT EXCEED OR ARE LIKELY TO EXCEED AN 8-HR TWA OF 0.1 MG/M3, A NIOSH APPROVED (N/R/P95) DUST RESPIRATOR IS RECOMMENDED.

FOR RESPIRABLE QUARTZ LEVELS THAT EXCEED OR ARE LIKELY TO EXCEED AN 8-HR TWA OF 0.5 MG/M3. A NIOSH APPROVED HEPA (N/R/P100) FILTER RESPIRATOR IS RECOMMENDED.

FOR RESPIRABLE QUARTZ LEVELS THAT EXCEED OR ARE LIKELY TO EXCEED AN 8-HR TWA OF 5.0 MG/M3. A NIOSH APPROVED POSITIVE PRESSURE (SAR), FULL FACE RESPIRATOR OR EQUIVALENT IS RECOMMENDED.

EYES (SPECIFY):
ANSI, CSA OR ASTM APPROVED SAFETY GLASSES WITH SIDE SHIELDS. TIGHT FITTING DUST GOGGLES SHOULD BE WORN WHEN EXCESSIVE (VISIBLE) DUST CONDITIONS ARE PRESENT. DO NOT WEAR CONTACT LENSES WITHOUT TIGHT FITTING GOGGLES WHEN HANDLING THIS CHEMICAL.

FOOTWEAR (SPECIFY): RESISTANT TO CAUSTICS.

CLOTHING (SPECIFY):
FULLY COVERING SKIN. REMOVE WHEN WET OR CONTAMINATED. CHANGE DAILY.

OTHER (SPECIFY):
EVALUATE DEGREE OF EXPOSURE AND USE PPE IF NECESSARY. AFTER HANDLING LIME, EMPLOYEES MUST SHOWER. IF EXPOSED DAILY, USE OIL, VASELINE, SILICONE BASE CREME ETC. TO PROTECT EXPOSED SKIN, PARTICULARLY NECK, FACE AND WRISTS.

ENGINEERING CONTROLS (E.G. VENTILATION, ENCLOSED PROCESS, SPECIFY):
ENCLOSE DUST SOURCES; USE EXHAUST VENTILATION (DUST COLLECTOR) AT HANDLING POINTS, KEEP LEVELS BELOW MAX. CONCENTRATION PERMITTED.

LEAK AND SPILL PROCEDURE:
LIMIT ACCESS TO TRAINED PERSONNEL. USE INDUSTRIAL VACUUMS FOR LARGE SPILLS. VENTILATE AREA.

WASTE DISPOSAL:
TRANSPORT TO DISPOSAL AREA OR BURY. REVIEW FEDERAL, PROVINCIAL AND LOCAL ENVIRONMENTAL REGULATIONS.

HANDLING PROCEDURES AND EQUIPMENT:
AVOID SKIN AND EYE CONTACT. MINIMIZE DUST GENERATION. WEAR PROTECTIVE GOGGLES AND IN CASES OF INSUFFICIENT VENTILATION, USE NIOSH APPROVED DUST RESPIRATOR. AN EYE WASH STATION AND SAFETY SHOWER SHOULD BE READILY AVAILABLE WHERE THIS MATERIAL OR ITS WATER DISPERSIONS ARE USED. CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH THIS CHEMICAL.

STORAGE REQUIREMENTS:
KEEP TIGHTLY CLOSED CONTAINERS IN A COOL, DRY AND WELL VENTILATED AREA, AWAY FROM ACIDS. KEEP OUT OF REACH OF CHILDREN.

SPECIAL SHIPMENT INFORMATION:
QUICKLIME IS NEITHER REGULATED BY THE TRANSPORTATION OF DANGEROUS GOODS (TDG) REGULATIONS (CANADA) NOR BY THE HAZARDOUS MATERIALS REGULATIONS (USA) UNLESS THIS MATERIAL IS OFFERED OR INTENDED FOR TRANSPORTATION BY AIRCRAFT.

------SECTION VIII - FIRST AID MEASURES ------

SKIN:
CAREFULLY AND GENTLY BRUSH THE CONTAMINATED BODY SURFACES IN ORDER TO REMOVE ALL TRACES OF LIME. USE A BRUSH, CLOTH OR GLOVES. REMOVE ALL LIME-CONTAMINATED CLOTHING. RINSE CONTAMINATED AREA WITH LUKEWARM WATER FOR 15 TO 20 MINUTES. CONSULT A PHYSICIAN IF EXPOSED AREA IS LARGE OR IF IRRITATION PERSISTS.

EYES:
IMMEDIATELY RINSE CONTAMINATED EYE(S) WITH GENTLY RUNNING LUKEWARM WATER (SALINE SOLUTION IS PREFERRED) FOR 15 TO 20 MINUTES. IN THE CASE OF AN EMBEDDED PARTICLE IN THE EYE, OR CHEMICAL BURN, AS ASSESSED BY FIRST AID TRAINED PERSONNEL, CONTACT A PHYSICIAN.

INHALATION:
MOVE SOURCE OF DUST OR MOVE VICTIM TO FRESH AIR. OBTAIN MEDICAL ATTENTION IMMEDIATELY. IF VICTIM DOES NOT BREATHE, GIVE ARTIFICIAL RESPIRATION.

INGESTION:
IF VICTIM IS CONSCIOUS, GIVE 300 ML (10 OZ) OF WATER, FOLLOWED BY DILUTED VINEGAR (1 PART VINEGAR, 2 PARTS WATER) OR FRUIT JUICE TO NEUTRALIZE THE ALKALI. DO NOT INDUCE VOMITING. CONTACT A PHYSICIAN IMMEDIATELY.

GENERAL ADVISE:
CONSULT A PHYSICIAN FOR ALL EXPOSURES EXCEPT MINOR INSTANCES OF INHALATION.

------SECTION IX - REGULATORY INFORMATION ------

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA TITLE III). / THE EMERGENCY PLANNING AND "COMMUNITY RIGHT-TO-KNOW" ACT (EPCRA). / COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA). / RESOURCE CONSERVATION AND RECOVERY ACT (RCRA).

COMPONENT CALCIUM OXIDE HAS BEEN REVIEWED AGAINST THE FOLLOWING REGULATORY LISTINGS:

SARA SECTION 302 - EMERGENCY PLANNING NOTIFICATION. EXTREMELY HAZARDOUS SUBSTANCES (EHS) LIST AND THRESHOLD PLANNING QUANTITY (TPQ). (40 CFR, PART 355, SECTION 30): NOT LISTED.

SARA SECTION 304 - EMERGENCY RELEASE NOTIFICATION. EXTREMELY HAZARDOUS SUBSTANCES (EHS) AND REPORTABLE QUANTITY (RQ) LIST. (40 CFR, PART 355, SECTION 40): NOT LISTED.

SARA SECTION 311/312 - HAZARD CATEGORIES (40 CFR, PART 370):
THIS PRODUCT IS REGULATED UNDER CFR 1910.1200 (OSHA HAZARD COMMUNICATION) AS IMMEDIATE (ACUTE) HEALTH HAZARDS - IRRITANT.

SARA SECTION 313 - TOXICS RELEASE INVENTORY (TRI). TOXIC CHEMICAL LIST (40 CFR, PART 372). NOT LISTED.

CERCLA - HAZARDOUS SUBSTANCE (40 CFR, PART 302): NOT LISTED IN TABLE 302.4.

RCRA - HAZARDOUS WASTE NUMBER (40 CFR, PART 261, SUBPART D): NOT LISTED.

RCRA - HAZARDOUS WASTE CLASSIFICATION (40 CFR, PART 261, SUBPART C):
NOT CLASSIFIED.

CWA 311 - CLEAN WATER ACT LIST OF HAZARDOUS SUBSTANCES:
CALCIUM OXIDE HAS BEEN WITHDRAWN FROM THE CLEAN WATER ACT (CWA) LIST OF HAZARDOUS SUBSTANCES. (11/13/79) (44FR65400)

CALIFORNIA PROPOSITION 65:

COMPONENT CALCIUM OXIDE DOES NOT APPEAR ON THE ABOVE REGULATORY LISTING. THIS PRODUCT MAY CONTAIN SMALL AMOUNTS OF CRYSTALLINE SILICA. SILICA, CRYSTALLINE (AIRBORNE PARTICLES OF RESPIRABLE SIZE) IS REGULATED UNDER CALIFORNIA'S SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65). CRYSTALLINE SILICA IS LISTED AS A CHEMICAL KNOWN TO THE STATE TO CAUSE CANCER.

TRANSPORTATION - HAZARDOUS MATERIALS REGULATIONS (USA) & TRANSPORTATION OF DANGEROUS GOODS (TDG) REGULATIONS (CAN):
CALCIUM OXIDE IS LISTED IN BOTH TABLE 172.101 OF TITLE 49 CFR 172 AND IN SCHEDULE 18 D.G. LIST (CHAPTER 34 TDG ACT, SOR/DORS 93-525). APPLICATION OF REQUIREMENTS IS RESTRICTED TO MATERIAL OFFERED OR INTENDED FOR TRANSPORTATION BY AIRCRAFT. - CALCIUM OXIDE. BY AIRCRAFT ONLY. CLASS 8 - CORROSIVES. PIN UN1910. PACKING GROUP III. MAXIMUM NET QUANTITY PER PACKAGE - PASSENGER VEHICLES, 25 KG.

TOXIC SUBSTANCES CONTROL ACT (TSCA):
ALL NATURALLY OCCURRING COMPONENTS OF THIS PRODUCT ARE AUTOMATICALLY INCLUDED IN THE USEPA TSCA INVENTORY LIST PER 40 CFR 710.4 (B). ALL OTHER COMPONENTS ARE LISTED ON THE USEPA TSCA CHEMICAL SUBSTANCES INVENTORY. CALCIUM OXIDE IS SUBJECT TO INVENTORY UPDATE REPORTING (IUR).

CANADIAN ENVIRONMENTAL PROTECTION ACT 1999 (CEPA) - SUBSTANCES LISTS (DSL/NDSL):
CALCIUM OXIDE IS SPECIFIED ON THE PUBLIC PORTION OF THE DOMESTIC SUBSTANCES LIST (DSL).

ANSI/NSF 60 - DRINKING WATER TREATMENT ADDITIVES:
QUICKLIME HAS BEEN INVESTIGATED WITH RESPECT TO ELEMENTS IDENTIFIED BY EPA AS TOXIC AND IT HAS BEEN CLASSIFIED FOR USE IN DIRECT CONTACT WITH DRINKING WATER. (IN ACCORDANCE WITH STANDARD ANSI/NSF 60). FOR A LIST OF CLASSIFIED

PRODUCTS, REFER TO UNDERWRITERS LABORATORIES INC.'S ONLINE CERTIFICATIONS DIRECTORY.

FDA - U.S. FOOD AND DRUG ADMINISTRATION, DEPARTMENT OF HEALTH AND HUMAN SERVICES:
CALCIUM OXIDE HAS BEEN DETERMINED AS "GENERALLY RECOGNIZED AS SAFE" (GRAS) BY FDA. SEE 21 CFR 184.1210. (CFR TITLE 21 PART 184 - DIRECT FOOD SUBSTANCES AFFIRMED AS GENERALLY RECOGNIZED AS SAFE).

------SECTION X - OTHER INFORMATION ------

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (U.S.):

HMIS(R*) CALCIUM OXIDE	
HEALTH	3*
FLAMMABILITY	0
PHYSICAL HAZARD	1
PERSONAL PROTECTION	E

CORROSIVE MATERIAL

HMIS(R*) (C)2001 NPCA - PRINTED BY JJKA

NATIONAL FIRE PROTECTION ASSOCIATION (U.S.) NFPA 704:

HEALTH HAZARD	3
FIRE HAZARD	0
INSTABILITY / THERMAL HAZARD	1
SPECIFIC HAZARD	

WHMIS - CLASSIFICATION: "E" CORROSIVE MATERIAL.

WHMIS - CLASSIFICATION:
"D2A AND D2B": MATERIALS CAUSING OTHER TOXIC EFFECTS.

SYMBOL: E - CORROSIVE MATERIAL
SYMBOL: D2 - MATERIALS CAUSING OTHER TOXIC EFFECTS

ADDITIONAL INFORMATION/COMMENTS:
THE TECHNICAL DATA CONTAINED HEREIN IS GIVEN AS INFORMATION ONLY AND IS BELIEVED TO BE RELIABLE. GRAYMONT MAKES NO GUARANTEE OF RESULTS AND ASSUMES NO OBLIGATION OR LIABILITY IN CONNECTION THEREWITH.

SOURCES USED:
NFPA, NLA, TDG, CSST, RSST, (LSRO-FASEB), HAZARDOUS PRODUCTS ACT, ENVIRONMENT CANADA, ENVIROGUIDE, OSHA, ACGIH, IARC, NIOSH, CFR, NTP, HSDB, EPA SRS, RTECS, DFG, CHEMISTRY AND TECHNOLOGY OF LIME AND LIMESTONE (JOHN WILEY AND SONS, INC.), LIME AND LIMESTONE (WILEY-VCH).

------SECTION XI - PREPARATION INFORMATION ------

PREPARED BY:
GRAYMONT (QC) INC.
QUALITY ASSURANCE & TECHNICAL SERVICES

TELEPHONE NUMBER: (450) 449-2262

DATE: SEPTEMBER 2009

AN ELECTRONIC VERSION OF THIS MSDS IS AVAILABLE AT:
WWW.GRAVMONT.COM UNDER THE PRODUCTS SECTION.

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING.

1.1 Identification of the substance or preparation.

Name: SODIUM CYANIDE BRIQUETTE PRS
Code: C1200

1.2 Use of the substance/preparation.

1.3 Identification of the company.

Company: Rams-Martínez, S.L. [Group T3]
Address: Torrent d'en Baiell, 36
City: SENTMENAT
Province: Barcelona
Telephone: +34 937152001
Fax: +34 937152379
E-mail: msds@groupt3.commsds@groupt3.com

1.4 Emergency telephone number: 915620420

2. HAZARDS IDENTIFICATION.

Contact with acids liberates very toxic gas.
Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Very toxic by inhalation, in contact with skin and if swallowed.

3. COMPOSITION OF/INFORMATION ABOUT THE COMPONENTS.

Substances presenting a health or environmental hazard within the meaning of Directive 67/548/EEC:

Index No	*CAS No.*	*EC No*	*Registration number*	*Name*	*Concentrate %*	*Symbols*	*R phrases **
006-007-00-5				hydrogen cyanide (Salts of ...)	25 - 100 %	T+ N	R32 R50/53 R26/27/28

* *The complete text of the R phrases is given in section 16 of this Safety Data Sheet.*

4. FIRST AID.

In case of doubt or when symptoms of feeling unwell persist, get medical attention. Never administer anything orally to persons who are unconscious.

Inhalation.
Take the victim into open air; keep them warm and calm. If breathing is irregular or stops, perform artificial respiration. Do not administer anything orally. If unconscious, place them in a suitable position and seek medical assistance.

Eye contact.

If wearing contact lenses, remove them. Wash eyes with plenty of clean and cool water for at least 10 minutes while pulling eyelids up, and seek medical assistance.

Skin contact.
Remove contaminated clothing. Wash skin vigorously with water and soap or a suitable skin cleaner. **NEVER** use solvents or thinners.

Ingestion.
If accidentally ingested, seek immediate medical attention. Keep calm. **NEVER** induce vomiting.

5. FIRE FIGHTING MEASURES.

Recommended extinguishing methods.
Extinguisher powder or CO_2. In case of more serious fires, also alcohol-resistant foam and water spray. Do not use a direct stream of water to extinguish.

Special risks.
Fire can cause thick, black smoke. As a result of thermal decomposition, dangerous products can form: carbon monoxide, carbon dioxide. Exposure to combustion or decomposition products can be harmful to your health.

Fire protection equipment.
According to the size of the fire, it may be necessary to use protective suits against the heat, individual breathing equipment, gloves, protective goggles or facemasks, and gloves.

Other recommendations.
Use water to cool tanks, cisterns, or containers close to the heat source or fire. Take wind direction into account.
Prevent the products used to fight the fire from going into drains, sewers, or waterways.

6. MEASURES TO TAKE IN CASE OF ACCIDENTAL SPILL.

Individual precautions.
Eliminate possible ignition points and ventilate the area. Avoid breathing fumes. For exposure control and individual protection measures, see section 8.

Cleaning methods.
Pick up the spill with non-combustible absorbent materials (soil, sand, vermiculite, diatomite, etc.). Pour the product and the absorbent in an appropriate container. The contaminated area should be immediately cleaned with an appropriate de-contaminator. Pour the decontaminator on the remains in an opened container and let it act various days until no further reaction is produced. For later elimination of waste, follow the recommendations under section 13.

Environmental protection precautions.
Prevent the contamination of drains, surface or subterranean waters, and the ground. In case of large spills or if the product contaminates lakes, rivers, or sewers, inform the responsible authorities according to local legislation.

7. HANDLING AND STORAGE.

7.1 Handling.

The fumes are heavier than air and can spread across the ground. They can form explosive mixtures with air. Prevent the creation of flammable or explosive fume concentrations in the air; prevent fume concentrations above work exposure limits. The preparation must only be used in areas where all unprotected flames and other ignition points have been eliminated. Electrical equipment has to be protected according to applicable standards.
The preparation can be electrostatically charged: always use earth grounds when transferring the product. Operators must use anti-static footwear and clothing, and floors must be conductors.
Keep the container tightly closed and isolated from heat sources, sparks, and fire. Do not use tools that can cause sparks.
Prevent the preparation from contacting the skin or eyes. Avoid the inhalation of fumes and mists that form when spraying.
For personal protection, see section 8. Never use pressure to empty the containers. They are not pressure-resistant containers.
In the application area, smoking, eating, and drinking must be prohibited.
Follow legislation on occupational health and safety.
Keep the product in containers made of a material identical to the original.

7.2 Storage.

Store according to local legislation. Observe indications on the label. Store the containers between 5 and 35º C, in a dry and well-ventilated place, far from sources of heat and direct solar light. Keep far away from ignition points. Keep away from oxidising agents and from highly acidic or alkaline materials. Do not smoke. Prevent the entry of non-authorised persons. Once the containers are open, they must be carefully closed and placed vertically to prevent spills.

7.3 Specific use(s).

8. EXPOSURE CONTROL/PERSONAL PROTECTION.

8.1 Exposure limits.

Work exposure limit for:

Name	VLA-ED *		VLA-EC *	
	ppm	mg/m^3	ppm	mg/m^3

* *According to the list of Limit Environmental Professional Exposure Values adopted by the National Institute for Safety and Hygiene at Work for the year 2007.*

8.2 Exposure controls

Measures of a technical nature: provide adequate ventilation, which can be achieved by using good local exhaust-ventilation and a good general exhaust system. If this were not enough to keep the particulate and fume concentrations of the solvent below the work exposure limit, suitable breathing equipment must be used.

Breathing protection: when workers are subjected to concentrations above the exposure limit, they must use suitable and officially approved equipment. Use active carbon masks.

Hand protection: for prolonged or repeated contact, use polyvinyl alcohol or nitrile rubber types of gloves. Protective creams can help to protect exposed areas of the skin. These creams must **NEVER** be applied once exposure has occurred.

Eye protection: use protective goggles especially designed to protect against liquid splatters. Install emergency eyewashes near the use area.

Skin protection: personnel must wear anti-static clothing made of natural fibre or synthetic fibres resistant to high temperatures. All body parts that have been in contact with the preparation must be washed.

9. PHYSICAL AND CHEMICAL PROPERTIES.

9.1. General information.

Aspect:
Smell:

9.2. Important health, safety and environmental information.

pH:
Boiling Point: ºC
Flash point: ºC
Inflammability (solid, gas):
Explosive properties:

Combustive properties:
Vapour pressure:
Relative density: gr/cm3
Solubility
Hydrosolubility:
Liposolubility:
Distribution coefficient (n-octanol/water):
Viscosity:
Vapour density:
Evaporation velocity:

10. STABILITY AND REACTIVITY.

Stable under the recommended handling and storage conditions (see section 7).
In case of fire, dangerous decomposition products can be generated, such as carbon monoxide and dioxide and nitrogen fumes and oxides.
Keep away from oxidising agents and from highly alkaline or acidic materials in order to prevent exothermic reactions.

11. TOXICOLOGICAL INFORMATION.

There are no tested data available on the product. Exposure to concentrations of solvent fumes above the work exposure limit can have negative effects (for example, irritation of the mucous membranes and respiratory system, adverse effects on the kidneys, liver, and the central nervous system). Among the symptoms are headaches, vertigo, fatigue, muscular weakness, drowsiness, and in extreme cases, unconsciousness.
Repeated or prolonged contact with the preparation can cause the elimination of oil from the skin, giving rise to non-allergic contact dermatitis and absorption of the preparation through the skin.
Splatters in the eyes can cause irritation and irreversible damage.

12. ECOLOGICAL INFORMATION.

There are no tested data available on the preparation. The product must not be allowed to go into sewers or waterways.
Prevent penetration into the ground. Prevent the emission of solvents into the atmosphere.

13. ELIMINATION CONSIDERATIONS.

Dumping into sewers or waterways is prohibited. Waste and empty containers must be handled and eliminated according to current, local/national legislation.

14. INFORMATION PERTAINING TO TRANSPORT.

Transport following ADR/TPC rules for highway transport, RID rules for railway, IMDG for sea, and ICAO/IATA for air transport.

Transport method

14.1 Land: Transport by road: ADR 2007, Transport by rail: RID

UN no.: 1689 Class: 6.1 Packaging group: I
Labels: 6.1 Hazard number: 66

Transport documentation: Consignment note and written instructions

14.2 Sea: Transport by ship: IMDG 33-06

UN no.: 1689 Class: 6.1
Packaging group: I Labels: 6.1
FEm – Emergency sheets (F – Fire, S - Spills): F-A,S-A
Sea pollutant (PP – Strong sea pollutant, P – Sea pollutant): P

Transport documentation: Bill of lading

14.3 Air: Transport by plane: IATA/ICAO

UN no.: 1689 Class: 6.1 Packaging group: I
Labels: 6.1

Transport document: Airway bill

15. REGULATORY INFORMATION.

Symbols:

T+

Very toxic

N

Dangerouse to the environment

R Phrases:

R32	Contact with acids liberates very toxic gas.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R26/27/28	Very toxic by inhalation, in contact with skin and if swallowed.

S prhases:

S7	Keep container tightly closed.
S28	After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer).
S29	Do not empty into drains.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S60	This material and its container must be disposed of as hazardous waste.
S61	Avoid release to the environment. Refer to special instructions/safety data sheets.
S1/2	Keep locked up and out of the reach of children.

Contains:

hydrogen cyanide (Salts of ...)

16. OTHER INFORMATION.

Complete text of the R phrases that appear in section 3:

R32	Contact with acids liberates very toxic gas.
R26/27/28	Very toxic by inhalation, in contact with skin and if swallowed.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

The information given in this Safety Data Sheet has been drafted in accordance with REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

SDP
FLOCULANT

Great Divide Chemical, Inc.

504 Mitchelson, Rock Springs, Wyoming 82901
Phone – (307) 382-5884 Fax – (307) 382-5889

Material Safety Data Sheet — Product: Great Floc 5500

Section I — Product Identification

Trade Name: GreatFloc 5500
Description: An acrylamide polymer in water.

NFPA 704M/HMIS Rating:

Health	1	0-Insignificant
Flammability	1	1-Slight
Reactivity	0	2-Moderate
Other	0	3-High
		4-Extreme

Section II — Hazardous Ingredients

Or hazard evaluation of the ingredients(s) under OSHA's Hazard Communication Rule, 29CFR 1910.1200 has found the following ingredient(s) hazardous.

Ingredient	CAS #	Approx. %
None		

Section III — Precautionary Label Information

Caution: Avoid contact with skin, eyes and clothing. Do not take internally. Empty containers may contain residual product. Do not reuse container unless properly reconditioned.

Section VIII Fire and Explosion Information (cont)

Preferred Fire Extinguishing Agents: Foam, carbon dioxide, or dry chemical.
Caution: Water may cause extremely slippery conditions. Use water to cool containers exposed to fire.
Unusual Fire and Explosion Hazard: May evolve NO_x under fire conditions.

Section IX Reactivity Information

Incompatibilty: Avoid strong oxidizers, chlorine, peroxide, nitric acid, etc., which can generate heat with splattering or boiling and the release of toxic fumes.

Thermal Decomposition Products: In the event of combustion CO, CO2, NO_x may be formed. Do not breath smoke or fumes. Wear suitable protective equipment.

Section X Personal Protection Equipment

Respiratory Protection:	Respiratory protection is not normally needed since the volatility and toxicity are low when product in a solution. OSHA approved dust mask should be used when opening and emptying containers of dry product.
Ventilation:	General ventilation is recommended.
Protective Equipment:	Use impermeable gloves and chemical splash goggles when attaching feeding equipment or doing maintenance.

If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

Section XI Spill and Disposal Information

In case of transportation accidents, call 1-435-640-4481.

Spill Control and Recovery:

Small liquid spills: Contain with absorbent material, such as clay, soil or any commercially available absorbent. Shovel reclaimed liquid and absorbent into recovery or salvage drums for disposal. Refer to CERCLA in Section 14.

Large liquid spills: Dike to prevent further movement and reclaim into recovery or salvage drums or tank truck for disposal. Refer to CERCLA in Section 14.

Section IV First Aid Information

Eyes: Flush with water for 15 minutes. Call a physician.
Skin: Wash thoroughly with soap and water. Rinse thoroughly.
Ingestion: Do not induce vomiting. Give Water. Call a physician.
Note to physician: No specific antidote is known.
Caution: If unconscious, having trouble breathing or in convulsions, do not induce vomiting or give water.

Section V Health Effects Information

Primary Route(s) of Exposure:	Eye, Skin.
Eye Contact:	Can cause slight irritation.
Skin Contact:	Can cause slight irritation.
Symptoms of exposure:	A review of available data does not identify any symptoms from exposure.
Aggravation of existing conditions:	A review of available data does not identify any worsening of existing conditions.

Section VI Toxicology Information

None available.

Section VII Physical and Chemical Properties

Color:	white	
Form:	dry granule/powder	
Odor:	None	
Density:	40-50 lbs/cu. Ft.	
Solubility in Water:	100%	
Specific Gravity:	NA	ASTM D-1298
pH (neat) =	NA	ASTM E-70
Freeze Point:	NA	ASTM D-1177
Flash Point:	>200 deg. F (PMCC)	ASTM D-93
Vapor Pressure:	1.0 mm Hg @ 20 deg. C	ASTM D-323

Note: These physical properties are typical values for this product.

Section VIII Fire and Explosion Information

Flash Point: Greater than 200 deg. F (PMCC) ASTM D-93
Extinguishing Media: This product would not be expected to burn unless all the water is boiled away. The remaining organics may be ignitable.

Section XI Spill and Disposal Information (cont.)

Disposal: If this product becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. As a non-hazardous liquid waste, it should be solidified with stabilizing agents (such as sand, fly ash, or cement) so that no free liquid remains before disposal to an industrial waste landfill. A non-hazardous liquid wast can also be incinerated in accordance with local, state and federal regulations.

Section XII Environmental Information

If released into the environment, see CERCLA in Section 14.

Section XIII Transportation Information

DOT Proper shipping name/hazard code – product is not regulated during transportation.

Section XIV Regulatory Information

The following regulations apply to this product.

Federal Regulations:
OSHA's Hazard Communication Rule, 29 CFR 1910.1200:
Based on our hazard evaluation, ingredients in this product are hazardous: None

CERCLA, 40 cfr 117, 302:
Notification of spills of this product is not required.

SARA/Superfund Amendments and Reauthorization Act of 1986
(Title III) – Sections 302, 311, 312 and 313

Section 302 – Extremely Hazardous Substances (40 CFR 355):
This product does not contain ingredients listed in Appendix A and B as an Extremely Hazardous Substance.

Sections 311 and 312 – Material Safety Data Sheet Requirements (40 CFR 370): Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.
EPA Hazard Classification Code:

Acute	No
Fire	No
Chronic	No
Pressure	No

Section XII Environmental Information (cont.)

Section 313 – list of toxic chemicals (40 CFR 372):
This product does not contain ingredients (at a level of 1 % or greater) on the List of Toxic Chemicals.
Toxic Substances Control Act (TSCA):
The chemical ingredients in this product are on the 8 (b) Inventory List (40 CFR 710).
Resource conservation and recovery act (RCRA), 40 CFR 261 Subpart C and D:
If this product becomes a waste, it does not meet the criteria of a hazardous waste.

State Regulations:
State Right to know laws:
This product does not contain ingredients listed by the State Right to Know Laws.

Section 15 Additional Information

None

Section 16 User's Responsibility

This product material safety data sheet provides health and safety information. This product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to ensure safe workplace operations. Please consult your local sales representative for further information.

Prepared by: Les Pickrell

Date changed: 3/8/2002

DAF-10	**MATERIAL SAFETY DATA SHEET**				PAGE 1 / 2

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Product Name	DAF-10		
Product Code	PVDAF10		
Company Name	Polymer Ventures, Inc.	HMIS Codes*	
Company Address	1612 Harbor View Road, Charleston, SC 29412	Health	1
Company Website	www.polymerventures.com	Flammability	0
Emergency Phone (24 Hrs)	800-424-9300	Reactivity	0
Information Phone	843-853-8817	Protection	B
Sheet Revised	1/1/2006		

PolymerVentures®

SECTION 2 - HAZARDOUS INGREDIENTS / SARA TITLE III INFORMATION

COMPONENTS	CAS #	% BY WT	OSHA PEL	ACGIH TWA	SARA TITLE III	RPT QTY
None						

SECTION 3 - HAZARDS IDENTIFICATION

Inhalation	Inhalation may cause inflammation of mucous membranes and irritation.					
Eyes	Causes pain, reddening, and swelling of the conjunctiva.					
Skin	May cause irritation similar to a rash with localized edema, reddening, and raised lesions.					
Ingestion	There is no direct data available pertaining to the hazards associated with ingestion of this product. As with most chemicals, ingestion may cause					
	gastrointestinal irritation accompanied by nausea, vomiting, and diarrhea.					
Carcinogenicity	NTP?	No	IARC MONOGRAPHS?	No	OSHA REGULATED?	No

SECTION 4 - FIRST AID MEASURES

Inhalation	Immediately remove individual to fresh air. If individual has stopped breathing, give artificial respiration. Get immediate medical attention.
Eyes	Immediately flush eyes with plenty of cool, clean water for at least 15 minutes. Keep eyelids apart to maintain maximum contact with water.
	Do not allow the individual to rub their eyes. Get immediate medical attention.
Skin	Remove contaminated clothing and footwear. Wash thoroughly with water, and do not reuse clothing until properly cleaned.
	Discard footwear. If a rash should develop, get medical attention.
Ingestion	If victim is conscious and able to swallow, quickly have them drink water or milk to dilute. Do not give anything by mouth if victim is unconscious or having
	convulsions. Induce vomiting only if advised by a physician or poison control center. Contact a physician or Poison Control Center immediately.

SECTION 5 - FIRE AND EXPLOSION HAZARD DATA

Flash Point	>212 Degrees F	Flammable Limits	LOWER	N/A		
Method Used	Tag Closed Cup		UPPER	N/A		
Extinguishing Media	Use water spray, dry chemicals, foam, or carbon dioxide. Use water spray to keep fire exposed containers cool. If a spill has ignited, use water spray to disperse					
	the vapors. Water spray may be used to flush spills away from a fire and to dilute spills to non-flammable mixtures. Do not flush into a storm drain or public sewer.					
Special Firefighting	Do not direct a solid stream of water or foam into hot, burning pools; this may cause frothing and increase fire intensity. Use self-contained breathing apparatus					
Procedures	(SCBA) and proper personal protection clothing.					
Unusual Fire and	There are no known unusual fire and explosion hazards associated with this material in its virgin form. However, in a fire-fighting scenario involving multiple chemicals,					
Explosion Hazards	fire fighters should be aware of possible synergistic effects and attack the fire accordingly.					

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Land Release	This material may cause groundwater contamination. Contain as much material as possible. Begin a containerization process as soon as practical. Rinse spill area
	with water after cleanup is complete and containerize all rinse water.
Water Release	This material is soluble/dispersible in water. Stop source of spill if safe to do so. Divert all flow and contain. Remove and containerize or neutralize in place,
	then remove for proper disposal.
Air Release	Vapors may be suppressed by the use of a water fog. Contain all run-off water for proper disposal.

SECTION 7 - HANDLING AND STORAGE

Storage	This material is safe to store in well ventilated areas at ambient temperatures. Keep containers closed when not in use to prevent
	evaporative losses and possible contamination. Protect product from freezing.
Other Precautions	Eyewash and safety showers are recommended in the immediate work area. Check with you state OSHA to determine the need and maximum distance for
	stations to be placed in regards to possible chemical exposure.

SECTION 8 - CONTROL MEASURES

Respiratory Protection	If air contaminants exceed a TLV, PEL, or STEL, use a NIOSH-MSHA approved full-face , air purifying respirator with appropriate cartridge or SCBA. Respirators and
	cartridges should be selected based upon the form and concentration of the contaminants in accordance with applicable regulations.
Ventilation	Normal ventilation has been found to be generally adequate. The end-user must determine if the process or methods involved with the use of this material
	requires any additional or special ventilation.
Protective Gloves	Rubber, butyl, neoprene, or plastic gloves should be worn when using this material to avoid skin contact.
Eye Protection	Safety glasses with side shields are recommended.
Other Protective Equipment	Not generally required under normal working conditions. The end user must determine if the process or methods involved require other
	personal protection clothing or equipment.
Hygienic Practices	Do not eat, drink, or smoke in areas where chemicals are being stored or handled. Wash thoroughly before handling food or drink.

SECTION 9 - PHYSICAL/CHEMICAL CHARACTERISTICS

Appearance and Odor	White granular powder	pH	4.0 - 9.0 typical
Boiling Point	N/D	Specific Gravity	N/D
Vapor Density	N/D	Evaporation Rate	N/D
Solubility in Water	Completely soluble	Percent Volatiles	N/D

MATERIAL SAFETY DATA SHEET

SECTION 10 - REACTIVITY DATA

Stability	Stable
Conditions to Avoid	None known or noted
Materials to Avoid	Strong oxidizing agents
Hazardous Byproducts	Oxides of carbon and nitrogen
Hazardous Polymerization	Will not occur

PolymerVentures®

SECTION 11 - TOXICOLOGICAL INFORMATION

Toxicity Test Results	No information is available.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Impact	No information is available.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste disposal methods	Dispose of material in an approved chemical waste landfill or incinerate in accordance with applicable federal, state, and local regulations.
	Since empty containers retain material residues, all labeled hazard precautions must be observed.

SECTION 14 - TRANSPORTATION INFORMATION

This material is regulated by the DOT?	No
DOT Description from Hazardous Materials Table 49 CFR 172.101	Not regulated
Reportable Quantity if Applicable	No reportable materials

SECTION 15 -REGULATORY INFORMATION

REGULATION	REPORTABLE COMPONENTS
CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act)	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 302 and 304	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 311 and 312	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 313	Refer to Section 2 of the MSDS.
Clean Air Act, Section 111, Volatile Organic Compounds (VOC)	None
Clean Air Act, Section 112, Hazardous Air Pollutants	None
Clean Water Act, Section 307, Priority Pollutants List	None

SECTION 16 -ADDITIONAL INFORMATION

ABBREVIATION	DEFINITION	ABBREVIATION	DEFINITION
N/A	Not Applicable	TLV	Threshold Limit Value
N/E	Not Established	PEL	Personal Exposure Limit
N/D	Not Determined	STEL	Short Term Exposure Limit
UNK	Unknown	<	Less Than
EHS	Environmental, Health, and Safety Department	>	Greater Than
OSHA	Occupational Safety and Health Administration	PNOR	Particulates Not Otherwise Regulated
ACGIH	American Conference of Governmental Industrial Hygienists	PNOC	Particulates Not Otherwise Classified

*Please Note: The Hazardous Material Information System (HMIS) is a voluntary, subjective alpha-numeric symbolic system for recommending hazard risk and personal protection equipment information. It is a subjective rating system based on the evaluator's understanding of the chemical associated risks. The end-user must determine if the code is appropriate for their use.

The regulatory listings provided herein are not all inclusive of possible regulations affecting this material. It is the end-user's responsibility to determine all local, state, federal, or international regulations/restrictions that may apply.

SECTION 17 - DISCLAIMER

This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty, or guarantee is made as to its accuracy, reliability, or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use. We do not accept liability for any loss or damage that may occur from the use of this information nor do we offer warranty against patent infringement.

END MSDS

UNIVAR USA INC.

MATERIAL SAFETY DATA SHEET

REPORT NUMBER: 703

MSDS NO: DQ4950CR

VERSION: 018

PRODUCT: SULFURIC ACID 77% - 100%

UNIVAR USA INC.
17425 NE UNION HILL RD.
REDMOND, WA 98052
(425) 889-3400

EMERGENCY ASSISTANCE:
FOR EMERGENCY ASSISTANCE INVOLVING CHEMICALS CALL - CHEMTREC: (800) 424-9300

PRODUCT NAME: SULFURIC ACID 77% - 100%

MSDS NUMBER: DQ4950CR

ISSUED BY: 004690

MAINFRAME UPLOAD DATE: 02/12/07

MATERIAL SAFETY DATA SHEET

WHMIS (CLASSIFICATION):
CLASS D-I A: VERY TOXIC MATERIAL CAUSING IMMEDIATE AND SERIOUS EFFECTS
CLASS E: CORROSIVE MATERIAL

DATE ISSUED: 01/24/2007

SUPERSEDES: 01/24/2005

------SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ------

TRADE NAME: SULFURIC ACID 77% - 100%

PRODUCT CODE: NONE

DISTRIBUTED BY:
UNIVAR USA INC.
17425 NE UNION HILL ROAD
REDMOND, WA 98052
425-889-3400

PHONE NUMBER (TRANSPORTATION EMERGENCY):
U.S.A.: 1-800-424-9300 CHEMTREC

SYNONYMS:
DIHYDROGEN SULFATE
OIL OF VITRIOL
VITRIOL BROWN OIL ACIDE SULFURIQUE (FRENCH)

DSL (DOMESTIC SUBSTANCE LIST): LISTED

NAME / CHEMICAL FORMULA: SULFURIC ACID / H2SO4

CHEMICAL FAMILY: ACID

UTILIZATION: CHEMICAL INDUSTRIES

------SECTION 2. COMPOSITION AND INFORMATION ON INGREDIENTS ------

NAME	CAS #	PERCENTAGE %	EXPOSURE LIMITS ACGIH (U.S.A.) 2006 TLV-TWA (MG/M3)	OSHA (U.S.A.) PEL - TWA (MG/M3)
SULFURIC (ACID)	7664-93-9	77% TO 100%	0.2 (THORACIC FR.)	1
60 DEG TECHNICAL		77.7		
66 DEG TECHNICAL		93.2		
1.835 ELECTROLYTE		93.2		
98% TECHNICAL		98		
99% TECHNICAL		99		
100% TECHNICAL		100		
WATER	7732-18-5	0-22	N/E	N/E

N/E = NOT ESTABLISHED

ACGIH: AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS.
OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION.

NOTE:

SULFURIC (ACID): EXPOSURE LIMITS MAY BE DIFFERENT IN OTHER JURISDICTIONS.

NIOSH REL-TWA (.10 HOURS): 1 MG/M3

IDLH: 15 MG/M3

ORAL ACUTE (LD50): 2.140 MG/KG (RAT)

INHALATION ACUTE (LC50, 2 HOURS):
510 MG/M3 (RAT)
320 MG/M3 (MOUSE). (RTECS).

CONSULT LOCAL AUTHORITIES FOR ACCEPTABLE EXPOSURE LIMITS.

------SECTION 3. RISK IDENTIFICATION FOR HUMAN HEALTH ------

ROUTES OF ENTRY:
INGESTION.
INHALATION.
SKIN AND EYE CONTACTS.

CARCINOGENICITY:
STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID (OCCUPATIONAL EXPOSURES) PROVEN (HUMAN, GROUP 1, IARC); SUSPECTED (HUMAN, GROUP A2, ACGIH); GROUP X (NTP); CLASSIFICATION NOT APPLICABLE TO SULFURIC ACID AND SULFURIC ACID SOLUTIONS.

MUTAGENICITY: NOT APPLICABLE.

TERATOGENICITY: NOT APPLICABLE.

ACUTE EFFECTS:

SULFURIC (ACID):
MAY BE FATAL IF INHALED OR INGESTED IN LARGE QUANTITY.
LIQUIDS OR ACID MISTS
MAY PRODUCE TISSUE DAMAGE
MUCOUS MEMBRANES (EYES, MOUTH, RESPIRATORY TRACT). EXTREMELY DANGEROUS BY EYES AND SKIN CONTACT (CORROSIVE).
SEVERE IRRITANT FOR EYES
INFLAMMATION (REDNESS, WATERING, ITCHING). VERY DANGEROUS IN CASE OF INHALATION (MISTS) AT HIGH CONCENTRATIONS
MAY PRODUCE SEVERE IRRITATION OF RESPIRATORY TRACT (COUGHING, SHORTNESS OF BREATH, CHOKING).

------SECTION 4. FIRST AID MEASURES ------

EYE CONTACT:
REMOVE CONTACT LENSES IF PRESENT. IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER, HOLDING EYELIDS OPEN FOR AT LEAST 15 MINUTES. CONSULT A PHYSICIAN. POSSIBILITY OF CONJUNCTIVITIS, SEVERE IRRITATION, SEVERE BURNS, PERMANENT EYE DAMAGE.

SKIN CONTACT:
REMOVE CONTAMINATED CLOTHING AND SHOES AS QUICKLY AS POSSIBLE PROTECTING YOUR HANDS AND BODY. PLACE UNDER A DELUGE SHOWER FOR 15 MINUTES. FLUSH EXPOSED SKIN GENTLY AND THOROUGHLY WITH RUNNING WATER (PAY PARTICULAR ATTENTION TO FOLDS, CREVICES, CREASES, GROIN). CALL A PHYSICIAN IF IRRITATION PERSISTS. MAY IRRITATE SKIN, CAUSE BURNS (HIGHLY CORROSIVE) AND POSSIBILITY OF SOME SCARRING.

WASH CONTAMINATED CLOTHING BEFORE REUSING. WHILE THE PATIENT IS BEING TRANSPORTED TO A MEDICAL FACILITY, CONTINUE THE APPLICATION OF COLD, WET COMPRESSES. IF MEDICAL TREATMENT MUST BE DELAYED, REPEAT THE FLUSHING WITH COLD WATER OR SOAK THE AFFECTED AREA WITH COLD WATER TO HELP REMOVE THE LAST TRACES OF SULFURIC ACID. CREAMS OR OINTMENTS SHOULD NOT BE APPLIED BEFORE OR DURING THE WASHING PHASE OF TREATMENT.

INHALATION:

TAKE PRECAUTIONS TO AVOID SECONDARY CONTAMINATION BY RESIDUAL ACIDS. REMOVE THE PERSON TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION.

DIFFICULT BREATHING:
GIVE OXYGEN. GET IMMEDIATE MEDICAL ATTENTION. POSSIBILITY OF DAMAGE TO THE UPPER RESPIRATORY TRACT AND LUNG TISSUES. MAINTAIN OBSERVATION OF THE PATIENT FOR DELAYED ONSET OF PULMONARY EDEMA.

MAY CAUSE IRRITATION TO THE UPPER RESPIRATORY TRACT:
COUGHING, SORE THROAT, SHORTNESS OF BREATH.

INGESTION:

DO NOT INDUCE VOMITING. CONSCIOUS AND ALERT PERSON:
RINSE MOUTH WITH WATER AND GIVE 1/2 TO 1 CUP OF WATER OR MILK TO DILUTE MATERIAL.

SPONTANEOUS VOMITING:
KEEP HEAD BELOW HIPS TO PREVENT ASPIRATION; RINSE MOUTH AND GIVE 1/2 TO 1 CUP

OF WATER OR MILK.

UNCONSCIOUS PERSON:
DO NOT INDUCE VOMITING OR GIVE ANY LIQUID. IMMEDIATELY OBTAIN MEDICAL ATTENTION.

NOTES TO PHYSICIANS:
CONTINUED WASHING OF THE AFFECTED AREA WITH COLD OR ICED WATER WILL BE HELPFUL IN REMOVING THE LAST TRACES OF SULFURIC ACID. CREAMS OR OINTMENTS SHOULD NOT BE APPLIED BEFORE OR DURING THE WASHING PHASE OF THE TREATMENT.

------SECTION 5. FIRE AND EXPLOSION DATA ------

FLASH POINT: NOT AVAILABLE

FLAMMABLE LIMITS: NOT AVAILABLE

AUTO-IGNITION TEMPERATURE: NOT AVAILABLE

PRODUCTS OF COMBUSTION:
RELEASES OF SULFUR DIOXIDE AT EXTREMELY HIGH TEMPERATURES.

FIRE HAZARD: NOT FLAMMABLE

EXPLOSION HAZARD:
REACTS WITH MOST METALS, ESPECIALLY WHEN DILUTE
HYDROGEN GAS RELEASE EXTREMELY FLAMMABLE, EXPLOSIVE). RISK OF EXPLOSION WHEN ACID COMBINED WITH WATER ORGANIC MATERIALS OR BASE SOLUTIONS IN ENCLOSED SPACES (VACUUM TRUCKS, TANKS), FOLLOW APPROPRIATE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) CODES.

FIRE FIGHTING (INSTRUCTIONS):
USE MEDIA APPROPRIATE FOR SURROUNDING MATERIAL. USE WATER SPRAY TO COOL CONTAINERS EXPOSED TO FIRE; DO NOT GET WATER INSIDE CONTAINERS.

EVACUATE PERSONNEL TO A SAFE AREA. KEEP PERSONNEL REMOVED AND UPWIND OF FIRE. GENERATES HEAT UPON ADDITION OF WATER, WITH POSSIBILITY OF SPATTERING. WEAR FULL PROTECTIVE CLOTHING. RUNOFF FROM FIRE CONTROL MAY CAUSE POLLUTION. NEUTRALIZE RUN-OFF WITH LIME, SODA ASH, ETC., TO PREVENT CORROSION OF METALS AND FORMATION OF HYDROGEN GAS. WEAR SELF-CONTAINED BREATHING APPARATUS IF FUMES OR MISTS ARE PRESENT.

------SECTION 6. ACCIDENTAL RELEASE MEASURES ------

SPILL:
REVIEW FIRE AND EXPLOSION HAZARDS AND SAFETY PRECAUTIONS BEFORE PROCEEDING WITH CLEAN UP. STOP FLOW IF POSSIBLE. SOAK UP SMALL SPILLS WITH DRY SAND, CLAY OR DIATOMACEOUS EARTH.

DIKE LARGE SPILLS, AND CAUTIOUSLY DILUTE AND NEUTRALIZE WITH LIME OR SODA ASH, AND TRANSFER TO WASTE WATER TREATMENT SYSTEM. PREVENT LIQUID FROM ENTERING SEWERS, WATERWAYS, OR LOW AREAS.

IF THIS PRODUCT IS SPILLED AND NOT RECOVERED, OR IS RECOVERED AS A WASTE FOR TREATMENT OR DISPOSAL, THE REPORTABLE QUANTITY (U.S. DOT) IS 1000 LBS (BASED ON THE SULFURIC ACID CONTENT OF THE SOLUTION SPILLED). COMPLY WITH FEDERAL, STATE, AND LOCAL REGULATIONS ON REPORTING RELEASES.

PERSONAL PROTECTION:
REVIEW FIRE FIGHTING MEASURES AND HANDLING (PERSONNEL PROTECTION) SECTIONS BEFORE PROCEEDING WITH CLEANUP. USE APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT

DURING CLEAN-UP.

------SECTION 7. HANDLING AND STORAGE / ENGINEERING CONTROLS AND ------ PERSONAL PROTECTION

HANDLING:
DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING. AVOID BREATHING VAPORS OR MIST. WEAR APPROVED RESPIRATORS IF ADEQUATE VENTILATION CANNOT BE PROVIDED. WASH THOROUGHLY AFTER HANDLING.

INGESTION OR INHALATION:
SEEK MEDICAL ADVICE IMMEDIATELY AND PROVIDE MEDICAL PERSONNEL WITH A COPY OF THIS MSDS.

STORAGE:
KEEP CONTAINER TIGHTLY CLOSED AND CLOSURE UP (DRUM) TO PREVENT LEAKAGE. DO NOT ADD WATER TO CONTENTS WHILE IN CONTAINER BECAUSE OF VIOLENT REACTION.
KEEP OUT OF SUN AND AWAY FROM HEAT, SPARKS, AND FLAME.

LOOSEN CLOSURE CAREFULLY. RELIEVE INTERNAL PRESSURE WHEN RECEIVED AND AT LEAST WEEKLY THEREAFTER. DO NOT USE PRESSURE TO EMPTY. BE SURE CLOSURE IS SECURELY FASTENED BEFORE MOVING CONTAINER. DO NOT WASH OUT CONTAINER OR USE IT FOR OTHER PURPOSES:
REPLACE CLOSURE AFTER EACH WITHDRAWAL AND RETURN IT WITH EMPTY CONTAINER.

------SECTION 8. ENGINEERING CONTROLS AND PERSONAL PROTECTION ------

ENGINEERING CONTROLS:
GOOD GENERAL VENTILATION SHOULD BE PROVIDED TO KEEP VAPOR AND MIST CONCENTRATIONS BELOW THE EXPOSURE LIMITS.

PERSONAL PROTECTION:
CHEMICAL SPLASH GOGGLES; FULL-LENGTH FACE SHIELD-CHEMICAL SPLASH GOGGLES COMBINATION; ACID-PROOF GAUNTLET GLOVES, APRON, AND BOOTS; LONG SLEEVE WOOL, ACRYLIC, OR POLYESTER CLOTHING; ACID PROOF SUIT AND HOOD; APPROPRIATE NIOSH RESPIRATORY PROTECTION.

IN CASE OF EMERGENCY OR WHERE THERE IS A STRONG POSSIBILITY OF CONSIDERABLE EXPOSURE, WEAR A COMPLETE ACID SUIT WITH HOOD, BOOTS, AND GLOVES. IF ACID VAPOR OR MIST ARE PRESENT AND EXPOSURE LIMITS MAY BE EXCEEDED, WEAR APPROPRIATE NIOSH RESPIRATORY PROTECTION.

------SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES ------

PHYSICAL STATE AND APPEARANCE: LIQUID (OILY; CLEAR TO TURBID)

ODOR: ODORLESS

MOLECULAR WEIGHT: 98.08

COLOR: COLORLESS TO LIGHT GREY

pH (1% SOLN/WATER): <1

VOLATILITY: <1 (BUTYL ACETATE = 1.0)

BOILING POINT: 193 DEG C TO 327 DEG C (379 DEG F TO 621 DEG F) @ 760 MMHg

VAPOR DENSITY: 3.4

MELTING POINT: -35 DEG C TO 11 DEG C (-31 DEG F TO 52 DEG F)

DISPERSION: YES (WATER)

VAPOR PRESSURE:
<0.3 MMHg @ 25 DEG C (77 DEG F)
<0.6 MMHg @ 38 DEG C (100 DEG F)

SOLUBILITY: YES (WATER)

GRADE	BOILING POINT DEG C	BOILING POINT DEG F	FREEZING POINT DEG C	FREEZING POINT DEG F
60 DEG TECHNICAL	193	380	- 12	10
66 DEG TECHNICAL	279	535	- 35	- 31
1.835 ELECTROLYTE	279	535	- 35	- 31
98% TECHNICAL	327	621	- 2	29
99% TECHNICAL	310	590	4	40
100% TECHNICAL	274	526	11	51

SPECIFIC GRAVITY:
60 DEG TECHNICAL: 1.706
66 DEG TECHNICAL: 1.835
1.835 ELECTROLYTE: 1.835
98% TECHNICAL: 1.844
99% TECHNICAL: 1.842
100% TECHNICAL: 1.839

------SECTION 10. STABILITY AND REACTIVITY DATA ------

STABILITY: YES

CONDITIONS OF INSTABILITY:
REACTS VIOLENTLY WITH WATER AND ORGANIC MATERIALS WITH EVOLUTION OF HEAT.

POLYMERIZATION: POLYMERIZATION WILL NOT OCCUR.

INCOMPATIBILITIES:

VIGOROUS REACTIONS WITH:
WATER
ALKALINE SOLUTIONS
METALS, METAL POWDER
CARBIDES
CHLORATES
FULMINATES
NITRATES
PICRATES
STRONG OXIDIZING, REDUCING, OR COMBUSTIBLE ORGANIC MATERIALS. HAZARDOUS GASES ARE EVOLVED ON CONTACT WITH CHEMICALS SUCH AS CYANIDES, SULFIDES, AND CARBIDES.

CORROSIVITY: YES

------SECTION 11. TOXICOLOGICAL INFORMATION ------

CHRONIC EFFECTS:

SULFURIC ACID:
OVEREXPOSURE TO STRONG INORGANIC MISTS CONTAINING SULFURIC ACID POSSIBILITY OF LARYNGEAL CANCER (HSBD, IARC). TARGET ORGANS FOR ACUTE AND CHRONIC OVEREXPOSURE (NIOSH 90-117)
RESPIRATORY SYSTEM, EYES, SKIN, TEETH.

MISTS:
POSSIBILITY OF IRRITATION OF THE NOSE AND THROAT WITH SNEEZING, SORE THROAT OR RUNNY NOSE, HEADACHE, NAUSEA AND WEAKNESS. GROSS OVEREXPOSURE POSSIBILITY OF IRRITATION OF NOSE, THROAT, LUNGS WITH COUGH, DIFFICULTY BREATHING OR SHORTNESS OF BREATH. PULMONARY EDEMA WITH COUGH, WHEEZING, ABNORMAL LUNG SOUNDS, POSSIBLY PROGRESSING TO SEVERE SHORTNESS OF BREATH AND BLUISH DISCOLORATION OF THE SKIN. SYMPTOMS MAY BE DELAYED. REPEATED OR PROLONGED EXPOSURE TO MISTS MAY CAUSE
CORROSION OF TEETH.

CONTACT (SKIN):

POSSIBILITY OF CORROSION, BURNS OR ULCERS. CONTACT WITH A 1% SOLUTION:
POSSIBILITY OF SLIGHT IRRITATION WITH ITCHING, REDNESS OR SWELLING.

REPEATED OR PROLONGED EXPOSURE (MIST):
POSSIBILITY OF IRRITATION WITH ITCHING, BURNING, REDNESS, SWELLING OR RASH.

CONTACT (EYE):
POSSIBILITY OF CORROSION OR ULCERATION (BLINDNESS MAY RESULT). REPEATED OR PROLONGED EXPOSURE (MIST):
POSSIBILITY OF EYE IRRITATION WITH TEARING, PAIN OR BLURRED VISION.

INGESTION:

IMMEDIATE EFFECTS OF OVEREXPOSURE:
BURNS OF THE MOUTH, THROAT, ESOPHAGUS AND STOMACH, WITH SEVERE PAIN, BLEEDING, VOMITING, DIARRHEA AND COLLAPSE OF BLOOD PRESSURE. DAMAGE MAY APPEAR DAYS AFTER EXPOSURE.

TOXICITY:
PERSONS WITH THE FOLLOWING PRE-EXISTING CONDITIONS WARRANT PARTICULAR ATTENTION

SULFURIC ACID:
LARYNGEAL IRRITATION.
EATING, DRINKING AND SMOKING MUST BE PROHIBITED IN AREAS WHERE THIS MATERIAL IS HANDLED AND PROCESSED. WASH HANDS AND FACE BEFORE EATING, DRINKING AND SMOKING.

------SECTION 12. ECOTOXICOLOGICAL INFORMATION ------

ECOTOXICITY:

AQUATIC TOXICITY: SLIGHTLY TO MODERATELY TOXIC.

BLUEGILL SUNFISH (LC50; 48 HOURS):
49 MG/L (TAP WATER, 20 DEG C, CONDITIONS OF BIOASSAY NOT SPECIFIED). (HSBD).

FLOUNDER (LC50; 48 HOURS):
100-330 MG/L (AERATED WATER, CONDITIONS OF BIOASSAY NOT SPECIFIED). (HSBD).

TOXICITY TO ANIMALS:

EYE: CONCENTRATED COMPOUND IS CORROSIVE.
10% SOLUTION: MODERATE EYE IRRITANT.

SKIN: CONCENTRATED COMPOUND IS CORROSIVE.
10% SOLUTION: SLIGHT SKIN IRRITANT.

SINGLE AND REPEATED EXPOSURE:
IRRITATION OF THE RESPIRATORY TRACT
CORROSION OF THE RESPIRATORY TRACT
LUNG DAMAGE
LABORED BREATHING
ALTERED RESPIRATORY RATE
PULMONARY EDEMA.

REPEATED EXPOSURE: ALTERED RED BLOOD CELL COUNT.

BIODEGRADATION PRODUCTS: NOT AVAILABLE

BIODEGRADATION PRODUCTS (TOXICITY): NOT APPLICABLE

REMARKS ON ENVIRONMENT:
DUE TO THE PRODUCT'S COMPOSITION, PARTICULAR ATTENTION MUST BE TAKEN FOR TRANSPORTATION AND STORAGE. PROTECT FROM RAIN BECAUSE THE RUN-OFF WATER WILL BECOME ACIDIC AND MAY BE HARMFUL TO FLORA AND FAUNA.

BOD5 AND COD: NOT AVAILABLE

------SECTION 13. DISPOSAL ARRANGEMENTS ------

WASTE DISPOSAL:
CLEANED-UP MATERIAL MAY BE AN HAZARDOUS WASTE ON RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) ON DISPOSAL DUE TO THE CORROSIVITY CHARACTERISTIC. DO NOT FLUSH TO SURFACE WATER OR SANITARY SEWER SYSTEM. COMPLY WITH FEDERAL, STATE, AND LOCAL REGULATIONS. IF APPROVED, NEUTRALIZE AND TRANSFER TO WASTE TREATMENT SYSTEM.

------SECTION 14. TRANSPORT INFORMATION ------

TDG (PICTOGRAMS): CLASS 8 CORROSIVES

PIN: UN1830 SULFURIC ACID

PG: II

SPECIAL PROVISIONS (TRANSPORT): NONE

------SECTION 15 OTHER REGULATIONS ------

OTHER REGULATIONS:

DOT (U.S.A.)/IMO:
PROPER SHIPPING NAME: SULFURIC ACID
HAZARD CLASS: 8
UN NO.: 1830
DOT/IMO LABEL: CORROSIVE
PACKING GROUP: II
REPORTABLE QUANTITY: 1000 LBS (454 KG)
SHIPPING CONTAINERS: TANK CARS, TANK TRUCKS, VESSEL
EU (DIRECTIVE 67/548/EEC):
SULFURIC (ACID): ANNEX I

INDEX NUMBER:

016-020-00-8
EU CONSOLIDATED INVENTORIES

EC NUMBER: 231639

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA):
ON THE DOMESTIC SUBSTANCES LIST (DSL)
ACCEPTABLE FOR USE UNDER THE PROVISIONS OF CEPA.

CERCLA SECTION 103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

SARA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355): YES

SARA SECTION 313, TOXIC CHEMICALS (40 CFR 372.65):

US:
TSCA INVENTORY: LISTED

SULFURIC (ACID) (FINAL RQ): 1000 POUNDS (454 KG)

SULFURIC ACID IS SUBJECT TO REPORTING REQUIREMENTS OF SECTION 313, TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA), 40 CFR PART 372.

CERTAIN COMPANIES MUST REPORT EMISSIONS OF SULFURIC ACID AS REQUIRED UNDER THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT OF 1980 (CERCLA), 40 CFR PART 302

FOR MORE INFORMATION CALL THE SARA HOTLINE: 800-424-9346.

STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID:
CHEMICAL LISTED EFFECTIVE MARCH 14, 2003 TO THE STATE OF CALIFORNIA, PROPOSAL 65.

SULFURIC ACID IS A CLASS B DRUG PRECURSOR UNDER HEALTH CANADA'S CONTROLLED DRUGS AND SUBSTANCES ACT AND PRECURSOR CONTROL REGULATIONS.

U.S. FDA FOOD BIOTERRORISM REGULATIONS:
THESE REGULATIONS APPLY TO SULFURIC ACID WHEN BEING DISTRIBUTED, STORED OR USED FOR FOOD OR FOOD PROCESSING.

CLASSIFICATIONS HCS (U.S.A.):
DANGEROUS MAY CAUSE CANCER
CORROSIVE LIQUID

CLASSIFICATION DSCL (EEC):

R35: CAUSES SEVERE BURNS
R8: CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE

S26:
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE

S30: NEVER ADD WATER TO THIS PRODUCT

S36/37/39: WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION

S45:
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION) (USA):

HEALTH 3
FIRE HAZARD 0
REACTIVITY 2

NPCA-HMIS RATING:
HEALTH 3
FIRE HAZARD 0
REACTIVITY 2

------SECTION 16. OTHER INFORMATION ------

REFERENCES:

TLVS AND BEIS (2006). BASED ON THE DOCUMENTATION OF THE THRESHOLD LIMIT VALUES FOR CHEMICAL SUBSTANCES AND PHYSICAL AGENTS & BIOLOGICAL EXPOSURE INDICES. ACGIH, CINCINNATI, OH 2 HTTP://WWW.ACGIH.ORG

CCOHS (2006):
CANADIAN CENTRE FOR OCCUPATIONAL HEALTH AND SAFETY 2 HTTP://WWW.CCOHS.CA/

CSST (2006):
COMMISSION DE LA SANTE ET DE LA SECURITE DU TRAVAIL (QUEBEC). SERVICE DU REPERTOIRE TOXICOLOGIQUE - HTTP://WWW.REPTOX.CSST.QC.CA/

HSDB (2006):
HAZARDOUS SUBSTANCES DATA BANK. TOXNET. NETWORK OF DATABASES ON TOXICOLOGY, HAZARDOUS CHEMICALS, AND ENVIRONMENTAL HEALTH. NLM DATABASES & ELECTRONIC RESOURCES, U.S. NATIONAL LIBRARY OF MEDICINE, NHI, 8600 ROCKVILLE PIKE, BETHESDA, MD 20894 - HTTP://TOXNET.NIM.NIH.GOV/CGI-BIN/SIS/HTMLGEN?HSDB

IARC:
MONOGRAPHS ON THE EVALUATION OF CARCINOGENIC RISKS TO HUMANS COLLECTION) - HTTP://WWW-CIE.IARC.FR/-MERCK INDEX (1999). MERCK & CO., INC., 12TH EDITION

NIOSH U.S. (2006):
POCKET GUIDE TO CHEMICAL HAZARDS 2 HTTP://WWW.CDC.GOVINIOSH/NPG/

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK DOCUMENTS (2004), DEVELOPED BY THE U.S. DEPARTMENT OF TRANSPORTATION, TRANSPORT CANADA, AND THE SECRETARIAT OF COMMUNICATIONS AND TRANSPORTATION OF MEXICO - PATTY'S INDUSTRIAL HYGIENE AND TOXICOLOGY, 3RD REVISED EDITION

REGALEMENT SUR LES PRODUITS CONMILES (CANADA)

RTECS (2006). REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES, NIOSH, COC

TOXICOLOGIE INDUSTRIELLE & INTOXICATION PROFESSIONNELLE, 3E EDITION, LAUWERYS

GLOSSARY:
CSST: COMMISSION DE LA SANTE ET DE LA SECURITE DU TRAVAIL (QUEBEC).
HSDB: HAZARDOUS SUBSTANCES DATA BANK.
IARC: INTERNATIONAL AGENCY FOR RESEARCH ON CANCER.
NIOSH: NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH.
NTP: U.S. NATIONAL TOXICOLOGY PROGRAM.
RTECS: REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES

BECAUSE OF ITS CORROSIVE CHARACTERISTICS AND INHERENT HAZARDS, SULFURIC ACID SHOULD NOT BE USED IN SEWER OR DRAIN CLEANERS OR ANY SIMILAR APPLICATION; REGARDLESS OF WHETHER THEY ARE FORMULATED FOR RESIDENTIAL, COMMERCIAL OR INDUSTRIAL USE. VENDOR WILL NOT KNOWINGLY SELL SULFURIC ACID TO INDIVIDUALS OR COMPANIES WHO REPACKAGE THE PRODUCT FOR SALE AS SEWER OR DRAIN CLEANERS, OR ANY OTHER SIMILAR USE.

FOR ADDITIONAL INFORMATION:

CONTACT: MSDS COORDINATOR

UNIVAR USA INC.

DURING BUSINESS HOURS, PACIFIC TIME: (425)889-3400

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APPENDIX T-C
WATER QUALITY MONITORING PLAN

Water Quality Monitoring Plan

Climax Molybdenum Company
Climax Mine and Mill
DRMS Permit No. M-1977-493

Prepared for:

Climax Molybdenum
A Freeport-McMoRan Company

Fremont Pass, Highway 91
Climax, CO 80429

Prepared by:

TETRA TECH

350 Indiana Street, Suite 500
Golden, CO 80401
(303) 217-5700

Tetra Tech Project No. 114-010428

Version R3 by Climax Mine
September 2014

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1.0 PURPOSE

Climax Molybdenum Company – Climax Mine (Climax) prepared this Water Quality Monitoring Plan (Plan) pursuant to Rule 3.1.7(5) of the Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for Hard Rock, Metal, and Designated Mining Operations. The Plan outlines a formal monitoring program to demonstrate that the Environmental Protection Plan (EPP) requirements are being met. This plan is being submitted together with an updated EPP as Technical Revision 24 (TR-24) to Climax Reclamation Permit No. M-1977-493.

A Water Quality Monitoring Plan for the Climax Mine was previously submitted to the Division of Reclamation Mining and Safety (DRMS) as TR-18 in December 2011. That plan included existing and proposed new monitoring locations and a monitoring schedule, which has been followed since that time and is still being followed. This Plan supersedes the 2011 plan with updated information on new monitoring locations, including groundwater points of compliance and internal groundwater monitoring locations between mine facilities and downgradient points of compliance. This Plan therefore contains much of the same information as TR-18 but with updated information, where applicable, to reflect current conditions

The Climax operations are located in three distinct watersheds: the Arkansas River Valley, Eagle River Valley, and Tenmile Creek Valley. Figure 1 shows the location of the Climax Mine Site, identifies major site feature, and delineates the three drainage basins. Specific conditions within each watershed are addressed individually throughout this document.

2.0 SITE DESCRIPTION

2.1 General Setting

The Climax Mine is located primarily within the Tenmile Mining District, extending into Summit, Lake, Eagle and Park Counties of Colorado. The mine site includes an open pit mine, underground mine workings, mill/crusher facilities, associated tailings impoundments, and water control facilities. The terrain at the site is mountainous with elevations ranging from approximately 10,800 feet above mean sea level (msl) in the vicinity of the mine to more than 14,000 feet msl on nearby mountain peaks. Weather conditions can be severe at the mine, with temperatures ranging from -20°F to mid-70°F and an annual average snowfall of 272 inches. Average annual precipitation is 23 inches, about 80 to 90 percent falls as snow.

Within the site there are three primary watersheds: the Arkansas River Valley, Eagle River Valley, and Tenmile Creek Valley. The mine and mill are located on the Continental Divide between Tenmile Creek and the East Fork of the Arkansas River, with the tailing impoundments located in the Tenmile Creek Valley and the Eagle River Valley (Figure 1).

Climax maintains a well within the Tenmile Watershed (McNulty Well) that can be used if needed, together with surface water sources, as makeup water for lime slaking and feed to a small potable water treatment system at the Sludge Densification Plant (SDP). Climax also constructed an industrial supply well within the Tenmile drainage alluvium for mixing water treatment chemicals at the Property Discharge Water Treatment Plant (PDWTP), and constructed a bedrock well along the West Interceptor road west of the PDWTP to provide water for potable use at the PDWTP. The PDWTP wells are described in TR-19.

Raw water for industrial uses in the mill and treatment for potable water is delivered from the Arkansas Pond, created by former gravel quarry operations in the upper Arkansas River Watershed. Although this location is identified as the Arkansas Well, it is essentially a surface water intake into a wet well. A submersible pump installed in the wet well delivers water to a clear well at the water treatment building in the mill area. Raw water is delivered directly from the clear well to the raw water storage tank, and a portion of the water is directed to a small potable water treatment plant.

2.2 Site Hydrogeology

Climax Mine is located in the Mosquito-Tenmile Range of the southern Rocky Mountain Cordillera. The ore body is hosted by two Precambrian rock formations, the Idaho Springs Formation, and the Silver Plume Granite. The Idaho Springs Formation is a meta-sedimentary rock, metamorphosed 1.7 billion years ago during a period of major geologic activity. Its major components are biotite schist and gneiss. Silver Plume Granite occurs in stocks, dikes and sills that intruded the Idaho Springs Formation approximately 1.4 billion years ago. These two formations also are intruded, to a lesser degree, by early Tertiary diorite porphyry and quartz monzonite approximately 60 million years old.

The Climax ore body lies just east of the Mosquito Fault, an important local structure that trends roughly north-south, and that dips approximately 60 degrees to the west. The fault, as shown on Figure 1, runs north-northeastward across the Tenmile Creek valley over a distance of approximately 30 miles. The Mosquito Fault presents a discontinuity between the Precambrian bedrock on the east with the Paleozoic and Tertiary bedrock on the west.

Groundwater in the vicinity of the Climax Mine site is generally present within a thin veneer of alluvium and glacial till overlaying the bedrock, and ranges from near ground surface to a few tens of feet below ground surface. Groundwater occurrence within the bedrock is limited to the upper fractured portion of the bedrock units. A hydrogeologic study of the underground workings (Titan, 1994) indicated that the bulk permeability of the bedrock is relatively low and that the bedrock is not capable of transporting significant quantities of groundwater.

Additionally, it was shown that the presence of the Mosquito Fault provides a hydraulic barrier to lateral flow of groundwater flow in the bedrock.

The direction of groundwater flow is generally coincident with the surface water drainages, where groundwater discharges into streams and creeks. The following sections present a discussion on the hydrogeologic conditions specific to the three watersheds at the Climax mine site.

Due to the location of Climax facilities within three different watersheds, each drainage basin is described separately in the following sections of this Plan. The descriptions include hydrogeological setting and selection of monitoring sites. Additional information on site hydrogeology is in the conceptual hydrogeological model provided to DRMS in May 2012 to fulfill commitments made in TR-18.

2.3 Monitoring Network

In accordance with the 2011 Water Quality Monitoring Plan submitted as TR-18, Climax has been conducting monitoring of groundwater quality within each of the watersheds at multiple locations in the Arkansas River Watershed, the Eagle River Watershed, and the Tenmile Creek Watershed. These monitoring wells have generally been sampled quarterly, weather and site conditions permitting, since the submittal of the 2011 Monitoring Plan, and analytical data for this period of record can be found in the Annual Reports Climax submits to DRMS. In accordance with TR-18, groundwater and surface water samples are being analyzed for the constituents specified in Tables 4-1, 4-2, and 4-3.

As a result of discussions with DRMS and the reservoir companies adjacent to Climax, several new monitoring sites were established during 2012. These new sites are identified, as appropriate, in the following sections of this Plan.

The Climax water management and treatment system treats surface water and underground water collected within the three drainage basins and discharges treated waters into Tenmile Creek at Outfall 001A. This surface water discharge is authorized under Colorado Discharge Permit System (CDPS) discharge permit No. CO0000248. Surface water sampling at the outfall is performed in accordance with this permit, and is not included in this Plan. Compliance with the discharge requirements demonstrates the overall effectiveness of the collection and treatment protection facilities.

3.0 CLIMAX DRAINAGE BASINS AND SELECTION OF MONITORING SITES

This section provides the rationale for selecting the Point of Compliance (POC) and internal monitoring locations in each drainage, and includes a summary of:

- Use classifications for stream segments in each watershed;
- Existing and potential future uses of groundwater;
- Potential contaminant sources;
- Hydrogeologic conditions; and
- Monitoring locations.

3.1 Arkansas River Watershed

The Arkansas River Watershed is located south of the open pit and mill facilities on the east side of the Continental Divide (Figure 1).

3.1.1 Existing and Potential Future Uses of Groundwater

Groundwater in the Arkansas River drainage basin at the Climax Mine flows mainly in a thin lens of alluvium and weathered bedrock that is bounded on all sides by lower permeability bedrock. The Water Quality Control Commission (WQCC) has not adopted classifications or site-specific groundwater standards in the Arkansas River Watershed in the vicinity of the Climax Mine. Raw water for industrial uses in the mill and treatment for potable water is delivered from the Arkansas Pond that was created by former gravel quarry operations in the upper Arkansas River Watershed. The source of this raw water is identified as the Arkansas Well. Unlike groundwater monitoring wells, the Arkansas Well is essentially a surface water intake into a wet well. A submersible pump installed in the wet well delivers water to a clear well at the water treatment building in the mill area. For the purposes of potable water treatment system permitting, this source is identified as groundwater under the influence of surface water.

3.1.2 Location and Description of Classified Stream Segments

Arkansas River Basin Segment 1b is the mainstem of the East Fork of the Arkansas River located from the source to a point immediately above the confluence above Bird's Eye Gulch. Segment 1b is classified as Aquatic Life Cold 1, Recreation E, and Water Supply.

3.1.3 Potential Contaminant Sources and EPFs

The upper Arkansas River Watershed contains portions of the Climax site that supported the historic underground mining operations. Prior to closure of the underground mine, the entrance to the underground operation at Climax was through 5-Shaft and the Storke Portal at the Storke Yard just east of the hairpin turn on Highway 91, in the upper Arkansas River Watershed. Potential contaminant sources and established environmental protection facilities within this portion of the site are identified and described in Section T-5.1 of the EPP.

3.1.4 Hydrogeology

Within the Arkansas River Watershed, groundwater occurs very close to the ground surface within layers of alluvial sands and gravels, and glacially derived silts and clays. These soils overlay the Paleozoic Minturn Formation (west of the Mosquito Fault) and the Precambrian Silver Plume Granite (east of the Mosquito Fault).

The thickness of the alluvial and glacial soils ranges between 10 and 40 feet in the Arkansas drainage. Hydraulic properties of the bedrock and soils in the drainage have not been measured, however, the results of a hydrogeologic evaluation on the flooding of the underground workings (Titan, 1994) determined that the bedrock on the east side of the Mosquito Fault is of low permeability and not capable of transmitting significant quantities of groundwater. This evaluation also determined that the seams of clay and fault gouge associated with the Mosquito Fault create a hydraulic barrier to east-west groundwater flow between the bedrock units.

Demonstration of the Mosquito Fault as a hydraulic barrier to potential process water impacts to the Arkansas was discussed with Allen Sorenson of DRMS during a site inspection and in verbal and written correspondence in the fall of 1994. Subsequent geophysical evaluations were performed to establish the criteria to maintain water levels 19 feet below the apex of the Mosquito Fault. The Mosquito Fault is located approximately 350 ft west of the 5 Shaft. A pumping station installed in 5-Shaft maintains the water level at an elevation (11,080 ft msl) that does not allow the flow of impacted water to the Arkansas River Valley. The level of water in 5-Shaft is kept below the apex of the Mosquito Fault to prevent mine water from potentially impacting the Arkansas River. Climax also monitors a well located approximately 60 feet from the 5-shaft for changes in water level.

Groundwater flow direction in the Arkansas River Watershed is generally westward, paralleling the flow of the Arkansas River. As in the Tenmile drainage, the groundwater flow is controlled by the bedrock topography.

3.1.5 Groundwater Monitoring Sites

3.1.5.1 POC Monitoring Site

The groundwater quality in the Arkansas River Valley has historically been monitored by well ARwell located downgradient of the Arkansas Pond (Figure 2). ARwell was constructed in September of 1993, and the well log is included in Appendix A. ARwell was completed in alluvium and is therefore representative of alluvial groundwater conditions in the valley below Climax facilities. Climax constructed a deeper, bedrock POC well (ARK-MW-001D) adjacent to ARwell in 2012 so that both shallow and deeper hydrostratigraphic units are monitored. Section 4 of this Plan describes the monitoring parameters and schedule and Section 5 describes the numeric protection levels and data evaluation procedures. Well logs are in Appendix A and water quality monitoring data are in Annual Reports to DRMS.

3.1.5.2 Internal Groundwater Monitoring Site

Climax has established additional groundwater monitoring sites in the Arkansas River Watershed between the ARwell POC location and the Mosquito Fault to monitor groundwater conditions closer to mine facilities. The paired wells, ARK-MW-002S (alluvium) and ARK-MW-002D (bedrock), are identified on Figure 2 and well logs are in Appendix A. Section 4 of this Plan describes the monitoring parameters and schedule and Section 5 describes the data evaluation procedures. Water quality monitoring data are in Annual Reports to DRMS.

3.1.6 Surface Water Monitoring Sites

Climax has previously established surface water monitoring sites in the Arkansas River at locations, both upstream and downstream of mine facilities (Arkansas #1 and Arkansas #2, respectively). Monitoring parameters, and monitoring frequencies for sampling are addressed in Section 4 and water quality monitoring data are in Annual Reports to DRMS.

3.2 Eagle River Watershed

As illustrated on Figure 1, the Eagle River Watershed is located in the western portion of the Site below the crest of 1 Dam.

3.2.1 Existing and Potential Future Uses of Groundwater

Groundwater in the upper Eagle River Watershed within the Climax Mine property boundary occurs primarily in the areas downstream of the former Robinson Tailings Storage Facility (TSF) and Robinson Lake. Upstream of the Eagle Park Reservoir, significant and continuous groundwater flow in the alluvium and bedrock throughout the valley is unlikely as groundwater flow is intercepted by the reservoirs and the cut-off wall associated with the Robinson Lake Seepage Collection system. The WQCC has not adopted classifications or site-specific groundwater standards in the Eagle River Watershed in the vicinity of the Climax Mine. Within these areas, current and future domestic or agricultural development of groundwater would not be likely given the site location and climate conditions. The current use of groundwater is limited to recharge of the East Fork Eagle River and Eagle Park Reservoir, which are classified for aquatic life, recreation, water supply, and agricultural uses.

3.2.2 Location and Description of Classified Stream Segments

Eagle River basin, Segment 3, contains all tributaries to the Eagle River, including wetlands, from the source to the compressor house bridge at Belden. Exceptions include; Segment 4 - the mainstem of Homestake Creek from the confluence of the East Fork to the confluence with the Eagle River as well as Segment 1 - all tributaries and wetlands to the Eagle River system within the Gore Range - Eagle's Nest and Holy Cross Wilderness Area.

Segment 3 of the Eagle River basin is classified as Aquatic Life Cold 1, Recreation E, Water Supply, and Agriculture.

3.2.3 Potential Contamination Sources and EPFs

The Eagle River Watershed is bounded on the east by 1 Dam, the western embankment of the former Robinson TSF, and contains two fresh water reservoirs (Eagle Park and Chalk Mountain), as well as Robinson Lake, which stores process water for use in the mill. Reclaimed process water decanted from the TSFs is delivered to Robinson Lake via the Tenmile Tunnel. Potential contaminant sources and established environmental protection facilities within this portion of the site are identified and described in Section T-5.2 of the EPP.

3.2.4 Hydrogeology

The groundwater in the upper Eagle River Watershed occurs primarily in the shallow alluvium above the bedrock. Data from test pits (Kumar and Assoc., 1993) located north-west of Robinson Lake indicated that groundwater is present close to the ground surface and that alluvium in the valley consists primarily of silts, sands, and gravels. The alluvium overlays bedrock consisting of the Minturn Formation and Tertiary-aged quartz monzonite intrusives.

The hydraulic properties of the Minturn Formation were determined from field packer tests conducted in open borings. A total of fifteen tests were conducted in four borings. The results of the packer tests indicate that the hydraulic conductivity of the Minturn Formation ranges from 0 to 2900 ft/yr, with an average conductivity of 480 ft/yr. (Kumar & Assoc., 1994). Hydraulic properties of the overlaying alluvium were not measured, but the hydraulic conductivity of sands and gravels typically range between 1,000 to 1 x 10^6 ft/yr (Freeze and Cherry, 1979). As in the other drainages at Climax, the bedrock topography controls the direction of groundwater flow.

Groundwater flow in the valley is also influenced by the presence of three surface water bodies: Chalk Mountain Reservoir, Robinson Lake, and Eagle Park Reservoir. Each of these reservoirs was constructed by excavating and building an engineered dam to impound water. Construction records for each dam indicate that a low permeability cut-off wall was excavated into the underlying bedrock to control groundwater. Cut-off trenches under each dam present a physical barrier to groundwater flow. Therefore, significant and continuous groundwater flow in the alluvium and bedrock throughout the valley is unlikely as groundwater flow is intercepted by the reservoirs.

Eagle Park Reservoir is privately owned and is located above the East Fork of the Eagle River and below Climax facilities (Figure 1). Seepage emanating from the toe of No.4 Dam is collected in a collection sump keyed into bedrock and pumped back to Robinson Lake. The average, intermittent pumping rate for the sump is approximately 10 gpm which reflects the low rate of groundwater flow in this area.

3.2.5 Groundwater Monitoring Sites

3.2.5.1 POC Groundwater Monitoring Site

A shallow/deep pair of property boundary POC monitoring wells (EVMW-3S (alluvium) and EVMW-3D (bedrock)) were constructed near the East Fork Pumping Station at the Climax property boundary above the East Fork of the Eagle River and downgradient of 4 Dam (a.k.a. Eagle Park Reservoir Dam). Climax also established an additional POC groundwater monitoring well site above Eagle Park Reservoir (EV-MW-004). The locations of the wells are in Figure 3 and well logs are in Appendix A. Section 4 of this Plan describes the monitoring parameters and schedule. Sections 5 and 6 describe the numeric protection levels and data evaluation procedures for the property boundary POC location, and the POC location above Eagle Park Reservoir, respectively. Water quality monitoring data are in Annual Reports to DRMS.

3.2.5.2 Internal Groundwater Monitoring Sites

Climax will monitor several internal sites located downgradient of mine facilities and above Eagle Park Reservoir (Figure 3). In addition to the protection afforded to Eagle Park Reservoir by the Environmental Protection Facilities (EPFs) described in the EPP, these internal water monitoring sites enable detection of potential changes in water quality upgradient of the reservoir so that appropriate actions can be taken.

Groundwater quality within the upper Eagle River Valley has historically been monitored quarterly at the EVMW monitoring well (Figure 3) which was constructed in September, 1993. EVMW is located above Eagle Park Reservoir, approximately 200 feet downstream from the Robinson Lake Seepage Collection system. In 2011, Climax constructed a shallow (alluvial) and deep (bedrock) well pair approximately 20 feet upgradient of EVMW. The new wells EVMW-1S (alluvial) and EVMW-1D (bedrock) are shown on Figure 3 and the well logs are included in Appendix A. The purpose of the new well pair was to replace EVMW that is plugged with silt and to add a deeper, bedrock well at that location. Groundwater analytical data from the EVMW are available from quarterly sampling events starting in 1997 up until late 2011, when monitoring at EVMW was discontinued. Climax now monitors EVMS-1S and EVMW-1D.

As described in Section 6.1, Climax has investigated the geology and groundwater conditions in the area between the north abutment of 1 Dam and Eagle Park Reservoir. As a result, one groundwater monitoring well (EVMW-2) and three spring/surface sites (EVS-1, EVS-2 and EVS-3) were established at the locations indicated on Figure 3. Well EVMW-2 is a bedrock well (no saturated alluvium encountered) and was constructed to monitor groundwater quality between the north abutment of 1 Dam and Eagle Park Reservoir. The EVS sites were established to monitor shallow groundwater directly above Eagle Park Reservoir.

Boring logs and well completion diagrams for these new wells are included in Appendix A. Monitoring parameters and frequencies are addressed in Section 4 and data evaluation procedures and follow-up actions to be taken by Climax specifically related to monitoring sites above Eagle Park and Clinton Reservoirs are described in Section 6 of this Plan. Water quality monitoring data are in Annual Reports to DRMS.

3.2.6 Surface Water Monitoring Sites

Climax has previously established surface water monitoring sites at two locations in the East Fork Eagle River, upstream (AI) and downstream (BI) of the confluence of the River with the outfall from Eagle Park Reservoir. In addition, in cooperation with the Eagle Park Reservoir Company, Climax has agreed to monitor the quality of water released from the Eagle Park Reservoir (EPR) at the reservoir discharge (EPR Outlet). This is an established monitoring location at the end of the outlet pipe at the base of 4 Dam before water passes through the flume and enters the drainage leading to the East Fort Eagle River. Monitoring parameters, and monitoring frequencies for future sampling efforts are addressed in Section 4 and water quality monitoring data are in Annual Reports to DRMS.

3.3 Tenmile Creek Watershed

The open pit mine, mill facilities, Overburden Storage Facilities (OSFs), and the Robinson, Tenmile and Mayflower TSFs are all located within the Tenmile Creek Watershed, west of the Continental Divide (Figure 1).

3.3.1 Existing and Potential Future Uses of Groundwater

Groundwater in the Tenmile Creek Valley within the Climax Mine property boundary occurs primarily in the areas downstream of the tailings storage facility. The WQCC has not adopted classifications or site-specific groundwater standards in the Tenmile Creek Watershed in the vicinity of the Climax Mine. Climax maintains wells in the McNulty and PDWTP areas for industrial and potable uses as needed, but further development of groundwater in these areas would not be likely given the site location and climate conditions. The majority of groundwater use within the lower property boundary of Climax is recharge of Tenmile Creek, which is classified for aquatic life, recreation, and agricultural uses.

3.3.2 Location and Description of Classified Stream Segments

Blue River basin, Segment 13, contains the mainstem of Tenmile Creek from the Climax Parshall Flume (Outfall 001A) to the point immediately above the confluence of West Tenmile Creek. Also included are all tributaries and wetlands from the source of Tenmile Creek to the point immediately above the confluence with West Tenmile Creek. Exceptions include: Segment 15, the mainstem of Clinton Creek from the source to the confluence with Tenmile Creek.

Segment 13 of the Blue River basin is classified as Aquatic Life Cold 1, Recreation P, and Agriculture.

3.3.3 Potential Contamination Sources and EPFs

The majority of the site, including most of the mine's water management and treatment activities occur within the Tenmile Creek drainage area, including the release of water at the permitted outfall to Tenmile Creek. Potential contaminant sources and established environmental protection facilities (EPFs) within this portion of the site are identified and described in Section T-5.3 of the EPP.

3.3.4 Hydrogeology

Groundwater in the Tenmile Creek valley primarily occurs in a veneer of alluvium and glacial till which overlay bedrock consisting of Paleozoic sedimentary and Tertiary quartz monzonite formations. Data from seismic refraction surveys and monitoring well logs (Climax Molybdenum Co., 1984) indicate that the alluvium and glacial till range in thickness from 0 to over 90 feet. The alluvium consists of deposits ranging in size from clays and silts to boulders. Depth to water data collected in monitoring wells GW#1 and GW#2 (identified in the previous WQMP as GWM-1 and GWM-2, respectively) indicate that groundwater occurs between 10 and 30 feet below ground surface with a seasonal flux in elevation.

The direction of groundwater flow in the Tenmile Creek valley is controlled by the bedrock topography. Hydraulic conductivity data of the bedrock and the overlaying soils are summarized in Table 1. These data were measured as part of the construction of the Mayflower Tailings Dam. A total of 44 tests in eight holes were conducted using both slug and packer testing methods (Kumar & Assoc., 1994).

Table 3-1 - Summary of Field Hydraulic Conductivity Tests

Unit	Hydraulic Conductivity Range (ft/yr)
Alluvium	2,595 – 88,378
Glacial Till	22 – 1,238
Paleozoic Sedimentary Bedrock	0 – 596
Tertiary Quartz Monzonite Bedrock	18 – 54

As shown, the field hydraulic conductivity test data indicate that the alluvium and glacial till in the Tenmile drainage are significantly more permeable than the bedrock units. By comparison, the bedrock units are of relatively low permeability. Therefore, the bedrock units are not capable of transporting significant quantities of groundwater.

3.3.5 Groundwater Monitoring Sites

3.3.5.1 POC Groundwater Monitoring Site

Climax will use well GW#2 as a POC monitoring well for the Tenmile basin. This well is completed in the Tenmile Creek Alluvium and is considered representative of shallow groundwater downgradient of the tailing facilities that may ultimately recharge Tenmile Creek. GW#2 was constructed in 1987 and its location is illustrated on Figure 4. Climax has also constructed TM-MW-002D, a deeper, bedrock POC well adjacent to GW#2 during 2012 as a second, deeper POC well, so that both shallow and deeper hydrostratigraphic units are monitored.

The well logs for GW#2 and TM-MW-002D are in Appendix A. Monitoring parameters and frequencies are addressed in Section 4 and data evaluation procedures are described in Section 5 of this Plan. Water quality monitoring data are in Annual Reports to DRMS.

3.3.5.2 Internal Groundwater Monitoring Site

Climax will use well GW#1 as an internal monitoring site down gradient of the Mayflower TSF and upgradient of the POC (Figure 4). Climax constructed TM-MW-001D, a deeper, bedrock well adjacent to GW#1 during 2012 so that both shallow and deeper hydrostratigraphic units are monitored.

Monitoring parameters and frequencies are addressed in Section 4 and data evaluation procedures related to these internal monitoring sites are described in Section 5 of this Plan. Water quality monitoring data are in Annual Reports to DRMS.

3.3.6 Surface Water Monitoring Sites

3.3.6.1 Tenmile Creek Surface Water Monitoring Site

The Climax water management and treatment system treats surface water and underground water collected within the three drainage basins and discharges treated waters into Tenmile Creek at Outfall 001A. This surface water discharge is authorized under Colorado Discharge Permit System (CDPS) discharge permit No. CO0000248. Surface water sampling at the outfall is performed in accordance with this permit, and is not included in this Plan. Compliance with the discharge requirements demonstrates the overall effectiveness of the collection and treatment protection facilities.

3.3.6.2 Internal Surface Water Monitoring Sites

As discussed in Section 6.1, Climax has two internal monitoring locations above Clinton Reservoir. The first location is a surface water monitoring site located in upper Clinton Creek (CC-SW1) above its confluence with Clinton Reservoir (Figure 5). The second location is a surface water monitoring site at the inlet to the East Interceptor culvert (EI-SW1) below the McNulty Overburden Storage Facility and upgradient of Clinton Reservoir (Figure 5). These locations are used to detect any potential water quality changes from surface runoff in the vicinity of mine facilities toward Clinton Reservoir.

Monitoring parameters and frequencies are addressed in Section 4 and data evaluation procedures and follow-up actions to be taken by Climax specifically related to the monitoring sites above Eagle Park and Clinton Reservoirs are described in Section 6 of this Plan.

4.0 SELECTION OF MONITORING PARAMETERS AND MONITORING SCHEDULE

This monitoring program is intended to provide data for (1) demonstrating that EPP requirements are being met, and (2) evaluating changes in water quality that may be related to mining and milling operations at the site. This Section describes the selection of monitoring parameters and the frequency of monitoring. Sections 5 and 6 establish the evaluation processes for identifying compliance with Numeric Protection Levels (NPLs) and for determining when changes may be occurring so that appropriate actions can be taken to prevent adverse off-site impacts. Section 5 addresses POC well locations and general internal monitoring locations, and Section 6 addresses specific data analyses procedures related to internal monitoring sites located above Eagle Park and Clinton Reservoirs, as well as the EPR Outlet and East Fork Eagle River monitoring locations.

4.1 Monitoring Parameters

The list of analytical parameters to be monitored was developed in TR-18 based on a review of available baseline data from the existing monitoring network, an evaluation of the monitoring requirements under the Site's existing CDPS permit, and a review of the Colorado Water Quality Control Commission Basic Standards for Groundwater; 5 CCR 1002-41 (CBSG).

Climax developed indicator parameter lists for groundwater and surface water monitoring locations. As described in TR-18, baseline monitoring utilizing an expanded analyte parameter list will be performed at all monitoring locations. The baseline dataset will be collected over a period of time necessary to provide a minimum of 5 successive quarterly samples. Following collection of the baseline data, the indicator parameter lists will be reviewed against the baseline data and parameters may be added or removed from the indicator parameter lists for long-term monitoring, subject to the approval of DRMS. This Plan continues the baseline monitoring and parameters established in TR-18.

4.1.1 Groundwater Monitoring

All of the identified groundwater monitoring sites are subject to the same monitoring program during the baseline monitoring period established in TR-18. The analytical parameter list for baseline monitoring includes the EPA metals and cyanide Target Analyte List (TAL) for dissolved metals, plus the addition of total and WAD cyanide, fluoride, chloride, sulfate (SO4), bicarbonate (HCO3), Nitrate (NO3) + Nitrite (NO2), total organic carbon, hardness, and total alkalinity, per the request of the DRMS. This analytical parameter list for groundwater monitoring is presented below as Table 4-1.

As stated above, Climax has also developed an indicator parameter list for long-term, post baseline, monitoring parameters and NPLs. The indicator parameter list for long-term groundwater monitoring is presented below in Table 4-1. The rationale for the parameter lists and NPLs are in TR-18.

Table 4-1 – Groundwater Monitoring Parameters

Indicator Parameters	
Cadmium, dissolved	Molybdenum, dissolved
Copper, dissolved	Zinc, dissolved
Iron, dissolved	pH
Lead, dissolved	Sulfate (SO4)
Manganese, dissolved	Total Dissolved Solids (TDS)
Additional Baseline Monitoring Parameters	
Aluminum, dissolved	Silver, dissolved
Antimony, dissolved	Sodium, dissolved
Arsenic, dissolved	Thallium, dissolved
Barium, dissolved	Vanadium, dissolved
Beryllium, dissolved	Bicarbonate (HCO3)
Calcium, dissolved	Total Alkalinity
Chromium (CrIII + CrVI), dissolved	Chloride, dissolved
Cobalt, dissolved	Cyanide, WAD
Magnesium, dissolved	Cyanide, total
Mercury, dissolved	Fluoride, dissolved
Nickel, dissolved	Total Nitrate + Nitrite as N
Potassium, dissolved	Total Organic Carbon (TOC)
Selenium, dissolved	

The baseline dataset will be collected over a period of time necessary to provide a minimum of 5 successive quarterly samples. Following collection of the baseline data, the indicator parameter lists will be reviewed against the baseline data and parameters may be added or removed from the lists for long-term monitoring, subject to the approval of DRMS.

4.1.2 Internal Surface Water Monitoring Sites

For the internal surface water monitoring sites identified in this Plan, the analytical list has been developed following the same approach as described above for groundwater sites. The analytical parameter list for internal surface water samples is presented below as Table 4-2. Differences from the groundwater list include the addition of hardness, ammonia (NH3), and total mercury in lieu of dissolved.

As indicated in Table 4-2, and as described in TR-18, dissolved iron, manganese, and molybdenum, pH, Sulfate, and Total Dissolved Solids are identified as appropriate indicator parameters for internal surface water monitoring, following the baseline data collection period.

The baseline dataset will be collected over period of time to provide a minimum of 5 successive quarterly samples. At the end of the baseline monitoring period, Climax will review the baseline data to verify the adequacy of the indicator parameter list for early detection of potential impacts of mining-related activity. If appropriate, and with the approval of DRMS additional parameters will be added to the indicator parameter monitoring list.

Table 4-2 – Internal Surface Water Monitoring Parameters

Indicator Parameters	
Iron, dissolved	pH
Manganese, dissolved	Sulfate (SO4)
Molybdenum, dissolved	Total Dissolved Solids (TDS)
Additional Baseline Monitoring Parameters	
Aluminum, dissolved	Silver, dissolved
Antimony, dissolved	Sodium, dissolved
Arsenic, dissolved	Thallium, dissolved
Barium, dissolved	Vanadium, dissolved
Beryllium, dissolved	Zinc, dissolved
Cadmium, dissolved	Ammonia (NH_3) as N
Calcium, dissolved	Bicarbonate (HCO3)
Chromium (CrIII + CrVI), dissolved	Total Alkalinity
Cobalt, dissolved	Chloride, dissolved
Copper, dissolved	Cyanide, WAD
Lead, dissolved	Cyanide, total
Magnesium, dissolved	Fluoride, dissolved
Mercury, total	Hardness
Nickel, dissolved	Total Nitrate + Nitrite as N
Potassium, dissolved	Total Organic Carbon (TOC)
Selenium, dissolved	

4.1.3 River and Eagle Park Reservoir Surface Water Monitoring

Table 4-3, below, presents the analytical parameter list for surface water monitoring of the Arkansas and East Fork Eagle Rivers, and the Eagle Park Reservoir outlet. The rationale for the parameter lists is in TR-18. Samples collected over at least the first 5 successive quarters will be analyzed for the additional baseline monitoring parameters listed in Table 4-3. At the end of the additional baseline monitoring period, Climax will present the five quarters of data along with the applicable surface water standards for the Arkansas and East Fork Eagle Rivers, and review the data to verify the adequacy of the indicator parameter list for long-term monitoring.

Table 4-3 – River and EPR Surface Water Monitoring Parameters

Indicator Parameters	
Aluminum, dissolved	Manganese, dissolved
Cadmium, dissolved	Molybdenum, dissolved
Calcium, dissolved	Zinc, dissolved
Copper, dissolved	pH
Iron, dissolved	Sulfate (SO4)
Lead, dissolved	Total Dissolved Solids (TDS)
Magnesium, dissolved	Hardness
Additional Baseline Monitoring Parameters	
Antimony, dissolved	Sodium, dissolved
Arsenic, dissolved	Thallium, dissolved
Arsenic, total recoverable	Vanadium, dissolved
Barium, dissolved	Ammonia (NH3) as N
Beryllium, dissolved	Bicarbonate (HCO3)
Chromium (CrIII + CrVI), dissolved	Total Alkalinity
Cobalt, dissolved	Chloride, dissolved
Iron, total recoverable	Cyanide, WAD
Mercury, total	Cyanide, total
Nickel, dissolved	Fluoride, dissolved
Potassium, dissolved	Total Nitrate + Nitrite as N
Selenium, dissolved	Total Organic Carbon (TOC)
Silver, dissolved	

4.2 Monitoring Schedule

All groundwater and internal surface water monitoring locations under this WQMP will be monitored quarterly, weather and access conditions permitting, to establish baseline conditions for a period of time necessary, to provide a minimum of 5 successive quarterly samples for baseline characterization. Future monitoring, at the completion of baseline monitoring, will continue on a quarterly basis, weather and access conditions permitting.

Initial sampling at the surface water monitoring locations on the Arkansas and the East Fork Eagle River will be performed quarterly, weather and access permitting, to provide a minimum of 5 successive quarterly samples for additional baseline characterization. Following this baseline data collection period, sampling at the surface water monitoring locations on the Arkansas and the East Fork Eagle River will be performed at least semi-annually, to collect data during high-flow and low-flow conditions. Concurrent monitoring will be conducted when possible at sampling stations on the East Fork Eagle River and the Eagle Park Reservoir outfall during periods of discharge from the reservoir. Sampling of the Eagle Park Reservoir outlet will be included during the baseline data collection period, although quarterly sampling will not likely be possible due to the timing of releases from the reservoir. The reservoir generally discharges,

or releases water, during winter months, November through February or March, but may also release water in late summer or fall. Climax will conduct concurrent sampling on the East Fork Eagle River and at the EPR Outlet once each year during the River low flow winter period and again in the late summer or early fall if water is released from the reservoir. An additional high flow sampling event will be conducted at the East Fork Eagle River monitoring stations, typically during the second quarter of the year.

5.0 NPLS, DATA ANALYSIS AND REPORTING

This section presents the approach described in TR-18 to establish numeric protection levels (NPLs) at the property boundary POC wells: ARwell and ARK-MW-001D in the Arkansas River Watershed; EVMW-3S, EVMW-3D, and EV-MW-004 in the Eagle River Watershed; and GW#2 and TM-MW-002D in the Tenmile Creek Watershed. Also presented are the data analysis and reporting procedures established for the POC wells and internal monitoring locations, other than those established above either Eagle Park or Clinton Reservoirs. Section 6 addresses data evaluation requirements for monitoring sites above Eagle Park and Clinton Reservoirs.

5.1 Numeric Protection Levels for POC Wells

Colorado Revised Statute (C.R.S.) 25-8-202(7) and the December 14, 2010 Memorandum of Agreement (MOA) between CDPHE, WQCC, and DRMS clarify that WQCC is the entity solely responsible to adopt water quality standards and classifications for state waters. The MOA provides that DRMS will establish points of compliance for discharges to groundwater and must provide reasonable assurance to the WQCD and WQCC that compliance with the Colorado Revised Statute (C.R.S.) 25-8-202(7) has been obtained by using the groundwater standards and classifications established by WQCC as the basis for setting enforceable performance standards, adopting rules and regulations to establish points of compliance for discharges to state waters other than point source discharges to surface water, and other requirements as included in the MOA. The WQCC has not established classified uses for groundwater at or near the Site for which standards specific to the area have been adopted, therefore the Interim Narrative Standard under the CBSG is applicable. DRMS Hard Rock Metal Mining Rule (HRMMR) 3.1.7(2)(c), requires the use of the groundwater quality table values in the CBSG as a guide for establishing numeric protection limits or permit conditions. In situations where ambient groundwater exceeds groundwater table values, the rule requires establishing permit conditions to protect existing and reasonably potential future uses against further lowering of groundwater quality. The Interim Narrative Statewide Standard (CBSG Section 41.5(C)(6)(b)(i)) states that groundwater quality shall be maintained for each parameter at whichever of the following levels is least restrictive: existing ambient quality as of January 31, 1994, or the most stringent criteria set forth in Tables 1 through 4 of the CBSG.

Consistent with DRMS rules, Numeric Protection Levels (NPLs) will be established for POC groundwater wells using the CBSG Table Value Standards as a guide with consideration given to baseline data, where available. In instances where the existing groundwater quality exceeds a CBSG table value, an alternate NPL is selected, based on the Interim Narrative Standard, to protect against the further lowering of groundwater quality.

Where ambient data are to be used to establish protection limits, baseline concentrations will be established using baseline monitoring data, from a minimum of five, representative quarterly sampling results generated subsequent to January 31, 1994. The NPL will be established equal to the mean concentration plus two standard deviations of this baseline data set.

The NPLs are discussed below for each of the watersheds. The data analysis approach to be used in evaluating data against the NPLs is described in Section 5.2.

5.1.1 Arkansas River Watershed

The property boundary POC for the Arkansas River Watershed is ARwell, a monitoring well that is located downgradient from the surface water intake well for the raw and domestic water supply for the Site.

Table 5-1 lists the parameters, following the additional data collection period described in Section 4, to be measured and the applicable NPL. NPLs have been established using CBSG table values for all parameters with the exception of manganese. As described in TR-18, observed manganese concentrations in ARwell exceed the secondary drinking water standard listed in Table 2 of the CBSG, with an average concentration of 0.21 mg/l. To prevent further degradation that would threaten the quality of surface water, an alternate NPL for manganese has been selected using existing ambient quality as of January 31, 1994. The data used for the calculation of the manganese NPL include data from the first five consecutive quarterly samples collected at this well post January, 1994. The methodology for evaluating data against the NPLs is discussed in Section 5.2.

Table 5-1 – ARwell Numeric Protection Limits

Analytical Parameter	Frequency	NPL (mg/L)	NPL Basis (see notes)
Cadmium, dissolved	Quarterly	0.005	Table 1, CBSG
Copper, dissolved	Quarterly	1.0	Table 2, CBSG
Iron, dissolved	Quarterly	0.3	Table 2, CBSG
Lead, dissolved	Quarterly	0.05	Table 1, CBSG
Manganese, dissolved	Quarterly	0.43	Ambient
Molybdenum, dissolved	Quarterly	0.035	Table 1, CBSG
Zinc, dissolved	Quarterly	2.0	Table 3, CBSG
pH	Quarterly	6.5 – 8.5	Table 2, CBSG
Sulfate (SO4)	Quarterly	250	Table 2, CBSG
Total Dissolved Solids (TDS)	Quarterly	NA (report)	NA

Notes:

Table 1, CBSG: Domestic Use Human Health Standards
Table 2, CBSG: Domestic Use Secondary Drinking Water Standards
Table 3, CBSG: Agricultural Use Standards
Ambient: Mean concentration plus two standard deviations of first five representative samples collected subsequent to January 31, 1994 (samples collected between February, 1997 and March, 1998 – see TR-18, Appendix A: Summary of Analytical Data)

As discussed in Section 3.1.5.1, a bedrock well (ARK-MW-001D) has been constructed adjacent to the existing shallow ARwell. A baseline dataset will be collected prior to the establishment of the NPLs to be used for this deeper well pair to ARwell. Table 4-1 lists the parameters to be measured at this well. The baseline dataset will be collected over a period of time necessary to provide a minimum of 5 samples. Following collection of the baseline data, NPLs for each parameter will be established, similar to the other POC wells, based upon a review of the baseline data, with consideration of the CBSG as a guide. The NPL parameter list for ARwell will also be reviewed against the expanded data, and parameters may be added or

removed from the list for long-term monitoring, following collection of the additional 'baseline' data at the existing ARwell.

5.1.2 Eagle River Watershed

The property boundary POC for this watershed is the shallow/deep well pair EVMW-3S and EVMW-3D, adjacent to the East Fork Pumping Station upgradient of the East Fork of the Eagle River. As discussed in Section 3.2.5 a POC well (EV-MW-004) has been established above Eagle Park Reservoir. A baseline dataset will be collected prior to the establishment of the NPLs at these wells, utilizing the expanded baseline parameter list as presented in Table 4-1. Table 5-2 lists the parameters anticipated to be measured at these wells following the baseline period, and the most stringent criteria from Tables 1 through 4 of the CBSG, as a starting point for the establishment of NPLs. The baseline dataset will be collected over a period of time necessary to provide a minimum of 5 samples. Following collection of the baseline data, results will be reviewed to verify or modify the routine monitoring parameters, and NPLs for each parameter will be established, similar to the other POC wells, based upon a review of the baseline data, with consideration of the CBSG as a guide.

In the event that ambient water quality data are considered for use in establishing NPLs for the new wells, an evaluation of the baseline dataset will be performed, as described in Section 5.1. Although the resumption of mining operations is not expected to result in any significant change in conditions, especially during the baseline data collection period, an upward trend in observed concentrations over the baseline period may indicate a reason to evaluate potential contaminant sources and protection facilities in this watershed and the appropriateness of these data to represent ambient baseline conditions.

Table 5-2 – EVMW-3S, EVMW-3D, and EVMW-4 Monitoring Parameters and CBSG Criteria

Analytical Parameter	Frequency	CBSG Criteria (mg/L)	CBSG Basis
Cadmium, dissolved	Quarterly	0.005	Table 1, CBSG
Copper, dissolved	Quarterly	1.0	Table 2, CBSG
Iron, dissolved	Quarterly	0.3	Table 2, CBSG
Lead, dissolved	Quarterly	0.05	Table 1, CBSG
Manganese, dissolved	Quarterly	0.05	Table 2, CBSG
Molybdenum, dissolved	Quarterly	0.035	Table 1, CBSG
Zinc, dissolved	Quarterly	2.0	Table 3, CBSG
pH	Quarterly	6.5 – 8.5	Table 2, CBSG
Sulfate (SO4)	Quarterly	250	Table 2, CBSG
Total Dissolved Solids (TDS)	Quarterly	NA (report)	NA

Notes:
Table 1, CBSG: Domestic Use Human Health Standards

Table 2, CBSG: Domestic Use Secondary Drinking Water Standards
Table 3, CBSG: Agricultural Use Standards

5.1.3 Tenmile Creek Watershed

The property boundary POC for the Tenmile Creek Watershed is GW#2, a monitoring well located downgradient of the permitted surface water discharge outfall.

Table 5-3 lists the parameters to be measured and the applicable NPL. NPLs have been established using CBSG table values for all parameters. The methodology for evaluating data against the NPLs is discussed in Section 5.2.

Table 5-3 – GW#2 Numeric Protection Limits

Analytical Parameter	Frequency	NPL (mg/L)	NPL Basis
Cadmium, dissolved	Quarterly	0.005	Table 1, CBSG
Copper, dissolved	Quarterly	1.0	Table 2, CBSG
Iron, dissolved	Quarterly	0.3	Table 2, CBSG
Lead, dissolved	Quarterly	0.05	Table 1, CBSG
Manganese, dissolved	Quarterly	0.05	Table 2, CBSG
Molybdenum, dissolved	Quarterly	0.035	Table 1, CBSG
Zinc, dissolved	Quarterly	2.0	Table 3, CBSG
pH	Quarterly	6.5 – 8.5	Table 2, CBSG
Sulfate (SO4)	Quarterly	250	Table 2, CBSG
Total Dissolved Solids (TDS)	Quarterly	NA (report)	NA

Notes:
Table 1, CBSG: Domestic Use Human Health Standards
Table 2, CBSG: Domestic Use Secondary Drinking Water Standards
Table 3, CBSG: Agricultural Use Standards

As discussed in Section 3.3.5.1, a bedrock well (TM-MW-002D) has been constructed adjacent to the existing shallow GW#2. A baseline dataset will be collected prior to the establishment of the NPLs to be used for the deeper well pair to GW#2. Table 4-1 lists the parameters to be measured at this well. The baseline dataset will be collected over a period of time necessary to provide a minimum of 5 samples. Following collection of the additional 'baseline' data at the existing GW#2, the proposed NPL parameter list will be reviewed against the expanded data and parameters may be added or removed from the list for long-term monitoring.

5.2 Data Analysis

5.2.1 POC Groundwater Monitoring Sites NPL Evaluation

This section presents the data analysis and reporting procedures established for the wells: ARwell and ARK-MW-001D in the Arkansas River Watershed; EVMW-3S, EVMW-3D and EV-MW-004 in the Eagle River Watershed; and GW#2 and TM-MW-002D in the Tenmile Creek Watershed.

The data evaluation for the POC wells (ARwell and GW#2) involves a comparison against NPLs, as provided in Tables 5-1 and 5-3, for the Arkansas and Tenmile Creek Watersheds, respectively. For newer wells constructed in the Arkansas River Watershed, Eagle River Watershed, and Tenmile Creek Watershed, NPLs will be established after the baseline sampling of at least five quarters is complete.

For POC wells, the first step in evaluating individual event results will be a simple comparison against the NPL. If a sample result exceeds the NPL, field forms will be reviewed and the laboratory will be contacted to check for potential errors. If the initial data quality review does not reveal any errors, the DRMS will be notified and the well will be resampled within 30 days of the receipt of the analytical data. If the second analytical result does not exceed the NPL, sampling will continue at the normally scheduled frequency. If the second sample confirms the first result, additional data evaluation including outlier tests and data distribution and trend analyses will be performed, along with the additional steps presented below.

5.2.1.1 Notification and Consultation

The following steps outline the procedure that will be taken if a result is confirmed to have exceeded an NPL.

1. Climax will verbally notify DRMS that an exceedance has occurred. Written notification will be provided within 5 days of receiving the analytical results for the second, confirmation sample. Notification will include, at a minimum, the following information:

   a. The constituent identified to be in excess of established action level or standard;
   b. The location at which the exceedance was identified;
   c. Analytical data, including the date the samples were collected and the concentrations at which the constituent was measured; and
   d. Increased monitoring measures being undertaken.

   Notifications will be submitted to the following location:

   Division of Reclamation, Mining and Safety
   1313 Sherman Street, Room 215
   Denver, Colorado 80203

2. The increased-monitoring proposal will address a modified sampling frequency for the POC well and may also include an increase of the frequency of sampling of upgradient internal monitoring locations and the receiving surface water in the vicinity of the POC well (the Arkansas River, the East Fork of the Eagle River, Eagle Park Reservoir, or Tenmile Creek) for DRMS review and approval. The proposal will include a schedule for reporting and follow up discussions with DRMS.

3. If the results of the additional monitoring data indicate that quality of the receiving water may be affected, Climax will notify DRMS and initiate timely discussions with DRMS and the affected reservoir company, if applicable, on the appropriate actions to be implemented.

5.2.2 Additional Data Evaluation

This section applies to the property boundary POC wells and the existing internal monitoring sites in the Tenmile Creek Watershed (GW#1 and TM-MW-001D) and in the Arkansas River Watershed (ARK-MW-002S and ARK-MW-002D).

5.2.2.1 Trend Evaluation

Climax will routinely evaluate water quality trends for the groundwater monitoring sites identified above on an annual basis, and report findings in the Annual Report to DRMS. This trend evaluation will be performed by viewing and presenting the data graphically and evaluating any observable visual trend. Evaluation of trends can be complicated by seasonal changes in precipitation and recharge, and by delayed response to events. Therefore, the evaluation will consider short-term changes (such as seasonal effects) in determining whether a declining trend in water quality exists. In other words, if seasonal peaks occur in concentrations, the evaluation should be performed to determine if there are trends in the peak concentrations.

If graphical trends do not suggest declining water quality, no further action is required and monitoring will continue on a quarterly basis, access and weather conditions permitting. However, if a trend that does suggest increasing concentrations in parameters is observed, Climax will evaluate downgradient data, consider potential sources or causes of the trend, and if necessary develop a plan for increased monitoring frequency or further actions.

5.2.2.2 Outlier Identification

Outlier results can and do occur in environmental monitoring. The general practice will be to not remove outliers from the water-quality database, but to consider them in the visual and statistical trend evaluations. However, Climax will perform outlier testing using Rosner's outlier or other applicable test, considering the size of the available sample set and the validity of statistical tests for the circumstance, and report the results in its annual monitoring report. Test results identified as "outlier" will be maintained in the monitoring database, but may be excluded in trend or statistical analyses.

5.2.2.3 Notification and Consultation

Upon determination that declining quality trends are being observed, Climax will notify DRMS of the evaluation findings. Climax will consult with the DRMS to determine the appropriate actions to be taken.

5.3 Reporting

Climax will report all data collected and the results of data analyses performed under this monitoring plan in its Annual Reclamation Report to DRMS.

6.0 MONITORING REQUIREMENTS ABOVE EAGLE PARK AND CLINTON RESERVOIRS

In accordance with the Stipulations to AM-06 to the Climax Reclamation Permit, the WQMP was provided to the reservoir companies for review and comment prior to submission to DRMS for review and approval as TR-18. Climax met with representatives of the reservoir companies and exchanged comments and responses on several separate occasions before and after TR-18 was submitted to DRMS. As a result of these discussions, and as included in TR-18, this Section contains monitoring and reporting conditions specific to the monitoring sites above Eagle Park and Clinton Reservoirs in addition to those that would be required under DRMS rules. Also addressed in this Section are additional data evaluation and reporting procedures specific to the POC well established above Eagle Park Reservoir (EV-MW-004) and the surface water monitoring at the Eagle Park Reservoir Outlet (EPR Outlet) and the East Fork Eagle River (AI and BI).

6.1 Monitoring Locations

As agreed to with the reservoir companies and DRMS, Climax has investigated the geology and groundwater conditions in the area between the north abutment of 1 Dam and Eagle Park Reservoir. In August of 2011, Climax also conducted a hydrologic reconnaissance with representatives of the reservoir companies to identify new monitoring locations above both Eagle Park and Clinton Reservoirs.

As a result of this reconnaissance, and in agreement with the reservoir companies, groundwater monitoring well (EVMW-2) and three spring/surface sites (EVS-1, EVS-2 and EVS-3) were established. Well EVMW-2 is a bedrock well (no saturated alluvium encountered) and was constructed to monitor groundwater quality between the north abutment of 1 Dam and Eagle Park Reservoir. The EVS sites were established to monitor expressions of shallow groundwater above Eagle Park Reservoir. These monitoring locations provide water quality data to detect potential changes in groundwater quality that could potentially reach Eagle Park Reservoir.

Also in accordance with the AM-06 Stipulations, two monitoring locations were selected above Clinton Reservoir and confirmed during the site reconnaissance with reservoir company representatives. The first location agreed to with the reservoir companies is a surface water monitoring site located in upper Clinton Creek above its confluence with Clinton Reservoir (Figure 5). The second location is a surface water monitoring site at the inlet to the East Interceptor culvert below the McNulty Overburden Storage Facility and upgradient of Clinton Reservoir (Figure 5). These locations were selected to detect water quality changes from surface runoff above Clinton Reservoir.

As described in TR-18, Climax also established an additional POC monitoring site (EV-MW-004) above Eagle Park Reservoir, identified on Figure 3. In addition, Climax will conduct monitoring of water released from the Eagle Park Reservoir (EPR Outlet) in conjunction with surface water monitoring in the East Fork Eagle River, above and below the confluence with the reservoir outlet.

In summary, and as discussed in Section 3, these sites include the following locations:

- Groundwater monitoring well (EVMW-2) constructed between the north abutment of 1 Dam and Eagle Park Reservoir (Figure 3);

- A shallow/deep pair of wells (EVMW-1S and 1D), replacing the existing EVMW well below the Robinson Lake Seepage Collection Pond;
- A POC well above Eagle Park Reservoir (EV-MW-004);
- Spring and seep sampling in the area above Eagle Park Reservoir as identified on Figure 3 (EVS-1, EVS-2, and EVS-3);
- The Eagle Park Reservoir Outlet, during discharge periods;
- Two locations on the East Fork Eagle River (AI and BI), as described in Section 3.2.6 (Figure 3);
- A surface water sampling site in Clinton Creek (CC-SW1), above Clinton Reservoir (Figure 5); and
- A surface water sampling site in the East Interceptor ditch (EI-SW1), above Clinton Reservoir (Figure 5).

Climax understands that the reservoir companies may also collect data, independent of Climax, at these established locations. It is anticipated that the reservoir companies will share this data with Climax for incorporation into the data analysis, where appropriate.

6.2 Monitoring Parameters

Analytical parameters to be monitored at the monitoring sites listed above will be the same as those identified in Section 4.1 for all other monitoring sites.

6.3 Data Analysis

As data from each sampling event are collected and quality assurance/quality control (QA/QC) completed, in accordance with the procedures outlined in Section 7, Climax will calculate the mean and standard deviation for each parameter at each sampling location, including the baseline data. These statistical parameters will be used in subsequent statistical evaluations of the data, as needed. Following the baseline period, Climax will review the monitoring results to determine whether the most recent sampling results are consistent with the baseline data, or if the results might be considered to contain one or more outliers. If Climax determines that the recent sampling results may not be consistent, they may elect to collect an additional sample for inclusion in the dataset to be used for trend analyses. If a statistically significant trend indicating declining water-quality is observed, Climax will promptly notify the DRMS and the relevant reservoir company. An upward trend in observed concentrations over the baseline period also may indicate a reason to evaluate potential contaminant sources and protection facilities and the appropriateness of the data to represent ambient baseline conditions. The following sections detail the procedures that will be followed to evaluate the data.

6.3.1 Eagle Park Reservoir POC Well NPL Evaluation

Once NPLs are established for the POC well above Eagle Park Reservoir (EV-MW-004), the NPL data evaluation procedures identified in Section 5.2.1 will be followed. When notification and/or consultation are required pursuant to these procedures relative to the monitoring results at EV-MW-004, the Eagle Park Reservoir Company will be notified and consulted, in addition to the DRMS. Written notification will be submitted to the following address:

Eagle Park Reservoir Company
c/o General Manager
Eagle River Water and Sanitation District
846 Forest Road
Vail, CO 81657

6.3.2 Additional Data Evaluation

This section applies to data collected from all of the monitoring locations identified in Section 6.1, including the POC well above Eagle Park Reservoir (EV-MW-004). Any additional water quality data from the established monitoring locations or other locations within Eagle Park Reservoir collected by the Eagle Park Reservoir Company and provided to Climax, will also be included in the data evaluation.

6.3.2.1 Visual and Statistical Trend Evaluation

Climax will routinely evaluate water quality trends, and report findings in the Annual Reclamation Report to DRMS. A copy of these findings will be made available to the reservoir companies. Evaluation of trends can be complicated by seasonal changes in precipitation and recharge, and by delayed response to events. It is expected that water quality in the reservoirs will respond quickly to changes in the quantity and/or quality of runoff water, and respond slowly to changes in the quantity and/or quality of groundwater. Before long-term changes can be identified, short-term changes (such as seasonal effects) need to be recognized and considered.

If graphical trends do not suggest declining water quality, no quantitative trend evaluation is needed. However, a trend that does suggest increasing concentrations in parameters will require a more rigorous statistical analysis and further actions by Climax to prevent potential impacts to the receiving water.

Following a graphical trend analysis that suggests declining water quality, the approach to determining whether there is a temporal trend will involve the following steps:

1. Based on temporal plots of the parameters of concern, define a window of time for evaluating whether a trend exists, including the baseline dataset through the most recent sampling period.

2. Develop an approach that corrects for the effects of seasonal variations and that is protective of the receiving waters. In other words, if seasonal peaks occur in concentrations, the evaluation should be performed to determine if there are trends in the peak concentrations.

3. Compare the most recent 4 sampling results against the 80th percentile upper prediction limit (UPL), and the most recent 2 sampling results against the 95th percentile UPL. If four consecutive sample results exceed the 80th percentile UPL, or if two consecutive results exceed the 95th percentile UPL this fact will be considered along with the other factors in the trend evaluation. Calculation of the UPLs will be done using the one-sided Student t test equation below:

$$UPL = mean + t[n-1, 1-\alpha]s\sqrt{1+\frac{1}{n}}$$

Where n is the number of samples, s is the standard deviation and α=0.20 for the 80th percentile and α=0.05 for the 95th percentile.

If a statistical test for a trend is needed, approaches such as Sen's or Mann-Kendall tests (Gibbons, 1994) will be used, if a sufficient number of samples are available to apply these tests appropriately.

6.3.2.2 Outlier Identification

Outlier results can and do occur in environmental monitoring. Because monitoring of internal monitoring sites is being performed to detect changes in the water quality that may impact uses of Eagle Park Reservoir or Clinton Reservoir, a careful evaluation of the data will be necessary. The general practice will be to not remove outliers from the water-quality database, but to consider them in the visual and statistical trend evaluations. However, Climax will perform outlier testing using Rosner's outlier or other applicable test, considering the size of the available sample set and validity of the statistical test for the circumstance, and report the results in its annual monitoring report. Test results identified as "outlier" will be maintained in the monitoring database.

6.3.2.3 Notification and Consultation

Upon determination that declining quality trends are being observed, Climax will notify DRMS and the affected reservoir company of the evaluation findings. Climax will consult with the DRMS and the affected reservoir company to determine the appropriate actions to be taken. In the event that declining trends in surface water quality are being observed, and there is a reasonable potential that those trends may be attributable to Climax operations, appropriate actions will be taken as soon as possible to ensure that further degradation does not occur; and Climax will consult with the affected reservoir company, the DRMS and the WQCD to develop such appropriate actions.

6.3.2.4 Increase Monitoring Frequency

If recent sampling results suggest that the water quality may be declining, the sampling frequency at the identified sampling site may be increased to better define changes that may be occurring. Samples will be collected during the period of the year when weather and site conditions allow access. This more frequent sampling schedule will be determined in consultation with DRMS and the affected reservoir company, and will be continued until a return to the previous routine monitoring frequency is approved by DRMS.

6.4 Reporting

Climax will report all data collected and the results of data analyses performed under this Section of the WQMP, and data from the EVMW-3 well pair, to the reservoir companies, and as part of its Annual Reclamation Report to the DRMS.

7.0 SAMPLING AND ANALYTICAL METHODS

Groundwater and surface water samples will be collected and analyzed following the procedures described in the sections below.

7.1 Sampling Methods

Groundwater and surface water sampling will be performed in accordance with the Standard Operating Procedure (SOP) included as Appendix B.

7.2 Analytical Methods

Tables 7-1 and 7-2, below describe the analytical parameters, methods, detection limits and holding times for the groundwater quality samples and internal surface water quality samples, respectively. These tables include both indicator parameters as well as the additional baseline monitoring parameters. Table 7.3 presents the parameters, methods, detection limits, and holding times for surface water samples to be collected from the Arkansas or East Fork Eagle River, and the Eagle Park Reservoir Outlet. This table also includes both indicator parameters as well as the additional baseline monitoring parameters.

Table 7-1 –Groundwater Monitoring Analytical Methods

Analytical Parameter	EPA Method	Detection Limit (mg/L)	Hold Time
Indicator Parameters			
Cadmium, dissolved	M200.8 ICP-MS	0.0001	6 months
Copper, dissolved	M200.8 ICP-MS	0.0005	6 months
Iron, dissolved	M200.7 ICP	0.02	6 months
Lead, dissolved	M200.8 ICP-MS	0.0001	6 months
Manganese, dissolved	M200.7 ICP	0.005	6 months
Molybdenum, dissolved	M200.7 ICP	0.02	6 months
Zinc, dissolved	M200.7 ICP	0.01	6 months
pH	SM4500H+B	0.1	Immediately
Sulfate (SO4)	D516-02	1	28 days
Total Dissolved Solids (TDS)	SM2540C	10	7 days
Additional Baseline Monitoring Parameters			
Aluminum, dissolved	M200.7 ICP	0.03	6 months
Antimony, dissolved	M200.8 ICP-MS	0.0004	6 months
Arsenic, dissolved	M200.8 ICP-MS	0.0002	6 months
Barium, dissolved	M200.7 ICP	0.003	6 months
Beryllium, dissolved	M200.8 ICP-MS	0.00005	6 months
Calcium, dissolved	M200.7 ICP	0.1	6 months
Chromium (CrIII + CrVI), dissolved	M200.8 ICP-MS	0.0005	6 months
Cobalt, dissolved	M200.8 ICP-MS	0.00005	6 months
Magnesium, dissolved	M200.7 ICP	0.2	6 months

Analytical Parameter	EPA Method	Detection Limit (mg/L)	Hold Time
Mercury, dissolved	M245.1 CVAA	0.0002	28 days
Nickel, dissolved	M200.8 ICP-MS	0.0006	6 months
Potassium, dissolved	M200.7 ICP	0.2	6 months
Selenium, dissolved	SM3114B,AA-Hydride	0.001	6 months
Silver, dissolved	M2007. ICP	0.01	6 months
Sodium, dissolved	M200.7 ICP	0.2	6 months
Thallium, dissolved	M200.8 ICP-MS	0.0001	6 months
Vanadium, dissolved	M200.7 ICP	0.005	6 months
Bicarbonate (HCO3)	SM2320B - Titration	2	14 days
Total Alkalinity	SM2320B - Titration	2	14 days
Chloride, dissolved	SM4500Cl-E	0.5	28 days
Cyanide, WAD	SM4500CN-I	0.003	14 days
Cyanide, total	M355.4	0.003	14 days
Fluoride, dissolved	SM4500F-C	0.05	6 months
Total Nitrate + Nitrite as N	M353.2	0.02	28 days
Total Organic Carbon (TOC)	SM5310B	1	28 days

Table 7-2 – Internal Surface Water Monitoring Analytical Methods

Analytical Parameter	EPA Method	Detection Limit (mg/L)	Hold Time
Indicator Parameters			
Iron, dissolved	M200.7 ICP	0.02	6 months
Manganese, dissolved	M200.7 ICP	0.005	6 months
Molybdenum, dissolved	M200.7 ICP	0.02	6 months
pH	SM4500H+B	0.1	Immediately
Sulfate (SO4)	D516-02	1	28 days
Total Dissolved Solids (TDS)	SM2540C	10	7 days
Additional Baseline Monitoring Parameters			
Aluminum, dissolved	M200.7 ICP	0.03	6 months
Antimony, dissolved	M200.8 ICP-MS	0.0004	6 months
Arsenic, dissolved	M200.8 ICP-MS	0.0002	6 months
Barium, dissolved	M200.7 ICP	0.003	6 months
Beryllium, dissolved	M200.8 ICP-MS	0.00005	6 months
Cadmium, dissolved	M200.8 ICP-MS	0.0001	6 months
Calcium, dissolved	M2007. ICP	0.1	6 months
Chromium (CrIII + CrVI), dissolved	M200.8 ICP-MS	0.0005	6 months
Cobalt, dissolved	M200.8 ICP-MS	0.00005	6 months
Copper, dissolved	M200.8 ICP-MS	0.0005	6 months

Analytical Parameter	EPA Method	Detection Limit (mg/L)	Hold Time
Lead, dissolved	M200.8 ICP-MS	0.0001	6 months
Magnesium, dissolved	M200.7 ICP	0.2	6 months
Mercury, total	M245.1 CVAA	0.0002	28 days
Nickel, dissolved	M200.8 ICP-MS	0.0006	6 months
Potassium, dissolved	M200.7 ICP	0.2	6 months
Selenium, dissolved	SM3114B, AA Hydride	0.001	6 months
Silver, dissolved	M200.7 ICP	0.01	6 months
Sodium, dissolved	M200.7 ICP	0.2	6 months
Thallium, dissolved	M200.8 ICP-MS	0.0001	6 months
Vanadium, dissolved	M200.7 ICP	0.005	6 months
Zinc, dissolved	M200.7 ICP	0.01	6 months
Ammonia (NH_3) as N	M350.1	0.05	28 days
Bicarbonate (HCO3)	SM2320B - Titration	2	14 days
Total Alkalinity	SM2320B - Titration	2	14 days
Chloride, dissolved	SM4500Cl-E	0.5	6 months
Cyanide, WAD	SM4500CN-I	0.003	14 days
Cyanide, total	M335.4	0.003	14 days
Fluoride, dissolved	SM4500F-C	0.05	6 months
Hardness	SM2340B	0.8	6 months
Total Nitrate + Nitrite as N	M353.2	0.02	28 days
Total Organic Carbon (TOC)	SM5310B	1	28 days

Table 7-3 – River and EPR Surface Water Monitoring Analytical Methods

Analytical Parameter	EPA Method	Detection Limit (mg/L)	Hold Time
Indicator Parameters			
Aluminum, dissolved	M200.7 ICP	0.03	6 months
Cadmium, dissolved	M200.8 ICP-MS	0.0001	6 months
Calcium, dissolved	M2007. ICP	0.1	6 months
Copper, dissolved	M200.8 ICP-MS	0.0005	6 months
Iron, dissolved	M200.7 ICP	0.02	6 months
Lead, dissolved	M200.8 ICP-MS	0.0001	6 months
Magnesium, dissolved	M200.7 ICP	0.2	6 months
Manganese, dissolved	M200.7 ICP	0.005	6 months
Molybdenum, dissolved	M200.7 ICP	0.02	6 months
Zinc, dissolved	M200.7 ICP	0.01	6 months
pH	SM4500H+B	0.1	Immediately
Sulfate (SO4)	D516-02	1	28 days
Total Dissolved Solids (TDS)	SM2540C	10	7 days

Analytical Parameter	EPA Method	Detection Limit (mg/L)	Hold Time
Hardness	SM2340B	0.8	6 months
Additional Baseline Monitoring Parameters			
Antimony, dissolved	M200.8 ICP-MS	0.0004	6 months
Arsenic, dissolved	M200.8 ICP-MS	0.0002	6 months
Arsenic, total recoverable	M200.8 ICP-MS	0.0002	6 months
Barium, dissolved	M200.7 ICP	0.003	6 months
Beryllium, dissolved	M200.8 ICP-MS	0.00005	6 months
Chromium (CrIII + CrVI), dissolved	M200.8 ICP-MS	0.0005	6 months
Cobalt, dissolved	M200.8 ICP-MS	0.00005	6 months
Iron, total recoverable	M200.7 ICP	0.02	6 months
Mercury, total	M245.1 CVAA	0.0002	28 days
Nickel, dissolved	M200.8 ICP-MS	0.0006	6 months
Potassium, dissolved	M200.7 ICP	0.2	6 months
Selenium, dissolved	SM3114B, AA Hydride	0.001	6 months
Silver, dissolved	M200.7 ICP	0.01	6 months
Sodium, dissolved	M200.7 ICP	0.2	6 months
Thallium, dissolved	M200.8 ICP-MS	0.0001	6 months
Vanadium, dissolved	M200.7 ICP	0.005	6 months
Ammonia (NH_3) as N	M350.1	0.05	28 days
Bicarbonate (HCO3)	SM2320B - Titration	2	14 days
Total Alkalinity	SM2320B - Titration	2	14 days
Chloride, dissolved	SM4500Cl-E	0.5	6 months
Cyanide, WAD	SM4500CN-I	0.003	14 days
Cyanide, total	M335.4	0.003	14 days
Fluoride, dissolved	SM4500F-C	0.05	6 months
Total Nitrate + Nitrite as N	M353.2	0.02	28 days
Total Organic Carbon (TOC)	SM5310B	1	28 days

7.3 Quality Assurance/Quality Control

Climax will ensure data quality through field and laboratory QA/QC procedures, data reporting and evaluation.

7.3.1 Field Duplicate

Field duplicates are co-located samples collected identically and consecutively over a minimum period of time. Field duplicates are sent to the same laboratory and analyzed for identical analytical parameters. One duplicate sample will be collected during each quarterly sampling event. The sample location for the field duplicate shall be selected randomly prior to each sampling event.

7.3.2 Laboratory Quality Assurance/Quality Control

The laboratory selected to analyze the water samples will operate under an internal quality assurance plan. Laboratory quality control (QC) includes method blanks, analytical duplicates, matrix spikes, matrix spike duplicates, calibration checks, surrogates and laboratory control standards, as required by the referenced analytical method.

7.3.3 Data Reporting

The analytical reports submitted by the laboratory under this monitoring plan will include, at a minimum, the following information:

- A copy of the chain of custody form, including the date of sample receipt;
- Sample temperature upon receipt at the laboratory;
- Field and laboratory sample identification numbers;
- Sampling date and time;
- Verification of preservation conditions (if appropriate);
- Sample preparation method references;
- Date and time of analysis;
- Analytical method references;
- Analytical result for each parameter requested, including results from QA/QC samples;
- Unit of measurement;
- Method detection limit (in units of sample results);
- Laboratory quantification or reporting limit (defined);
- Calibration verification results;
- Theoretical concentrations for laboratory control samples, if used;
- Method blank results;
- Results of laboratory QC analyses [laboratory control sample/laboratory control sample duplicate (LCS/LCSD); matrix spike/matrix pike duplicate samples (MS/MSD); analytical duplicate, etc.] associated with each batch of samples analyzed, as appropriate to the method protocol;
- Definition/explanation of any internal data qualifiers applied, and;
- A brief narrative describing sample analyses including description of any problems or unusual circumstances during analysis.

7.3.4 Data Evaluation

All data shall be evaluated according to the following procedures to ensure that only data of appropriate quality are used to evaluate site groundwater conditions.

7.3.4.1 Field Measurements

Field measurements including pH, specific conductance, and temperature will be collected during monitoring activities. The field data will be reviewed in an attempt to identify any transcriptional or computational errors.

7.3.4.2 Laboratory Data

Laboratory calculations and data review shall be performed by the laboratory in accordance with the procedures described by the analytical method. The laboratory review shall include the results of the QC analyses, instrument calibration, and maintenance records, calculations, and the chain of custody record and analytical holding times. The laboratory will prepare a case narrative to summarize the findings of their review, noting any problems associated with the analysis of the field samples.

After receipt of the data from the laboratory, data evaluation shall be performed to:

- Ensure that the analytical laboratory was operating in control at the time the samples were analyzed and to document that appropriate methods and holding times were observed;
- Assess whether the data are suitable to meet project objectives.

8.0 REFERENCES

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FIGURES

JAN 28, 2009 N:\arcprj2\010428\mxd\Figure1_LocationMap_PhaseI.mxd BY:jesse.carver

Frisco
Tenmile Creek
Parshall Flume/ Outfall 001
TENMILE CREEK BASIN
EAGLE BASIN
Mayflower Canal
91
West Interceptor
Mayflower TSF
Supply Canal #2
Clinton Canal
Clinton Creek
Clinton Reservoir
East Interceptor
Tenmile TSF
Upper North Interceptor
Eagle Park Reservoir
Robinson Pond (Reclaimed)
Robinson Lake
Chalk Mountain Res
Chalk Mountain Interceptor
Eagle Summit
East Side Channel
McNulty Overburden Stockpile
Buffehr Lake
North 40 Overburden Stockpile
Mine Pit Area
Plant Site
Eagle Lake
East Fork Eagle River
ARKANSAS BASIN
TENMILE CREEK BASIN
Summit Lake
SOUTH PLATTE BASIN
Lake Park
Arkansas Well
5 Shaft
Storke Wastewater Pump Station
Leadville

Legend

- Climax Project Boundary
- Interceptor
- Canal
- Intermittent Stream
- Perennial Stream
- Channel
- Tunnel
- County Boundary
- Water Basin
- Mosquito Fault

N

SCALE IN FEET
0 3,000

FIGURE 1

LOCATION MAP

CLIMAX MINE SITE
FREMONT PASS, CO

BUFFEHRS LAKE

BUFFEHRS LAKE PUMP STATION (FRESH WATER)

BUFFEHR/ CHALK PIPELINE

ETDL

TEN MILE CREEK

NORTH 40 OSF

DSM INTERCEPTOR

CAMP DRAIN

NO. 6 CRUSHER

SANITARY WASTEWATER TREATMENT PLANT

MILL BUILDING

OPEN PIT

SUMMIT COUNTY
LAKE COUNTY

CHALK MTN. (EL. 12,017)

DOMESTIC WATER TREATMENT PLANT

FREMONT PASS (11,320)

NO. 3 MILL

STORKE PIPELINE

SWPS PIPELINE

ARKANSAS WELL PIPELINE

CERESCO RIDGE

MOSQUITO FAULT

ARK-MW-001D
ARwell

ARKANSAS POND
10,903

AR-MW-002S
AR-MW-002D

STORKE WASTEWATER PUMP STATION

STORKE PORTAL

5 SHAFT PUMP STATION

HIGHWAY 91

ARKANSAS RIVER

AFFECTED LAND BOUNDARY

MCNAMEE PEAK

STORKE AREA INTERCEPTOR

1 2 3 4 5

LEGEND:

- PROPERTY BOUNDARY
- WATERSHED BOUNDARY
- AFFECTED AREA BOUNDARY
- COUNTY LINE
- EXISTING GROUNDWATER MONITORING WELL

N

SCALE
500' 0 500' 1000'
CONTOUR INTERVAL 25'

Issued by:

TETRA TECH
350 Indiana Street, Suite 500
Golden, Colorado 80401
(303) 217-5700 (303) 217-5705 fax

Title:
CLIMAX MINE
WATER QUALITY MONITORING PLAN
ARKANSAS RIVER WATERSHED
MONITORING LOCATIONS

REVISION

Project: CLIMAX MINE
Project no.: 114-010428
Location: CLIMAX, COLORADO
Date: 4/11

FIGURE 2

Philippi, Brian – T:\Clients\Climax Moly\GW Mon Plan\Figures\Fig02-03-04_041713.dwg – 9/19/2014 10:53 AM

UPPER NORTH INTERCEPTOR
EAGLE PARK OUTLET
4 DAM SEEPWATER PUMP STATION
EAGLE PARK RESERVOIR
BI
EVMW-3(S,D)
AI
EAST FORK PUMP STATION (EAGLE PARK RES. CO.)
4 DAM SEEPWATER PIPELINE
ROBINSON LAKE OUTLET WORKS
EVS-3
EVMW-2
EVS-2
EV-MW-004
EVS-1
EVMW-1(S,D)
ROBINSON LAKE SEEPWATER PUMP STATION
ROBINSON LAKE PUMP STATION
TENMILE TUNNEL
SOUTH PORTAL
WARREN'S PUMP STATION
ROBINSON LAKE
CHALK MTN. RESERVOIR PUMP STATION (FRESH WATER)
CHALK MTN. RESERVOIR
CHALK PIPELINE
CHALK MTN INTERCEPTOR
LAKE IRWIN
TUNNEL BULKHEAD
TENMILE TSF (APPROX. CONFIGURATION)
11,110
11,110
SLUDGE DISPOSAL CELL
SLUDGE DENSIFICATION PLANT (SDP)
2 DAM
2 DAM PIPELINE
1 DAM
TIM'S POND
ROBINSON TSF
EAST SIDE CHANNEL
ETDL
MCNULTY WELL
BUFFEHRS PIPELINE

LEGEND:

- PROPERTY BOUNDARY
- WATERSHED BOUNDARY
- AFFECTED AREA BOUNDARY
- COUNTY LINE
- EXISTING GROUNDWATER MONITORING WELL
- EXISTING SURFACE WATER MONITORING LOCATION
- SPRING/SURFACE SAMPLING LOCATION

N

SCALE
500' 0 500' 1000'
CONTOUR INTERVAL 25'

Issued by:

TETRA TECH
350 Indiana Street, Suite 500
Golden, Colorado 80401
(303) 217-5700 (303) 217-5705 fax

Title:
CLIMAX MINE
WATER QUALITY MONITORING PLAN
EAGLE RIVER WATERSHED
MONITORING LOCATIONS

C
REVISION

Project: CLIMAX MINE
Project no.: 114-010428
Location: CLIMAX, COLORADO
Date: 09/14

FIGURE 3

Philippi, Brian – T:\Clients\Climax Moly\GW Mon Plan\Figures\Fig02-03-04_041713.dwg – 9/19/2014 10:53 AM

RISER 7.1

MAYFLOWER TSF

MAYFLOWER DECANT

5 DAM SEEPWATER PIPELINE EXTENSION

SEEPWATER PIPELINE

SURGE RISER

5 DAM TAILING DISTRIBUTION SYSTEM

5 DAM

12

5 DAM SEEPWATER PUMP STATION

MAYFLOWER PH CONTROL SYSTEM

TUCKER GULCH

COPPER CREEK

MAYFLOWER CANAL

TM-MW-001D GW#1

SUPPLY CANAL NO. 1

AFFECTED LANDS BOUNDARY

HIGHWAY 91

TM-MW-002D GW#2

TEN MILE CREEK

PROPERTY LINE FLUME (OUTFALL 001)

SUPPLY CANAL NO. 1

HUMBUG CREEK

MAYFLOWER CREEK

11800 11600 11400 11200 11000 10800 10600 10500 11000 11200 11400

LEGEND:

- PROPERTY BOUNDARY
- WATERSHED BOUNDARY
- AFFECTED AREA BOUNDARY
- COUNTY LINE
- EXISTING GROUNDWATER MONITORING WELL

N

SCALE

500' 0 500' 1000'

CONTOUR INTERVAL 25'

Issued by:

TETRA TECH

350 Indiana Street, Suite 500
Golden, Colorado 80401
(303) 217-5700 (303) 217-5705 fax

Title:

CLIMAX MINE
WATER QUAILTY MONITORING PLAN
TENMILE CREEK WATERSHED
MONITORING LOCATIONS

B
REVISION

Project: CLIMAX MINE

Project no.: 114-010428

Location: CLIMAX, COLORADO

Date: 4/11

FIGURE 4

Philippi, Brian – T:\Clients\Climax Moly\GW Mon Plan\Figures\Fig02-03-04_041713.dwg – 9/19/2014 10:53 AM

GOLD HILL

CC-SW1

CLINTON RESERVOIR

CLINTON DITCH

LITTLE BARTLETT MTN.
(12,935')

MCNULTY GULCH

MCNULTY OSF

HIGHWAY 91

EAST INTERCEPTOR

SLAKED LIME PIPELINE

Tailing Distribution System

SLUDGE DISPOSAL CELL

NSIFICATION LANT (SDP)

MCNULTY WELL

ETDL

EI - SW1

DSM INTERCEPTOR

TDL

10

6

5

LEGEND:

- PROPERTY BOUNDARY
- WATERSHED BOUNDARY
- AFFECTED AREA BOUNDARY
- COUNTY LINE
- EXISTING GROUNDWATER MONITORING WELL
- SURFACE SAMPLING LOCATIONS

N

SCALE

500' 0 500' 1000'

CONTOUR INTERVAL 25'

Issued by:

TETRA TECH

350 Indiana Street, Suite 500
Golden, Colorado 80401
(303) 217-5700 (303) 217-5705 fax

Title:

CLIMAX MINE
WATER QUALITY MONITORING PLAN
CLINTON RESERVOIR
MONITORING LOCATIONS

C
REVISION

Project: CLIMAX MINE

Project no.: 114-010428

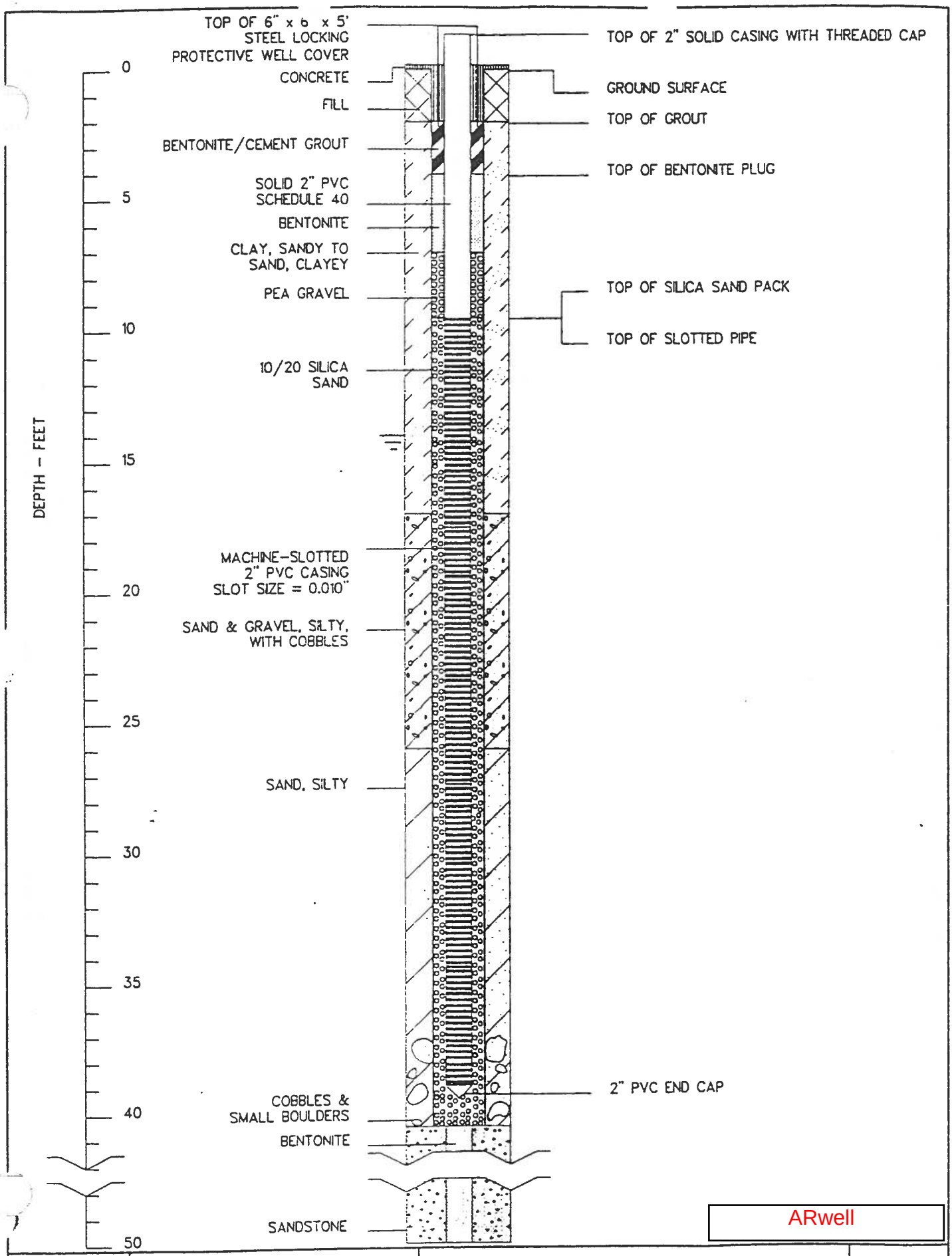
Location: CLIMAX, COLORADO

Date: 4/11

FIGURE 5

T:\Clients\Climax Moly\GW Mon Plan\Figures\Fig02-03-04 Ryan.dwg — 12/15/2011 10:46 AM

APPENDIX A
GROUNDWATER MONITORING WELL COMPLETION LOGS



ARwell

92-220.1E	Kumar & Associates	MONITORING WELL DIAGRAM: MW-ARK	FIG. 3

DRAFT

ARCADIS

Boring/Well Construction Log

Job Number:	Client:	Location:	Well Number:	Page 1 of 3
CO001701.0001	Climax Molybdenum Co.	Climax Mine	ARK-MW-001D	

Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.	Sampling Method: Chips Seperated by Cyclone
Drilling Start: 08/30/12 16:45 Finish: 09/6/12 17:30	Develop Start: 09/8/12 09:50 Finish: 09/8/12 10:40
Depth to Water: -5.5 ft bgs	Drilled By: Precision Sampling, Inc.
Elevation TOC: N/A GL: N/A	Logged By: Paul Williams & Matthew W. Bauer, PG

Location:

UTM: 13N 396993, 4357590 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
-5 to 0	Locking Surface Completion; Concrete					
0 to 5			GW	Fill	10YR 4/2	Fill: 0-6" Aggregate fill. Dark brown sandy loam and gravel, little silt, trace clay. Pebbles rounded to sub angular.
5 to 10			GW	Fill	10YR 2/2	50% unconsolidated silt to very coarse sand grained, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. 50% Granite aggregate, fine to coarse gravel grained, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Trace wood in sample.
10 to 15			GW	Fill	10YR 2/2	50% unconsolidated silt to very coarse sand grained, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. 50% Granite aggregate, fine to coarse gravel grained, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. 10% wood and synthetic fabric in sample.
15 to 20			GW	Glacial Till	10YR 2/2	Glacial Till: 60% Granite aggregate, fine to medium gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.
20 to 25			GW	Glacial Till	10YR 2/2	60% Granite aggregate, fine to medium gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand with trace clay, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.
25 to 30	High Solids Bentonite Grout; 4" - Sch 40 PVC		GW	Glacial Till	10YR 5/3	60% Granite aggregate, fine to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.
30 to 40				Weathered Granite	GLEY 1 4/N	Granodiorite: weathered contact, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix.
40 to 50						Granodiorite: porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix.

Electronic log compiled by: Laura Madsen

DRAFT

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: ARK-MW-001D	Page 2 of 3	Location: 
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone			
Drilling Start: 08/30/12 16:45 Finish: 09/6/12 17:30		Develop Start: 09/8/12 09:50 Finish: 09/8/12 10:40			
Depth to Water: -5.5 ft bgs		Drilled By: Precision Sampling, Inc.			
Elevation TOC: N/A GL: N/A		Logged By: Paul Williams & Matthew W. Bauer, PG			UTM: 13N 396993, 4357590 N

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
50–105	Coated Bentonite Pellets; Centralizer; Centralizer; Centralizer; 10/20 Sand; 4" - 20 Slot			Granodiorite	GLEY 1 5/N	Producing ~1 gpm water. Slowing with depth. Hole drying
				Shale	GLEY 1 2.5/N	Shale: laminated, hard, fine grained matrix with muscovite, quartz and feldspar crystals, trace pyrite. Hole producing ~0.25 gpm water. Hole producing ~0.20 gpm water.
						Granodiorite: porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix, 20% Shale, laminated, hard, fine grained, muscovite, quartz, and feldspar, trace pyrite Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix, Cuttings wet at 100 - 110 ft bgs

Electronic log compiled by: Laura Madsen

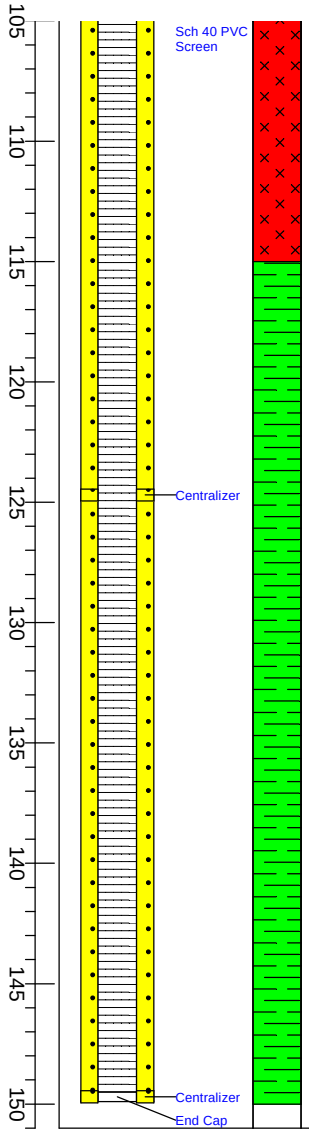
ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: ARK-MW-001D	Page 3 of 3
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 08/30/12 16:45 Finish: 09/6/12 17:30		Develop Start: 09/8/12 09:50 Finish: 09/8/12 10:40		
Depth to Water: -5.5 ft bgs		Drilled By: Precision Sampling, Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Paul Williams & Matthew W. Bauer, PG		

Location:

UTM: 13N 396993, 4357590 **N**



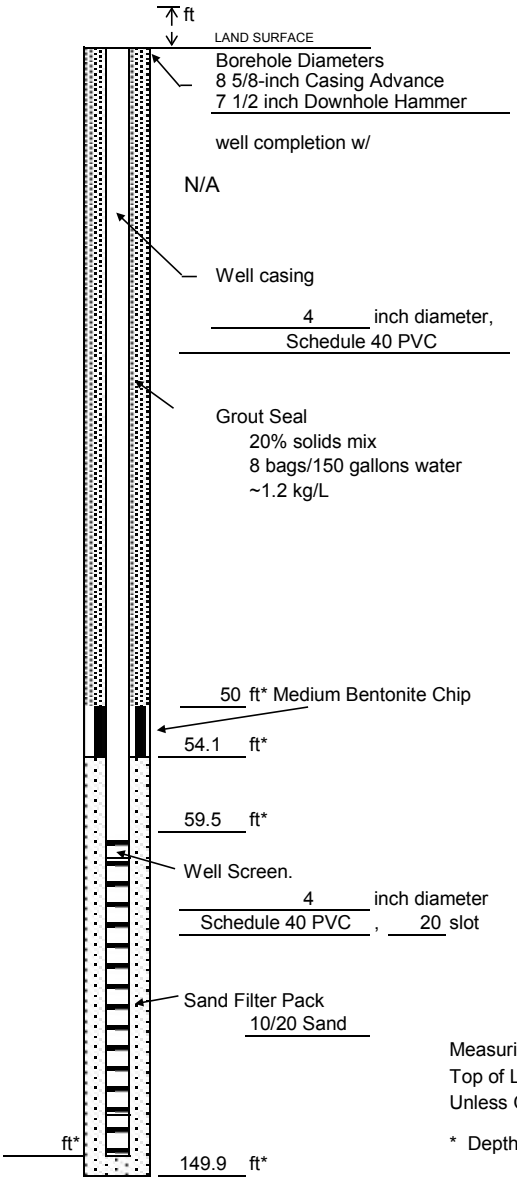
Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
				Granodiorite	GLEY 1 5/N	
				Shale	GLEY 1 2.5/N	Shale: laminated, hard, fine grained, muscovite, quartz, and feldspar, trace pyrite. Hole Dry.

Electronic log compiled by: Laura Madsen

ARCADIS

W□□□C□□□□□□□□□□□□□□ L□□

Not to Scale



P□□□□□□ Climax Molybdenum Wells **W□□□** ARK-MW-001D

T□□ □□C□□□ Leadville

C□□□□□ Lake **S□□□□** CO

I□□□□□□□□□□□□ D□□□(□) 08/30/2012 -09/07/2012

D□□□□□□□ M□□□□□ ODEX Casing/Downhole Hammer

D□□□□□□□ C□□□□□□□□□□ Precision Samploing, Inc.

D□□□□□□□ □□□□□ Air and Water

W□□□P□□□□□□ Compliance and Monitoring

R□□ □□□□ Artesian - Static water at ~6ft above land surface.

Centralizers at 59.5, 74.5, 99.5, 124.5, and 149.5 ft below ground surface

P□□□□□□□ □□ Matt Bauer, PG

Measuring Point is
Top of Land Surface
Unless Otherwise Noted.

* Depth Below Land Surface

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/23/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	ARK-MW-001D
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	5S05-13
Pump Serial #	B8010013-P11338
Date Code	2013
Rated GPM	5
Rated head	247 ft
Rated horsepower	0.5

WELL INFORMATION

Well depth	151.1 ft
casing size	4 in
static level	artesian
pumping level	UNK
pitless adapter	4 well packer,4x1 seal
pick sub size	1 in

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	1.2
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	115
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	115
Phase	single
Motor Model #	MS402
Motor serial #	79922102PC P21340
Date Code	2013
Name plate amps	10.5
SF amperage	12
RPM	34540

SETTING INFORMATION

Pump setting	146ft to bottom of motor
column pipe size	1 in
column pipe material	PVC sch 80
column pipe lengths	20 ft
Thread pattern	NPT
pick up subs	1 in
change over nipples	N/A
check valve	built into pump
knock out (yes/no)	NO
check valve depths	144 ft
monitoring tube	4" well packer
airline	N/A
wire size	10/2 w/grnd
probes setting	N/A

ELECTRICAL CONTROLS

voltage	115
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

DRAFT

ARCADIS

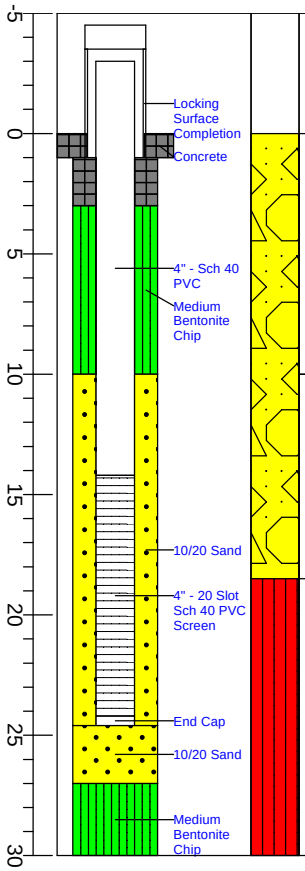
Boring/Well Construction Log

Job Number:	Client:	Location:	Well Number:	Page 1 of 1
CO001701.0001	Climax Molybdenum Co.	Climax Mine	ARK-MW-002S	

Drilling Method: Air Rotary: ODEX, 8.75 in.	Sampling Method: Chips Seperated by Cyclone
Drilling Start: 08/25/12 08:30 Finish: 08/25/12 18:50	Develop Start: 8/29/12 11:00 Finish: 8/29/12 12:00
Depth to Water: 19.5' bgs	Drilled By: Precision Sampling Inc.
Elevation TOC: N/A GL: N/A	Logged By: Matthew W. Bauer, PG

Location:

UTM: 13N 398208, 4357524 **N**



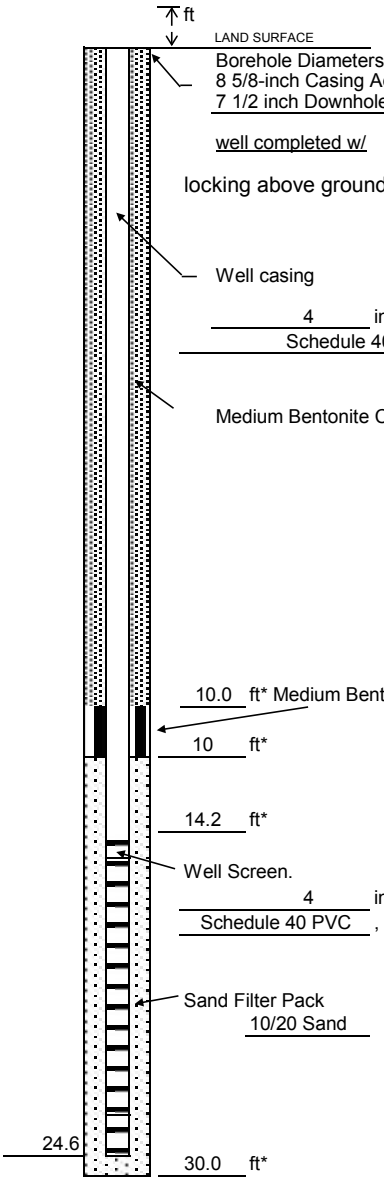
Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
			ML	Glacial Till	10YR 3/3	Glacial Till: 30% Granite aggregate, fine to medium gravel, poorly sorted, rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated 50% silt to 20% coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.
						30% Granite aggregate, fine to medium gravel, poorly sorted, rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated 50% silt to 20% coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Paste pH: 6.80 pH, 0.22 mS
			ML		2.5Y 3/1	10% Granite aggregate, fine to medium gravel, poorly sorted, rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated 50% silt to 40% coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Wood particles @ 15' bgs Paste pH: 7.00 pH, 0.20 mS
				Weathered Rhyolite	2.5Y 5/1	Rhyolite: Unconsolidated 10% silt to 50% very coarse sand, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, and biotite with trace pyrite, and 40% weathered, porphyritic rhyolite, containing abundant phenocrysts up to 0.2 inches in length of quartz and feldspar, with smaller phenocrysts of biotite in a crystalline matrix of plagioclase.
				Rhyolite Porphyry	10YR 5/1	Split spoon sample 19.5-21.5' bgs; hammer count: 13, 15, 28, 37. Paste pH: 8.59 pH, 0.28 mS
						Rhyolite: porphyritic rhyolite, containing abundant phenocrysts up to 0.2 inches in length of quartz and feldspar, with smaller phenocrysts of biotite and trace pyrite in a crystalline matrix of plagioclase. Paste pH: 9.42 pH, 0.14 mS

Electronic log compiled by: Laura Madsen

ARCADIS

W□□□C□□□□□□□□□□□□□ L□□

Not to Scale



P□□□□□□□ Climax Molybdenum Wells **W□□□** ARK-MW-002S

T□□ □C□□□ Climax

C□□□□□ Lake **S□□□□** CO

I□□□□□□□□□□□□ D□□□(□) 8/25/2012

D□□□□□□□ M□□□□□ ODEX Casing/Downhole Hammer

D□□□□□□□ C□□□□□□□□□□ Precision Samploing, Inc.

D□□□□□□□ □□□□□ Air and Water

W□□□P□□□□□□ Compliance and Monitoring

R□□ □□□□ None

P□□□□□□□ □□ Matt Bauer, PG

Measuring Point is
Top of Land Surface
Unless Otherwise Noted.

* Depth Below Land Surface

DRAFT

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: ARK-MW-002D	Page 1 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 08/26/12 07:45 Finish: 08/26/12 18:30		Develop Start: 08/29/12 07:00 Finish: 08/29/12 12:00		
Depth to Water: 18.5' bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

UTM: 13S 398211, 4357521 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
-5 to 0	Locking Surface Completion; Concrete; 4" - Sch 40 PVC		GM	Glacial Till	10YR 4/2	Glacial Till: 50% Granite aggregate, fine to medium gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated 30% silt to 20% very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Paste pH: 6.60 pH, 0.15 mS
0 to 5			GM		2.5Y 3/3	40% granite aggregate, fine to medium gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated 30% silt to 30% very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.
5 to 10			GM		2.5Y 3/2	40% granite aggregate, fine to medium gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar, olivine and biotite with trace pyrite. Matrix is unconsolidated 30% silt to 30% very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Slow dilatancy. Paste pH: 6.88 pH, 0.14 mS.
10 to 15	Medium Bentonite Chip			Weathered Rhyolite	2.5Y 5/1	
15 to 20				Rhyolite Porphyry	7.5YR 4/1	Rhyolite: Unconsolidated 10% silt to 50% very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite, and 40% weathered, porphyritic rhyolite, containing abundant phenocrysts up to 0.2 inches in length of quartz and feldspar, with smaller phenocrysts of biotite in a crystalline matrix of plagioclase.
20 to 25						
25 to 30				Sandstone	10YR 5/6	Rhyolite: porphyritic rhyolite, containing abundant phenocrysts up to 0.2 inches in length of quartz and feldspar, with smaller phenocrysts of biotite in a crystalline matrix of plagioclase. Paste pH: 9.42 pH, 0.14 mS
30 to 35						Sandstone: Sandstone: Arkosic, hard, fine grained and well sorted, primarily composed of quartz, feldspar, and muscovite mica, minor micritic limestone. Minturn Formation
35 to 40	4" - Sch 40 PVC					
40 to 45						
45 to 50						

Electronic log compiled by: Laura Madsen

DRAFT

ARCADIS

Boring/Well Construction Log

Job Number:	Client:	Location:	Well Number:	Page 2 of 4
CO001701.0001	Climax Molybdenum Co.	Climax Mine	ARK-MW-002D	

Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.	Sampling Method: Chips Seperated by Cyclone
Drilling Start: 08/26/12 07:45 Finish: 08/26/12 18:30	Develop Start: 08/29/12 07:00 Finish: 08/29/12 12:00
Depth to Water: 18.5' bgs	Drilled By: Precision Sampling Inc.
Elevation TOC: N/A GL: N/A	Logged By: Matthew W. Bauer, PG

Location:

UTM: 13S 398211, 4357521 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
50–105	Centralizer; Centralizer			Sandstone	2.5Y 5/4	Sandstone: Sandstone: Arkosic, hard, fine grained and well sorted, primarily composed of quartz, feldspar, and muscovite mica, minor micritic limestone. Minturn Formation

Electronic log compiled by: Laura Madsen

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: ARK-MW-002D	Page 3 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 08/26/12 07:45 Finish: 08/26/12 18:30		Develop Start: 08/29/12 07:00 Finish: 08/29/12 12:00		
Depth to Water: 18.5' bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

UTM: 13S 398211, 4357521 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
105						
110	Centralizer					
115						
120						
125						
130	10/20 Sand 4" - 20 Slot Sch 40 PVC Screen					
135	Centralizer			Quartz Monzonite	10YR 4/1 & 5YR 4/3	Quartz Monzonite: Quartz monzonite porphyry: quartz and feldspar crystals in an aphanetic matrix, minor interbedded, fine grained shale. Formation becoming dry.
140						
145						
150						
155						
160						

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: ARK-MW-002D	Page 4 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 08/26/12 07:45 Finish: 08/26/12 18:30		Develop Start: 08/29/12 07:00 Finish: 08/29/12 12:00		
Depth to Water: 18.5' bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

UTM: 13S 398211, 4357521 **N**

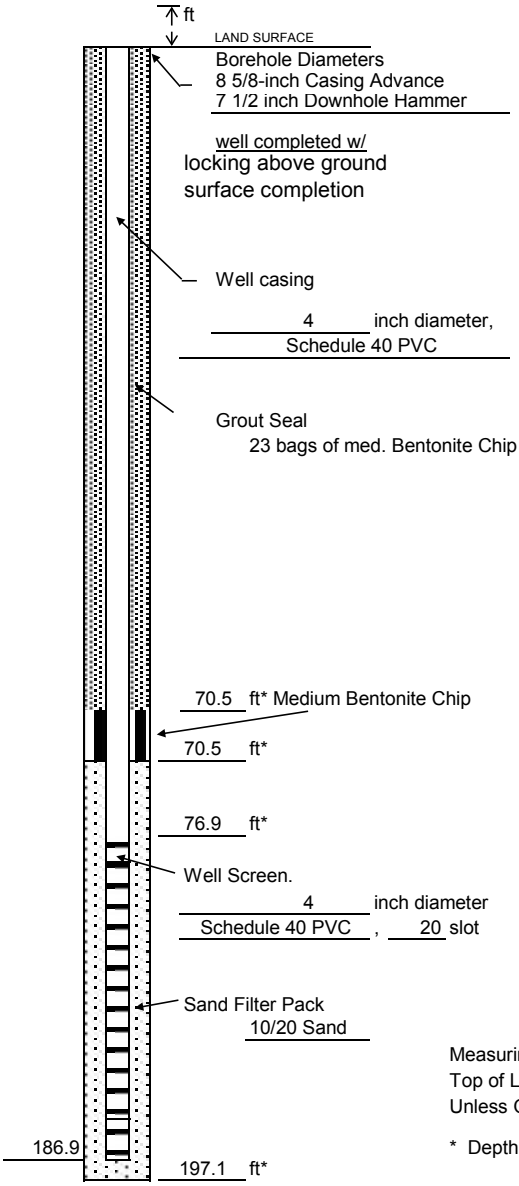
Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
160	Centralizer					
165				Granodiorite	GLEY 1 3/N	Granodiorite: Granodiorite: porphyry, primarily containing hornblende and biotite with phenocrysts of quartz and feldspar in an aphanitic matrix. Unit dry.
170						
175						
180				Granodiorite	10YR 4/1	Granodiorite: Granodiorite: porphyry, primarily containing hornblende and biotite with phenocrysts of quartz and feldspar in an aphanitic foliated matrix. Unit dry.
185	Centralizer					
190	Coated Bentonite Pellets			Sandstone	10YR 5/4	Sandstone: Sandstone: Arkosic, hard, fine grained and well sorted, primarily composed of quartz, feldspar, and muscovite mica, minor micritic limestone. Minturn Formation
195	End Cap					

Electronic log compiled by: Laura Madsen

ARCADIS

W□□□C□□□□□□□□□□□□□ L□□

Not to Scale



P□□□□□□ Climax Molybdenum Wells **W□□□** ARK-MW-002D

T□□ □C□□□ Climax

C□□□□□ Eagle **S□□□□** CO

I□□□□□□□□□□□□ D□□□(□) 8/26/2012

D□□□□□□□ M□□□□□ ODEX Casing/Downhole Hammer

D□□□□□□□ C□□□□□□□□□□ Precision Samploing, Inc.

D□□□□□□□ □□□□□ Air and Water

W□□□P□□□□□□ Compliance and Monitoring

R□□ □□□□ Surged 10 times then airlifted.

Centralizers at 76.9, 91.9, 111.9, 136.9, 161.9 and 186.9 ft below ground surface

P□□□□□□□ □□ Matt Bauer, PG

Measuring Point is
Top of Land Surface
Unless Otherwise Noted.

* Depth Below Land Surface

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/23/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	ARK-MW-002D
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	5S05-13
Pump Serial #	B8010013-P11338
Date Code	2013
Rated GPM	5
Rated head	247 ft
Rated horsepower	0.5

WELL INFORMATION

Well depth	199.82 ft
casing size	4 in
static level	12.3 ft
pumping level	UNK
pitless adapter	4x1 san seal
pick sub size	N/A

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

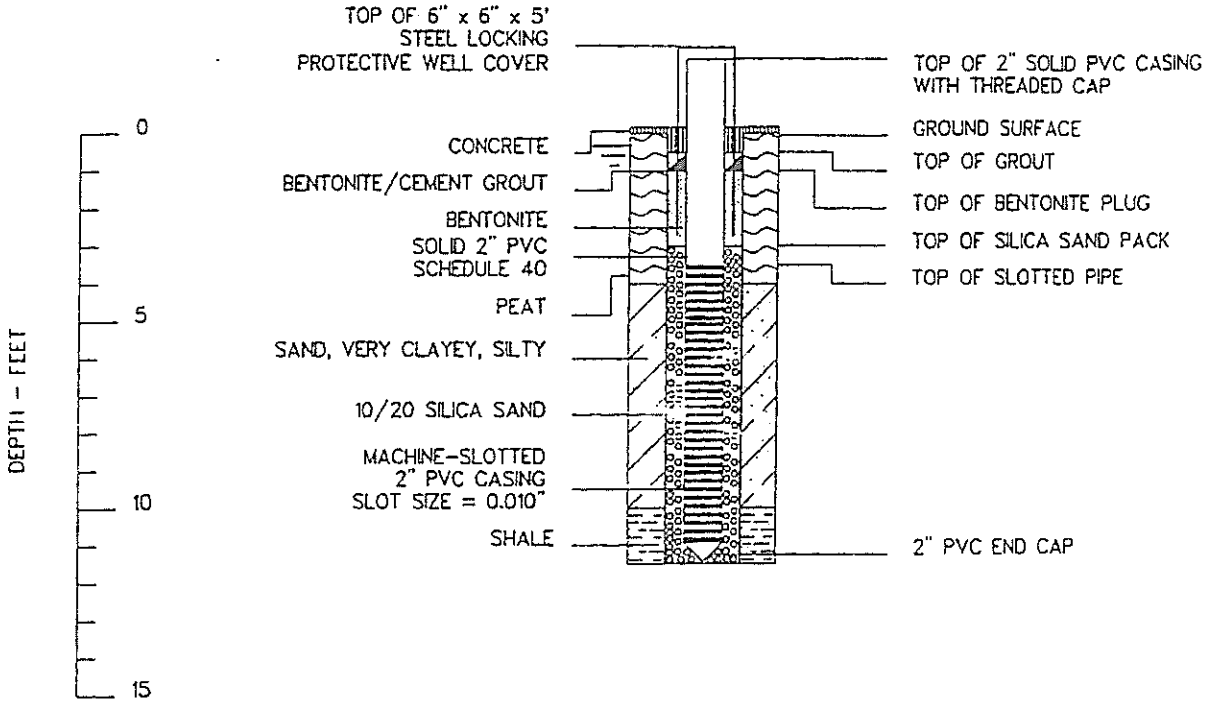
Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	115
Phase	single
Motor Model #	MS402
Motor serial #	79922102 PC: P2 P11339
Date Code	2013
Name plate amps	10.5
SF amperage	12
RPM	3450

SETTING INFORMATION

Pump setting	194ft to bottom of motor
column pipe size	1 in
column pipe material	PVC sch 80
column pipe lengths	20 ft & 12 ft
Thread pattern	NPT
pick up subs	N/A
change over nipples	N/A
check valve	built into pump
knock out (yes/no)	No
check valve depths	192 ft
monitoring tube	3/4in PVC sight tube
airline	N/A
wire size	10/2 w/grnd
probes setting	N/A

ELECTRICAL CONTROLS

voltage	115
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A



92-220.1E	Kumar & Associates	MONITORING WELL DIAGRAM: MW-EGL	FIG. 2

EVMW

Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-1S Log

CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *10/03/2011 - 10/03/2011* **GROUND ELEVATION:** *Not Recorded* **HOLE SIZE:** *0-14' - 6.5" 14'-24.5' - 5.5"*

LOGGED BY: *Joe Reed* **NORTHING:** *Not Recorded* **SAMPLE:**

DRILLING CONTRACTOR: *Precision Sampling Inc.* **EASTING:** *Not Recorded* **TOTAL DEPTH:** *24.5 ft*

DRILL RIG: *Longyear Delta Base 540* **GROUNDWATER:** *4.04' Below Ground Surface 10/5/11*

METHOD: *Rotary Air Hammer* **NOTES:**

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			
			Fill
2			2.0
			clayey silty sandy GRAVEL, dark brown, moist, loose, fine to coarse grained sand and gravel, cohesive, organic
4			3.5
			sandy clayey GRAVEL, dark gray (10YR 3/1), moist, loose to dense, fine to coarse grained sand and gravel, more gravel than above
6			
8			
10			
12			12.0
			SCHIST, weathered, black, micaceous
14			14.0
			Stop ODEX, start rotary air hammer
			QUARTZ MONZONITE, dark gray
16			
18			
20			20.0
			QUARTZ MONZONITE, gray (10YR 5/1)
22			
24			24.5
			Bottom of hole at 24.5 feet.

Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-1S

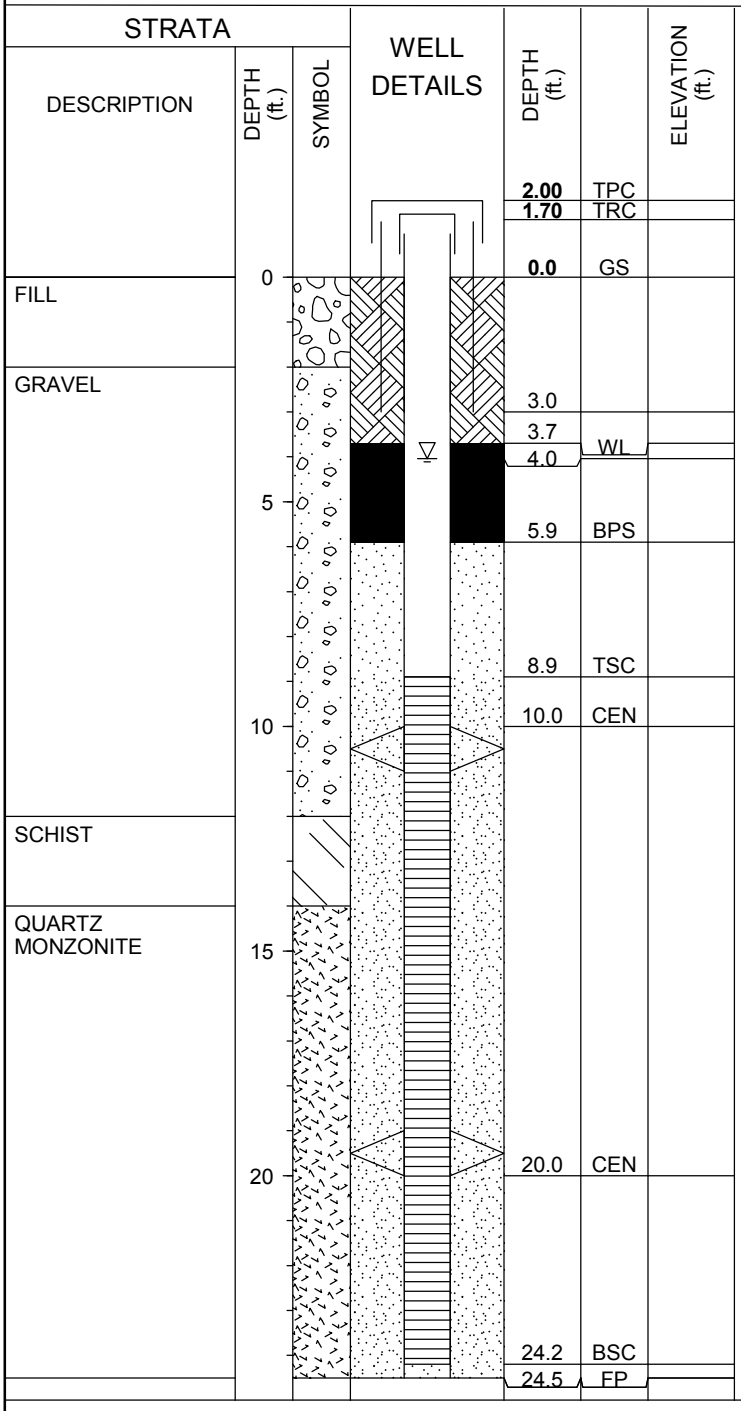
CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *10/03/2011 - 10/03/2011* **PERMIT NUMBER:** *N/A*

GROUNDWATER: *4.04' Below Ground Surface 10/5/11* **TOTAL DEPTH:** *24.5*

NOTES: **LOGGED BY:** *Joe Reed*



WELL CONSTRUCTION DETAILS

PROTECTIVE CASING
Diameter: *5"*
Type: *Steel*
Interval: *+2.0 - 3.0*

RISER CASING
Diameter: *2"*
Type: *2" Schedule 40*
Interval: *+1.7 - 8.9*
Stickup: *1.7*

SANDPACK
Type: *10-20*
Interval: *5.9 - 24.5*

SCREEN
Diameter: *2"*
Type: *2" Schedule 40 0.010" Slots*
Interval: *8.9 - 24.2*

GROUT
Type: *N/A*
Interval:

SEAL
Type: *Bentonite Pellets*
Interval: *3.7 - 5.9*

SEAL
Type: *Concrete*
Interval: *0 - 3.7*

SEAL
Type: *N/A*
Interval:

WELL DEVELOPMENT DATA

DATE: 10/5/2011
METHOD: Surge Block, Air Lift, and Pumping
DURATION: Not Recorded
RATE: Recovery Rate 1.5 gpm
FINAL MEASUREMENTS: N/A

pH	Temperature (° C)	Conductivity (µmhos / meter)	Turbidity (visual)

LEGEND

- FILTER PACK
- BENTONIE CHIP
- BENTONITE PELLETS
- CONCRETE
- CUTTINGS / BACKFILL
- SCREEN

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
GS	GROUND SURFACE
BCS	BENTONITE CHIP SEAL
BPS	BENTONITE PELLET SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
BS	BOTTOM SUMP
TSD	TOTAL SAMPLE DEPTH
CEN	CENTRALIZER
WL	WATER LEVEL

GROUND ELEVATION: *Not Recorded*
MEASURING POINT ELEVATION: *Not Recorded*
NORTHING: *Not Recorded*
EASTING: *Not Recorded*

DRILL RIG: *Longyear Delta Base 540*
METHOD: *Rotary Air Hammer*
HOLE SIZE: *0-14' - 6.5" 14'-24.5' - 5.5"*
HOLE DEPTH: *24.5*

DRILLING CONTRACTOR: *Precision Sampling Inc.*
LOGGED BY: *Joe Reed*

PROTECTIVE CASING WELL LOG CLIMAX.GPJ ALL REPORTS JLR 2-14-11.GDT 10/10/11

Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-1D Log

CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *09/29/2011 - 09/30/2011* **GROUND ELEVATION:** *Not Recorded* **HOLE SIZE:** *0-19' - 6.5" 19'-149' - 5.5"*

LOGGED BY: *Joe Reed* **NORTHING:** *Not Recorded* **SAMPLE:**

DRILLING CONTRACTOR: *Precision Sampling Inc.* **EASTING:** *Not Recorded* **TOTAL DEPTH:** *149 ft*

DRILL RIG: *Longyear Delta Base 540* **GROUNDWATER:** *3.65' Below Ground Surface 10/5/11*

METHOD: *Rotary Air Hammer* **NOTES:**

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			
			2.0 FILL
			3.0 TOP SOIL, wet, very organic with some wood/roots
			8.0 sandy silty clayey GRAVEL, dark brown (10YR 3/3), wet, loose, fine to coarse sand and gravel, trace roots
			13.5 sandy clayey GRAVEL, dark gray (10YR 3/1), moist, loose to dense, fine to coarse grained sand and gravel, more gravel than above
			16.0
20			19.0 QUARTZ MONZONITE, gray (1-YR 5/1)
			Increase in water production
			Stop ODEX, start rotary air hammer
			Fractures - increase in water production
			35.0
40			40.0
			40.5 0.5 gpm
			45.5 SCHIST, very dark gray (10YR 3/1) to dark gray (10YR 4/1)
			QUARTZ MONZONITE, Porphyritic, dark gray (10YR 4/1)
60			
			72.0
			QUARTZ MONZONITE
80			80.0
			0.5 gpm
100			
			115.0
			SCHIST
120			
			130.0
			0.9 gpm, discharge surges with cuttings
140			
			149.0
			0.75 - 1.0 gpm
			Bottom of hole at 149.0 feet.

BOREHOLE LOG WITHOUT WELL 20'SCALE CLIMAX.GPJ ALL REPORTS JLR 2-14-11.GDT 10/10/11

TETRA TECH
Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-1D

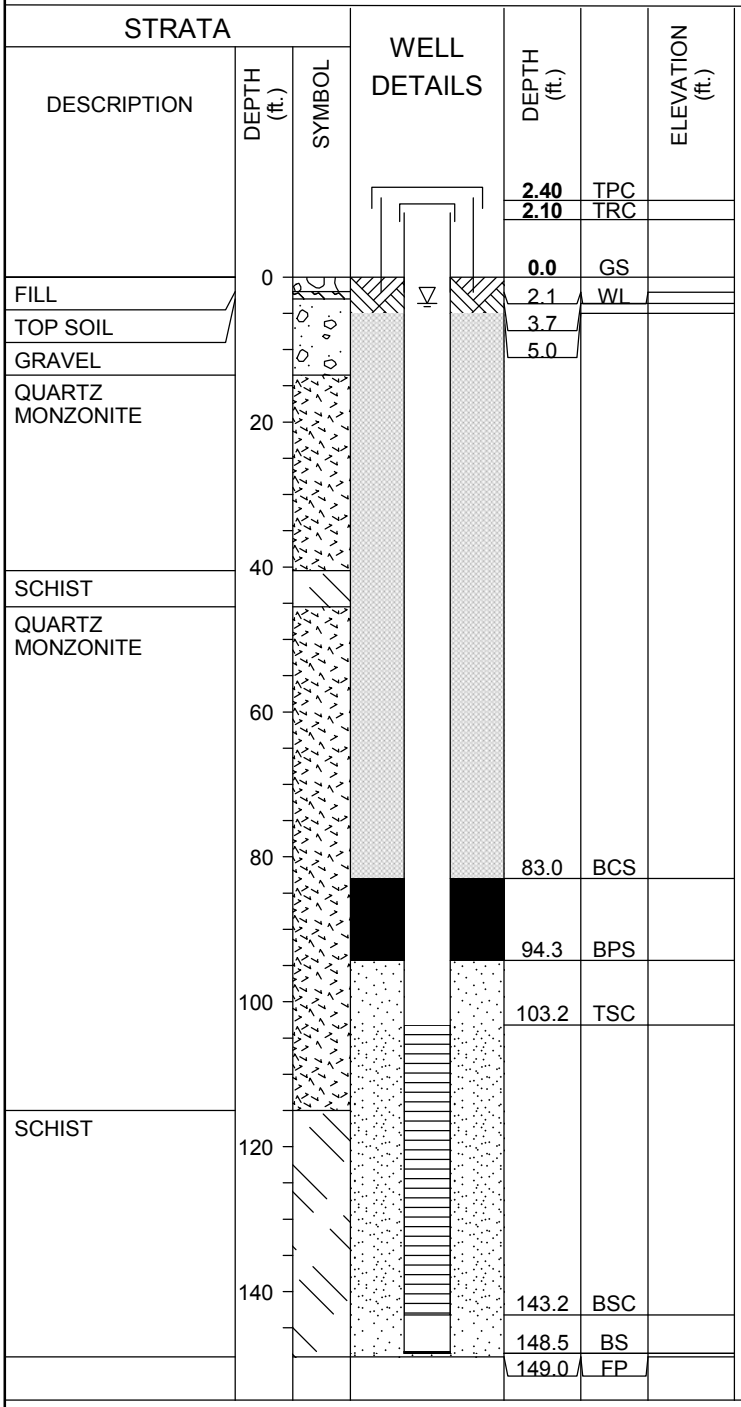
CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *09/29/2011 - 09/30/2011* **PERMIT NUMBER:** *N/A*

GROUNDWATER: *3.65' Below Ground Surface 10/5/11* **TOTAL DEPTH:** *149.01*

NOTES: **LOGGED BY:** *Joe Reed*



WELL CONSTRUCTION DETAILS

PROTECTIVE CASING
Diameter: *5"*
Type: *Steel*
Interval: *+2.4 - 2.6*

RISER CASING
Diameter: *2"*
Type: *2" Schedule 40*
Interval: *+2.1 - 103.2*
Stickup: *2.1*

SANDPACK
Type: *10-20*
Interval: *94.3 - 149*

SCREEN
Diameter: *2"*
Type: *2" Schedule 40 0.010" Slots*
Interval: *103.2 - 143.2*

GROUT
Type: *N/A*
Interval:

SEAL
Type: *Bentonite Pellets*
Interval: *83.0 - 94.3*

SEAL
Type: *Bentonite Chip*
Interval: *5.0 - 83.0*

SEAL
Type: *Concrete*
Interval: *0 - 5.0*

WELL DEVELOPMENT DATA

DATE: 10/5/2011
METHOD: Surge Block, Air Lift, and Pumping
DURATION: Not Recorded
RATE: Recovery Rate 0.15 gpm
FINAL MEASUREMENTS: N/A

pH	Temperature (° C)	Conductivity (µmhos / meter)	Turbidity (visual)

LEGEND
- FILTER PACK
- BENTONIE CHIP
- BENTONITE PELLETS
- CONCRETE
- CUTTINGS / BACKFILL
- SCREEN

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
GS	GROUND SURFACE
BCS	BENTONITE CHIP SEAL
BPS	BENTONITE PELLET SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
BS	BOTTOM SUMP
TSD	TOTAL SAMPLE DEPTH
CEN	CENTRALIZER
WL	WATER LEVEL

GROUND ELEVATION: *Not Recorded*
MEASURING POINT ELEVATION: *Not Recorded*
NORTHING: *Not Recorded*
EASTING: *Not Recorded*

DRILL RIG: *Longyear Delta Base 540*
METHOD: *Rotary Air Hammer*
HOLE SIZE: *0-19' - 6.5" 19'-149' - 5.5"*
HOLE DEPTH: *149.01*

DRILLING CONTRACTOR: *Precision Sampling Inc.*
LOGGED BY: *Joe Reed*

PROTECTIVE CASING WELL LOG 20 SCALE A 1 CLIMAX.GPJ ALL REPORTS JLR 2-14-11.GDT 10/10/11

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/25/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	EVMW-1D
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	MP1-2-A-B-G-TV
Pump Serial #	A1A106003PI1340025
Date Code	2013
Rated GPM	4.4
Rated head	242 ft
Rated horsepower	0.5

WELL INFORMATION

Well depth	150.4 ft
casing size	2in PVC
static level	12.6 ft
pumping level	UNK
pitless adapter	2" PVC cap
pick sub size	N / A

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	0.2
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	UNK
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	3 x 220
Phase	3
Motor Model #	same as pump
Motor serial #	same as pump
Date Code	2013
Name plate amps	5.5
SF amperage	5.5
RPM	22800

SETTING INFORMATION

Pump setting	144 ft
column pipe size	3/4 in
column pipe material	blue poly "pure core"
column pipe lengths	144 ft
Thread pattern	barbed
pick up subs	N / A
change over nipples	NPT to barbed
check valve	N / A
knock out (yes/no)	N / A
check valve depths	N / A
monitoring tube	N / A
airline	N / A
wire size	20/4 w/grnd
probes setting	N / A

ELECTRICAL CONTROLS

voltage	3 x 220
phase	3 phase
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

TETRA TECH
Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-2 Log

CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *09/10/2011 - 09/20/2011* **GROUND ELEVATION:** *Not Recorded* **HOLE SIZE:** *0-4.5' - 6.5" 4.5'-200' - 5.5"*

LOGGED BY: *Joe Reed* **NORTHING:** *Not Recorded* **SAMPLE:**

DRILLING CONTRACTOR: *Precision Sampling Inc.* **EASTING:** *Not Recorded* **TOTAL DEPTH:** *200 ft*

DRILL RIG: *Longyear Delta Base 540* **GROUNDWATER:** *36.36' Below Ground Surface 9/27/11*

METHOD: *Rotary Air Hammer* **NOTES:**

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			
		4.5	QUARTZ MONZONITE, greenish gray (Gley1 6/1) and reddish brown (5YR 4/4) Stop ODEX, start rotary air hammer
		14.0	Possible fractures
20		24.0	
		29.0	QUARTZ MONZONITE, reddish brown (5YR 4/4), softer than above
		38.0	QUARTZ MONZONITE, greenish gray (Gley1 6/1) and reddish brown (5YR 4/4)
40		45.0	QUARTZ MONZONITE, greenish gray (Gley1 6/1)
		50.0	Slight moisture after drilling break
		60.0	Slight moisture after drilling break
60		65.0	Slight moisture after drilling break
		70.0	Slightly more moisture after drilling break, moist cuttings throughout interval
		77.0	Moisture still increasing, free water not observed but enough moisture boot up returns
80		79.0	No moisture, dusty
		80.0	QUARTZ MONZONITE, greenish gray (Gley1 6/1) and dark greenish gray
		85.0	QUARTZ MONZONITE, greenish gray (Gley1 6/1)
		90.0	More water. booting up, thick concrete consistency After 10 minutes, water and thick cuttings
100		105.0	SCHIST, dark gray (10YR 4/1)
		120.0	QUARTZ MONZONITE, gray (2.5Y 6/1)
120		135.0	QUARTZ MONZONITE, gray (7.5YR 6/1) and pinkish gray (7.5YR 6/2)
140		150.0	Add 10 gallons of water to clean out borehole, no additional inflow since 90'
		160.0	Add 10 gallons of water to clean out borehole, no additional inflow since 90'
160		170.0	Add 20 gallons of water to clean out borehole, no additional inflow since 90'
		200.0	QUARTZ MONZONITE, mottled pinkish gray (7.5YR 6/2) and gray (2.5Y 6/1) to mostly gray at 180'
180			
200			Bottom of hole at 200.0 feet.

BOREHOLE LOG WITHOUT WELL 20'SCALE CLIMAX.GPJ ALL REPORTS JLR 2-14-11.GDT 10/10/11

Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-2

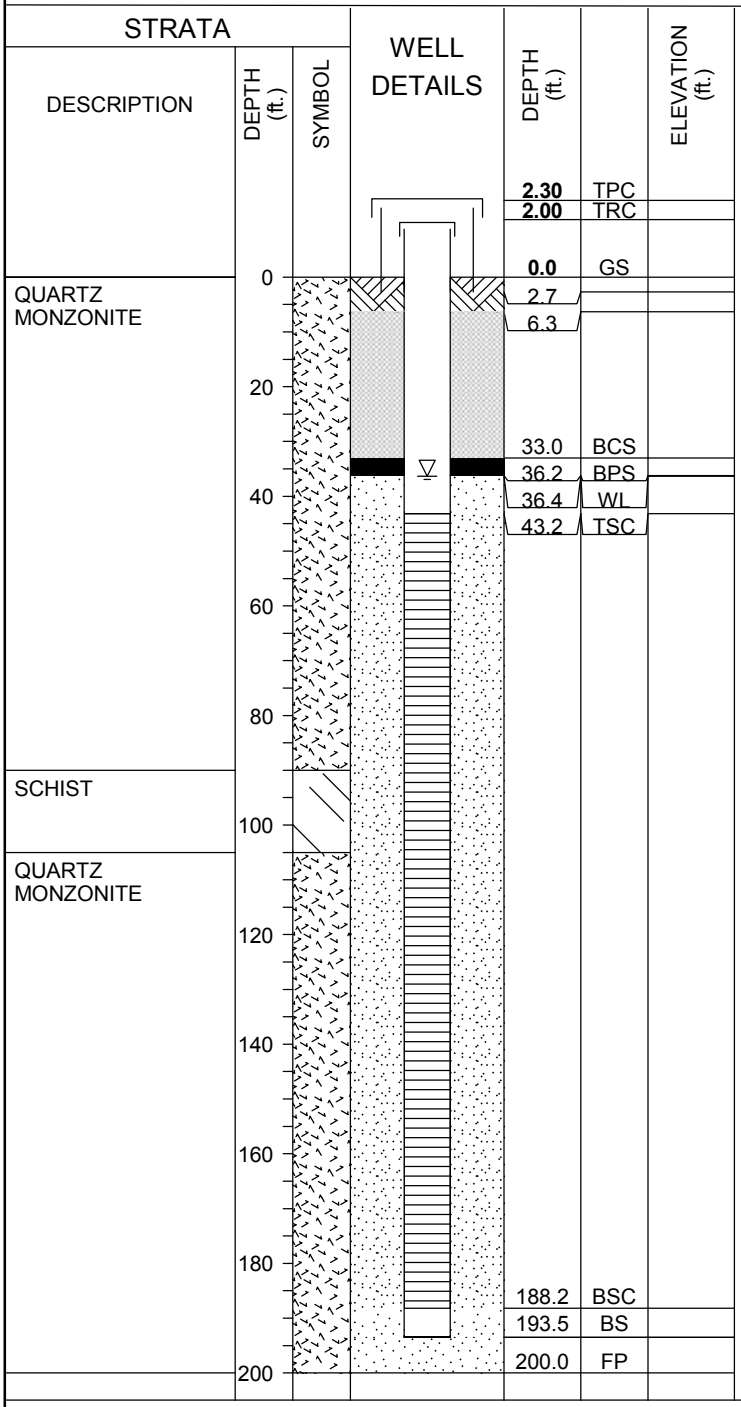
CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *09/10/2011 - 09/20/2011* **PERMIT NUMBER:** *N/A*

GROUNDWATER: *36.36' Below Ground Surface 9/27/11* **TOTAL DEPTH:** *200*

NOTES: **LOGGED BY:** *Joe Reed*



WELL CONSTRUCTION DETAILS

PROTECTIVE CASING
Diameter: *5'*
Type: *Steel*
Interval: *+2.2 - 2.7*

RISER CASING
Diameter: *2'*
Type: *2" Schedule 40*
Interval: *+2.0 - 43.2*
Stickup: *2*

SANDPACK
Type: *10-20*
Interval: *36.2 - 200*

SCREEN
Diameter: *2'*
Type: *2" Schedule 40 0.010" Slots*
Interval: *43.2 - 188.2*

GROUT
Type: *N/A*
Interval:

SEAL
Type: *Bentonite Pellets*
Interval: *33.0 - 36.2*

SEAL
Type: *Bentonite Chip*
Interval: *6.3 - 33.0*

SEAL
Type: *Concrete*
Interval: *0 - 6.3*

WELL DEVELOPMENT DATA

DATE: 9/27/2011
METHOD: Surge Block, Air Lift, and Pumping
DURATION: Not Recorded
RATE: Recovery Rate 0.5 gpm
FINAL MEASUREMENTS: N/A

pH	Temperature (° C)	Conductivity (µmhos / meter)	Turbidity (visual)

LEGEND

- FILTER PACK
- BENTONIE CHIP
- BENTONITE PELLETS
- CONCRETE
- CUTTINGS / BACKFILL
- SCREEN

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
GS	GROUND SURFACE
BCS	BENTONITE CHIP SEAL
BPS	BENTONITE PELLET SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
BS	BOTTOM SUMP
TSD	TOTAL SAMPLE DEPTH
CEN	CENTRALIZER
WL	WATER LEVEL

GROUND ELEVATION: *Not Recorded*
MEASURING POINT ELEVATION: *Not Recorded*
NORTHING: *Not Recorded*
EASTING: *Not Recorded*

DRILL RIG: *Longyear Delta Base 540*
METHOD: *Rotary Air Hammer*
HOLE SIZE: *0-4.5' - 6.5" 4.5'-200' - 5.5"*
HOLE DEPTH: *200*

DRILLING CONTRACTOR: *Precision Sampling Inc.*
LOGGED BY: *Joe Reed*

PROTECTIVE CASING WELL LOG 20 SCALE A 1 CLIMAX.GPJ ALL REPORTS JLR 2-14-11.GDT 10/10/11

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/25/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	EVMW-2
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	MP1-2-A-B-G-TV
Pump Serial #	A1A06003P1 13410011
Date Code	2013
Rated GPM	4.4
Rated head	242 ft
Rated horsepower	0.5

WELL INFORMATION

Well depth	195.4 ft
casing size	2 in PVC
static level	29.3 ft
pumping level	UNK
pitless adapter	2" PVC well cap
pick sub size	N / A

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	0.2
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	UNK
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	3 x 220
Phase	single
Motor Model #	pump & motor identical
Motor serial #	pump & motor identical
Date Code	2013
Name plate amps	5.5
SF amperage	5.5
RPM	22800

SETTING INFORMATION

Pump setting	189.4 ft
column pipe size	3/4 in
column pipe material	blue poly pure core
column pipe lengths	189 ft
Thread pattern	NPT x barb
pick up subs	N / A
change over nipples	NPT x barb
check valve	N / A
knock out (yes/no)	N / A
check valve depths	N / A
monitoring tube	N / A
airline	N / A
wire size	20/3 came with pump
probes setting	N / A

ELECTRICAL CONTROLS

voltage	3 x 220V
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-3S Log

CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *09/28/2011 - 09/28/2011* **GROUND ELEVATION:** *Not Recorded* **HOLE SIZE:** *0-4.5' - 6.5" 4.5'- 24.0' - 5.5"*

LOGGED BY: *Joe Reed* **NORTHING:** *Not Recorded* **SAMPLE:**

DRILLING CONTRACTOR: *Precision Sampling Inc.* **EASTING:** *Not Recorded* **TOTAL DEPTH:** *24 ft*

DRILL RIG: *Longyear Delta Base 540* **GROUNDWATER:** *5.39' Below Ground Surface 10/5/11*

METHOD: *Rotary Air Hammer* **NOTES:**

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			
			sandy GRAVEL, dark yellow brown (10YR 4/4), moist to wet at 6', medium dense, fine to coarse gravel, coarse sand, silt micaceous, trace clay, trace roots Stop ODEX, start rotary air hammer
4.5			
			QUARTZ MONZONITE
10.5			
			QUARTZ MONZONITE
16.0			
			SCHIST
19.5			
			QUARTZ MONZONITE
24.0			
			Bottom of hole at 24.0 feet.

Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-3S

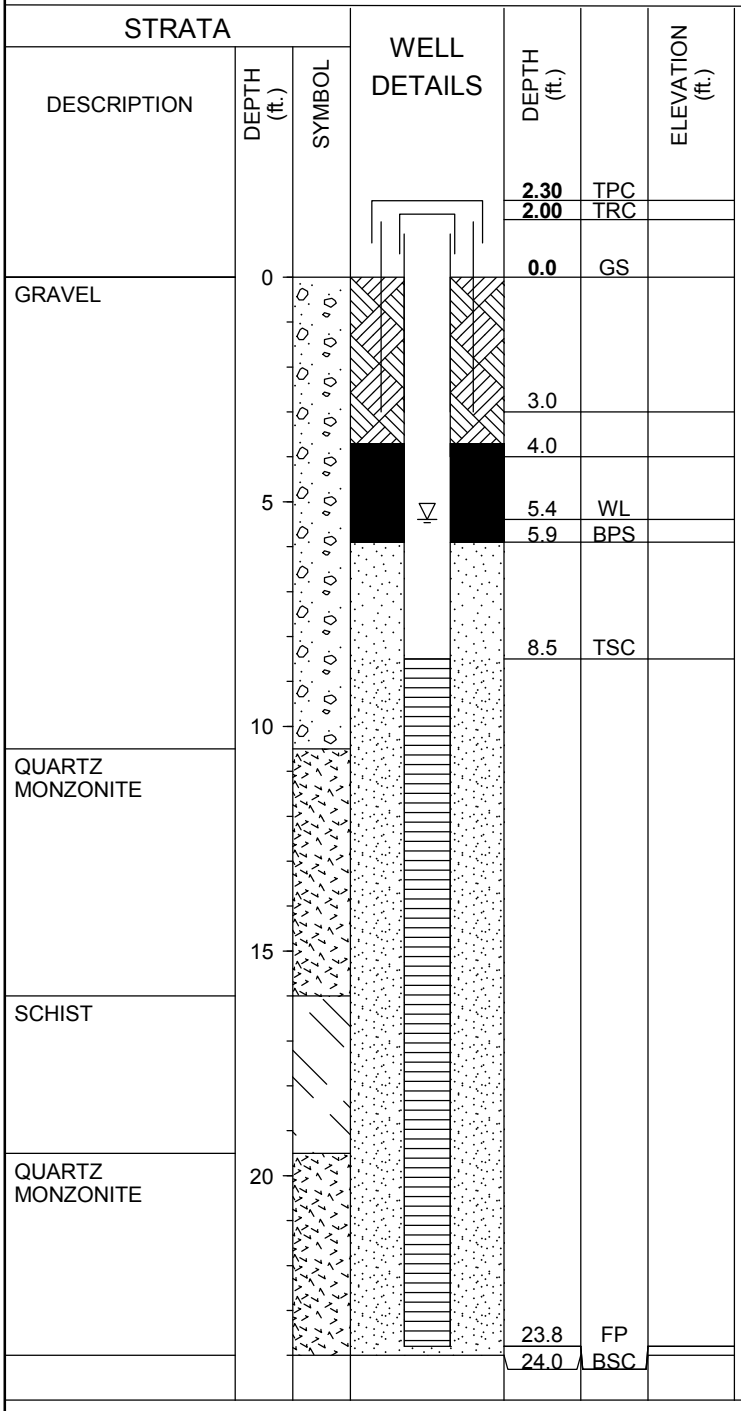
CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *09/28/2011 - 09/28/2011* **PERMIT NUMBER:** *N/A*

GROUNDWATER: *5.39' Below Ground Surface 10/5/11* **TOTAL DEPTH:** *24*

NOTES: **LOGGED BY:** *Joe Reed*



WELL CONSTRUCTION DETAILS

PROTECTIVE CASING
Diameter: *5'*
Type: *Steel*
Interval: *+2.3 - 2.7*

RISER CASING
Diameter: *2'*
Type: *2" Schedule 40*
Interval: *+2.0 - 8.5*
Stickup: *2*

SANDPACK
Type: *10-20*
Interval: *6.1 - 23.8*

SCREEN
Diameter: *2"*
Type: *2" Schedule 40 0.010" Slots*
Interval: *8.5 - 23.8*

GROUT
Type: *N/A*
Interval:

SEAL
Type: *Bentonite Pellets*
Interval: *4.0 - 6.1*

SEAL
Type: *Concrete*
Interval: *0 - 4.0*

SEAL
Type: *N/A*
Interval:

WELL DEVELOPMENT DATA

DATE: 10/5/2011
METHOD: Surge Block, Air Lift, and Pumping
DURATION: Not Recorded
RATE: Recovery Rate 0.15 gpm
FINAL MEASUREMENTS: N/A

pH	Temperature (° C)	Conductivity (µmhos / meter)	Turbidity (visual)

LEGEND

- FILTER PACK
- BENTONIE CHIP
- BENTONITE PELLETS
- CONCRETE
- CUTTINGS / BACKFILL
- SCREEN

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
GS	GROUND SURFACE
BCS	BENTONITE CHIP SEAL
BPS	BENTONITE PELLET SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
BS	BOTTOM SUMP
TSD	TOTAL SAMPLE DEPTH
CEN	CENTRALIZER
WL	WATER LEVEL

GROUND ELEVATION: *Not Recorded*
MEASURING POINT ELEVATION: *Not Recorded*
NORTHING: *Not Recorded*
EASTING: *Not Recorded*

DRILL RIG: *Longyear Delta Base 540*
METHOD: *Rotary Air Hammer*
HOLE SIZE: *0-4.5' - 6.5" 4.5'- 24.0' - 5.5"*
HOLE DEPTH: *24*

DRILLING CONTRACTOR: *Precision Sampling Inc.*
LOGGED BY: *Joe Reed*

PROTECTIVE CASING WELL LOG CLIMAX.GPJ ALL REPORTS JLR 2-14-11.GDT 10/10/11

Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-3D Log

CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *09/21/2011 - 09/27/2011* **GROUND ELEVATION:** *Not Recorded* **HOLE SIZE:** *0-14.5' - 6.5" 14.5'- 151.5' - 5.5"*

LOGGED BY: *Joe Reed* **NORTHING:** *Not Recorded* **SAMPLE:**

DRILLING CONTRACTOR: *Precision Sampling Inc.* **EASTING:** *Not Recorded* **TOTAL DEPTH:** *151.5 ft*

DRILL RIG: *Longyear Delta Base 540* **GROUNDWATER:** *8.52' Below Ground Surface 10/5/11*

METHOD: *Rotary Air Hammer* **NOTES:**

DEPTH (ft)	SAMPLE TYPE	GRAPHIC LOG	MATERIAL DESCRIPTION
0			
			sandy GRAVEL, dark yellow brown (10YR 4/4), moist to wet at 4', medium dense, fine to coarse gravel, coarse sand, silt, micaceous, trace clay, trace roots
			7.5
			QUARTZ MONZONITE, very dark gray brown (10YR 3/2), weathering decreases with depth
			14.5
			14.5 Stop ODEX, start rotary air hammer
20			SCHIST
			20.0
			21.5 QUARTZ MONZONITE, gray (10YR 6/1)
			Damp Cuttings
			35.0
40			QUARTZ MONZONITE, slightly darker than above
			43.0
			QUARTZ MONZONITE, pinkish gray (5YR 7/2) and gray (10YR 6/1)
			55.0
			56.5 After 10 minutes trace of moisture
60			Possible fracture
			68.5
			SCHIST, weak red (10R 4/2)
			75.0
80			After 10 minutes damp cuttings, dust returns 1.5' later
			80.0
			QUARTZ MONZONITE
			93.5
			95.5 SCHIST, weak red (10R 4/2)
100			100.0 QUARTZ MONZONITE
			103.0 <0.1 gpm
			105.0 Wet fracture
			~0.2 gpm
			115.0
120			SCHIST
			120.0
			QUARTZ MONZONITE
			125.0
			SCHIST
			135.0
140			QUARTZ MONZONITE
			151.5
			Bottom of hole at 151.5 feet.

BOREHOLE LOG WITHOUT WELL 20'SCALE CLIMAX.GPJ ALL REPORTS JLR 2-14-11.GDT 10/10/11

TETRA TECH
Tetra Tech MM
3801 Automation Way # 100
Fort Collins, Colorado 80525
Telephone: 970-223-9600
Fax: 970-223-7171

BOREHOLE ID: EVMW-3D

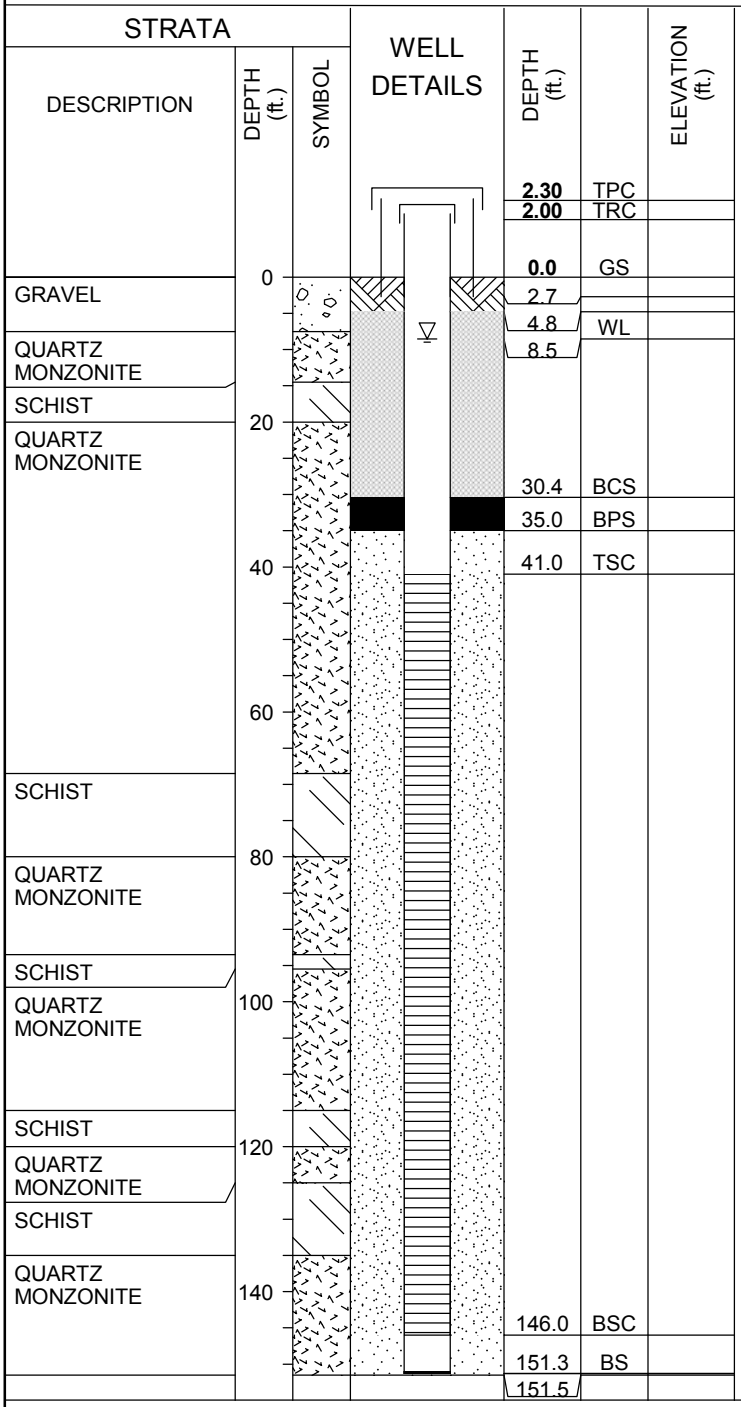
CLIENT Climax Molybdenum **PROJECT NAME** Climax Mine

PROJECT NUMBER 114-010428 **PROJECT LOCATION** Climax Mine, Climax Colorado

DATE(S) OF DRILLING: *09/21/2011 - 09/27/2011* **PERMIT NUMBER:** *N/A*

GROUNDWATER: *8.52' Below Ground Surface 10/5/11* **TOTAL DEPTH:** *151.5*

NOTES: **LOGGED BY:** *Joe Reed*



WELL CONSTRUCTION DETAILS

PROTECTIVE CASING
Diameter: *5"*
Type: *Steel*
Interval: *+2.3 - 2.7*

RISER CASING
Diameter: *2"*
Type: *2" Schedule 40*
Interval: *+2.0 - 41.0*
Stickup: *2*

SANDPACK
Type: *10-20*
Interval: *35.0 - 151.5*

SCREEN
Diameter: *2"*
Type: *2" Schedule 40 0.010" Slots*
Interval: *41.0 - 146.0*

GROUT
Type: *N/A*
Interval:

SEAL
Type: *Bentonite Pellets*
Interval: *30.4 - 35.0*

SEAL
Type: *Bentonite Chip*
Interval: *4.8 - 30.4*

SEAL
Type: *Concrete*
Interval: *0 - 4.8*

WELL DEVELOPMENT DATA

DATE: 10/4/2011
METHOD: Surge Block, Air Lift, and Pumping
DURATION: Not Recorded
RATE: Recovery Rate 0.15 gpm
FINAL MEASUREMENTS: N/A

pH	Temperature (° C)	Conductivity (µmhos / meter)	Turbidity (visual)

LEGEND

- FILTER PACK
- BENTONIE CHIP
- BENTONITE PELLETS
- CONCRETE
- CUTTINGS / BACKFILL
- SCREEN

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
GS	GROUND SURFACE
BCS	BENTONITE CHIP SEAL
BPS	BENTONITE PELLET SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
BS	BOTTOM SUMP
TSD	TOTAL SAMPLE DEPTH
CEN	CENTRALIZER
WL	WATER LEVEL

GROUND ELEVATION: *Not Recorded*
MEASURING POINT ELEVATION: *Not Recorded*
NORTHING: *Not Recorded*
EASTING: *Not Recorded*

DRILL RIG: *Longyear Delta Base 540*
METHOD: *Rotary Air Hammer*
HOLE SIZE: *0-14.5' - 6.5" 14.5'- 151.5' - 5.5"*
HOLE DEPTH: *151.5*

DRILLING CONTRACTOR: *Precision Sampling Inc.*
LOGGED BY: *Joe Reed*

PROTECTIVE CASING WELL LOG 20 SCALE A 1 CLIMAX.GPJ ALL REPORTS JLR 2-14-11.GDT 10/10/11

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/25/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	EVMW-3D
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	MP1-2-A-B-G-TV
Pump Serial #	A1A106003P1 1340022
Date Code	2013
Rated GPM	4.4
Rated head	242 ft
Rated horsepower	N / A

WELL INFORMATION

Well depth	153.1 ft
casing size	2 in PVC
static level	12.3
pumping level	UNK
pitless adapter	2" PVC well cap
pick sub size	N / A

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	UNK
Motor voltage	3 x 220
Phase	single
Motor Model #	pump & motor identical
Motor serial #	pump & motor identical
Date Code	2013
Name plate amps	5.5
SF amperage	5.5
RPM	UNK

SETTING INFORMATION

Pump setting	148 ft bottom of motor
column pipe size	3/4" blue poly pure core
column pipe material	blue poly pure core
column pipe lengths	147 ft
Thread pattern	NPT to barb
pick up subs	N / A
change over nipples	1/2in to 3/4in
check valve	N / A
knock out (yes/no)	N / A
check valve depths	N / A
monitoring tube	N / A
airline	N / A
wire size	20/3 came with pump
probes setting	N / A

ELECTRICAL CONTROLS

voltage	3 x 220
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

DRAFT

ARCADIS

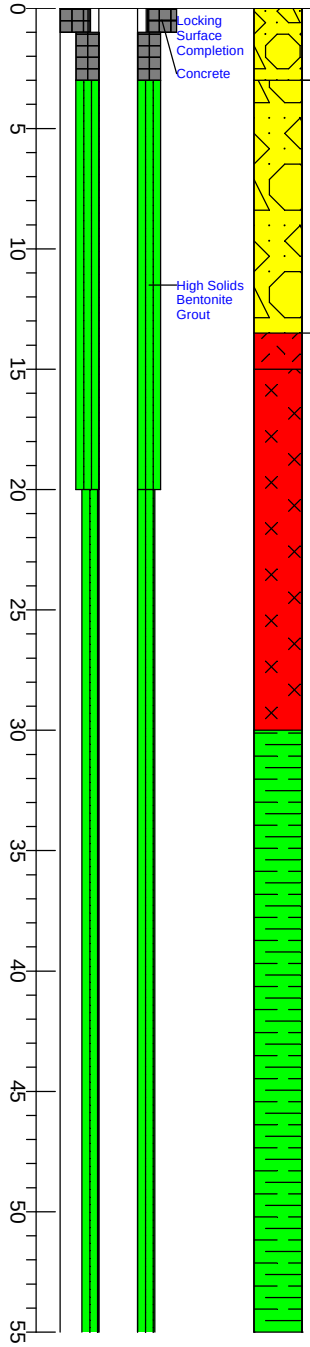
Boring/Well Construction Log

Job Number:	Client:	Location:	Well Number:	Page 1 of 4
CO001701.0001	Climax Molybdenum Co.	Climax Mine	EV-MW-004	

Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.	Sampling Method: Chips Seperated by Cyclone
Drilling Start: 09/09/12 15:00 Finish: 09/12/12 09:00	Develop Start: 9/12/12 09:00 Finish: 9/12/12 11:00
Depth to Water: 180' bgs	Drilled By: Precision Sampling Inc.
Elevation TOC: N/A GL: N/A	Logged By: Matthew W. Bauer, PG

Location:

UTM: 13N 394638, 4362044 **N**



Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
0			SM	Fill	2.5Y 5/3	Fill
5			SM	Silty Sand	2.5Y 5/3	Silty Sand: Topsoil with float rock. Increasing rock content with depth.
15				Granodiorite	GLEY 1 4/N	Granodiorite: Granodiorite, weathered contact, moderately hard and slightly friable, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix. Occasional quartz veins.
20				Granodiorite	GLEY 1 4/N	Granodiorite: Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix. Calcite veins present.
30				Shale	GLEY 1 2.5/N	Shale: Shale, laminated, hard, fine grained matrix with muscovite, quartz and feldspar crystals, trace pyrite.

Electronic log compiled by: Laura Madsen

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: EV-MW-004	Page 2 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/09/12 15:00 Finish: 09/12/12 09:00		Develop Start: 9/12/12 09:00 Finish: 9/12/12 11:00		
Depth to Water: 180' bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

UTM: 13N 394638, 4362044 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
55–110	4" - Sch 40 PVC			Rhyolite	10YR 5/1	Rhyolite: porphyritic rhyolite, hard, containing abundant phenocrysts up to 0.2 inches in length of quartz and feldspar, with smaller phenocrysts of biotite and trace pyrite in a crystalline matrix.
				Shale	GLEY 1 2.5/N	Shale: Shale, laminated, hard, fine grained matrix with muscovite and feldspar crystals, quartz veins present, trace pyrite.

Electronic log compiled by: Laura Madsen

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: EV-MW-004	Page 3 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/09/12 15:00 Finish: 09/12/12 09:00		Develop Start: 9/12/12 09:00 Finish: 9/12/12 11:00		
Depth to Water: 180' bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

UTM: 13N 394638, 4362044

N

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
110–165	Coated Bentonite Pellets; Centralizer					
				Granodiorite	GLEY 1 6/N	Granodiorite: Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix. 20% Shale, laminated, hard, fine grained matrix with muscovite, quartz and feldspar crystals, trace pyrite.
				Shale	GLEY 1 3/N	Shale: Shale, laminated, hard, fine grained matrix with muscovite and feldspar crystals, quartz veins present, trace pyrite.

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: EV-MW-004	Page 4 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/09/12 15:00 Finish: 09/12/12 09:00		Develop Start: 9/12/12 09:00 Finish: 9/12/12 11:00		
Depth to Water: 180' bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

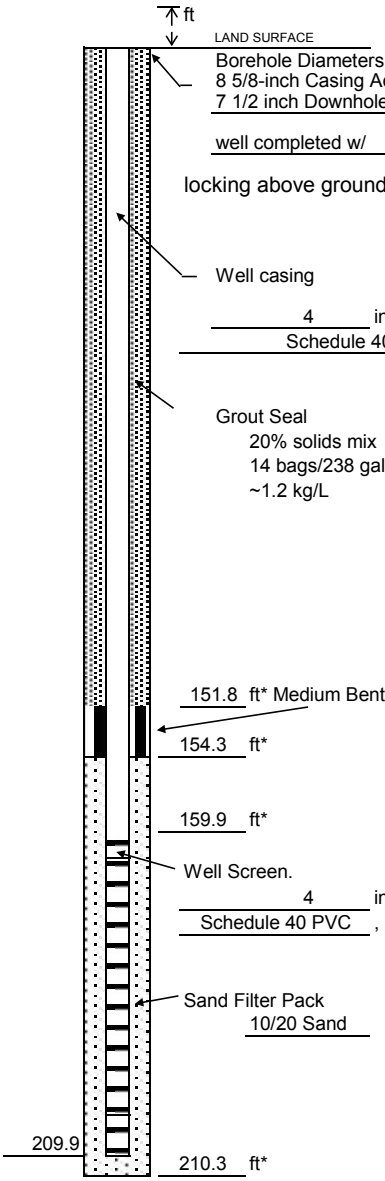
UTM: 13N 394638, 4362044 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
165						
170				Granodiorite	GLEY 1 6/N	Granodiorite: Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix. 20% Shale, laminated, hard, fine grained matrix with muscovite, quartz and feldspar crystals, trace pyrite.
175						
180	10/20 Sand					
185	4" - 20 Slot Sch 40 PVC Screen; Centralizer					
190						
195					GLEY 1 6/N	Cutting recovery poor due to fouling of the borehole from cutting fines and produced water. Washed borehole thoroughly after reaching depth.
200						
205						
210	End Cap; Centralizer					

ARCADIS

W□□□C□□□□□□□□□□□□□ L□□

Not to Scale



P□□□□□□ Climax Molybdenum Wells **W□□□** EV-MW-004

T□□ □C□□ Climax

C□□□□□ Eagle **S□□□□** CO

I□□□□□□□□□□ D□□□(□) 09/09/2012 -09/12/2012

D□□□□□□ M□□□□□ ODEX Casing/Downhole Hammer

D□□□□□□ C□□□□□□□□□ Precision Samploing, Inc.

D□□□□□□ □□□□□ Air and Water

W□□□P□□□□□□ Compliance and Monitoring

R□□ □□□□ Surged 10 times then airlifted.

Centralizers at 160, 185, and 210 ft below ground surface

P□□□□□□□ □□ Matt Bauer, PG

Measuring Point is
Top of Land Surface
Unless Otherwise Noted.

* Depth Below Land Surface

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/26/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	EVMW-004
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	5S05-13
Pump Serial #	B8010013-P11333
Date Code	2013
Rated GPM	5
Rated head	247 ft
Rated horsepower	0.5

WELL INFORMATION

Well depth	213.25 ft
casing size	4 in PVC
static level	68.6 ft
pumping level	UNK
pitless adapter	4x1 san seal
pick sub size	N / A

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	1.2
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	UNK
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	115
Phase	single
Motor Model #	MS402
Motor serial #	799221102 PC: P21330
Date Code	2013
Name plate amps	10.5
SF amperage	12
RPM	345

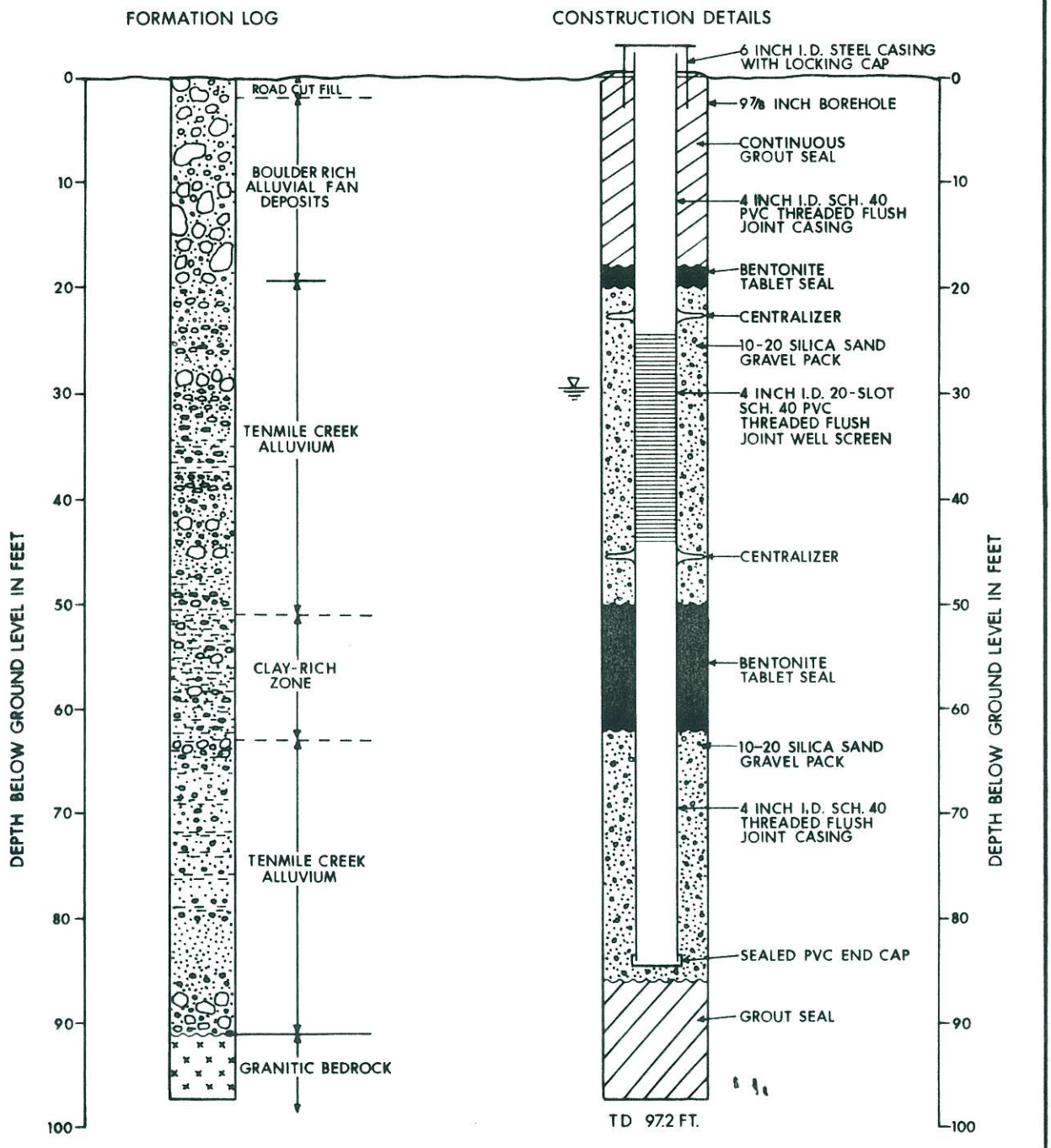
SETTING INFORMATION

Pump setting	208 ft bottom of motor
column pipe size	1 in
column pipe material	PVC sch 80
column pipe lengths	20 ft
Thread pattern	NPT
pick up subs	N / A
change over nipples	N / A
check valve	built into pump
knock out (yes/no)	N / A
check valve depths	206
monitoring tube	206ft 3/4in PVC
airline	N / A
wire size	10/2 w/grnd
probes setting	N / A

ELECTRICAL CONTROLS

voltage	115
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

JOHN C. HALE[illegible]KA AND ASSOCIATES, INC.



LEGEND

- CLAYS
- SANDS AND GRAVELS
- COBLES AND BOULDERS
- BEDROCK
- STATIC WATER LEVEL

NO HORIZONTAL SCALE

NOTES:

- PERMIT NO. 31726-M
- LOCATED SE¼ NE¼ SEC. 13 T 7 S R 79 W, SUMMIT CO., COLO.
- WELL DRILLED 6/15 - 6/26/87 USING MUD ROTARY SYSTEM WITH A 9⅞" BIT.
- STATIC WATER LEVEL RECORDED 7/8/87

CLIMAX MOLYBDENUM COMPANY
GROUND WATER MONITORING WELL NO.1
FORMATION LOG AND WELL CONSTRUCTION DETAILS

PROJECT NO. 5110 | FIG. NO. 2

GW#1

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 11/01/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	GW #1
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	10SQ05-160
Pump Serial #	0030
Date Code	2013
Rated GPM	10
Rated head	250 ft
Rated horsepower	0.5

WELL INFORMATION

Well depth	83.5 ft
casing size	4 in
static level	32.2 ft
pumping level	UNK
pitless adapter	4x1 san seal
pick sub size	N / A

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	1.2
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	115
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	10
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	115
Phase	single
Motor Model #	pump & motor identical
Motor serial #	pump & motor identical
Date Code	2013
Name plate amps	10.9
SF amperage	15
RPM	10000

SETTING INFORMATION

Pump setting	80' bottom of motor
column pipe size	1 in
column pipe material	PVC sch 80
column pipe lengths	20 ft
Thread pattern	NPT
pick up subs	N / A
change over nipples	N / A
check valve	built into pump
knock out (yes/no)	N / A
check valve depths	78 ft
monitoring tube	3/4 poly pure core
airline	N / A
wire size	10/2 w/grnd
probes setting	N / A

ELECTRICAL CONTROLS

voltage	115
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

DRAFT

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: TM-MW-001D	Page 1 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/13/12 13:00 Finish: 09/22/12		Develop Start: 09/27/2012 12:45 Finish: 09/27/2012 12:45		
Depth to Water: 28 ft bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

UTM: 13N 400226, 4366835 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
-5 to 0	Locking Surface Completion Concrete					
0 to 5			GW-GC	Glacial Till	10YR 4/3	Glacial Till: 60% Granite aggregate, medium to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.
5 to 50						Glacial Till: 70% Granite aggregate, medium to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Glacial Till: 70% Granite aggregate, medium to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Paste pH: 8.97 pH, 0.15 mS.

Electronic log compiled by: Laura Madsen

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: TM-MW-001D	Page 2 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/13/12 13:00 Finish: 09/22/12		Develop Start: 09/27/2012 12:45 Finish: 09/27/2012 12:45		
Depth to Water: 28 ft bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

UTM: 13N 400226, 4366835 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
50–105	High Solids Bentonite Grout; 4" - Sch 40 PVC			Glacial Till	10YR 4/3	Glacial Till: 60% Granite aggregate, medium to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Water encountered at 28' bgs.
				Quartz Monzonite		Monzonite: Quartz Monzonite, slightly weathered, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite.

Electronic log compiled by: Laura Madsen

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: TM-MW-001D	Page 3 of 4
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/13/12 13:00 Finish: 09/22/12		Develop Start: 09/27/2012 12:45 Finish: 09/27/2012 12:45		
Depth to Water: 28 ft bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Matthew W. Bauer, PG		

Location:

UTM: 13N 400226, 4366835 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
105–160	Coated Bentonite Pellets; Centralizer; 10/20 Sand			Quartz Monzonite	GLEY 1 7/N	Monzonite: Quartz Monzonite, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite.
				Quartz Monzonite	GLEY 1 2.5/N	Monzonite: Quartz Monzonite, slightly weathered, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite. 10% Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix, trace pyrite.
				Quartz Monzonite	GLEY 1 7/N	Monzonite: Quartz Monzonite, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite. Borehole producing ~1 gpm water.

Electronic log compiled by: Laura Madsen

DRAFT

ARCADIS

Boring/Well Construction Log

Job Number:	Client:	Location:	Well Number:	Page 4 of 4
CO001701.0001	Climax Molybdenum Co.	Climax Mine	TM-MW-001D	

Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.	Sampling Method: Chips Seperated by Cyclone
Drilling Start: 09/13/12 13:00 Finish: 09/22/12	Develop Start: 09/27/2012 12:45 Finish: 09/27/2012 12:45
Depth to Water: 28 ft bgs	Drilled By: Precision Sampling Inc.
Elevation TOC: N/A GL: N/A	Logged By: Matthew W. Bauer, PG

Location:

UTM: 13N 400226, 4366835 **N**

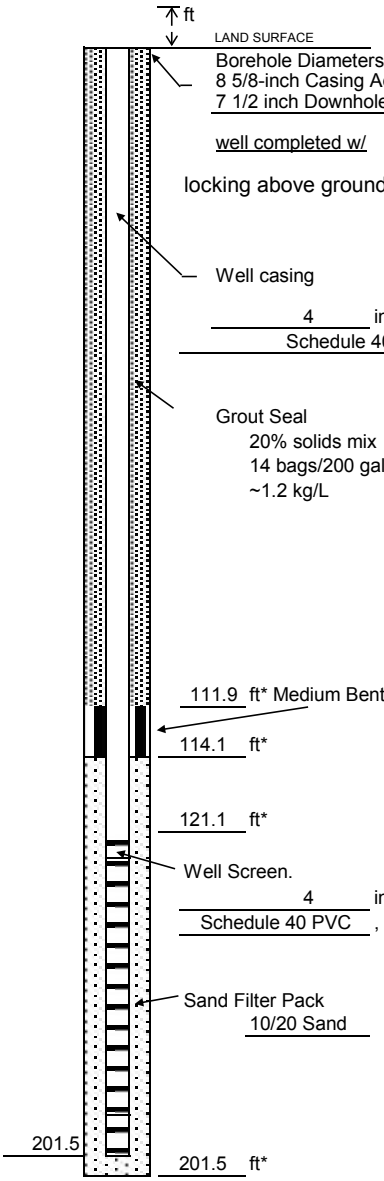
Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
160	4" - 20 Slot Sch 40 PVC Screen; Centralizer					
165						
170						
175				Granodiorite	10YR 3/1	Granodiorite: 70% Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix, trace pyrite. 30% Quartz Monzonite, slightly weathered, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite.
180	Centralizer					
185						
190				Granodiorite	GLEY 1 7/N	Granodiorite: 60% Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix, trace pyrite. 40% Quartz Monzonite, slightly weathered, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite.
195					GLEY 1 7/N	Granodiorite: 60% Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, and feldspar in a crystalline matrix, trace pyrite. 40% Quartz Monzonite, slightly weathered, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite. Borehole producing ~2 gpm.
200	Centralizer; End Cap; Formation Collapse					

Electronic log compiled by: Laura Madsen

ARCADIS

W□□□C□□□□□□□□□□□□□ L□□

Not to Scale



P□□□□□□ Climax Molybdenum Wells **W□□□** TM-MW-001D

T□□ □C□□ Climax

C□□□□□ Summit **S□□□□** CO

I□□□□□□□□□□ D□□□(□) 09/13/2012 -09/22/2012

D□□□□□□ M□□□□□ ODEX Casing/Downhole Hammer

D□□□□□□ C□□□□□□□□□ Precision Samploing, Inc.

D□□□□□□ □□□□□ Air and Water

W□□□P□□□□□□ Compliance and Monitoring

R□□ □□□□ Surged 10 times then airlifted.

Centralizers at 121.1, 161.1, 181.1 and 201.1 ft below ground surface

P□□□□□□□ □□ Richard Walther, PG

Measuring Point is
Top of Land Surface
Unless Otherwise Noted.

* Depth Below Land Surface

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/25/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	TM-MW-001D
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	s05-13
Pump Serial #	B8010013-P11336
Date Code	2013
Rated GPM	5
Rated head	247 ft
Rated horsepower	0.5

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	115
Phase	single
Motor Model #	MS402
Motor serial #	79922102 PC: P21330
Date Code	2013
Name plate amps	10.5
SF amperage	12
RPM	3450

WELL INFORMATION

Well depth	202.5 ft
casing size	4 in PVC
static level	34.2 ft
pumping level	UNK
pitless adapter	4x1 san seal
pick sub size	N / A

SETTING INFORMATION

Pump setting	197 ft bottom of motor
column pipe size	1 in
column pipe material	PVC sch 80
column pipe lengths	20 ft
Thread pattern	NPT
pick up subs	N / A
change over nipples	N / A
check valve	built into pump
knock out (yes/no)	N / A
check valve depths	195
monitoring tube	3/4 in PVC
airline	N / A
wire size	10/2 w/grnd
probes setting	N / A

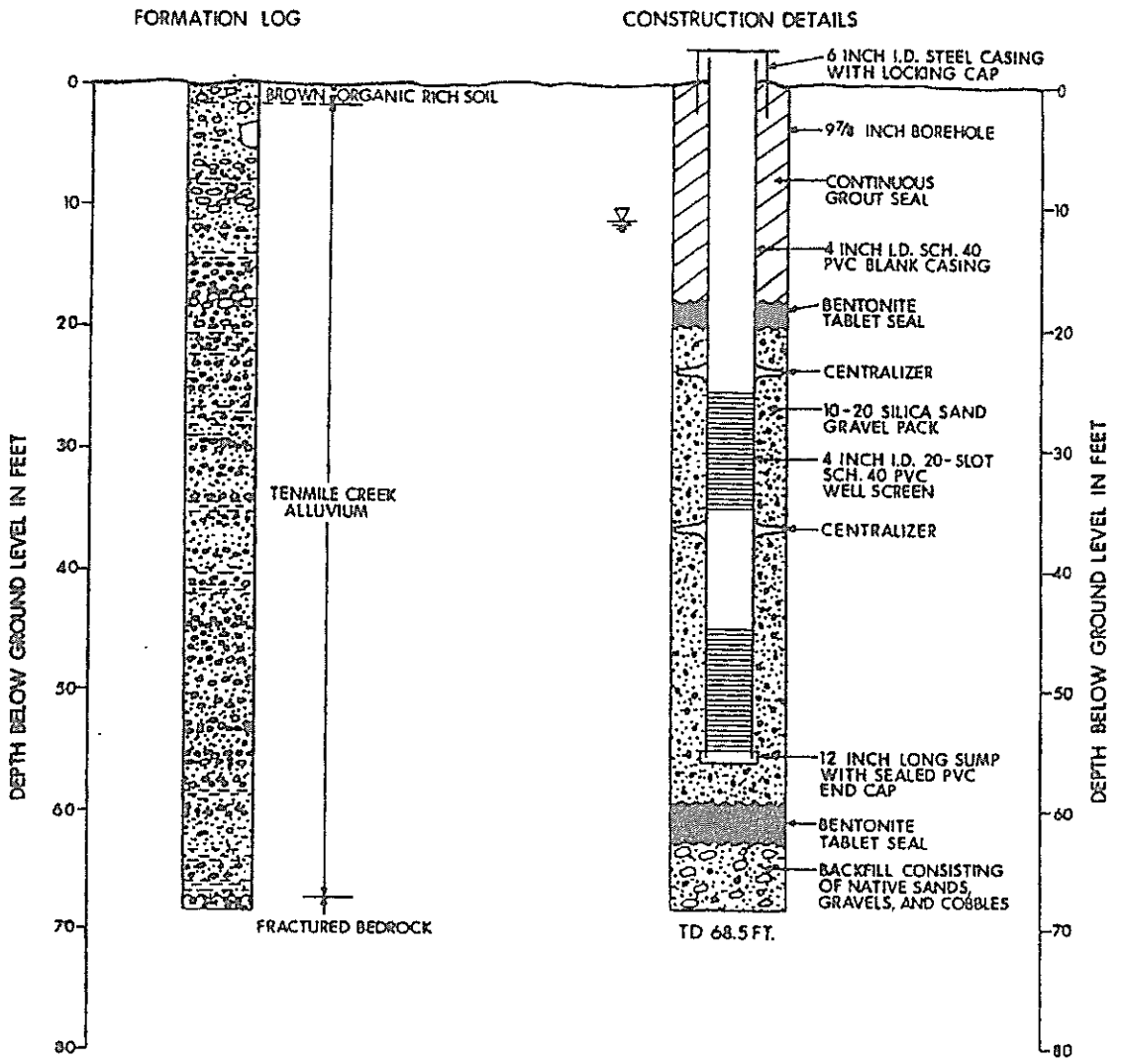
START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	1.2
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	115
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

ELECTRICAL CONTROLS

voltage	115
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

JOHN C. HALEPASKA AND ASSOCIATES, INC.



LEGEND

- CLAYS
- SANDS AND GRAVELS
- COBBLES AND BOULDERS
- BEDROCK
- STATIC WATER LEVEL

NO HORIZONTAL SCALE

NOTES:

- PERMIT NO. 31727-M
- LOCATED SE¼ SW¼ SEC.7 T7S R78W, SUMMIT CO., COLO.
- WELL DRILLED 6/7-6/30/87 USING MUD ROTARY SYSTEM WITH A 9⅞" BIT
- STATIC WATER LEVEL RECORDED 7/8/87

CLIMAX MOLYBDENUM COMPANY
GROUND WATER MONITORING WELL NO.2
FORMATION LOG AND WELL CONSTRUCTION DETAILS

PROJECT NO. 5110	FIG. NO. 3

GW#2

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/24/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	GW #2
Permit #	

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	5S05-13
Pump Serial #	B8010013-P11337
Date Code	2013
Rated GPM	5
Rated head	247 ft
Rated horsepower	0.5

WELL INFORMATION

Well depth	56.7 ft
casing size	4 in PVC
static level	15.4 ft
pumping level	UNK
pitless adapter	4x1 san seal
pick sub size	N / A

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	1.2
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	115
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	115
Phase	single
Motor Model #	MS402
Motor serial #	79922102PC: P21336
Date Code	2013
Name plate amps	10.5
SF amperage	12
RPM	3450

SETTING INFORMATION

Pump setting	51 ft to bottom of motor
column pipe size	1 in
column pipe material	PVC sch 80
column pipe lengths	20 ft
Thread pattern	NPT
pick up subs	N / A
change over nipples	N / A
check valve	built into pump
knock out (yes/no)	N / A
check valve depths	48 ft
monitoring tube	3/4in PVC sight tube
airline	N / A
wire size	10/2 w/grbd
probes setting	N / A

ELECTRICAL CONTROLS

voltage	115
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

DRAFT

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: TM-MW-002D	Page 1 of 3
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/23/12 10:40 Finish: 09/27/12		Develop Start: 9/27/12 Finish: 9/27/12		
Depth to Water: 8.0 ft bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Richard Walther		

Location:

UTM: 13S 401031, 4367662 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
-5 to 0	Locking Surface Completion; Concrete					
0 to 5			GW-GC	Glacial Till	10YR 4/3	Glacial Till: 60% Granite aggregate, medium to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.
5 to 10						
10 to 15				Glacial Till	10YR 4/3	Glacial Till: 70% Granite aggregate, medium to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.
15 to 20						
20 to 25						
25 to 30						
30 to 35						
35 to 40						
40 to 45	High Solids Bentonite Grout; 4" - Sch 40 PVC					
45 to 50				Glacial Till	10YR 4/3	Glacial Till: 60% Granite aggregate, medium to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite.

Electronic log compiled by: Laura Madsen

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: TM-MW-002D	Page 2 of 3
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/23/12 10:40 Finish: 09/27/12		Develop Start: 9/27/12 Finish: 9/27/12		
Depth to Water: 8.0 ft bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Richard Walther		

Location:

UTM: 13S 401031, 4367662 **N**

Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
50–105	Medium Bentonite chips; Medium Bentonite chips; Centralizer				2.5YR 5/4	Clay and Silt: Reddish brown silty clay, soft, plastic, poor induration with trace silt.
					10YR 4/3	60% Granite aggregate, medium to coarse gravel, poorly sorted, sub-rounded to angular, primary minerals include quartz, feldspar and biotite with trace pyrite. Matrix is unconsolidated silt to very coarse sand, poorly sorted, sub-rounded to sub-angular, primary minerals include quartz, feldspar, and biotite with trace pyrite. Pressurized formation while drilling with air 60-80 gpm.
				Granodiorite	GLEY 1 5/N	Granodiorite: Granodiorite, porphyritic, containing phenocrysts of quartz, biotite, and feldspar in a crystalline matrix.
				Quartz Monzonite	GLEY 1 6/N	Monzonite: Quartz Monzonite, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite.

Electronic log compiled by: Laura Madsen

ARCADIS

Boring/Well Construction Log

Job Number: CO001701.0001	Client: Climax Molybdenum Co.	Location: Climax Mine	Well Number: TM-MW-002D	Page 3 of 3
Drilling Method: Air Rotary: ODEX, 8.75 in.; Downhole Hammer 7.5 in.		Sampling Method: Chips Seperated by Cyclone		
Drilling Start: 09/23/12 10:40 Finish: 09/27/12		Develop Start: 9/27/12 Finish: 9/27/12		
Depth to Water: 8.0 ft bgs		Drilled By: Precision Sampling Inc.		
Elevation TOC: N/A GL: N/A		Logged By: Richard Walther		

Location:

UTM: 13S 401031, 4367662 **N**

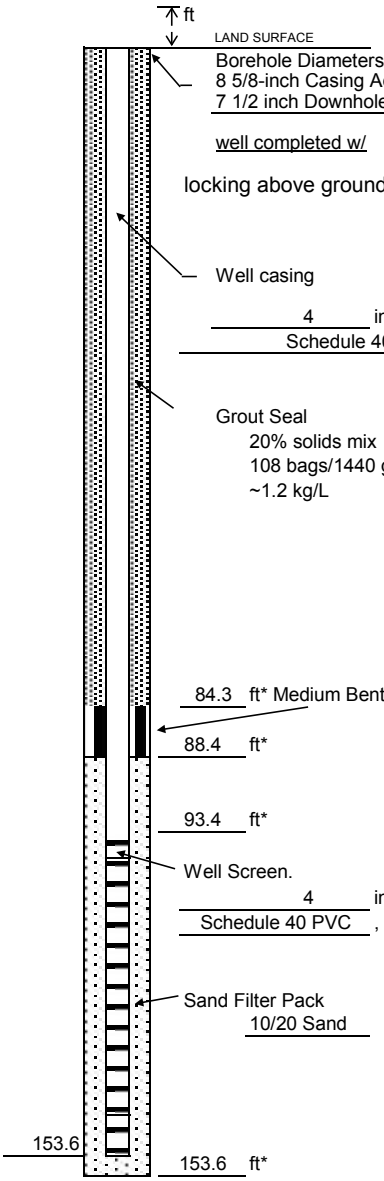
Depth Feet	Well Construction	Column	USCS Class	Name	Color	Description, Remarks
105						
110	Centralizer					
115				Quartz Monzonite	GLEY 1 8/N	Monzonite: 80% Quartz Monzonite, slightly weathered, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, trace pyrite. 20% Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, hornblende and feldspar in a crystalline matrix, trace pyrite.
120	10/20 Sand					
125	4" - 20 Slot Sch 40 PVC Screen					
130	Centralizer					
135						
140						
145						Monzonite: 80% Quartz Monzonite, slightly weathered, hard, porphyritic, containing phenocrysts of quartz and feldspar in a crystalline matrix, increased pyrite. 20% Granodiorite, porphyritic, containing abundant phenocrysts of quartz, biotite, hornblende and feldspar in a crystalline matrix, increased pyrite. Producing 1.0 gpm water.
150						
155	Centralizer End Cap					

Electronic log compiled by: Laura Madsen

ARCADIS

W□□□C□□□□□□□□□□□□□ L□□

Not to Scale



P□□□□□□ Climax Molybdenum Wells **W□□□** TM-MW-002D

T□□ □C□□ Climax

C□□□□□ Summit **S□□□□** CO

I□□□□□□□□□□ D□□□(□) 09/23/2012 -09/28/2012

D□□□□□□ M□□□□□ ODEX Casing/Downhole Hammer

D□□□□□□ C□□□□□□□□□ Precision Samploing, Inc.

D□□□□□□ □□□□□ Air and Water

W□□□P□□□□□□ Compliance and Monitoring

R□□ □□□□ Surged 10 times then airlifted.

Centralizers at 93.4, 113.4, 133.4 and 153.4 ft below ground surface

P□□□□□□□ □□ Richard Walther, PG

Measuring Point is
Top of Land Surface
Unless Otherwise Noted.

* Depth Below Land Surface

Colorado Water Well Pump
PUMP INSTALLATION REPORT

DATE INSTALLED: 10/26/13

Customer	F M I
Job	Climax Mine
Address	11236 Highway 91
City State Zip	Climax, CO 80429

Contact	Aaron
Phone	719-486-7678
Well #	
Permit #	TM-MW-002D

PUMP INFORMATION

Pump Type	submersible
Pump Mfr	Grundfos
Pump Model #	5S05-13
Pump Serial #	B8010013-P11337
Date Code	2013
Rated GPM	5
Rated head	247 ft
Rated horsepower	0.5

WELL INFORMATION

Well depth	155.7 ft
casing size	4 in PVC
static level	19.8 ft
pumping level	UNK
pitless adapter	4x1 san seal
pick sub size	N / A

START UP DATA

Resistance L1 to GRD	INF
Resistance L2 to GRD	INF
Resistance L3 to GRD	N / A
Resistance L1 to L2	1.2
Resistance L1 to L3	N / A
Resistance L2 to L3	N / A
Voltage L1 to L2	UNK
Voltage L1 to L3	N / A
Voltage L2 to L3	N / A
Amperage L1	UNK
Amperage L2	UNK
Amperage L3	UNK
GPM	5
PWL	UNK
Discharge pressure	UNK

MOTOR INFORMATION

Motor Type	submersible
Motor Mfr	Grundfos
Motor horsepower	0.5
Motor voltage	115
Phase	single
Motor Model #	MS402
Motor serial #	79922102 PC: P21336
Date Code	2013
Name plate amps	10.5
SF amperage	12
RPM	3450

SETTING INFORMATION

Pump setting	148 ft
column pipe size	1 in
column pipe material	PVC sch 80
column pipe lengths	20 ft
Thread pattern	NPT
pick up subs	N / A
change over nipples	N / A
check valve	built into pump
knock out (yes/no)	N / A
check valve depths	146 ft
monitoring tube	146 ft 3/4 in PVC
airline	N / A
wire size	10/3 w/grnd
probes setting	N / A

ELECTRICAL CONTROLS

voltage	115
phase	single
fuse size & type	N / A
motor starter mfr	N / A
motor starter size	N / A
heater size	N / A
control voltage	N / A
control fuse size	N / A
phase protection	N / A

APPENDIX B
ENVIRONMENTAL WATER QUALITY SAMPLING SOP

Climax Molybdenum
A Freeport-McMoRan Company

Climax Mine
Standard Operating Procedure

Department	Operating Area
Environmental	Site Wide

SOP Title

Ground and Surface Water Sampling

Purpose & Scope

The purpose of this procedure is to outline the practices employed by Climax Molybdenum – Climax Mine (Climax) for the collection of ground and surface water samples to demonstrate compliance with permits and regulations, or for general water quality information gathering purposes.

Safety

All personnel, contactors and visitors must conduct field activities in compliance with Climax's health and safety requirements

In addition to standard personal protective equipment (i.e. foot protection, eye protection, hard hat and reflective safety vest) field personnel will use disposable gloves, hearing protection, and/or protective clothing as determined necessary to meet the hazard requirements of the particular sampling event. Life vests will be worn when sampling from a stream, river, lake or any location where a drowning hazard is present.

********** PPE list not limited to items listed below please add if necessary***********

Employees are responsible for ensuring all PPE is in good serviceable condition and worn properly.

PPE required:

- ☒ Hard hat
- ☒ Steel toed boots
- ☒ Reflective vest
- ☐ Respirator (if conditions dusty)
- ☒ Safety glasses
- ☐ Gloves
- ☐ Flashlight (night)
- ☐ Hearing protection (if necessary)

Hazards include:

- **Electrical** – A portable generator is used to power all well motors. Care needs to be taken that all energizing of motors is done without exposing electrical contacts to water, while hands are dry and not standing in wet areas.
- **Chemical** – Chemicals are used as calibration standards for field meters and as preservatives in sample bottles. The chemicals are small in quantity and some are acidic so care should be taken to avoid exposure.
- **Biological** – Sampling is done out in the field where exposure to animals or other animal related conditions (dead animals, feces, etc.) can occur. Care should be taken to avoid contact with animals.
- **Mechanical** – Several pieces of sampling equipment require opening, closing, winding/unwinding, and the risk of pinch points and other hand related injuries is present. Pay attention to where your hands are at all times.
- **Slips, Trips, Falls** – Sampling is conducted out in the field in areas of natural terrain and during all times of year.
- **Weather** – Sampling is conducted out in the field and there is no protection from the weather. Pay attention to the surrounding conditions to avoid exposure to dangerous weather situations.

Environmental

Dispose of any wastes generated as a result of this procedure according to the correct requirements for the class of materials.

Responsible Parties

All Climax field personnel and contractors are responsible for following the requirements of the procedure when collecting ground or surface water samples from Climax sample points.

Specialized Tools/Skills/Training

No training is required under this SOP. There are specialized tools and other items required and they are as follows:

a) Sample containers provided by lab, if possible (may include pre-preserved or unpreserved containers)

b) Container labels generated by field personnel (either printed labels attached to the container or written legibly on the container with permanent marker)

   i) Container labels are to include the following:

      (1) Site Name, Sample Date, Sample Time, Analysis Suite

c) Field measurement equipment

   i) Field parameter measurement meters (i.e. pH, temperature, specific conductance, etc., as necessary)

   ii) Well sounders for depth to water determinations

   iii) Stopwatch and container for flow rate determination (or flow meter, if available)

d) Sampling Equipment (as needed)

   i) Generator

   ii) Hoses/tubing

   iii) Extension cords

   iv) 0.45 µm filters for dissolved constituents (i.e. metals and sulfate)

   v) Filtration and hose connection fixtures

   vi) Sample dippers

   vii) Decontamination solutions (DI water and DI water mixed with Liquinox, if necessary)

   viii) Coolers

   ix) Ice bottles or bagged ice

Reference Materials

The Climax Mine Field Sampling Log Book is required for proper collection of sampling related data. It is also suggested to bring the Environmental Data Management System (EDMS) Field Laptop.

Step by Step Procedure

GROUND AND SURFACE WATER SAMPLING

It is your responsibility to ensure that you understand this SOP prior to performing the following process steps. You are to contact your immediate supervisor if you have any questions about this safe operating procedure.

List each process step below:

1) GROUNDWATER SAMPLING PROCEDURE

a) **Arrival at Groundwater Sampling Site**

i) Confirm that all reusable equipment has been decontaminated prior to use or will be flushed with enough water to remove any contaminants.

ii) Perform all required calibrations on field test equipment according to the user manuals specific to the equipment.

iii) Perform a site safety inspection and note the hazards in the Site Safety Inspection section of the log sheet, including any hazard mitigation conducted.

iv) Enter the following information in the Climax Mine Field Sampling Logbook:

(1) Site ID (i.e. EVMW-3D)

(2) Arrival date

(3) First initial and last name of all sample personnel

(4) Record the Site Properties

(a) Well Total Depth, if appropriate

(b) Sample Collection Method (i.e. portable pump, dedicated pump, bailer, grab)

(c) Well Diameter, if appropriate

(d) Static Water Level, if appropriate

(i) Using the well sounder, measure the static water level by lowering the sounding tape down the well until the alarm sounds. Document the depth as measured by the sounding tape.

(e) Calculate the Casing Volumes

(i) The following table, or Constants & Conversions section of the Logbook, can be used to determine casing volumes using this equation:

Casing Volume (gallons) = (TD-DW)*GPF

Where: TD = Total Depth of Well (feet)

DW = Depth to Water, or Static Water Level (feet)

GPF = Gallons per Foot (taken from chart below, or Logbook)

(ii) Record the results for one, three, and five casing volumes in the Logbook.

(f) Weather conditions (i.e. sunny, raining, cloudy, etc.)

(g) Location Condition

(i) Upon arrival: status of security, accessibility, site condition, ability to sample

(ii) Upon departure: status of security, site condition, sample collected (time and sample suite, if collected).

(5) Record the equipment that is being used for the site in the Equipment Usage area of the log sheet.

WELL CASING DIAMETER/CAPACITY	
Inside Casing Diameter (Inches)	Gallons/Linear Ft. **
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
8	2.61

** Calculated as $0.041 \times D^2$ where D = the well's inside casing diameter in inches

b) **Well Purging**

i) Connect well sampling aparatus and generator to wells with dedicated pumps or lower portable pump into wells without dedicated.

ii) Start pump, recording pump start time in field log book and calculate the flow rate.

(1) For dedicated and portable pumps, use a 5 gallon bucket (or 8 oz. cup) and a stopwatch.

(a) When using the 5 gallon bucket, time the duration it takes to fill the bucket. Calculate the flow rate using the following equation:

$$300/S = GPM$$

Where S is the number of seconds it takes to fill the five gallon bucket. NOTE: For fractions of seconds **always round up** to the nearest second.

(Alternatively use the Flow Rate conversion table in the front of the Climax Mine Field Sampling Logbook for the 5 gallon bucket or 8 oz. cup).

iii) A valid groundwater sample can be collected when the pH readings vary by no more than 0.1 units and temperature and conductivity readings vary by no more than 10%. Stabilized readings are indicative of formation water and not column water.

iv) Measure and record field parameters at the initial draw and every two or three minutes afterwards (or less frequently, depending on flow rate and initial readings). (Refer to sample schedule or permit requirements for proper field parameters.)

(1) Rinse the collection cup three times with the purge water prior to collecting the parameter sample.

c) **Groundwater Sample Collection**

i) Collect the samples in containers that have been selected and preserved for the applicable sample suite. CAUTION: Some containers contain chemical preservatives. Check MSDS for safety precautions and actions to be taken in the event of accidental exposure.

(1) Slow the flow from the well in order to avoid overflowing the sample containers while filling them.

(2) Samples to be analyzed for dissolved metals and sulfate are filtered through a 0.45 µm filter.

ii) Place the filled sample containers in a cooler with ice for transport to the sample refrigerator if not being shipped that day.

iii) Complete the field log book entries:

(1) Note the sample suite and time collected along with any duplicate identification in the " Condition at Departure" section of the page under Sample Collected.

(2) If a sample is collected, "Z" out the unused portion of the Field Data Collection section, initialing and dating the diagonal line of the Z.

d) **Adaptations for Low Yielding Wells**

i) Wells that purge dry prior to parameter stabilization will require that the above procedures be adapted as follows:

(1) Purge the well until it is dry, recording the time it purges dry and the total volume purged in the field log book.

(2) Return to the well within 24 hours after it purged dry and collect a sample and field parameters, recording the sample time and field measurements in the log book

e) **QA/QC Sample Collection**

i) Duplicate Sample – is taken immediately after the initial sample is taken to verify the accuracy of the lab analysis.

(1) Once the primary sample is collected, immediately begin filling a separate set of sample containers (using the same sample filter).

(2) Duplicate samples are to be collected once per quarter.

(3) Duplicate Samples will be identified using the following naming convention – DUPYYYYMMDDX, where:

(a) DUP stands for Duplicate.

(b) YYYYMMDD is the year, month, and day the sample was collected.

2) SURFACE WATER SAMPLING PROCEDURE

a) Arrival at Surface Water Sampling Site

i) Confirm that all reusable equipment has been decontaminated prior to use.

ii) Perform all required calibrations on field test equipment according to the user manuals specific to the equipment.

iii) Perform a site safety inspection and note the hazards in the safety inspection section of the log sheet, including any hazard mitigation conducted.

iv) Enter the following information in the Ground and Surface Water Sampling Logbook page:

(1) Site ID (i.e. CC-SW1)

(2) Arrival date

(3) First initial and last name of all sample personnel

(4) Site Properties

(a) Sample Collection Method (i.e. grab, peristaltic pump, etc.)

(b) Collection Depth

(c) Weather conditions (i.e. sunny, raining, cloudy, etc .)

(d) Location Condition

(i) Upon arrival: status of security, accessibility, site condition, ability to sample

(ii) Upon departure: status of security, site condition, sample collect (sample suite and time, if collected).

(e) The following fields of the Logbook do not typically need to be filled out for surface water samples and can be marked NA or stricken through.

(i) Well Total Depth, Well Diameter, Static Water Level, Casing Volume

b) Determine Sampling Location

i) Channels or Streams

(1) Unless otherwise specified, the sample should be collected from the approximate midpoint between the stream bed and stream surface of the deepest flow channel of the stream.

(a) It may be necessary for sampling personnel to enter the stream to collect a sample. If so, care should be taken to not disturb the area and the sampler will stand downstream of the sample being collected.

ii) Lakes and ponds

(1) Unless otherwise specified, samples should be collected from the same general location with the assumption that the pond/lake is well mixed and homogenous.

c) Surface Water Sample Collection

i) Submerge the sample dipper (or transfer kit container) in the water, with the mouth pointing upstream and below the surface of the water. Try to minimize the solids that are allowed to enter the sampling container.

(1) If collecting a sample to be filtered, use a vacuum filtration unit and hand pump to filter on site.

ii) Place the filled sample containers in a cooler with ice for transport to the sample refrigerator if not being shipped that day.

iii) Complete the field log book entries:

(1) Note the sample suite and time collected along with any duplicate identification in the " Condition at Departure" section of the page under Sample Collected.

(2) If a sample is collected, "Z" out the unused portion of the Field Data Collection section, initialing and dating the diagonal line of the Z.

d) **QA/QC Sample Collection**

i) Please refer to section 1.e. above for QA/QC sample collection.

Records

Climax Mine Field Sampling Log Book.

Maintain in accordance with Climax Molybdenum records archival requirements or whichever regulatory program or permit the samples were collected under.

REVISION DATE	REVISION DESCRIPTION
02/01/13	Transferred SOP to new format.
9/26/14	Updated procedures to reflect current sample collection techniques.

APPENDIX T-D
ROBINSON LAKE OPERATING PLAN

Robinson Lake Operating Plan

Climax Molybdenum Company
Climax Mine and Mill
DRMS Permit No. M-1977-493

Fremont Pass, Highway 91
Climax, CO 80429

December 2011

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LIST OF FIGURES

1.0 OVERVIEW

In accordance with the requirements described in the Climax Mine EPP, Robinson Lake is designed and operated as a zero discharge facility to preclude overflow to Eagle Park Reservoir and the East Fork of the Eagle River. To fulfill this commitment, the water level in Robinson Lake is maintained well below the spillway control crest to provide sufficient surcharge capacity to store, without release, runoff from the probable maximum precipitation (PMP) event, plus runoff from the 100-year snowmelt event, plus seepwater from the Robinson Dam, 1 Dam, and 4 Dam seepage collection systems, plus operating return flows from the Tenmile Tunnel. The following technical discussion provides the basis and assumptions used to establish the Robinson Lake Operating Plan.

2.0 BASIS AND ASSUMPTIONS

2.1 Probable Maximum Precipitation

A site-specific PMP study for the Climax Mine was completed by *Applied Weather Associates* in 2005 and revised in 2009. This study concluded that the PMP event at Climax would produce 4.41 inches of total rainfall. A discussion of the analyses and conclusions are presented in Permit Amendment AM-06 Exhibit G.

2.2 100-Year Snowmelt

As part of the Climax flood hydrology study completed in 2005, Wheeler developed 100-year snowmelt runoff rates for the Climax site. These rates were based on an analysis of the Black Gore Creek drainage basin near Vail and adjusted for the Climax site. The snowmelt study determined the 100-year 1-day maximum snowmelt runoff rate to be 15.28 gpm per acre (0.0675 acre-feet per acre in one day). Correspondingly, the peak 100-year 5-day-average snowmelt runoff rate was determined to be 12.40 gpm per acre (0.2740 acre-feet per acre in five days).

2.3 Seepwater Inflow

The Robinson Dam and 4 Dam seepwater systems collect seepage below the respective dams and pump that water into Robinson Lake. The seepage rate from Robinson Dam has historically been less than about 25 gpm. The pump system that pumps this seepwater back to Robinson Lake has a nominal capacity of 480 gpm and is therefore only run on an intermittent basis. The seepage rate from 4 Dam has historically been less than 25 gpm. This pump system also has a pumpback capacity of 480 gpm.

Seepage from 1 Dam is conveyed to Warren's Pump System where it is normally pumped into the Tenmile Creek basin for treatment. The rate of 1 Dam seepage has historically been less than 1,000 gpm. Warren's Pump System has a nominal capacity of 4,500 gpm.

2.4 Operating Return Flows

During operation, approximately 10,000 gpm of process water will be pumped from Robinson Lake to supply the demands of the mine and mill. Whenever the natural inflow to the lake is not sufficient to maintain the desired operating water levels, water can be diverted into the lake from the Tenmile Creek basin through the Tenmile Tunnel. Water from the Tenmile TSF water pool

can be released through the Tenmile Decant and water from the Mayflower TSF water pool can be reclaimed using a future pump barge. Both of these facilities discharge into the Tenmile Tunnel. Fresh water from Supply Canal No. 2 can also be discharged into the Tenmile Tunnel. Inside the tunnel, bulkhead valves can be operated to direct water toward the south to Robinson Lake or toward the north to the Mayflower TSF. These valves are hydraulically actuated and controlled by a hydraulic pump located on the ground surface above the tunnel bulkhead.

2.5 Robinson Lake Surcharge Storage Capacity

In 2008, 2010, and early 2011, Climax conducted a project to remove sediment from within Robinson Lake. The modified lake contours were partially surveyed in 2010. Climax intends to conduct a bathymetric survey of the lake in 2011. The 2010 survey data was coupled with data from a 2006 aerial survey to determine the currently available surcharge storage capacity in Robinson Lake. The spillway control crest lies at an elevation of 10,890. Robinson Lake has the following surcharge storage capacities for the incremental water levels for the top ten feet below the spillway crest.

Robinson Lake Surcharge Storage Capacity		
Elevation (feet)	Depth Below Spillway (feet)	Surcharge Storage Capacity (acre-feet)
10,890	0	0
10,889	1	81
10,888	2	161
10,887	3	240
10,886	4	319
10,885	5	397
10,884	6	474
10,883	7	549
10,882	8	628
10,881	9	698
10,880	10	771

3.0 NORMAL OPERATING CONDITIONS

Figure 1, attached, presents the drainage basins tributary to Robinson Lake under normal operating conditions when no extreme flood events are occurring. For this condition, the Chalk Mountain Interceptor collects unimpacted runoff and snowmelt from the northeast side of Chalk Mountain and conveys it around the Climax facilities for release either into Eagle Park Reservoir or into the upper Eagle River basin. As shown on Figure 1, the area below the Chalk Mountain Interceptor can be partitioned into three distinct drainage basins consisting of approximately 54 acres tributary to Chalk Mountain Reservoir, 218 acres tributary to the Warren's Pump System, and 152 acres directly tributary to Robinson Lake. Chalk Mountain Reservoir and the Warren's Pump System lie within the overall Robinson Lake basin so that the total 424 acres together are tributary to Robinson Lake. Water that is discharged through the spillway on Chalk Mountain Dam and water that overflows Warren's Pump System flow directly into Robinson Lake.

During 100-year snowmelt conditions, the 1-day rate of snowmelt runoff tributary to Warren's Pump System would be about 3,330 gpm. Under normal operating conditions, this water, along with the 1 Dam seepage of up to about 1,000 gpm, would be pumped by the Warren's Pump System into the Tenmile Creek basin for treatment. Warren's Pump System has a capacity of

approximately 4,500 gpm. During a wet year, Chalk Mountain Reservoir would likely be full and overflowing through its spillway into Robinson Lake. If it was conservatively assumed that Warren's Pump System is not being used, the entire 424 acres tributary to Robinson Lake would produce a 1-day snowmelt runoff rate of 6,480 gpm. With this snowmelt runoff, 1,000 gpm of seepage from 1 Dam, and 480 gpm being pumped back from each the Robinson Dam and 4 Dam seepwater collection systems, the maximum inflow to Robinson Lake during 100-year snowmelt conditions would be about 8,440 gpm. The capacity of the Robinson Lake Pump Station without using the installed spare pump is approximately 10,000 gpm.

4.0 PMP EVENT CONDITIONS

During a PMP event, it has been assumed that the Chalk Mountain Interceptor would fail. Figure 2 shows the drainage basin configuration for this condition. In this scenario, approximately 696 acres is tributary to Robinson Lake; this area includes the area tributary to Chalk Mountain Reservoir. During a rainfall event, a portion of the rainfall amount is retained by vegetation or infiltrated into the ground. These losses are typically modeled through hydrologic analyses. For conservatism, however, Climax has accounted for the full volume of rainfall, without subtracting losses. In this case, the total volume of the site-specific PMP event in the Robinson Lake drainage basin would be **256 acre-feet**.

Climax recognizes that during and immediately after an extreme event such as the PMP, conditions may not allow immediate access for maintenance and repair of inoperable facilities. It is also recognized that power to the pump stations that remove water from the Robinson Lake basin may be unavailable for a short period of time. To account for these conditions, Climax is committed to maintaining available surcharge storage capacity in Robinson Lake equivalent to five days worth of inflow from the 1 Dam, Robinson Dam, and 4 Dam seepage collection systems. The combined 5-day volume of seepwater inflow to Robinson Lake would be about **43 acre-feet**. This amount is conservatively based on 480 gpm being continuously pumped from both the Robinson Dam and 4 Dam seepage collection systems, in addition to 1,000 gpm from the 1 Dam seep.

When natural inflows are not sufficient to maintain Robinson Lake at the desired operating level, Climax could be diverting water into the lake through the Tenmile Tunnel from the Tenmile Creek basin. Climax recognizes that access to the hydraulic pump to close the bulkhead valves may be hindered during the PMP event. To account for this temporary condition, Climax is committed to maintaining available surcharge storage capacity in Robinson Lake equivalent to two days worth of diverted inflow from the Tenmile Tunnel. The 2-day volume of diverted inflow to Robinson Lake would be about **88 acre-feet** based on a flow rate of 10,000 gpm through the Tenmile Tunnel.

If the PMP event happened to occur simultaneously with the peak of the 100-year snowmelt event and the Chalk Mountain Interceptor had failed, the additional 5-day snowmelt volume from the entire 696 acres tributary to Robinson Lake would be **191 acre-feet,** using the 5-day average snowmelt runoff rate of 0.2740 acre-feet per acre, discussed previously.

5.0 OPERATING CRITERIA

Climax is committed to maintain the water level in Robinson Lake with sufficient surcharge storage capacity to store, without release, the full 256 acre-feet of rainfall from the site-specific PMP event, plus five days worth or 43 acre-feet of seepwater inflow from the 1 Dam, Robinson

Dam, and 4 Dam seepage collection systems, plus two days worth, or 88 acre-feet, of diverted inflow from the Tenmile Tunnel throughout the year. To meet these criteria, the surcharge storage requirement is **387 acre-feet**. This volume of surcharge storage capacity can be achieved by setting the upper operating limit for Robinson Lake at an elevation of **10,885** feet. This level is five feet below the control crest of the emergency spillway on Robinson Dam.

During the period from April 15th through July 15th, which corresponds to the time frame when high snowmelt can occur, Climax will maintain an additional allowance for five days worth, or 191 acre-feet, of the 100-year snowmelt runoff from the entire Robinson Lake drainage basin including the area above the Chalk Mountain Interceptor. During this period, the total surcharge storage requirement would then be **578 acre-feet**. This volume of surcharge storage capacity can be achieved by setting an upper operating limit for Robinson Lake at an elevation of **10,882** feet. This level is eight feet below the control crest of the emergency spillway.

6.0 FACILITY MONITORING AND CONTROL SYSTEMS

6.1 Robinson Lake

Visual monitoring of Robinson Lake is performed routinely by Climax personnel. When the construction of the Robinson Lake Pump Station is completed and the facility brought online, it will operate as the main level control for Robinson Lake. A water level indicator will be installed to continuously monitor the water level within Robinson Lake. The water level indicator will be connected telemetrically to the mill control room to provide immediate notification should water levels exceed set points for high water action levels.

6.2 Robinson Lake Pump Station

The Robinson Lake Pump Station will be the primary facility to remove water from Robinson Lake. This pump station pumps water from the lake to the mill facilities. The pump station has a nominal pumping capacity of 10,000 gpm with two pumps running. A third pump is installed as a backup during normal operating conditions and could be used to evacuate additional water from Robinson Lake if needed. Pressure indicators on the intake and discharge sides of the pumps will control operation of the pumps and will also be tied to automated alarms to warn of upset conditions. As with the other pump stations at Climax, the pump station pressure alarms will be connected telemetrically to the mill control room to provide immediate notification should intake or discharge pressures exceed certain set points or pump upsets occur.

The pump station is also equipped with instrumentation to monitor pump operating status, temperature, and vibration as well as discharge flow rate. These parameters will be relayed to and monitored at the mill control room.

6.3 Robinson Dam

Robinson Dam is considered to be a jurisdictional dam by the Dam Safety Branch of the Colorado State Engineer's Office (SEO) and must therefore meet the dam safety and inspection requirements of the SEO's "Rules and Regulations for Dam Safety and Dam Construction." The Dam is inspected regularly by Climax personnel and generally once per year by SEO personnel.

A total of nine piezometers are located in the Robinson Dam embankment. Seven piezometers are located along the dam crest for monitoring phreatic water levels in the embankment. Five of the dam crest piezometers are full-depth, that is, they extend from the dam crest down to the approximate natural ground surface. The other two dam crest piezometers are perched so that

they only extend part way down into the embankment. The perched piezometers were installed in 2008 to monitor for unusual seepage conditions in the upper portion of the dam. The two additional piezometers are located along the downstream toe of the embankment. Climax personnel routinely monitor the piezometers, typically on a monthly basis, and maintain a database of phreatic water levels. These data are typically reported to the SEO on an annual basis. At this time, the SEO has not set trigger levels for the phreatic surface montoring in Robinson Dam.

A foundation drain system is located on the right downstream abutment of the dam. The flow rate from the drain is monitored regularly by Climax personnel and recorded during the SEO's Dam Safety Engineer's inspections. A small collection pond near the toe of the dam also collects dam seepage. This system is monitored regularly by Climax personnel; however, this system also collects some surface runoff and shallow subsurface flows from the area to the left of the dam embankment.

Six structural monuments are located along the crest of the dam for monitoring for ground movement. These monuments are surveyed once per year, or more frequently if requested by the SEO, to monitor for indications of settlement, sliding, or dam instability.

6.4 Robinson Lake Seepage Pump System

The Robinson Lake Seepage Pump System lies below Robinson Dam and consists of a collection pond and pumping system to return seepwater back to Robinson Lake. The collection pond was excavated on the upstream side of a concrete-bedrock cutoff wall and has a total storage capacity of 400,000 gallons. The pumping system consists of two 30-horsepower submersible pumps that are installed in a vertical wet well. The pumping capacity is approximately 480 gpm with one pump running and about 750 gpm with both pumps running in parallel. Inflows to the system are such that only one pump is required to operate on an intermittent basis, with the second pump serving as an installed backup. Water level readings from a level probe in the wet well control the on/off operation of the pumps. A backup generator, which is located in the Robinson Lake Pump Station, provides backup power to the seepwater system in the event of a power failure. This system is monitored regularly by Climax personnel.

6.5 4 Dam Seepage Collection and Pump System

Seepage flow from the toe of 4 Dam (aka Eagle Park Dam) is collected and pumped to Robinson Lake. The system discharges into the west side of the lake near the left upstream abutment of Robinson Dam. The volume of this seepage is typically minimal (approximately 20 gpm) except for a brief period when the snow is melting off the face of Eagle Park Dam. Water level readings from a level probe control the on/off operation of the pumps. A backup generator provides backup power to the 4 Dam seepwater system in the event of a power failure. This system is monitored regularly by Climax personnel.

7.0 CONTINGENCY PLAN

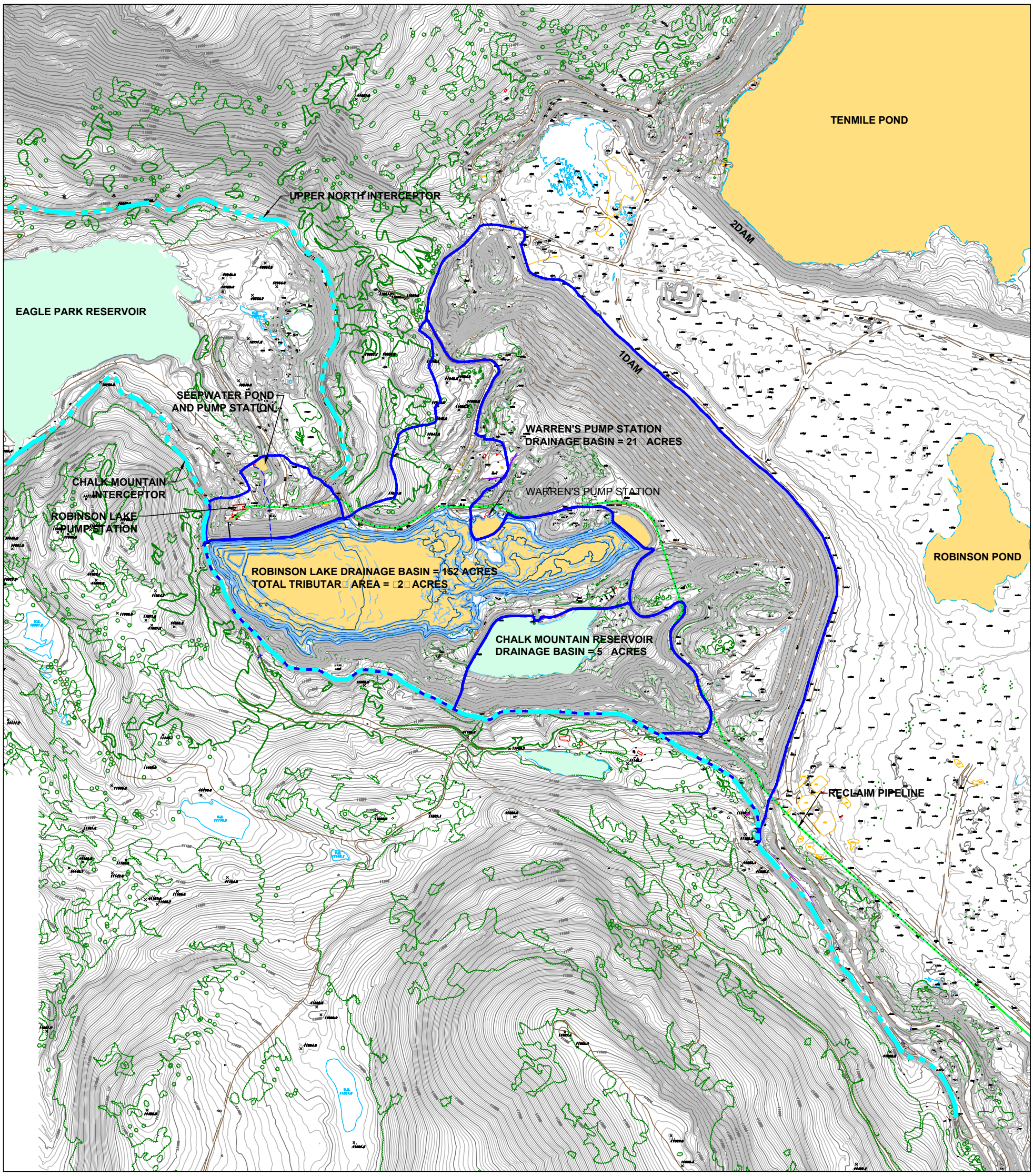
Climax has imposed several mechanisms to maintain the water level in Robinson Lake in accordance with this operating plan and to prevent an overflow through the emergency spillway into Eagle Park Reservoir. During an upset condition such as a major storm event or facility upset, Climax personnel will implement the following actions as needed:

- Close the bulkhead valves inside the Tenmile Tunnel. This will reduce the inflow to Robinson Lake to only the uncontrolled natural inflows from snowmelt or storm events.
- Operate the Robinson Lake Pump Station to remove water from Robinson Lake, utilizing the installed spare pump to increase pumping capacity as needed.
- Operate Warren's Pump Station to remove water from the Robinson Lake basin into the Tenmile Creek basin.
- In the event of a long-term power failure, Climax will mobilize a generator(s) to the Site to power pumps as needed.
- In the event of catastrophic failure of one or more of the pump systems, Climax will mobilize portable diesel-powered pumps to the Site to provide adequate pumping capacity.

8.0 REPORTING

An annual report will be prepared that documents the flood storage and release status for the year. Climax will provide a copy of this report to the Eagle Park Reservoir Company and the Clinton Ditch & Reservoir Company concurrently with its provision to the DRMS.

FIGURES



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W. W. Wheeler and Associates, Inc.
Water Resources Engineers

Climax Mine EPP
Robinson Lake Operating Plan
Normal Drainage Basin Map

July 2011

Job Number
1051.27

Figure 1

TENMILE POND

UPPER NORTH INTERCEPTOR

2DAM

EAGLE PARK RESERVOIR

SEEPWATER POND
AND PUMP STATION

1DAM

CHALK MOUNTAIN
INTERCEPTOR

WARREN'S PUMP STATION

ROBINSON LAKE
PUMP STATION

ROBINSON POND

ROBINSON LAKE

CHALK MTN
RESERVOIR

ROBINSON LAKE DRAINAGE BASIN
A = 696 ACRES (INCLUDING CMR)

RECLAIM PIPELINE

CHALK MOUNTAIN RESERVOIR
DRAINAGE BASIN, A = 255 ACRES

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July 2011

W. W. Wheeler and Associates, Inc.
Water Resources Engineers

Climax Mine EPP
Robinson Lake Operating Plan
PMP Drainage Basin Map

Job Number
1051.27

Figure 2

APPENDIX T-E
GEOCHEMICAL DATA

Environmental Protection Plan
Appendix T-E
Climax Molybdenum Company
Geochemical Data
Table T-E-1 - Synthetic Precipitation Leaching Procedure (SPLP) - Tailing and Road Fill Material

Sample ID	Matrix	Depth feet	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Copper mg/L	Fluoride mg/L	Iron mg/L	Lead mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Molybdenum mg/L	Phosphorous mg/L	Potassium mg/L	Selenium mg/L	Sodium mg/L	Sulfate mg/L	Zinc mg/L	Total Dissolved Solids	pH saturated paste units
Shepherd Miller Report - January 1997																								
MAYFLOWER IMPOUNDMENT																								
MB-1-10-11.5	Core	10-11.5	0.172	<0.034		<0.0024	30.3	<0.005	0.004		0.235	0.003	2.12	0.571	<0.002	1.13		10.7	<0.005	2.58		0.044		6.84
MB-2-85-87	Core	85-87	0.377	<0.034		0.0048	242	<0.005	0.007		0.037	<0.004	9.68	2.49	<0.002	13.5		51	<0.005	18.6		0.064		7.25
T5-2	Surface	2	2.86	<0.034		<0.0024	256	<0.005	0.043		2.6	<0.004	3.53	1.42	<0.002	<0.014		8.08	<0.005	2.56		0.155		3.62
TENMILE IMPOUNDMENT																								
TB-1-10-12	Core	10-12	46.3	<0.034		0.0033	305	0.013	0.515		70.2	0.002	9.36	2.01	<0.002	0.038		7.87	<0.005	1.61		1.09		3.08
TB-2-125-126.5	Core	125.126.5	0.201	<0.034		<0.0024	67.1	<0.005	0.011		0.053	0.005	5.3	1.75	<0.002	17.1		23	<0.005	2.47		0.05		6.54
TM-T1-1	Surface	1	21.3	<0.034		0.0098	422	<0.005	1.71		1.84	0.016	4.2	1.83	<0.002	<0.014		7.79	<0.005	4.88		1.08		4.11
ROBINSON IMPOUNDMENT																								
RB-2-55-57	Core	55-57	0.161	<0.034		<0.0024	56.7	<0.005	0.006		<0.024	0.002	4.4	1.08	<0.002	7.18		29.7	<0.005	17.7		0.047		6.38
RB-4-10-12	Core	10-12	0.656	<0.034		<0.0024	343	<0.005	0.046		0.11	<0.0016	336	4.96	<0.002	66		43.4	<0.005	17.1		0.034		7.96
RT-T1-1	Surface	1	40.9	0.037		0.0034	208	0.048	0.411		101	0.028	7.31	1.25	<0.002	0.077		2.23	<0.005	1.35		1.07		2.88
Ceresco Ridge - Road Fill Material December 2010																								
CMC-CERESCO B 1-10					0.0005	0.0001			0.0015	0.4	0.03	0.0004		0.005	0.0002	0.01	0.01		0.0001		8	0.01	40	6.0

Shepherd Miller, 1997 Characterization of Mine Tailings, Climax Mine, Climax, Colorado. Prepared for Climax Molybedenum Company by Shepherd Miller Inc. January 1997
Ceresco Ridge, 2010 Ceresco Ridge - Road Fill Material Analytical Results from Drill Chip Samples from Drilling and Blasting on Ceresco Ridge, December 2010.

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Table T-E-2 - Acid Base Accounting - Waste Rock, Tailing, and Road Fill Material

Sample ID	Matrix	Depth feet	Acid Generating Potential (AGP) based on Sulfide Sulfur tons $CaCO_3$/kton	Acid Neutralization Potential (NP or ANP) tons CaCO3/kton	Net Neutralization Potential (NNP) (ANP-AGP) tons $CaCO_3$/kton	Neutralization Potential Ratio (NPR) (ANP/AGP) unitless	Saturated Paste pH pH units	Sulfur - T %	Sulfate Sulfur (HCl extractable sulfur) %	Sulfide Sulfur (HNO_3 extractable sulfur) %	Hot Water extractable sulfur %	Residual Sulfur (Insoluble) %
Miscellaneous Data									See Note 1	See Note 2		
CM-SRTP-WR-BS01	Soil		2.2	0.0	-2.2	0	4.4	0.45	0.13	0.07		0.25
CM-SRTP-WR-BS02	Soil		2.2	0.3	-1.9	0.01	4.5	0.69	0.19	0.07		0.43
Ceresco Ridge - Road Fill Material December 2010									See Note 1	See Note 2		
CMC-CERESCO B 1-10	drill chips		14.1	0.0	-14.1	0.0	4.6	0.56	0.11	0.45		<0.01
CMC-CERESCO B-1/2-10	drill chips		5.9	2.0	-3.9	0.3	4.7	0.21	0.02	0.19		<0.01
CMC-CERESCO B-1/2-R-10	drill chips		9.7	3.0	-6.7	0.3	5.0	0.39	0.08	0.31		<0.01
CMC CERESCO B 2-10	drill chips		9.4	0.0	-9.4	0.0	4.6	0.41	0.11	0.3		<0.01
CMC CERESCO B 2-11	drill chips		9.7	1.0	-8.7	0.1	4.3	0.42	0.11	0.31		<0.01
CMC CERESCO B 2-20	drill chips		16.3	0.0	-16.3	0.0	4.3	0.62	0.1	0.52		<0.01
CMC-CERESCO B-3-10	drill chips		7.2	3.0	-4.2	0.4	4.6	0.28	0.05	0.23		<0.01
ProMac Systems - September 9, 1988									See Note 1	See Note 2		
88049-1	Core		1.7	2.77	1.11	1.7	5.5	0.219	0.164	0.053		0.002
88049-2	Core		2.8	4.05	1.24	1.4	6.0	0.12	0.03	0.09		<0.001
88049-3	Core		35.6	5.18	-30.45	0.1	6.3	1.238	0.07	1.14		0.028
88049-4	Core		30.2	6.26	-23.9	0.2	5.9	1.18	0.196	0.965		0.019
88049-5	Core		19.0	82.19	63.16	4.3	7.2	0.799	0.179	0.609		0.011
88049-6	Core		69.4	25.42	-43.96	0.4	5.7	2.683	0.43	2.22		0.033
88049-7	Core		29.5	5.57	-23.96	0.2	5.6	1.07	0.092	0.945		0.033
88049-8	Core		19.4	6.75	-12.63	0.3	6.5	0.782	0.137	0.62		0.025
88049-9	Core		22.6	3.17	-19.46	0.1	5.7	0.884	0.16	0.724		<0.001
88049-10	Core		15.5	2.36	-13.17	0.2	6.3	0.64	0.143	0.497		<0.001
Shepherd Miller Report - January 1997												
MAYFLOWER IMPOUNDMENT												
MB-1	Core	10.75	38	3	-35	0.1	6.84	1.42	0.16	1.2	<0.01	0.06
MB-1	Core	31	63	3	-60	0.0	5.15	2.34	0.15	2.02	0.13	0.04
MB-1	Core	51	86	4	-82	0.0	5.61	2.8	<0.01	2.74	<0.01	0.06
MB-1	Core	96	34	6	-28	0.2	7.65	1.11	<0.01	1.09	<0.01	0.02
MB-1	Core	126	15	4	-11	0.3	8.10	0.56	0.04	0.49	0.02	0.01
MB-2	Core	7.1	17	5	-12	0.3	6.29	0.61	<0.01	0.55	0.05	0.01
MB-2	Core	28	21	3	-18	0.1	7.35	0.79	<0.01	0.68	0.08	0.03
MB-2	Core	41	24	5	-19	0.2	8.13	0.85	0.05	0.78	0.01	0.01
MB-2	Core	66	20	5	-15	0.3	7.49	0.7	0.02	0.64	0.04	<0.01
MB-2	Core	86	20	4	-16	0.2	7.25	0.67	<0.01	0.63	0.04	<0.01
T5-1	Surface	0.5	20	4	-16	0.2	4.9	0.63	<0.01	0.63	<0.01	<0.01
T5-2	Surface	2	16	4	-12	0.3	3.62	0.58	<0.01	0.52	0.06	<0.01

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Table T-E-2 - Acid Base Accounting - Waste Rock, Tailing, and Road Fill Material

Sample ID	Matrix	Depth feet	Acid Generating Potential (AGP) based on Sulfide Sulfur tons $CaCO_3$/kton	Acid Neutralization Potential (NP or ANP) tons CaCO3/kton	Net Neutralization Potential (NNP) (ANP-AGP) tons $CaCO_3$/kton	Neutralization Potential Ratio (NPR) (ANP/AGP) unitless	Saturated Paste pH pH units	Sulfur - T %	Sulfate Sulfur (HCl extractable sulfur) %	Sulfide Sulfur (HNO_3 extractable sulfur) %	Hot Water extractable sulfur %	Residual Sulfur (Insoluble) %
T5-4	Surface	3	17	3	-14	0.2	4.59	0.64	<0.01	0.55	0.07	0.02
T5-5	Surface	4	29	3	-26	0.1	4.78	1.1	0.1	0.94	0.02	0.04
T6-3	Surface	4.6	16	2	-14	0.1	2.92	0.66	0.07	0.5	0.09	<0.01
T6-4	Surface	5	19	3	-16	0.2	2.69	0.8	0.09	0.62	0.09	<0.01
T6-7	Surface	20	71	3	-68	0.0	3.85	2.41	0.01	2.27	0.03	0.1
MF-T1-3.5	Surface	3.5	33	5	-28	0.2	3.11	1.19	0.1	1.06	<0.01	0.03
MF-T1-7	Surface	7	18	1	-17	0.1	2.83	0.77	0.02	0.58	0.17	<0.01
MF-T2-2	Surface	2	31	3	-28	0.1	6.75	1.03	0.02	0.99	<0.01	0.02
MF-T2-4	Surface	4	26	3	-23	0.1	4.57	0.87	0.02	0.83	<0.01	0.02
MF-T3-1.2	Surface	1.2	12	16	4	1.3	8.51	0.62	0.04	0.39	0.18	0.01
MF-T3-2.2	Surface	2.2	20	14	-6	0.7	8.40	0.68	0.02	0.63	<0.01	0.03
MF-T3-2.3	Surface	2.3	16	104	88	6.5	8.39	0.95	0.11	0.51	0.32	0.01
NO. 5 DAM												
N5D-T1-8.5A	Surface	8.5	41	6	-35	0.1	3.33	1.52	<0.01	1.31	0.16	0.05
N5D-T2-4	Surface	4	33	3	-30	0.1	2.78	1.48	0.1	1.07	0.29	0.02
N5D-T2-7	Surface	7	31	7	-24	0.2	3.36	1.09	0.07	0.99	<0.01	0.03
N5D-T3-4	Surface	4	48	4	-44	0.1	3.42	1.78	0.12	1.53	0.08	0.05
N5D-T3-6.5	Surface	6.5	140	3	-137	0.0	3.45	5.6	0.57	4.49	0.32	0.22
N5D-T4-4	Surface	4	41	3	-38	0.1	3.18	1.57	<0.01	1.31	0.2	0.06
N5D-T4-9	Surface	9	15	4	-11	0.3	3.38	0.68	<0.01	0.48	0.15	0.05
TENMILE IMPOUNDMENT												
TB-1	Core	11	43	3	-40	0.1	3.08	1.48	<0.01	1.38	0.07	0.03
TB-1	Core	31	49	4	-45	0.1	4.64	1.67	0.06	1.58	<0.01	0.03
TB-1	Core	51	34	5	-30	0.1	5.73	1.2	0.04	1.1	0.05	0.01
TB-1	Core	91	38	5	-33	0.1	7.68	1.27	0.04	1.2	<0.01	0.03
TB-1	Core	121	44	5	-39	0.1	8.05	1.59	<0.01	1.4	0.17	0.02
TB-2	Core	8.85	16	3	-13	0.2	6.01	0.57	<0.01	0.52	0.05	<0.01
TB-2	Core	31	20	6	-14	0.3	6.95	0.72	0.01	0.63	0.08	<0.01
TB-2	Core	51	27	7	-20	0.3	6.84	1.04	0.04	0.86	0.12	0.02
TB-2	Core	57.75	24	5	-19	0.2	6.65	0.87	0.03	0.78	0.06	<0.01
TB-2	Core	125.75	37	6	-31	0.2	6.54	1.25	0.04	1.19	0.01	0.01
TMD	Surface		14	18	4	1.3		0.74	0.03	0.44	0.27	<0.01
T3-1	Surface	1	30	2	-28	0.1	8.40	1.09	0.07	0.96	0.04	0.02
T3-2	Surface	2.5	13	3	-10	0.2	4.27	0.63	0.05	0.43	0.15	<0.01
T3-3	Surface	3.7	32	9	-23	0.3	5.98	1.05	<0.01	1.04	<0.01	0.01
T4-1	Surface	0.9	16	4	-12	0.3	3.73	0.53	0.03	0.5	0.03	<0.01

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Sample ID	Matrix	Depth feet	Acid Generating Potential (AGP) based on Sulfide Sulfur tons $CaCO_3$/kton	Acid Neutralization Potential (NP or ANP) tons CaCO3/kton	Net Neutralization Potential (NNP) (ANP-AGP) tons $CaCO_3$/kton	Neutralization Potential Ratio (NPR) (ANP/AGP) unitless	Saturated Paste pH pH units	Sulfur - T %	Sulfate Sulfur (HCl extractable sulfur) %	Sulfide Sulfur (HNO_3 extractable sulfur) %	Hot Water extractable sulfur %	Residual Sulfur (Insoluble) %
T4-3	Surface	3	30	5	-25	0.2	3.35	0.98	0.01	0.96	0.01	0.01
T4-4	Surface	3.4	24	0.5	-23.5	0.0	2.86	1.01	<0.01	0.76	0.25	<0.01
TM-T1-1	Surface	1	19	3	-16	0.2	4.11	0.72	0.04	0.61	0.06	0.01
TM-T1-3	Surface	3	28	9	-19	0.3	5.44	0.9	<0.01	0.89	<0.01	0.01
TM-T2-1	Surface	1	38	4	-34	0.1	5.33	1.26	0.03	1.21	<0.01	0.02
TM-T2-3	Surface	3	17	6	-11	0.4	6.85	0.54	<0.01	0.53	<0.01	0.01
TM-T3-1	Surface	1	23	2	-21	0.1	3.66	0.81	0.08	0.73	<0.01	<0.01
TM-T3-3.3	Surface	3.3	39	2	-37	0.1	3.93	1.37	0.07	1.24	0.02	0.04
NO. 3 DAM												
N3D-T1-2	Surface	2	11	7	-3.6	0.6	3.38	0.49	<0.01	0.34	0.11	0.04
N3D-T1-4	Surface	4	8.4	2	-6.4	0.2	2.88	0.37	<0.01	0.27	0.09	0.01
N3D-T2-2	Surface	2	18	3	-15	0.2	3.04	0.64	0.03	0.57	<0.01	0.04
N3DT2-4	Surface	4	13	3	-10	0.2	2.96	0.59	0.09	0.41	0.05	0.04
N3D-T3-1.5	Surface	1.5	21	1	-20	0.0	2.80	0.76	0.05	0.66	0.01	0.04
N3D-T3-3	Surface	3	52	2	-50	0.0	3.12	1.77	<0.01	1.66	<0.01	0.11
N3S-T3-5	Surface	5	48	2	-46	0.0	3.02	1.93	0.15	1.53	0.08	0.17
ROBINSON IMPOUNDMENT												
RB-1	Core	11	22	0.5	-21.5	0.0	3.19	0.9	<0.01	0.71	0.18	0.01
RB-1	Core	31	32	3	-29	0.1	3.42	1.16	0.1	1.02	0.03	0.01
RB-1	Core	55.3	40	1	-39	0.0	3.47	1.47	0.01	1.27	0.19	<0.01
RB-1	Core	81	20	2	-18	0.1	4.92	0.76	0.09	0.65	0.02	<0.01
RB-1	Core	121	21	5	-16	0.2	5.32	0.83	0.09	0.68	0.06	<0.01
RB-2	Core	13	21	5	-16	0.2	5.14	0.75	0.05	0.68	<0.01	0.02
RB-2	Core	35.75	39	3	-36	0.1	4.82	1.35	<0.01	1.25	0.06	0.04
RB-2	Core	56	43	0.5	-42.5	0.0	6.38	1.44	0.03	1.39	<0.01	0.02
RB-2	Core	76	24	2	-22	0.1	7.40	0.79	<0.01	0.78	0.01	<0.01
RB-2	Core	121	23	3	-20	0.1	5.21	0.75	<0.01	0.73	0.02	<0.01
RB-3	Core	11	2.5	0.5	-2	0.2	2.82	0.29	0.03	0.08	0.16	0.02
RB-3	Core	51	60	3	-57	0.1	3.85	2.24	0.25	1.93	<0.01	0.06
RB-3	Core	126.5	14	4	-10	0.3	5.93	0.5	<0.01	0.46	0.02	0.02
RB-4	Core	11	21	33	12	1.6	7.96	0.96	<0.01	0.68	0.25	0.03
RB-4	Core	26	30	13	-17	0.4	6.81	1.07	<0.01	0.96	0.11	<0.01
RB-4	Core	46	0.93	7	6.07	7.5	6.15	0.05	<0.01	0.03	0.02	<0.01
T1-1	Surface	1.25	50	9	-41	0.2	3.07	1.84	<0.01	1.6	0.2	0.04
T1-2	Surface	1.625	40	1	-39	0.0	3.18	1.41	<0.01	1.29	0.09	0.03
T1-3	Surface	2.25	50	8	-42	0.2	6.22	1.67	<0.01	1.61	0.02	0.04

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Sample ID	Matrix	Depth feet	Acid Generating Potential (AGP) based on Sulfide Sulfur tons $CaCO_3$/kton	Acid Neutralization Potential (NP or ANP) tons CaCO3/kton	Net Neutralization Potential (NNP) (ANP-AGP) tons $CaCO_3$/kton	Neutralization Potential Ratio (NPR) (ANP/AGP) unitless	Saturated Paste pH pH units	Sulfur - T %	Sulfate Sulfur (HCl extractable sulfur) %	Sulfide Sulfur (HNO_3 extractable sulfur) %	Hot Water extractable sulfur %	Residual Sulfur (Insoluble) %
T1-4	Surface	3.25	134	8	-126	0.1	4.07	4.43	<0.01	4.3	<0.01	0.13
T2-1	Surface	1.25	42	4	-38	0.1	4.86	1.4	<0.01	1.36	<0.01	0.04
T2-2	Surface	2.5	43	0.5	-42.5	0.0	3.34	1.47	<0.01	1.38	0.08	0.01
T2-4	Surface	4.5	3.1	3	-0.1	1.0	3.22	0.33	0.04	0.1	0.19	<0.01
RT-T1-1	Surface	1	31	2	-29	0.1	2.88	1	<0.01	0.99	<0.01	0.01
RT-T1-3.6	Surface	3.6	120	4	-116	0.0	3.07	3.85	<0.01	3.71	<0.01	0.14
RT-T2-1.5	Surface	1.5	36	0.5	-35.5	0.0	3.04	1.29	0.05	1.15	0.04	0.05
RT-T2-2	Surface	2	9.4	1	-8.y	0.1	3.17	0.34	0.03	0.3	0.01	<0.01
RT-T3-2	Surface	2	3.1	0.5	-2.6	0.2	2.95	0.22	0.03	0.1	0.09	<0.01
RT-T3-3	Surface	3	14	0.5	-13.5	0.0	3.13	0.56	0.01	0.45	0.1	<0.01
RT-T4-2	Surface	2	34	4	-30	0.1	2.99	1.14	<0.01	1.1	<0.01	0.04
RT-T4-3	Surface	3	28	4	-24	0.1	3.19	0.92	0.01	0.91	<0.01	<0.01
NO. 1 DAM												
N1D-T1-2.5	Surface	2.5	9.1	1	-8.1	0.1	2.86	0.46	<0.01	0.29	0.11	0.06
N1D-T1-4	Surface	4	14	3	-11	0.2	3.54	0.71	<0.01	0.45	0.24	0.02
N1D-T2-2	Surface	2	15	1	-14	0.1	3.00	0.5	<0.01	0.48	<0.01	0.02
N1D-T2-3	Surface	3	5	1	-4	0.2	3.08	0.25	0.01	0.16	0.08	<0.01
N1D-T3-3.5	Surface	3.5	110	3	-107	0.0	3.06	3.69	<0.01	3.53	0.01	0.15
N1D-T3-6	Surface	6	25	3	-22	0.1	3.13	1.02	<0.01	0.8	0.19	0.03

Notes
1. Sulfate Sulfur could be HCl or HNO_3 extratable
2. Sulfide Sulfur could be HCl or Hot Water extractable
3. AGP Calculated based on Sulfide Sulfur

Miscellaneous Data	Soil Analysis Report for two samples from the South Robinson Tailings Pond-Waste Rock-Biosolids at the Climax Mine
Ceresco Ridge, 2010	Ceresco Ridge - Road Fill Material Analytical Results from Drill Chip Samples from Drilling and Blasting on Ceresco Ridge, December 2010.
ProMac Systems , 1988	Quote to the Climax Molybdenum Company for the Treatment of the McNulty Rock Dump, prepared by ProMac Systems, September 9, 1988
Shepherd Miller, 1997	Characterization of Mine Tailings, Climax Mine, Climax, Colorado. Prepared for Climax Molybedenum Company by Shepherd Miller Inc. January 1997

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Table T-E-3 - McNulty Overburden Storage Facility Reactor Data

Sample ID	Matrix	Lab ID	Date Sampled	Conductivity (field) umhos/cm	Dissolved Oxygen (field) mg/L	pH (field) units	Temp (field) C	Aluminum - D mg/L	Aluminum - T mg/L	Calcium - D mg/L	Copper - D mg/L	Copper - T mg/L	Iron - D mg/L	Iron (Ferric) mg/L	Iron (Ferrous) mg/L	Iron - T mg/L	Magnesium - D mg/L	Manganese - D mg/L	Manganese - T mg/L	Molybdenum - D mg/L
McNulty OSF Reactors - ACZ Laboratories, Inc.																				
MC1a	Surface Water	L20241-01	9/6/1998					0.03	0.22	180	0.003	0.003	0.01	0.19	0.02	0.21	22.6	0.031	0.039	0.91
MC1a	Surface Water	L20941-01	10/28/1998	470		6.6	13.3	0.07	0.49	162	0.003	0.003	0.14	0.5		0.5	20.4	0.03	0.072	2.68
MC1a (CL-RPM)	Surface Water	L23469-01	6/8/1999	380	6.4	5.6	25	3.58	3.69	152	0.005	0.005	0.03	0.62	0.06	0.68	15.3	0.754	0.742	3.99
MC1a	Surface Water	L25247-01	10/18/1999			5.7		1.2	1.57	125	0.003	0.002		0.38		0.38	13.2	0.074	0.081	4.61
MC1a (CL-RPM)	Surface Water	L28398-03	7/26/2000		5.13	5.8	18	2.47	2.32	91.8	0.002	0.003			0.05	0.02	9.3	0.305	0.276	4.7
MC1b	Surface Water	L20941-02	10/28/1998	350		5.9	13.2	13.9	14.6	140	0.008	0.01		1.57	0.04	1.61	15.9	0.431	0.497	1.12
MC1b (CL-RPM)	Surface Water	L23469-02	6/8/1999	85.1	6.29	5.1	25	18.5	16.9	134	0.026	0.025		0.6	0.07	0.67	12.4	1.2	1.15	1.89
MC1b	Surface Water	L25247-02	10/18/1999			5.8		14.6	14.5	160	0.011	0.01		0.1		0.1	15.4	0.69	0.666	2.03
MC1b (CL-RPM)	Surface Water	L28398-02	7/26/2000		5.38	5.6	18	15.9	15.9	124	0.006	0.015			0.14	0.08	11.4	0.985	0.966	1.34
MC1c	Surface Water	L20241-02	9/6/1998					6.9	7.49	147	0.003	0.002	0.01	0.08	0.02	0.1	17.1	0.261	0.261	0.1
MC1c	Surface Water	L20941-03	10/28/1998	290		6	12.2	8.05	7.66	131	0.002	0.003		0.1		0.1	15.9	0.269	0.271	0.12
MC1c (CL-RPM)	Surface Water	L23469-03	6/8/1999	49.7	6.25	5.1	25	16.7	16.2	90.2	0.017	0.018		1.09	0.09	1.18	9	1.09	1.12	0.27
MC1c	Surface Water	L25247-03	10/18/1999			5.9		15.1	15.6	106	0.007	0.006				0.01	11.1	0.7	0.725	0.2
MC1c (CL-RPM)	Surface Water	L28398-01	7/26/2000		5.22	5.7	18	13.8	13.7	89	0.01	0.011			0.05	0.02	8.5	0.835	0.833	0.47
MC2a (CL-RPM)	Surface Water	L23469-04	6/8/1999	61	5.28	4.7	25	12	54.7	49.9	0.025	0.172		84.7	0.03	84.7	5.6	0.515	3.45	0.03
MC2a	Surface Water	L25281-01	10/18/1999			4.8		19.7	33.9	108	0.052	0.09	0.05	19.1	0.03	19.1	11.9	1.36	1.99	
MC2a (CL-RPM)	Surface Water	L28398-06	7/26/2000		5.19	4.4	19	13.7	13.2	51.6	0.102	0.112	0.03	0.07		0.07	5.4	0.587	0.551	
MC2b	Surface Water	L20241-03	9/6/1998					0.71	1.09	73.8	0.003	0.005		0.25	0.03	0.28	9.1	0.029	0.044	0.04
MC2b	Surface Water	L20941-04	10/28/1998	180		6.1	12.6	2.23	3.85	78.6	0.003	0.005		1.94	0.04	1.98	10	0.055	0.153	0.01
MC2b (CL-RPM)	Surface Water	L23469-05	6/8/1999	70	7.05	4.9	25	12.9	13.6	62.6	0.025	0.03		3.65	0.1	3.75	7	0.498	0.565	0.02
MC2b	Surface Water	L25247-04	10/18/1999			5.7		11.4	11.3	82.6	0.01	0.01	0.02	0.29		0.29	9.6	0.438	0.441	0.03
MC2b (CL-RPM)	Surface Water	L28398-05	7/26/2000		5.38	4.4	19	11.9	12.2	63.3	0.032	0.03		0.04		0.04	6.4	0.66	0.654	0.05
MC2c	Surface Water	L20241-04	9/6/1998					6.73	8.26	66.3	0.006	0.014	0.03	1.88	0.05	1.93	7.9	0.235	0.286	0.03
MC2c	Surface Water	L20941-05	10/28/1998	110		5.6	13	5.98	5.75	48.6	0.02	0.02	0.02	0.21		0.21	5.9	0.259	0.267	0.02
MC2c (CL-RPM)	Surface Water	L23469-06	6/8/1999	52.5	6.01	3.6	25	14.2	11.7	41.5	0.13	0.126	0.08	1.26	0.09	1.35	4.3	0.603	0.537	
MC2c	Surface Water	L25247-05	10/18/1999			4.5		12	12.6	78.6	0.029	0.03	0.03	0.23		0.23	8.4	0.709	0.723	0.02
MC2c (CL-RPM)	Surface Water	L28398-04	7/26/2000		4.99	4.7	18	14.9	14.7	58.7	0.076	0.073	0.01	0.06		0.06	6	0.97	0.924	0.01
MC3a	Surface Water	L20241-05	9/6/1998					909	892	549	3.1	2.93	266	218	17.2	235	538	102	99.6	
MC3a	Surface Water	L20941-06	10/28/1998	910		2.1	12.6	1010	960	325	4.4	3.9	806	713	16.9	730	607	121	125	0.02
MC3a (CL-RPM)	Surface Water	L23469-07	6/8/1999	797	4.85	2	25	743	656	296	3.97	3.78	1360	1130	96	1230	651	135	121	
MC3a	Surface Water	L25247-06	10/18/1999			2.1		312	319	408	1.94	2.13	668	684	6.3	690	263	36.8	37.6	0.04
MC3a (CL-RPM)	Surface Water	L28398-09	7/26/2000		0.58	2.3	18	407	414	311	2.1	1.95	1680	1710	9.6	1720	421	49.7	49.1	
MC3b	Surface Water	L20241-06	9/6/1998					325	316	585	0.68	0.68	32.8	23.2	5.4	28.6	356	39.9	38.9	
MC3b	Surface Water	L20941-07	10/28/1998	780		2.4	12.9	374	358	303	0.94	0.87	140	129	7.9	137	426	42.5	44.1	
MC3b (CL-RPM)	Surface Water	L23469-08	6/8/1999	551	4.29	2.7	25	543	498	351	1.94	4.6	311	241	35	276	766	87.6	86.1	
MC3b	Surface Water	L25247-07	10/18/1999			3.1		290	297	370	1.18	1.42	37	39.2	1.24	40.4	629	47.4	48.1	
MC3b (CL-RPM)	Surface Water	L28398-08	7/26/2000		0.8	2.4	18	321	341	343	2	1.8	376	431	8.1	439	599	41.3	43.1	
MC3c	Surface Water	L20241-07	9/6/1998			3.5	21.2	495	498	524	1.5	1.5	20.5	19.6	1.5	21.1	615	62.5	62.4	0.08
Mc3c	Surface Water	L20941-08	10/28/1998	710		2.3	13.4	379	367	294	1.82	1.74	149	135	8.4	143	491	50.5	48.3	0.02
MC3c (CL-RPM)	Surface Water	L23469-09	6/8/1999	774	4.95	2	25	1010	973	329	5.2	4.5	991	962	21	983	1250	167	164	
MC3c	Surface Water	L25247-08	10/18/1999			2.9		303	311	369	2	2.21	314	303	5.4	308	471	44.7	43.6	
MC3c (CL-RPM)	Surface Water	L28398-07	7/26/2000		1.42	2.1	18	408	418	392	2.3	2.2	842	920	6.5	926	500	58.8	58.6	

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Sample ID	Matrix	Lab ID	Date Sampled	Molybdenum - T mg/L	Potassium - D mg/L	Potassium - T mg/L	Silica - D mg/L	Sodium - D mg/L	Sodium - T mg/L	Strontium - D mg/L	Zinc - D mg/L	Zinc - T mg/L	Bicarbonate as CaCO3 mg/L	Total Alkalinity mg/L	Cation-Anion Balance %	Sum of Anions meq/L	Sum of Cations meq/L	Chloride mg/L
McNulty OSF Reactors - ACZ Laboratories, Inc.																		
MC1a	Surface Water	L20241-01	9/6/1998	0.91	4.7	4.7	12.1	3.5	3.5	0.84	0.04	0.05	11	11	2.8	10.6	11.2	
MC1a	Surface Water	L20941-01	10/28/1998	2.63	5.5	5.5	10.3	2.7	2.7	0.7	0.04	0.06	11	11	-2.4	10.6	10.1	2
MC1a (CL-RPM)	Surface Water	L23469-01	6/8/1999	3.96	4.3	4.3	25.7	2.5	2.5	0.31	1.37	1.4	6	6	2.2	9.1	9.5	1
MC1a	Surface Water	L25247-01	10/18/1999	4.72	3.8	3.8	25	2.2	2.2	0.35	0.24	0.24	5	5	-1.3	7.8	7.6	
MC1a (CL-RPM)	Surface Water	L28398-03	7/26/2000	4.58	3.6	3.6	27.4	1.9	1.9	0.21	0.83	0.75	5	5	0.9	5.7	5.8	
MC1b	Surface Water	L20941-02	10/28/1998	1.13	4.6	4.6	19.5	2.7	2.7	0.58	0.92	0.94	5	5	-1	10.4	10.2	
MC1b (CL-RPM)	Surface Water	L23469-02	6/8/1999	1.84	5.1	5.1	34.9	2.6	2.6	0.27	2.61	2.53	4	4	6.2	9	10.2	1
MC1b	Surface Water	L25247-02	10/18/1999	1.97	5.2	5.2	40	2.7	2.7	0.39	1.68	1.69	4	4	5.2	10.1	11.2	
MC1b (CL-RPM)	Surface Water	L28398-02	7/26/2000	1.4	5.4	5.4	39.2	2.5	2.5	0.28	2.52	2.57	4	4	1.6	9	9.3	1
MC1c	Surface Water	L20241-02	9/6/1998	0.09	5.6	5.6	25.8	3.1	3.1	0.67	0.24	0.24	4	4	2.6	9.3	9.8	
MC1c	Surface Water	L20941-03	10/28/1998	0.12	4.8	4.8	21	2.7	2.7	0.58	0.35	0.35	5	5	-1.6	9.3	9	
MC1c (CL-RPM)	Surface Water	L23469-03	6/8/1999	0.32	5.5	5.5	28.7	1.9	1.9	0.24	1.73	1.75	3	3	2.1	7.1	7.4	1
MC1c	Surface Water	L25247-03	10/18/1999	0.22	6	6	44.1	2.4	2.4	0.34	1.39	1.45	3	3	0	8.2	8.2	
MC1c (CL-RPM)	Surface Water	L28398-01	7/26/2000	0.48	6.4	6.4	43.5	2.2	2.2	0.25	1.89	1.85	3	3	1.4	6.8	7	
MC2a (CL-RPM)	Surface Water	L23469-04	6/8/1999	1.42	4	4	38.1	1.4	1.4	0.21	0.61	1.58	2	2	2.3	4.3	4.5	
MC2a	Surface Water	L25281-01	10/18/1999	0.25	9.1	9.1	53.6	3	3	0.43	1.48	1.79			-1.6	9.3	9	2
MC2a (CL-RPM)	Surface Water	L28398-06	7/26/2000		3.9	3.9	33.1	1.2	1.2	0.18	0.85	0.82			1.1	4.6	4.7	
MC2b	Surface Water	L20241-03	9/6/1998	0.04	3.3	3.3	26.7	2.4	2.4	0.37	0.03	0.03	5	5	4.4	4.3	4.7	
MC2b	Surface Water	L20941-04	10/28/1998	0.02	3.2	3.2	17.5	2.1	2.1	0.4	0.07	0.1	5	5	3	4.8	5.1	
MC2b (CL-RPM)	Surface Water	L23469-05	6/8/1999	0.22	3.7	3.7	32.3	1.4	1.4	0.23	0.8	0.84	2	2	2.9	5	5.3	
MC2b	Surface Water	L25247-04	10/18/1999	0.04	4.4	4.4	43	1.8	1.8	0.29	0.75	0.76	3	3	1.6	6.2	6.4	
MC2b (CL-RPM)	Surface Water	L28398-05	7/26/2000	0.03	4.6	4.6	39.3	1.7	1.7	0.21	1.14	1.04	2	2	2	5	5.2	
MC2c	Surface Water	L20241-04	9/6/1998	0.08	3.3	3.3	37.8	1.9	1.9	0.33	0.25	0.27	3	3	0	4.9	4.9	
MC2c	Surface Water	L20941-05	10/28/1998	0.01	2.9	2.9	13.4	1.3	1.3	0.25	0.32	0.33	3	3	0	3.7	3.7	
MC2c (CL-RPM)	Surface Water	L23469-06	6/8/1999	0.08	2.9	2.9	25.8	1.1	1.1	0.14	0.82	0.73			1.2	4.1	4.2	1
MC2c	Surface Water	L25247-05	10/18/1999	0.04	3.6	3.6	38.9	1.7	1.7	0.29	0.84	0.87	2	2	2.5	5.9	6.2	
MC2c (CL-RPM)	Surface Water	L28398-04	7/26/2000		4	4	36.1	1.4	1.4	0.21	1.2	1.2			5	4.8	5.3	
MC3a	Surface Water	L20241-05	9/6/1998		13	13	141	7	7	2.15	30.4	28.7			-3	208	196	
MC3a	Surface Water	L20941-06	10/28/1998		14	14	138	6	6	1.64	36	37.1			-1.7	240	232	170
MC3a (CL-RPM)	Surface Water	L23469-07	6/8/1999		3	3	87			0.33	22	19.9			-0.9	237	233	2
MC3a	Surface Water	L25247-06	10/18/1999	0.02			127	2.2	2.2	0.55	11.3	11.7			-4.2	125	115	
MC3a (CL-RPM)	Surface Water	L28398-09	7/26/2000				90			0.24	10.3	10.6			0.8	185	188	3
MC3b	Surface Water	L20241-06	9/6/1998		6	6	59	3	3	1.71	8.83	8.1			6.3	88	99.8	
MC3b	Surface Water	L20941-07	10/28/1998		5.7	5.7	47.2	2.8	2.8	1.29	9.31	9.58			-1.4	106	103	
MC3b (CL-RPM)	Surface Water	L23469-08	6/8/1999	0.02	5	5	74			0.64	13.1	13.1			-0.9	167	164	2
MC3b	Surface Water	L25247-07	10/18/1999		6.9	6.9	95.9	2.2	2.2	0.81	12.2	12.5			-6.9	124	108	
MC3b (CL-RPM)	Surface Water	L28398-08	7/26/2000		4	4	95.3	1.7	1.7	0.48	9.84	10.3			-2	130	125	2
MC3c	Surface Water	L20241-07	9/6/1998		8	8	106	3	3	1.58	15.3	14.6			-4.2	150	138	
Mc3c	Surface Water	L20941-08	10/28/1998		9.2	9.2	82.2	3.4	3.4	1.07	14.1	13.9			-3.9	119	110	
MC3c (CL-RPM)	Surface Water	L23469-09	6/8/1999	0.05	8	8	97	2	2	0.52	29.7	27.4			4.9	269	297	3
MC3c	Surface Water	L25247-08	10/18/1999	0.01	8.8	8.8	131	3.3	3.3	0.75	15.3	15.2			-11.8	142	112	
MC3c (CL-RPM)	Surface Water	L28398-07	7/26/2000				130	2	2	0.47	13.1	13.4			-1.3	159	155	2

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Table T-E-3 - McNulty Overburden Storage Facility Reactor Data

Sample ID	Matrix	Lab ID	Date Sampled	Conductivity @25C umhos/cm	Fluoride mg/L	pH (lab) units	Sulfate mg/L
McNulty OSF Reactors - ACZ Laboratories, Inc.							
MC1a	Surface Water	L20241-01	9/6/1998	1110	1.8	5.8	490
MC1a	Surface Water	L20941-01	10/28/1998	924	8.5	6.3	470
MC1a (CL-RPM)	Surface Water	L23469-01	6/8/1999	793	12	5.7	400
MC1a	Surface Water	L25247-01	10/18/1999	714	11	6.2	340
MC1a (CL-RPM)	Surface Water	L28398-03	7/26/2000	530	10.6	6.8	240
MC1b	Surface Water	L20941-02	10/28/1998	815	28	5.3	420
MC1b (CL-RPM)	Surface Water	L23469-02	6/8/1999	758	37	5.4	330
MC1b	Surface Water	L25247-02	10/18/1999	878	11	5.8	450
MC1b (CL-RPM)	Surface Water	L28398-02	7/26/2000	700	30	5.9	350
MC1c	Surface Water	L20241-02	9/6/1998	872	12	6.5	410
MC1c	Surface Water	L20941-03	10/28/1998	769	19	5.5	390
MC1c (CL-RPM)	Surface Water	L23469-03	6/8/1999	560	31	5.3	260
MC1c	Surface Water	L25247-03	10/18/1999	665	28	5.6	320
MC1c (CL-RPM)	Surface Water	L28398-01	7/26/2000	558	25	6	260
MC2a (CL-RPM)	Surface Water	L23469-04	6/8/1999	357	18	5.1	160
MC2a	Surface Water	L25281-01	10/18/1999	699	33	4.7	360
MC2a (CL-RPM)	Surface Water	L28398-06	7/26/2000	408	15.5	4.1	180
MC2b	Surface Water	L20241-03	9/6/1998	496	5	5.7	190
MC2b	Surface Water	L20941-04	10/28/1998	503	7	5.5	210
MC2b (CL-RPM)	Surface Water	L23469-05	6/8/1999	426	20	5.2	190
MC2b	Surface Water	L25247-04	10/18/1999	524	21	5.5	240
MC2b (CL-RPM)	Surface Water	L28398-05	7/26/2000	420	15.7	5	200
MC2c	Surface Water	L20241-04	9/6/1998	470	17	5.4	190
MC2c	Surface Water	L20941-05	10/28/1998	344	10	5.1	150
MC2c (CL-RPM)	Surface Water	L23469-06	6/8/1999	346	19	4.4	150
MC2c	Surface Water	L25247-05	10/18/1999	502	20	5.2	230
MC2c (CL-RPM)	Surface Water	L28398-04	7/26/2000	428	16.6	4.6	190
MC3a	Surface Water	L20241-05	9/6/1998	7370	1420	2.9	6320
MC3a	Surface Water	L20941-06	10/28/1998	7410	1250	2.7	8030
MC3a (CL-RPM)	Surface Water	L23469-07	6/8/1999	7500	1110	2.6	8470
MC3a	Surface Water	L25247-06	10/18/1999	5140	390	2.7	4990
MC3a (CL-RPM)	Surface Water	L28398-09	7/26/2000	6190	650	2.5	7180
MC3b	Surface Water	L20241-06	9/6/1998	4780	630	3.3	2600
MC3b	Surface Water	L20941-07	10/28/1998	4540	550	3	3650
MC3b (CL-RPM)	Surface Water	L23469-08	6/8/1999	6360	900	3.1	5660
MC3b	Surface Water	L25247-07	10/18/1999	5340	443	3.2	4780
MC3b (CL-RPM)	Surface Water	L28398-08	7/26/2000	5870	440	2.7	5070
MC3c	Surface Water	L20241-07	9/6/1998	6120	900	3.3	4870
Mc3c	Surface Water	L20941-08	10/28/1998	5010	530	3	4320
MC3c (CL-RPM)	Surface Water	L23469-09	6/8/1999	9800	1380	2.7	9340
MC3c	Surface Water	L25247-08	10/18/1999	5270	900	2.9	4490
MC3c (CL-RPM)	Surface Water	L28398-07	7/26/2000	6370	560	2.6	6160

McNulty Overburden Storage Facility (OSF) Reactor Data was obtained from waste rock reactors set up on the McNulty OSF in 1998. Natural precipitation was sampled as it percolated through the reactors over time. Nine reactors were set up, each composed of a 100 gallon HDPE tank with a conical bottom, containing approximately 1,000 pounds of waste rock. Samples were taken periodically between 1998 and 2000.

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Climax Molybdenum Company
Geochemical Data
Table T-E-4-Tailing Storage Facility Metals and Additional Parameter Data

Sample ID	Matrix	Depth feet	pH saturated paste units	Calcium mg/kg	Potassium mg/kg	Magnesium mg/kg	Sodium mg/kg	Aluminum mg/kg	Arsenic mg/kg	Antimony mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Selenium mg/kg	Zinc mg/kg	Residual Sulfur (%)	Temp (field) C
Shepherd Miller Report - January 1997																						
MAYFLOWER IMPOUNDMENT																						
MB-1	Core	10.75	6.84																		0.06	
MB-1	Core	31	5.15																		0.04	14
MB-1	Core	51	5.61																		0.06	10.9
MB-1	Core	96	7.65																		0.02	
MB-1	Core	126	8.1																		0.01	15.3
MB-1	Core	5.8	6.31																			
MB-1	Core	16	3.24																			2.9
MB-1	Core	21	3.96																			
MB-1	Core	25																				2.8
MB-1	Core	26	4.76																			
MB-1	Core	36	4.85																			11.2
MB-1	Core	41	4.6																			
MB-1	Core	45.2	4.81																			
MB-1	Core	46	4.8																			11.1
MB-1	Core	46.8	4.46																			
MB-1	Core	56	6.91																			
MB-1	Core	61	7.27																			16.8
MB-1	Core	71	7.17																			15.7
MB-1	Core	81	8.14																			15
MB-1	Core	91	7.71																			9.5
MB-1	Core	105	9.55																			
MB-1	Core	116	7.53																			
MB-1	Core	136	8.3																			15.2
MB-1	Core	151	7.41																			10
MB-1-10-11.5	Core	10-11.5	6.84	3900	1550	790	43	2890	<0.1	4.1	0.66	4.9	23.3	15300	9.5	113	<0.1	532	<0.500	170		
MB-1-50-52	Core	50-52	5.61	4010	1400	691	52	2330	NM	NM	0.55	NM	32.6	14200	2.1	179	NM	384	NM	82		
MB-1-125-127	Core	125-127	8.1	3140	1710	1110	61	2750	NM	NM	0.41	NM	34.4	8290	4.9	138	NM	440	NM	73.1		
MB-2	Core	7.1	6.29																		0.01	
MB-2	Core	28	7.35																		0.03	
MB-2	Core	41	8.13																		0.01	4.2
MB-2	Core	66	7.49																		<0.01	-1.9
MB-2	Core	86	7.25																		<0.01	
MB-2	Core	6	6.01																			
MB-2	Core	6	5.49																			
MB-2	Core	8.1	6.74																			
MB-2	Core	16	7.2																			
MB-2	Core	25.5																				2.2
MB-2	Core	26	6.56																			
MB-2	Core	46	7.5																			
MB-2	Core	47.2	7.65																			
MB-2	Core	48.2	8.04																			
MB-2	Core	56	7.65																			frozen
MB-2	Core	58	7.49																			
MB-2	Core	58	7.86																			
MB-2	Core	67.8	7.64																			
MB-2	Core	68.6	7.34																			
MB-2	Core	69	7.31																			
MB-2	Core	76	7.99																			4.3
MB-2	Core	78	8.31																			3.3
MB-2	Core	86	7.22																			
MB-2	Core	96	7.17																			
MB-2	Core	106	7.1																			
MB-2	Core	121	7.12																			
MB-2	Core	122.5	7.38																			

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Climax Molybdenum Company
Geochemical Data
Table T-E-4-Tailing Storage Facility Metals and Additional Parameter Data

Sample ID	Matrix	Depth feet	pH saturated paste units	Calcium mg/kg	Potassium mg/kg	Magnesium mg/kg	Sodium mg/kg	Aluminum mg/kg	Arsenic mg/kg	Antimony mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Selenium mg/kg	Zinc mg/kg	Residual Sulfur (%)	Temp (field) C
MB-2-7-7.2	Core	7-7.2	6.29	6400	4680	2440	105	12200	NM	NM	2.23	NM	90.1	12900	49.7	241	NM	858	NM	249		
MB-2-40-42	Core	40-42	8.13	4070	1690	962	59	2870	NM	NM	0.52	NM	32.2	10400	16.4	154	NM	377	NM	74.6		
MB-2-85-87	Core	85-87	7.25	6560	2770	1230	130	5630	<0.1	9.2	0.83	9.5	75.9	11300	7.1	188	<0.1	606	<0.500	115		
T5-1	Surface	0.5	4.9																		<0.01	
T5-2	Surface	2	3.62	4660	2160	1550	64	3590	0.2	<3.4	<0.24	8.8	15.5	8590	14	119	<0.1	311	<0.500	42.3	<0.01	
T5-3	Surface	2	4.42																			
T5-4	Surface	3	4.59																		0.02	
T5-5	Surface	4	4.78																		0.04	
T6-1	Surface	0.17	2.88																			
T6-2	Surface	3.5	3.1																			
T6-3	Surface	4.6	2.92																		<0.01	
T6-4	Surface	5	2.69																		<0.01	
T6-5	Surface	6	2.62																			
T6-6	Surface	15	4.01																			
T6-7	Surface	20	3.85																		0.1	
MF-T1-3.5	Surface	3.5	3.11																		0.03	
MF-T1-7	Surface	7	2.83																		<0.01	
MF-T1-14	Surface	14	3.63																			
MF-T2-2	Surface	2	6.75																		0.02	
MF-T2-4	Surface	4	4.57																		0.02	
MF-T2-5	Surface	5	6.61																			
MF-T2-8	Surface	8	7.02																			
MF-T2-12	Surface	12	6.51																			
MF-T3-1.2	Surface	1.2	8.51																		0.01	
MF-T3-2.2	Surface	2.2	8.4																		0.03	
MF-T3-2.3	Surface	2.3	8.39																		0.01	
MF-T3-3	Surface	3	7.9																			
MF-T3-4	Surface	5	8.12																			
MF-T3-5	Surface	5	6.76																			
MF-T3-7	Surface	7	6.96																			
Mayflower 3'	Tailings	3	2.7																			
NO. 5 DAM																						
N5D-T1-8.5A	Surface	8.5	3.33																		0.05	
N5D-T1-8.5B	Surface	8.5	3.33																			
N5D-T2-4	Surface	4	2.78																		0.02	
N5D-T2-7	Surface	7	3.36																		0.03	
N5D-T2-12	Surface	12	3.57																			
N5D-T3-4	Surface	4	3.42																		0.05	
N5D-T3-6.5	Surface	6.5	3.45																		0.22	
N5D-T3-11.5	Surface	11.5	3.59																			
N5D-T4-4	Surface	4	3.18																		0.06	
N5D-T4-9	Surface	9	3.38																		0.05	
N5D-T4-12.5	Surface	12.5	3.26																			
TENMILE IMPOUNDMENT																						
TB-1	Core	11	3.08																		0.03	
TB-1	Core	31	4.64																		0.03	
TB-1	Core	51	5.73																		0.01	5.9
TB-1	Core	91	7.68																		0.03	8.4
TB-1	Core	121	8.05																		0.02	
TB-1	Core	6	3.05																			
TB-1	Core	6.6	2.71																			
TB-1	Core	16	3.49																			4.7
TB-1	Core	20.6	4.07																			
TB-1	Core	21.35	4.57																			
TB-1	Core	26	4.28																			
TB-1	Core	31.3	4.3																			
TB-1	Core	35.6	4.62																			

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Geochemical Data
Table T-E-4-Tailing Storage Facility Metals and Additional Parameter Data

Sample ID	Matrix	Depth feet	pH saturated paste units	Calcium mg/kg	Potassium mg/kg	Magnesium mg/kg	Sodium mg/kg	Aluminum mg/kg	Arsenic mg/kg	Antimony mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Selenium mg/kg	Zinc mg/kg	Residual Sulfur (%)	Temp (field) C
TB-1	Core	36.6	5.1																			6.7
TB-1	Core	41	4.41																			15.7
TB-1	Core	46	4.17																			
TB-1	Core	46.2	4.45																			
TB-1	Core	56	4.7																			8.4
TB-1	Core	61	4.14																			9.8
TB-1	Core	71	6.08																			9.3
TB-1	Core	81	7.28																			12.1
TB-1	Core	101	7.92																			
TB-1	Core	111	7.89																			11.1
TB-1	Core	131	7.14																			14.1
TB-1	Core	136	7.4																			
TB-1-10-12	Core	10-12	3.08	4440	1730	754	56	3010	<0.1	6.3	0.3	2.9	20.3	15900	<0.1	77.7	<0.1	702	<0.500	43.4		
TB-1-30-32	Core	30-32	4.64	4650	1260	699	38	2230	NM	NM	<0.24	NM	67.2	24500	<0.1	131	NM	635	NM	67		
TB-1-50-52	Core	50-52	5.73	4950	1930	1180	63	3400	NM	NM	<0.24	NM	23.9	11700	8.8	264	NM	391	NM	73.3		
TB-1-120-122	Core	120-122	8.05	4620	2250	1090	66	3270	NM	NM	0.58	NM	59.3	13600	20.8	202	NM	563	NM	108		
TB1-16	Tailings	16	3.49																			
TB1-50	Tailings	50	5.73																			
TB1-60	Tailings	60	4.14																			
TB1-92-A	Tailings	92	7.68																			
TB1-92-B	Tailings	92	7.68																			
TB-2	Core	8.85	6.01																		<0.01	
TB-2	Core	31	6.95																		<0.01	-6.3
TB-2	Core	51	6.84																		0.02	frozen
TB-2	Core	57.75	6.65																		<0.01	
TB-2	Core	125.75	6.54																		0.01	
TB-2	Core	6	5.71																			
TB-2	Core	7.5	5.19																			
TB-2	Core	7.8	5.54																			
TB-2	Core	16	6.72																			
TB-2	Core	21	7.05																			
TB-2	Core	36	6.42																			frozen
TB-2	Core	41	7.22																			frozen
TB-2	Core	56	6.84																			frozen
TB-2	Core	57.2	6.93																			
TB-2	Core	57.8																				
TB-2	Core	66	6.99																			frozen
TB-2	Core	76	7.4																			frozen
TB-2	Core	81	6.97																			frozen
TB-2	Core	96	7.01																			frozen
TB-2	Core	106	7.36																			frozen
TB-2	Core	116	7.31																			frozen
TB-2	Core	126																				frozen
TB-2	Core	136	6.77																			-0.2
TB-2-8.7-9	Core	8.7-9	6.01	3890	1850	1310	50	3060	NM	NM	<0.24	NM	16.1	11500	1.5	161	NM	275	NM	56.4		
TB-2-57.5-58	Core	57.5-58	6.65	6740	3120	1160	148	5120	NM	NM	0.55	NM	34.6	9780	2.4	227	NM	329	NM	95.3		
TB-2-125-126.5	Core	125.126	6.54	6610	2570	791	71	4000	<0.1	3.8	<0.24	6.5	63.7	9740	5	147	<0.1	357	<0.500	87.8		
TMD	Surface																				<0.01	
T3-1	Surface	1	8.4																		0.02	
T3-2	Surface	2.5	4.27																		<0.01	
T3-3	Surface	3.7	5.98																		0.01	
T3-4	Surface	4	5.49																			
T3-5	Surface	4.5	5.62																			
T4-1	Surface	0.9	3.73																		<0.01	
T4-2	Surface	2	3.15																			
T4-3	Surface	3	3.35																		0.01	

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Geochemical Data
Table T-E-4-Tailing Storage Facility Metals and Additional Parameter Data

Sample ID	Matrix	Depth feet	pH saturated paste units	Calcium mg/kg	Potassium mg/kg	Magnesium mg/kg	Sodium mg/kg	Aluminum mg/kg	Arsenic mg/kg	Antimony mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Selenium mg/kg	Zinc mg/kg	Residual Sulfur (%)	Temp (field) C
T4-4	Surface	3.4	2.86																			
T4-5	Surface	4.5	3.62																			
T4-6	Surface	20	4.12																			
T4-4	Surface	3.4	2.86																		<0.01	
TM-T1-1	Surface	1	4.11	5610	2250	1180	64	5080	<0.1	5.6	<0.24	9.6	43.9	9170	6.7	121	<0.1	451	<0.005	88.8	0.01	
TM-T1-2	Surface	2	5.32																			
TM-T1-3	Surface	3	5.44																		0.01	
TM-T1-4	Surface	4	5.55																			
TM-T1-5	Surface	5	6.52																			
TM-T2-1	Surface	1	5.33																		0.02	
TM-T2-2	Surface	2	4.73																			
TM-T2-3	Surface	3	6.85																		0.01	
TM-T2-3.5	Surface	3.5	6.51																			
TM-T2-7	Surface	7	4.59																			
TM-T2-10	Surface	10	8.53																			
TM-T3-1	Surface	1	3.66																		<0.01	
TM-T3-2	Surface	2	6.28																			
TM-T3-3.3	Surface	3.3	3.93																		0.04	
TM-T3-4	Surface	4	3.15																			
TM-T3-8	Surface	8	3.65																			
TM-T3-10	Surface	10	3.22																			
Tenmile 1'	Tailings	1	3.1																			
NO. 3 DAM																						
N3D-T1-2	Surface	2	3.38																		0.04	
N3D-T1-4	Surface	4	2.88																		0.01	
N3D-T1-5	Surface	5	3.01																			
N3D-T1-10	Surface	10	2.83																			
N3D-T2-2	Surface	2	3.04																		0.04	
N3DT2-4	Surface	4	2.96																		0.04	
N3DT2-6	Surface	6	2.93																			
N3DT2-10.5	Surface	10.5	3.07																			
N3D-T3-1.5	Surface	1.5	2.8																		0.04	
N3D-T3-3	Surface	3	3.12																		0.11	
N3S-T3-5	Surface	5	3.02																		0.17	
N3S-T3-7	Surface	7	3.13																			
N3S-T3-10	Surface	10	3.3																			
ROBINSON IMPOUNDMENT																						
RB-1	Core	11	3.19																		0.01	6.3
RB-1	Core	16																				2.4
RB-1	Core	31	3.42																		0.01	
RB-1	Core	55.3	3.47																		<0.01	
RB-1	Core	81	4.92																		<0.01	8.1
RB-1	Core	121	5.32																		<0.01	
RB-1	Core	6	2.88																			
RB-1	Core	15.7	2.97																			
RB-1	Core	16.4	2.79																			
RB-1	Core	21	3.1																			
RB-1	Core	25.5																				2
RB-1	Core	25.7	3.05																			
RB-1	Core	26.7	2.99																			
RB-1	Core	36	4.7																			0.9
RB-1	Core	36.2	4.51																			
RB-1	Core	41	4.54																			2.8
RB-1	Core	45.4	3.64																			
RB-1	Core	45.8	3.94																			
RB-1	Core	46.4	3.79																			
RB-1	Core	51	3.75																			3

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Geochemical Data
Table T-E-4-Tailing Storage Facility Metals and Additional Parameter Data

Sample ID	Matrix	Depth feet	pH saturated paste units	Calcium mg/kg	Potassium mg/kg	Magnesium mg/kg	Sodium mg/kg	Aluminum mg/kg	Arsenic mg/kg	Antimony mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Selenium mg/kg	Zinc mg/kg	Residual Sulfur (%)	Temp (field) C
RB-1	Core	56.1	4.63																			
RB-1	Core	56.8	4.37																			
RB-1	Core	61	4.52																			4.4
RB-1	Core	71	4.88																			6.6
RB-1	Core	90.7	5.4																			
RB-1	Core	91.7	4.94																			
RB-1	Core	91																				8.6
RB-1	Core	100.9	4.88																			
RB-1	Core	101																				13.7
RB-1	Core	101.9	5.1																			
RB-1	Core	111	4.87																			6.2
RB-1	Core	131	4.79																			
RB-1	Core	136	4.39																			0.9
RB-1	Core	146	4.69																			
RB-1	Core	151	4.34																			6.4
RB-1-30-32	Core	30-32	3.42	4540	1610	634	39	2670	NM	NM	0.29	NM	27.5	13000	5.3	88.3	NM	417	NM	110		
RB-1-55-55.6	Core	55-55.6	3.47	6590	1770	562	49	2630	NM	NM	0.57	NM	61.7	14100	12.8	216	NM	256	NM	198		
RB-1-120-122	Core	120-122	5.32	3220	1120	374	39	1930	NM	NM	0.46	NM	20.6	16200	4.5	58.2	NM	751	NM	31.7		
RB-2	Core	13	5.14																		0.02	
RB-2	Core	35.75	4.82																		0.04	
RB-2	Core	56	6.38																		0.02	-.0.6
RB-2	Core	76	7.4																		<0.01	frozen
RB-2	Core	121	5.21																		<0.01	-7.6
RB-2	Core	6	3.67																			
RB-2	Core	8	3.2																			8.7
RB-2	Core	11	5.43																			-3.2
RB-2	Core	13	5.26																			
RB-2	Core	16	5.17																			
RB-2	Core	18	4.95																			
RB-2	Core	21	5.38																			-3.4
RB-2	Core	25.5																				-4.1
RB-2	Core	26	5.74																			
RB-2	Core	36																				-2.4
RB-2	Core	36.8	4.03																			
RB-2	Core	41	6.78																			
RB-2	Core	46	6.61																			-2.4
RB-2	Core	66	6.32																			
RB-2	Core	70.3	6.08																			
RB-2	Core	70.8	7.18																			
RB-2	Core	71																				frozen
RB-2	Core	91	7.36																			2.4
RB-2	Core	96	6.51																			
RB-2	Core	106	6.04																			-4.5
RB-2	Core	126	6.15																			
RB-2	Core	126	6.09																			
RB-2-12-14	Core	12-14	5.14	6760	3950	1310	75	9250	NM	NM	5.62	NM	92.4	11700	66.3	226	NM	732	NM	134		
RB-2-35-36.5	Core	35-36.5	4.82	6260	3860	1270	83	7610	NM	NM	1.03	NM	111	13500	57.3	292	NM	492	NM	130		
RB-2-55-57	Core	55-57	6.38	3860	1220	327	68	1800	<0.1	7.7	0.4	1.9	52.1	13900	<1.0	57.1	<0.1	358	<0.500	88.3		
RB-3	Core	11	2.82																		0.02	
RB-3	Core	51	3.85																		0.06	
RB-3	Core	126.5	5.93																		0.02	
RB-3	Core	6	2.82																			12.6
RB-3	Core	8	3.03																			12.6
RB-3	Core	13	2.91																			9.9
RB-3	Core	16	2.88																			
RB-3	Core	18	2.97																			12.3

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Table T-E-4-Tailing Storage Facility Metals and Additional Parameter Data

Sample ID	Matrix	Depth feet	pH saturated paste units	Calcium mg/kg	Potassium mg/kg	Magnesium mg/kg	Sodium mg/kg	Aluminum mg/kg	Arsenic mg/kg	Antimony mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Selenium mg/kg	Zinc mg/kg	Residual Sulfur (%)	Temp (field) C
RB-3	Core	21	2.95																			
RB-3	Core	23	2.98																			7.8
RB-3	Core	26	3.01																			
RB-3	Core	28	4.27																			8.2
RB-3	Core	31	3.94																			
RB-3	Core	33	4.1																			
RB-3	Core	36	4.07																			
RB-3	Core	37.9	4.16																			
RB-3	Core	38																				11.4
RB-3	Core	38.9	3.83																			
RB-3	Core	41	3.94																			
RB-3	Core	43	4.05																			5.4
RB-3	Core	46	3.85																			
RB-3	Core	47.8	3.71																			
RB-3	Core	48																				6.2
RB-3	Core	48.8	3.55																			
RB-3	Core	53	3.37																			2.6
RB-3	Core	61	4.45																			-0.1
RB-3	Core	76																				3.3
RB-3	Core	76.5	4.57																			
RB-3	Core	86																				5
RB-3	Core	86.5	4.75																			
RB-3	Core	96.5	4.59																			
RB-3	Core	106																				4
RB-3	Core	106.5	5.81																			
RB-3	Core	116																				6.2
RB-3	Core	117	5.46																			
RB-3	Core	117.2	6.01																			
RB-3	Core	126																				3.4
RB-3	Core	136																				12.9
RB-3	Core	136.5	6.45																			
RB-3-10-12	Core	10-12	2.82	3260	1540	349	24	1440	NM	NM	<0.24	NM	14.5	5080	15.8	44.3	NM	674	NM	35.9		
RB-3-50-52	Core	50-52	3.85	3910	897	211	21	1220	NM	NM	0.57	NM	32	21800	23.8	62.1	NM	403	NM	106		
RB-3-126-127	Core	126-127	5.93	2600	1120	351	41	1540	NM	NM	0.26	NM	13.6	6900	18	67.3	NM	727	NM	41.5		
RB-4	Core	11	7.96																		0.03	
RB-4	Core	26	6.81																		<0.01	
RB-4	Core	46	6.15																		<0.01	
RB-4	Core	6	5.57																			
RB-4	Core	8	5.92																			
RB-4	Core	16	6.95																			
RB-4	Core	21	6.73																			-1.2
RB-4	Core	31	6.2																			
RB-4	Core	36	6.17																			
RB-4-10-12	Core	10-12	7.96	18100	5590	6660	215	24800	1.5	39	9.45	11.1	422	25800	78.5	1800	<0.1	3560	<0.5	825		
RB-4-45-47	Core	45-47	6.15	2170	1410	1510	56	3970	NM	NM	0.35	NM	17.1	7940	20.6	150	NM	167	NM	76		
T1-1	Surface	1.25	3.07																		0.04	
T1-2	Surface	1.625	3.18																		0.03	
T1-3	Surface	2.25	6.22																		0.04	
T1-4	Surface	3.25	4.07																		0.13	
T1-5	Surface	4.3	3.69																			
T1-6	Surface	5	3.92																			
T2-1	Surface	1.25	4.86																		0.04	
T2-2	Surface	2.5	3.34																		0.01	
T2-3	Surface	3	3.48																			
T2-4	Surface	4.5	3.22																		<0.01	
T2-5	Surface	4.9	3.78																			

Environmental Protection Plan
Appendix T-E
Climax Molybdenum Company
Geochemical Data
Table T-E-4-Tailing Storage Facility Metals and Additional Parameter Data

Sample ID	Matrix	Depth feet	pH saturated paste units	Calcium mg/kg	Potassium mg/kg	Magnesium mg/kg	Sodium mg/kg	Aluminum mg/kg	Arsenic mg/kg	Antimony mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Selenium mg/kg	Zinc mg/kg	Residual Sulfur (%)	Temp (field) C
T2-6	Surface	6.5	3.77																			
RT-T1-1	Surface	1	2.88	4620	1860	724	59	2860	0.5	7.1	0.42	3.6	21.3	13400	19.4	63.9	<0.1	665	<0.500	61.8	0.01	
RT-T1-3.6	Surface	3.6	3.07																		0.14	
RT-T1-5	Surface	5	2.8																			
RT-T1-6	Surface	6	3.07																			
RT-T1-12	Surface	12	2.82																			
RT-T2-1.5	Surface	1.5	3.04																		0.05	
RT-T2-2	Surface	2	3.17																		<0.01	
RT-T2-4.3	Surface	4.3	3.69																			
RT-T2-6.5	Surface	6.5	3.71																			
RT-T2-10	Surface	10	3.77																			
RT-T2-13	Surface	13	3.67																			
RT-T3-2	Surface	2	2.95																		<0.01	
RT-T3-3	Surface	3	3.13																		<0.01	
RT-T3-3.5	Surface	3.5	2.9																			
RT-T3-5	Surface	5	3.29																			
RT-T3-8	Surface	8	3.17																			
RT-T3-10	Surface	10	3.54																			
RT-T4-2	Surface	2	2.99																		0.04	
RT-T4-3	Surface	3	3.19																		<0.01	
RT-T4-5	Surface	5	3.1																			
RT-T4-8	Surface	8	2.8																			
RT-T12	Surface	12	2.84																			
Trench # 1	Surface	0.5																				10.6
Trench # 1	Surface	1.75																				9
Trench # 1	Surface	2.8																				6.9
Trench # 1	Surface	4.2																				4.5
Trench # 2	Surface	0.5																				12.9
Trench # 2	Surface	1																				12
Trench # 2	Surface	2																				10.5
Trench # 2	Surface	3																				8.8
Trench # 2	Surface	4																				7.1
Trench # 2	Surface	5																				6.5
Trench # 3	Surface	1																				4.7
Trench # 3	Surface	2																				3.9
Trench # 3	Surface	3																				2.8
Trench # 3	Surface	4																				2.4
Trench # 3	Surface	4.5																				1.6
Trench # 3	Surface																					2
Trench # 4	Surface	0.5																				10.4
Trench # 4	Surface	1																				6.5
Trench # 4	Surface	2																				4.2
Trench # 4	Surface	3																				2.3
Trench # 4	Surface	4																				0.9
Trench # 4	Surface	5																				-0.5
Trench # 5	Surface	1																				8
Trench # 5	Surface	2																				7.2
Trench # 5	Surface	3																				7.1
Trench # 5	Surface	4																				6.1
Trench # 6	Surface	2																				8.8
Trench # 6	Surface	3.5																				7.1
Trench # 6	Surface	4																				5.3
Trench # 6	Surface	5																				4.4
Trench # 6	Surface	6																				2.3
Robinson 2.5'	Tailings	2.5	2.7																			

Table T-E-4-Tailing Storage Facility Metals and Additional Parameter Data

Sample ID	Matrix	Depth feet	pH saturated paste units	Calcium mg/kg	Potassium mg/kg	Magnesium mg/kg	Sodium mg/kg	Aluminum mg/kg	Arsenic mg/kg	Antimony mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Selenium mg/kg	Zinc mg/kg	Residual Sulfur (%)	Temp (field) C
NO. 1 DAM																						
N1D-T1-2.5	Surface	2.5	2.86																		0.06	
N1D-T1-4	Surface	4	3.54																		0.02	
N1D-T1-5	Surface	5	3.03																			
N1D-T1-8	Surface	8	3.06																			
N1D-T1-11	Surface	11	3.14																			
N1D-T2-2	Surface	2	3																		0.02	
N1D-T2-3	Surface	3	3.08																		<0.01	
N1D-T2-4	Surface	4	3.25																			
N1D-T2-8	Surface	8	3.22																			
N1D-T2-10	Surface	10	3.16																			
N1D-T3-3.5	Surface	3.5	3.06																		0.15	
N1D-T3-6	Surface	6	3.13																		0.03	
N1D-T3-8	Surface	8	3.24																			
N1D-T3-10	Surface	10	3.25																			

Shepherd Miller, Characterization of Mine Tailings, Climax Mine, Climax, Colorado. Prepared for Climax Molybedenum Company by Shepherd Miller Inc. January 1997

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Appendix T-E
Climax Molybdenum Company
Geochemical Data
Table T-E-5 - Reclamation Cover Material Geochemical Data

				Acid/Base Accounting					Metals												Other		
Sample ID	Sampled Location	Material Source	Date	Sulfur - T %	Sulfide Sulfur %	Acid Generating Potential (AGP) based on Sulfide Sulfur tons $CaCO_3$/kton	Acid Neutralization Potential (NP or ANP) tons CaCO3/kton	Net Neutralization Potential (NNP) (ANP-AGP) tons $CaCO_3$/kton	As mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg	Pb mg/kg	Hg mg/kg	Mo mg/kg	Ni mg/kg	P mg/kg	Se mg/kg	Si mg/kg	Zn mg/kg	pH 1:1	pH Sat. Paste	Soluble Salts mmhos/cm	CEC meq/100
2-DAM	2 Dam	Cirque Slide	7/19/2005	0.66	0.18	5.63	30.5	24.87													7.7	4.46	
1 SOUTH	Robinson TSF	Pit Overburden	7/19/2005	0.43	0.07	2.19	1.25	-0.94													5.7	2.56	
2 SOUTH	Robinson TSF	Pit Overburden	7/19/2005	0.4	0.02	0.63	0.25	-0.38													5.4	0.97	
3 SOUTH	Robinson TSF	Pit Overburden	7/19/2005	0.57	0.06	1.88	0	-1.88													4.8	2.64	
4 SOUTH	Robinson TSF	Pit Overburden	7/19/2005	0.32	0.05	1.56	0	-1.56													6.6	1.43	
5 SOUTH	Robinson TSF	Pit Overburden	7/19/2005	0.19	0.03	0.93	8	7.07													5.6	0.71	
5 SOUTH B	Robinson TSF	Pit Overburden	7/19/2005	0.35	0.3	0.93	0	-0.93													3	2.05	
6 SOUTH	Robinson TSF	Pit Overburden	7/19/2005	0.25	0.03	0.93	0	-0.93													3.5	1.44	
2 Dam 1	2 Dam	Cirque Slide	8/11/2005	0.37	0.04	1.25	2	0.75													5.1		
2 Dam 2	2 Dam	Cirque Slide	8/11/2005	0.31	0.03	0.93	2.75	1.82													6.1		
2 Dam 3	2 Dam	Cirque Slide	8/11/2005	1	0.05	1.56	0	-1.56													3.9		
F Dump 1	F Dump	Pit Overburden	8/11/2005	0.43	0.04	1.25	1.5	0.25													4.1		
F Dump 2	F Dump	Pit Overburden	8/11/2005	0.85	0.03	0.93	0	-0.93													3.3		
F Dump 3	F Dump	Pit Overburden	8/11/2005	0.78	0.1	3.12	4	0.88													4.2		
SROB 1	Robinson TSF	Cirque Slide	8/11/2005	0.65	0.07	2.19	11	8.81													6.2		
SROB 2	Robinson TSF	Cirque Slide	8/11/2005	1.75	0.4	12.5	7.75	-4.75													5.7		
Cover 1-Dark Grey	Robinson TSF	Mosquito Fault Overburden	9/7/2005	0.67	0.38	11.9	18.8	6.9													6.8		
Cover 2-Maroon	Robinson TSF	SDP	9/7/2005	0.33	0.11	3.44	52.5	49.06													7.5		
Cover 3-Brown	Robinson TSF	Mosquito Fault Overburden	9/7/2005	0.09	0.03	0.94	72.5	71.56													8.1		
Cover 4-Dark Grey	Robinson TSF	Mosquito Fault Overburden	9/7/2005	0.4	0.03	0.94	62.5	61.56													7.8		
Cover 5-Maroon	Robinson TSF	SDP	9/7/2005	0.57	0.33	10.3	28.8	18.5													7.1		
Cover 6-Dark Brown	Robinson TSF	Mosquito Fault Overburden	9/7/2005	0.29	0.17	5.31	23.8	18.49													7.1		
So Rob Grey	Robinson TSF	Mosquito Fault Overburden	9/7/2005	0.38	0.1	3.13	37.5	34.37													7.4		
ACID CVR 1	Robinson TSF	Pit Overburden	10/24/2005	0.45	0.14	4.38	23.8	19.42	n.d.	n.d.	7.7	22.3	49.9	n.d.	933	4.2	509	n.d.	758	33.3	7.6	7.4	1.1	12.3
ACID CVR 2	Robinson TSF	Pit Overburden	10/24/2005	0.33	0.03	0.93	38.8	37.87	n.d.	n.d.	7.4	15	28.9	n.d.	955	3.6	502	n.d.	1072	31.7	7.4	8.2	0.7	11
ACID CVR 3	Robinson TSF	Pit Overburden	10/24/2005	0.32	0.07	2.19	22.5	20.31	n.d.	n.d.	7.1	16.2	27.7	n.d.	800	4.3	474	n.d.	841	30.6	8	7.6	0.6	12.7
ACID CVR 4	Robinson TSF	Pit Overburden	10/24/2005	0.42	0.08	2.5	15	12.5	2.08	n.d.	10.7	61	67.8	n.d.	878	6.3	693	n.d.	1018	54.6	7.3	7.2	0.7	11.6
BROWN	Robinson TSF	Mosquito Fault Overburden	10/24/2005	0.14	0.03	0.93	7.25	6.32	2.97	n.d.	9.2	16.1	21.7	n.d.	340	6.6	499	n.d.	822	48.6	6.7	6.9	0.7	9.5
CIRQUE 1	Robinson TSF	Cirque Slide	10/24/2005	0.37	0.13	4.06	3.25	-0.81	4.65	n.d.	7.8	12.6	17.8	n.d.	530	4.5	538	n.d.	923	38.6	6.4	6.1	0.3	8
CIRQUE 2	Robinson TSF	Cirque Slide	10/24/2005	0.54	0.2	6.25	5	-1.25	7.51	0.94	11.4	20.6	25	n.d.	405	6.8	508	n.d.	1367	91	6.6	6.7	1.4	12.4
DARK GREY	Robinson TSF	Mosquito Fault Overburden	10/24/2005	0.32	0.25	7.81	42.5	34.69	n.d.	n.d.	9.5	45.5	15.8	n.d.	30.2	10.8	371	n.d.	670	48.6	7.5	7.6	1.5	14.1
MAROON	Robinson TSF	SDP	10/24/2005	0.15	0.02	0.63	41.2	40.57	1.06	n.d.	14.8	15.6	24	n.d.	63.8	11.3	538	n.d.	2984	72.3	7.7	8.1	0.9	11.5
McNulty Acid	Lower McNulty Gulch	Pit Overburden	8/21/2006	0.44	0.29	9	2	-7													4.3		2.81	
McNulty Brown	Lower McNulty Gulch	Mosquito Fault Overburden	8/21/2006	0.01		0.46	22	21.54													7.1		1.35	
McNulty Cirque 1	Lower McNulty Gulch	Cirque Slide	8/21/2006	0.02		0.5	36	35.5													6.7		2.76	
McNulty Cirque 2	Lower McNulty Gulch	Cirque Slide	8/21/2006	0.42	0.34	11	26	15													6.6		2.76	
McNulty Maroon 1	Lower McNulty Gulch	SDP	8/21/2006	<0.01		0.21	37	36.79													6.9		1.53	
McNulty Maroon 2	Lower McNulty Gulch	SDP	8/21/2006	0.01		0.4	31	30.6													6.8		1.83	
McNulty Maroon 3	Lower McNulty Gulch	SDP	8/21/2006	0.02		0.71	34	33.29													7		1.34	
ACID CVR 1	Robinson TSF	Pit Overburden	10/2/2006	0.44	0.07	2.19	9.25	7.06	1.19	n.d.	6.3	22.9	38.9	n.d.	1,108	3.7		n.d.	443	31.9	6.6	7.5	0.8	11.4
ACID CVR 2	Robinson TSF	Pit Overburden	10/2/2006	0.48	0.07	2.19	24.8	22.61	1.29	n.d.	6.5	16.8	30.5	n.d.	849	3.4		n.d.	541	27	8.9	7.9	0.9	14.2
ACID CVR 3	Robinson TSF	Pit Overburden	10/2/2006	0.63	0.01	0.32	12.2	11.88	1.14	n.d.	20.5	21.2	17	n.d.	432	12.1		n.d.	621	59.8	7.2	6.9	1.6	11.7
ACID CVR 4	Robinson TSF	Pit Overburden	10/2/2006	0.43	0.02	0.63	33.8	33.17	1.35	n.d.	5.5	22.7	31.4	n.d.	1,155	2.7		n.d.	565	35	8.2	9	1.6	14.6
ACID CVR 5	Robinson TSF	Pit Overburden	10/2/2006	0.26	0.03	0.94	157	156.06	5.4	n.d.	8.5	13.4	19.2	n.d.	420	4.5		n.d.	826	35.8	9.9	11	1.2	18.1
ACID CVR 6	Robinson TSF	Pit Overburden	10/2/2006	0.31	0.05	1.56	9	7.44	3.56	n.d.	9.9	28.6	25.3	n.d.	550	4.8		n.d.	653	52.4	6.9	7	1.2	8.8
BROWN 1	Robinson TSF	Mosquito Fault Overburden	10/2/2006	0.09	0.04	1.25	115	113.75	3.45	0.64	7.2	8	21.1	n.d.	164	8.4		n.d.	445	74.2	7.6	8	0.4	10.3
BROWN 2	Robinson TSF	Mosquito Fault Overburden	10/2/2006	0.11	0.01	0.32	111	110.68	1.12	n.d.	9.9	4.3	16.3	n.d.	168	12.2		n.d.	461	19.1	7.6	7.8	0.4	10.1
CIRQUE 1	Robinson TSF	Cirque Slide	10/2/2006	0.18	0.03	0.94	27.5	26.56	1.29	n.d.	4.3	13.2	29.2	n.d.	556	3.3		n.d.	620	32.1	7.5	7.6	0.5	8.9
CIRQUE 2	Robinson TSF	Cirque Slide	10/2/2006	0.31	0.09	2.81	8	5.19	0.9	n.d.	10.5	40.7	28.6	n.d.	482	6.8		n.d.	662	70.7	7.1	7.7	1	6.7
CIRQUE 3	Robinson TSF	Cirque Slide	10/2/2006	0.25	0.01	0.32	24.8	24.48	3.91	n.d.	8.1	30.1	20.7	n.d.	343	5.7		n.d.	826	60.9	6.6	6.7	0.9	7.3
CIRQUE 4	Robinson TSF	Cirque Slide	10/2/2006	0.26	0.03	0.94	6.5	5.56	4.07	n.d.	9.2	17	20.7	n.d.	313	5.1		n.d.	826	58.1	6.7	6.8	0.7	6.9
DARKGREY 1	Robinson TSF	Mosquito Fault Overburden	10/2/2006	0.32	0.06	1.88	47.5	45.62	2.1	n.d.	7.3	18.3	17.9	n.d.	48.1	9.7		n.d.	425	36.2	7.7	7.6	1.3	10.1
GREY/BWN 1	Robinson TSF	Mosquito Fault Overburden	10/2/2006	0.22	0.06	1.88	119	117.12	4.13	0.63	7.6	31.4	28.4	n.d.	235	7.7		n.d.	607	105	7.5	7.5	1.1	11
GREY/BWN 2	Robinson TSF	Mosquito Fault Overburden	10/2/2006	0.2	0.05	1.56	106	104.44	2.67	0.66	9	33.8	21.3	n.d.	175	10.9		n.d.	702	80	7.7	7.6	1.3	10.6
MAROON 1	Robinson TSF	SDP	10/2/2006	0.11	0.01	0.33	40.8	40.47	0.69	n.d.	11.6	12.5	14.1	n.d.	16	10.3		n.d.	912	47.6	7.9	7.7	0.7	11.9
MAROON 2	Robinson TSF	SDP	10/2/2006	0.65	0.47	14.7	43.8	29.1	0.76	n.d.	11.8	18.2	24.5	n.d.	242	9.1		n.d.	1,455	88	7.7	7.7	1.5	10.7
MAROON 3	Robinson TSF	SDP	10/2/2006	0.09	0.03	0.94	61.2	60.26	1.26	n.d.	16.7	13.1	17.1	n.d.	69.2	13		n.d.	1,083	46.6	8	7.8	0.5	10.9
MAROON 4	Robinson TSF	SDP	10/2/2006	0.06	0.02	0.63	34.5	33.87	0.81	n.d.	14.5	6.3	17.5	n.d.	7.5	10.3		n.d.	1,343	52.3	7.9	7.5	0.4	10.5
3DAM-BIO	3 Dam	Pit Overburden	6/22/2007	0.47	0.18	5.63	33.8	28.17	1.57	n.d.	8.6	23.5	28	n.d.	196	5.5	482	n.d.	1749	89.7		7.5	0.4	

Environmental Protection Plan
Appendix T-E
Climax Molybdenum Company
Geochemical Data
Table T-E-5 - Reclamation Cover Material Geochemical Data

				Acid/Base Accounting					Metals												Other			
Sample ID	Sampled Location	Material Source	Date	Sulfur - T %	Sulfide Sulfur %	Acid Generating Potential (AGP) based on Sulfide Sulfur tons $CaCO_3$/kton	Acid Neutralization Potential (NP or ANP) tons CaCO3/kton	Net Neutralization Potential (NNP) (ANP-AGP) tons $CaCO_3$/kton	As mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg	Pb mg/kg	Hg mg/kg	Mo mg/kg	Ni mg/kg	P mg/kg	Se mg/kg	Si mg/kg	Zn mg/kg	pH 1:1	pH Sat. Paste	Soluble Salts mmhos/cm	CEC meq/100
BIOSOLIDS-AREA 20	Robinson TSF	Pit Overburden	7/19/2007	0.41	0.11	3.44	32.5	29.06	1.31	n.d.	9.6	41.4	57.4	n.d.	1400	4.8	748	n.d.	1296	54.6		7.4	0.4	
MCNULTY CIRQUE 3-BIO	Lower McNulty Gulch	Cirque Slide	8/8/2007	0.24	n.d.	0	77.5	77.5	3.06	n.d.	12.8	35.8	39.1	n.d.	475	10.1	460	n.d.	2485	91.4		7.5	0.8	
MCNULTY MAROON 5-6-8-BIO	Lower McNulty Gulch	SDP	8/8/2007	0.13	0.01	0.31	42.5	42.19	1.14	0.56	13.2	21.4	57.3	n.d.	127	9.3	554	n.d.	2612	82.2		7.6	0.5	
Ark-SW	Storke	Shaft Overburden	8/30/2007	0.06		1.2	5	3.8	6	2	18	26	79	<1				0.074		270		6.2	1.52	
Ark-SE	Storke	Shaft Overburden	8/31/2007	0.07		1.7	4	2.3	<5	2	15	38	110	<1			6.3	0.058		260		6.8	0.98	
Ark-S-IP	Storke	Shaft Overburden	9/1/2007	0.05		1.3	3	1.7	<5	2	25	29	83	<1				0.037		190		6.3	0.35	
ARKANSAS-BIO	Storke	Shaft Overburden	9/18/2007	0.1	0.05	1.56	8.75	7.19	2.36	1.4	21	34.6	127	n.d.	36	13.8	556	n.d.	1735	423		7.2	0.4	
BROWN-2-BIO	Robinson TSF	Mosquito Fault Overburden	9/19/2007	0.15	0.02	0.63	80	79.37	1.34	n.d.	9.5	31.5	21.9	n.d.	230	7.1	708	n.d.	1614	75.1		7.1	0.5	
CIRQUE-9-10-BIO	Robinson TSF	Cirque Slide	9/19/2007	0.24	n.d.	0	88.8	88.8	2.11	n.d.	12.1	30	20.1	n.d.	492	6.8	550	n.d.	1893	86.5		7.4	0.8	
MAROON-11-BIO	Robinson TSF	SDP	9/19/2007	0.03	0.01	0.31	35	34.69	0.93	n.d.	18.5	9	23.5	n.d.	6.2	12.6	570	n.d.	3933	86.6		7.4	0.5	
bathtub Ring (dry wt)	Robinson TSF	Tailings	9/17/2008	0.07	n.d.	0.16	35	34.84	0.78	n.d.	14.9	6.1	18.7	n.d.	3	11.1	572	n.d.		55.8		9		
5 Shaft Slope 0-6	Storke	Shaft Overburden	7/16/2010	0.14	0.12	3.7	8	4.3	8	1		76	137	<1	356	20	8.6	<5		534		6.4	0.79	
5 Shaft Slope 6-12	Storke	Shaft Overburden	7/16/2010	0.2	0.18	5.6	8	2.4	8	<1		98	200	<1	724	20	6.9	<5		912		6.9	1.42	
1-DAM 0-6	1 Dam	Pit Overburden	10/8/2010						n.d.	n.d.	11.2		39	n.d.	1,031	6	665	n.d.		47.2		6.8	0.9	8.3
1-DAM 6-12	1 Dam	Pit Overburden	10/8/2010						n.d.	n.d.	3.9		34.9	n.d.	650	2.1	299			93.8		6.5	1	6.5
ROBINSON POND-WEST 0-6	Robinson TSF	Pit Overburden	10/8/2010						n.d.	n.d.	7.8		36.2	n.d.	941	4	459	n.d.		29.2		7.4	1.2	12.4
ROBINSON POND-WEST 6-12	Robinson TSF	Pit Overburden	10/8/2010						n.d.	n.d.	7.2		93.8	n.d.	1,286	3.9	618	n.d.		24.8		6.8	1.5	11.6
SOUTH ROBINSON CIRQUE 0-6	Robinson TSF	Cirque Slide	10/8/2010						n.d.	n.d.	8.2		22.6	n.d.	517	6.7	429	n.d.		46.1		7.8	0.8	11.7
SOUTH ROBINSON CIRQUE 6-12	Robinson TSF	Cirque Slide	10/8/2010						n.d.	n.d.	9.6		29.9	n.d.	501	7.8	526	n.d.		67.7		7.7	1.3	11.4

Soil data collected from reclamation materials utilized 2005-2010. Data for pit overburden materials sampled after they were placed as cover on Robinson Tailings Pond.

Table T-E-6
Collected Water - Analytical Data Summary

SiteNbr	Site Description / Location	SampleDate	Ag, Diss mg/l	Al, Diss mg/l	As, Diss mg/l	Cd, Diss mg/l	CN, Tot_ mg/l	Cond, Lab umho	Cr, TR mg/l	Cu, Diss mg/l	Fe, Diss mg/l	Hardness mg/l	Pb, Diss mg/l	Mn, Diss mg/l	Hg, Total mg/l	Mo, Diss mg/l	pH, Field su	pH, Lab su	TDS, mg/l	SO4, Diss mg/l	Zn, Diss mg/l
DS1	Dam Seep 1	30-May-96										467					4.77	3.45	2020		
DS1	Dam Seep 1	17-Jun-96	0.0002	90.9		0.014	0.003			0.82	468	550	0.001	31.9		7.47	3.39	3.72	3730		2.64
DS1	Dam Seep 1	30-Jul-96	-0.0001	99.1		0.0113				0.568	531	770	-0.001	39.6		9.43	3.5	3.54	3080		3
DS1	Dam Seep 1	14-Aug-96										667						3.06	4540		
DS1	Dam Seep 1	13-Sep-96					0.003					593					4.4	3.31	4480		
DS1	Dam Seep 1	13-Oct-96										1090					5.9	4.98			
DS1	Dam Seep 1	13-Oct-96										529					3.1	3.05			
DS1	Dam Seep 1	13-Oct-96										981					7	4.66			
DS1	Dam Seep 1	13-Oct-96										705					4.9	3.46			
DS1	Dam Seep 1	14-Nov-96		89.2							571	653		26.3			3.6	3.32			4.57
DS1	Dam Seep 1	14-Nov-96		26.1								318	737	26.6			4.4	3.7			1.26
DS1	Dam Seep 1	27-Aug-98		21.9				2980		-0.001		350		36.5		20.6	6.36	4		2130	2.41
DS1	Dam Seep 1	25-Sep-98		37.6				3260		0.04		354		39.4		7.58	5.5	3.4		2280	3.12
DS1	Dam Seep 1 1996 and 1998 13 events	**MIN**	-0.0001	21.9	0	0.0113	0.003	2980	0	-0.001	318	467	-0.001	26.3	0	7.47	3.1	3.05	2020	2130	1.26
		MAX	0.0002	99.1	0	0.014	0.003	3260	0	0.82	571	1090	0.001	39.6	0	20.6	7	4.98	4540	2280	4.57
		AVERAGE	0.00005	60.80		0.013	0.003	3120		0.36	432	704	0.000	33.38		11.27	4.74	3.67	3570	2205	2.83
		Number of Analyses	2	6	0	2	2	2	0	4	6	11	2	6	0	4	12	13	5	2	6
DS3	Dam Seep 3	30-May-96	0.0002	35.1		0.0137				0.024	218	1210	-0.001	30.1		1.09	6.11	4.27	3380		3.46
DS3	Dam Seep 3	18-Jun-96	0.0002	26.4		0.0149				0.04	252	1360	-0.001	29.3		5.24	5.96	4.66	3350		3.83
DS3	Dam Seep 3	30-Jul-96	0.0001	35.9		0.009				0.127	286	1140	-0.001	28.7		2.92	5.38	3.98	3720		3.48
DS3	Dam Seep 3	14-Aug-96	0.0002	36.3		0.0115				0.053	323	1090	-0.001	35.8		4.17	5.54	3.7	3760		3.43
DS3	Dam Seep 3	12-Sep-96	-0.0001	33.9		0.0088				0.131	263	1000	-0.001	29.5		5.66	5.68	4.4	3640		3.62
DS3	Dam Seep 3	11-Oct-96		31.4							283	1340		32.1			6.33	3.27			3.81
DS3	Dam Seep 3	14-Nov-96		31.2							262	816		29.5			5.9	4.49			3.25
DS3	Dam Seep 3	29-Dec-96		32.4							308	1090		34.5			6.07	4.58		2290	3.84
DS3	Dam Seep 3	03-Jan-97		32.2							304	968		31.4			5.6	3.09	3710		3.55
DS3	Dam Seep 3	18-Feb-97										1460				1.96		4.3	3950	2480	
DS3	Dam Seep 3	13-Mar-97						3458				499					5.8	4.4	4100	2630	
DS3	Dam Seep 3	29-Apr-97						2640				1630					6.7	4.3	4160	2590	
DS3	Dam Seep 3	26-May-97						2690				1120						4.5	2780	1760	
DS3	Dam Seep 3	29-Jun-97						3930				1680					3.38	3.1	4500	2720	
DS3	Dam Seep 3	13-Jul-97						3560				1450					3.31	3.2	4610	3150	
DS3	Dam Seep 3	14-Aug-97						3870				1490					3.76	3.3	4240	2840	
DS3	Dam Seep 3	19-Sep-97						4000				1500					4.48	3.1	4330	3960	
DS3	Dam Seep 3	07-Oct-97						3820				1530					3.01	3.1	4580	2590	
DS3	Dam Seep 3	05-Nov-97						3740				1480		47			4.2	3.4	4190	2710	
DS3	Dam Seep 3	14-Dec-97						3730			423	1510					5.3	3.9	4210	2640	
DS3	Dam Seep 3	29-Dec-97		32.4							308	1090		34.5			6.07	4.58			3.84
DS3	Dam Seep 3	26-Jan-98		48.2				3210		0.16	404	1460		46.5		2.23		4.1	4060	2600	4.78
DS3	Dam Seep 3	23-Feb-98						3710				1500						4.3	4150	2540	
DS3	Dam Seep 3	18-Apr-98		48.4				2790		0.115	444	1450		51.9		2.9		4.2	4120	2520	4.8
DS3	Dam Seep 3	20-May-98		17.8				2080		0.028	168	836		26.2		2.74		4	2070	1340	1.89
DS3	Dam Seep 3	30-Jun-98		42.2				3210		0.071	385	1390		48.7		1.25		3.8	4010	2440	4.3
DS3	Dam Seep 3	30-Jul-98		33.2						0.078	343			44.3		5.35		4.4		2680	4.18
DS3	Dam Seep 3	27-Aug-98		24.8				3290		0.036	349			46.7		4.96	6.77	3.7		2510	4.51
DS3	Dam Seep 3	25-Sep-98		20.7				3430		0.024	318			44.7		7.54	6.19	3.6		2320	4.04
DS3	Dam Seep 3 1996 to 1998 29 events	**MIN**	-0.0001	17.8	0	0.0088	0	2080	0	0.024	168	499	-0.001	26.2	0	1.09	3.01	3.09	2070	1340	1.89
		MAX	0.0002	48.4	0	0.0149	0	4000	0	0.16	444	1680	-0.001	51.9	0	7.54	6.77	4.66	4610	3960	4.8
		AVERAGE	0.0001	33.09		0.0116		3362		0.07	313	1273	-0.001	37.30		3.69	5.31	3.92	3892	2566	3.80
		Number of Analyses	5	17	0	5	0	17	0	12	18	26	5	18	0	13	21	29	22	20	17
3 Dam East	3 Dam East Seep	25-Jul-06	-0.01	4.62						-0.01	196			32.5		10.7	6.4	3.8	2800	1560	1.32
3 Dam East	3 Dam East Seep	01-Aug-06	-0.01	6.22						-0.01	228			35.8		10.7	5.8	3.5	3030	1930	1.21
3 Dam East	3 Dam East Seep	08-Aug-06	-0.01	4.84						-0.01	211			34.5		11.5		3.7	2860	1830	2.43
3 Dam West	3 Dam West Seep	25-Jul-06	-0.01	3.2						-0.01	139			46.2		6.22	6.5	3.5	2960	1910	2.28
3 Dam West	3 Dam West Seep	01-Aug-06	-0.01	3.64						-0.01	134			45.5		6.09	5.5	3.3	2940	1740	2.33
3 Dam West	3 Dam West Seep	08-Aug-06	-0.01	3.07						-0.01	141			47.9		6.58		3.3	3000	1910	-0.02
3 Dam Seeps	Miscellaneous 2006 and 2010 6 events	**MIN**	-0.01	3.07	0	0	0	0	0	-0.01	134	0	0	32.5	0	6.09	5.5	3.3	2800	1560	-0.02
		MAX	-0.01	6.22	0	0	0	0	0	-0.01	228	0	0	47.9	0	11.5	6.5	3.8	3030	1930	2.43
		AVERAGE	-0.01	4.27						-0.01	175			40.40		8.63	6.05	3.52	2932	1813	1.59
		Number of Analyses	6	6	0	0	0	0	0	6	6	0	0	6	0	6	4	6	6	6	6

Notes:
1. Negative numbers indicate non-detect result at detection limit represented by absolute value of concentration listed (may skew average concentrations calculated)
2. All units in mg/L unless otherwise noted

Table T-E-6
Collected Water - Analytical Data Summary

SiteNbr	Site Description / Location	SampleDate	Ag, Diss mg/l	Al, Diss mg/l	As, Diss mg/l	Cd, Diss mg/l	CN, Tot_ mg/l	Cond, Lab umho	Cr, TR mg/l	Cu, Diss mg/l	Fe, Diss mg/l	Hardness mg/l	Pb, Diss mg/l	Mn, Diss mg/l	Hg, Total mg/l	Mo, Diss mg/l	pH, Field su	pH, Lab su	TDS, mg/l	SO4, Diss mg/l	Zn, Diss mg/l
DS4	4 Dam Seep - Pond	30-May-96										452					6.8	6.21	750		
DS4	4 Dam Seep - Pond	17-Jun-96	-0.0001	0.81		-0.0003				-0.001	69.5	624	-0.001	4.02		0.03	6.66	6.12	902		-0.02
DS4	4 Dam Seep - Pond	14-Aug-96										357					6.35	5.78	1570		
DS4	4 Dam Seep - Pond	13-Sep-96										800					6.1	5.66	1740		
DS4	4 Dam Seep - Pond	13-Oct-96										989					6.8	7.39			
DS4	4 Dam Seep - Pond	03-Nov-96	-0.0001	0.14		-0.0003				-0.001	1.84	776	-0.001	3.36		-0.02	6.5	7.38			-0.02
DS4	4 Dam Seep - Pond	12-Dec-96		0.05						0.02	1.34	535		2.77			7.22	7.5	792		0.02
DS4	4 Dam Seep - Pond	03-Jan-97		0.17							0.84	585		2.73			7.3	7.93	904		-0.02
DS4	4 Dam Seep - Pond	05-Feb-97		5.46		0.091	-0.01			-0.05	319	1410	-0.2	10.8		-0.02	6.5	1.3	2890	1680	0.1
DS4	4 Dam Seep - Pond	16-Feb-97					-0.01	2623				1330				0.02	6.2	6.2	2540	1700	
DS4	4 Dam Seep - Pond	18-Mar-97						1882				1050					6.6	6.2	1620	1180	
DS4	4 Dam Seep - Pond	13-Apr-97						2220				1120						6.1	2000	1310	
DS4	4 Dam Seep - Pond	28-May-97						1050				586						6.3	860	550	
DS4	4 Dam Seep - Pond	11-Jun-97						591				314					6.91	7.4	390	150	
DS4	4 Dam Seep - Pond	01-Jul-97						904				506						7.6	720	340	
DS4	4 Dam Seep - Pond	31-Jul-97						1200				695						7.5	1040	510	
DS4	4 Dam Seep - Pond	23-Aug-97						1170				672						7.8	880	460	
DS4	4 Dam Seep - Pond	20-Sep-97						1090				598					7.3	7.7	780	450	
DS4	4 Dam Seep - Pond	19-Oct-97						2040				1290						6	1810	1190	
DS4	4 Dam Seep - Pond	05-Nov-97						2360				1460					6.7	5.9	2260	1560	
DS4	4 Dam Seep - Pond	27-Dec-97						3160				1780					6.29	6.3	3240	2030	
DS4	4 Dam Seep - Pond	08-Feb-98						2810				1850						6.3	3140	2070	
DS4	4 Dam Seep - Pond	11-Mar-98						3470				1930					6.19	6.2	3620	2310	
DS4	4 Dam Seep - Pond	18-Apr-98						2350				1770						6.1	3330	2170	
DS4	4 Dam Seep - Pond	15-May-98						1740				850					6.6	5.8	1620	1010	
DS4	4 Dam Seep - Pond	27-Jun-98						2040				1260					7.3	5.7	2550	1420	
DS4	4 Dam Seep - Pond	15-Jul-98						1500				840					7.33	7	1360	800	
DS4	4 Dam Seep - Pond	29-Jul-98						2540				1410					7.25	6.1	2670	1690	
DS4	4 Dam Seep - Pond	22-Aug-98	-0.0005	2.81			-0.01		-0.001		244	1480	-0.001	13.3	-0.0002			5.9	2940	1830	0.05
DS4	4 Dam Seep - Pond	08-Sep-98	-0.0005	2.48			-0.01		-0.001		170	1380	-0.001	12.4	-0.0002		6.86	5.6	2470	1470	0.05
DS4	4 Dam Seep - Pond	16-Oct-98	-0.0005	5.18			-0.01		-0.001		336	1740	-0.001	16.3	-0.0002		6.74	6	3620	240	0.08
DS4	4 Dam Seep - Pond	17-Nov-98	-0.0005	5.07			-0.01		-0.001		326	1860	-0.001	19.7	-0.0002		6.19	5.8	3420	2170	0.05
DS4	4 Dam Seep - Pond	28-Dec-98	-0.0005	5.62			-0.01		-0.001		341	1970	-0.001	20.2	0.0011		6.35	6.1	3740	2390	0.1
DS4	4 Dam Seep - Pond	13-Jan-99	-0.0005	5.64			-0.01		-0.001		325	1950	-0.001	20	-0.0002		5.77	5.9	3790	2330	0.1
DS4	4 Dam Seep - Pond	14-Feb-99															6.5				
DS4	4 Dam Seep - Pond	14-Mar-99	-0.0005	3.47			-0.01		-0.001		175	1060	-0.001	10.4	-0.0002		6.5	5.5	1780	1200	0.06
DS4	4 Dam Seep - Pond	15-May-99	-0.0005	1.23			-0.01		-0.001		85.9	790	-0.001	6.21	-0.0002		5.93	6.1	1200	790	0.03
DS4	4 Dam Seep - Pond	07-Jun-99	-0.0005	3.6			-0.02		-0.001		131	895	-0.001	8.55	-0.0002		6.16	5.8	660	1040	0.08
DS4	4 Dam Seep - Pond	11-Jul-99	-0.0005	0.3			-0.01		-0.001		29.2	313	-0.001	2.01	-0.0002		7.85	6.1	520	270	0.01
DS4	4 Dam Seep - Pond	29-Aug-99	-0.0005	5.14			-0.01		0.001		333	1580	-0.001	18.3	-0.0002		5.9	5.6	3340	2110	0.08
DS4	4 Dam Seep - Pond	31-Oct-99	-0.0005	3.54			-0.1		-0.001		191	1310	-0.001	12.7	-0.0002		6.38	6.2	2560	1700	0.07
DS4	4 Dam Seep - Pond	01-Jan-00															6.54				
DS4	4 Dam Seep - Pond	10-Jun-00	-0.0005	0.04			-0.01		-0.001		4.49	632	-0.001	4.07	-0.0002		7.49	6.8	840	550	0.03
DS4	4 Dam Seep - Pond	17-Sep-00	-0.0005	3.54			-0.01		0.002		194	1380	-0.001	14.1	-0.0002		5.86	8.4	2500	1710	0.07
DS4	4 Dam Seep - Pond	09-Oct-00	-0.0005	2.92			-0.01		0.005		203	1400	0.002	13.7	-0.0002		6.6	6.1	2470	1680	0.12
DS4	4 Dam Seep - Pond	21-Mar-01	-0.0005	7.97			-0.01		0.001		384	1920	-0.001	22.3	-0.0002		5.85	5.9	3820	2540	0.13
DS4	4 Dam Seep - Pond	21-Oct-01	-0.0005	6.4					-0.001		354	1630	-0.001	18.2	-0.0002		6.33	6.2	3470	230	0.1
DS4	Dam Seep 4 1996 to 2001 47 events	**MIN**	-0.0005	0.04	0	-0.0003	-0.1	591	-0.001	-0.05	0.84	313	-0.2	2.01	-0.0002	-0.02	5.77	1.3	390	150	-0.02
		MAX	-0.0001	7.97	0	0.091	-0.01	3470	0.005	0.02	384	1970	0.002	22.3	0.0011	0.03	7.85	8.4	3820	2540	0.13
		AVERAGE	-0.0005	3.25		0.0301	-0.02	1934	0.000	-0.01	191.78	1136	-0.01	11.64	-0.0001	0.00	6.60	6.30	2073	1320	0.06
		Number of Analyses	19	22	0	3	18	19	17	4	22	45	20	22	17	4	38	45	43	37	22
4 Dam #1		14-Oct-92	0.0002	0.89		-0.0003	-0.001	2050		-0.001	12.8	1060	0.002	10.5		6.55	6.8		1810		0.02
4 Dam #2		14-Oct-92	0.0003	0.92		-0.0003	0.003	2040		0.005	3.1	1060	-0.001	10.8		4.4	6.5		1810		0.1
4 Dam #3		14-Oct-92	0.0001	0.93		0.0016	-0.001	1840		0.004	1.6	1060	-0.001	5.96		2.68	7.3		1580		0.02
4 Dam Seep - Bubbler		05-Feb-97		0.03		-0.003	-0.01	1433		-0.01	0.14	881	-0.04	3.15		0.01	7.9	7.9	1090	670	
4 Dam Seep - Bubbler		16-Feb-97					-0.01	1443				858				-0.01	6.8	7.7	1210	730	0.01
4 Dam Seep - Bubbler		10-Jun-00	-0.0005	-0.03	-0.001		-0.01		-0.001		2.54	631	-0.001	2.17			7.0	7.0	830	510	0.02
4 Dam Seep - Bubbler		07-Jun-05		-0.03		0.0001		1020			1.92	618	-0.0001	2.42		-0.01			770	420	
4 Dam Seep		07-Jun-05		0.04		0.0001		843			0.86	516	0.0001	1.41		0.02			600	330	-0.01
4 DAM SEEPS		02-Sep-10		0.51	-0.0005	-0.0001				0.0012	52.3		-0.0001	5.48	-0.0002	-0.01		7.2	1400	740	-0.01
4 DAM SEEPS		16-Sep-10		0.92	-0.0005	-0.0001				0.0016	68.4		0.0001	6.69	-0.0002	0.01		7.1	1580	860	0.02
4 DAM SEEPS		30-Sep-10		0.23	-0.0005	-0.0001				0.0008	47.5		0.0002	6.01	-0.0002	0.01		7.3	1520	870	-0.01
4 DAM SEEPS		14-Oct-10		0.6	-0.0005	-0.0001				0.002	45.4		0.0002	7.29	-0.0002	0.02		7.1	1660	1010	0.01
4 DAM SEEPS		28-Oct-10		0.48	-0.0005	-0.0001				0.0014	40.1		0.0001	7.29	-0.0002	0.02		7.1	1560	910	0.02
4 DAM SEEPS		11-Nov-10		0.85	-0.0005	0.0001				0.0009	62.6		-0.0001	7.46	-0.0002	0.03		7.1	1650	930	0.02
4 DAM SEEPS		23-Nov-10		0.91	-0.0005	-0.0001				0.0011	69.5		-0.0001	7.6	-0.0002	0.02		7.1	1740	980	0.02
4 DAM SEEPS		09-Dec-10		0.95	-0.0005	-0.0001				0.003	67		-0.0001	7.69	-0.0002	0.03		7.2	1730	1020	0.02
4 DAM SEEPS		21-Dec-10		-0.03	-0.0005	-0.0001				0.0011	0.5	585	-0.0001	1.14	-0.0002	0.02		8.1	790		-0.01
4 DAM SEEPS		06-Jan-11		0.91	-0.0005	0.0001				0.0026	82		-0.0001	7.99	-0.0002	0.01		7.2	1730	1110	0.15
4 DAM SEEPS		20-Jan-11		1.14	0.0005	0.0001				0.0016	88.2		-0.0001	8.26	-0.0002	0.02		7.0	1720	1110	0.02
4 Dam Seep	Miscellaneous 92, 97, 2000, 05, 2010-2011 19 events	**MIN**	-0.0005	-0.03	-0.001	-0.003	-0.01	843	-0.001	-0.01	0.14	516	-0.04	1.14	-0.0002	-0.01	6.5	7.0	600	330	-0.01
		MAX	0.0003	1.14	0.0005	0.0016	0.003	2050	-0.001	0.005	88.2	1060	0.002	10.8	-0.0002	6.55	7.9	8.1	1810	1110	0.15
		AVERAGE	0.0000	0.57	-0.0005	-0.0001	-0.005	1524.14	-0.001	0.001	35.91	807.67	-0.002	6.07	-0.0002	0.77	7.05	7.29	1409	813	0.02
		Number of Analyses	4	18	12	17	6	7	1	15	18	9	18	18	11	18	6	14	19	15	17

Notes:
1. Negative numbers indicate non-detect result at detection limit represented by absolute value of concentration listed (may skew average concentrations calculated)
2. All units in mg/L unless otherwise noted

Table T-E-6
Collected Water - Analytical Data Summary

SiteNbr	Site Description / Location	SampleDate	Ag, Diss mg/l	Al, Diss mg/l	As, Diss mg/l	Cd, Diss mg/l	CN, Tot_ mg/l	Cond, Lab umho	Cr, TR mg/l	Cu, Diss mg/l	Fe, Diss mg/l	Hardness mg/l	Pb, Diss mg/l	Mn, Diss mg/l	Hg, Total mg/l	Mo, Diss mg/l	pH, Field su	pH, Lab su	TDS, mg/l	SO4, Diss mg/l	Zn, Diss mg/l
DS5	5 Dam Seep	30-May-96	-0.0001	50.8		0.0076				0.283	44	832	-0.001	13		0.11	5.19	3.5	1730		
DS5	5 Dam Seep	18-Jun-96	-0.0001	26.1		0.0081				0.17	26.5	904	-0.001	14.1		0.8	5.55	5.56	1660		
DS5	5 Dam Seep	30-Jul-96	-0.0001	7.58		0.0039				0.029	23.2	1530	-0.001	14.8		3.6	5.8	5.08	1810		
DS5	5 Dam Seep	14-Aug-96	0.0001	4.22		0.0035				0.006	20.7	560	0.001	12.9		3.87	6.24	4.95	1820		0.45
DS5	5 Dam Seep	12-Sep-96	-0.0001	4.42		0.0031				0.01	23.2	1060	-0.001	12.6		3.85	6.48	6.1	1660		0.44
DS5	5 Dam Seep	09-Oct-96					-0.001					1030					6.32	4.98	1700		
DS5	5 Dam Seep	06-Nov-96		4.68							24.8	915		14.8			6.28	5.51			0.55
DS5	5 Dam Seep	07-Jan-97	0.0013	4.44		0.029				0.002	28.6	925	-0.001	15		3.79	7.5	5.49	1890		0.58
DS5	5 Dam Seep	18-Feb-97										1090				3.18		6.2	1830	1200	
DS5	5 Dam Seep	13-Mar-97						1961				1120					6.5	6	1860	1210	
DS5	5 Dam Seep	26-Apr-97						1850				1120						6	1830	1190	
DS5	5 Dam Seep	26-May-97						1840				903						5.6	1570	1030	
DS5	5 Dam Seep	08-Jun-97						1940				1020						5.3	1760	1120	
DS5	5 Dam Seep	13-Jul-97						1680				969					5.3	5.4	1870	1090	
DS5	5 Dam Seep	11-Aug-97						2120				1020						5.4	1860	1130	
DS5	5 Dam Seep	19-Sep-97						1980				1090					5.73	5	1840	1230	
DS5	5 Dam Seep	18-Oct-97						1960				1060						4.8	1770	1140	
DS5	5 Dam Seep	05-Nov-97						1960				1020		16.6			6.24	5.5	1740	1190	
DS5	5 Dam Seep	14-Dec-97						2090			38.3	1090					5.36	5.9	1880	1220	
DS5	5 Dam Seep	26-Jan-98		5.61				1890		-0.01	33.1	312		16.7		4.11		6	1880	1250	0.62
DS5	5 Dam Seep	23-Feb-98						2070				1080						6	1930	1190	
DS5	5 Dam Seep	18-Apr-98		4.24				1820		0.005	28.6	1070		16.7		4.26		6	1910	1250	0.59
DS5	5 Dam Seep	20-May-98		7.37				1770		0.016	22.6	907		13.6		3.14		5.4	1290	1100	0.68
DS5	5 Dam Seep	30-Jun-98		3.22				1790		0.003	20.1	1040		14.2		3.73		5.8	1820	1170	0.48
DS5	5 Dam Seep	30-Jul-98		3.64						0.004	23			13.7		3.83		5.9		1160	0.46
DS5	5 Dam Seep	27-Aug-98		3.57				1960		0.003	26			15.5		3.92	5.61	5.8		1250	0.48
DS5	5 Dam Seep	25-Sep-98		3.93				2050		0.005	24.9			15.8		4.35	6.07	5.8		1230	0.53
DS5	5 Dam Seep	22-Jul-02		4.04				2220			19			16.2		2.99	5.77	6.1		1370	0.54
DS5	5 Dam Seep	09-Sep-03															6.16				
DS5	5Dam Seep 1996 to 2003 29 events	**MIN**	-0.0001	3.22	0	0.0031	-0.001	1680	0	-0.01	19	312	-0.001	12.6	0	0.11	5.19	3.5	1290	1030	0.44
		MAX	0.0013	50.8	0	0.029	-0.001	2220	0	0.283	44	1530	0.001	16.7	0	4.35	7.5	6.2	1930	1370	0.68
		AVERAGE	0.0002	9.19		0.009	-0.001	1942		0.040	26.66	986	-0.001	14.76		3.30	6.01	5.54	1779	1186	0.53
		Number of Analyses	6	15	0	6	1	18	0	13	16	24	6	16	0	15	17	28	23	20	12
5 Dam Seep	5 Dam Seep	25-Jul-06	-0.01	6.13						-0.01	19			13.7		1.93	6.3	4.1	2020	1420	0.56
5 Dam Seep	5 Dam Seep	01-Aug-06	-0.01	6.94						-0.01	19.8			14		1.91	5.6	4.1	2000	1280	0.59
5 Dam Seep	5 Dam Seep	08-Aug-06	-0.01	7.46						-0.02	23.4			14.8		2.22		4.4	1990	1300	110
5 DAM SEEPS	5 Dam Seep	10/14/2010																			
5 DAM SEEPS	5 Dam Seep	11/11/2010																			
5 Dam Seep	Miscellaneous 2006 & 2010 5 events	**MIN**	-0.01	6.13	0	0	0	0	0	-0.02	19	0	0	13.7	0	1.91	5.6	4.1	1990	1280	0.56
		MAX	-0.01	7.46	0	0	0	0	0	-0.01	23.4	0	0	14.8	0	2.22	6.3	4.4	2020	1420	110
		AVERAGE	-0.01	6.84						-0.01	20.73			14.17		2.02	5.95	4.20	2003	1333	37.05
		Number of Analyses	3	3	0	0	0	0	0	3	3	0	0	3	0	3	2	3	3	3	3
5 Shaft	5-Shaft	15-Feb-96		900										260							94
5 Shaft	5-Shaft	20-Feb-96		910										260							92
5 Shaft	5-Shaft	29-Apr-96		804										242			3.48				-0.02
5 Shaft	5-Shaft	29-May-96		-0.05										-0.02			2.8				75
5 Shaft	5-Shaft	17-Jun-96		940										129			2.6				77.8
5 Shaft	5-Shaft	18-Jun-96	0.0003	936		0.631				35.8	544		0.008	129		3.76	2.28	2.99			66.9
5 Shaft	5-Shaft	16-Jul-96		733			-0.001							140			2.88				65
5 Shaft	5-Shaft	13-Aug-96		734										163			2.53	3			63
5 Shaft	5-Shaft	10-Sep-96		706										164			2.6	2.93			667
5 Shaft	5-Shaft	09-Oct-96		707							405	275		168			2.64	3.17			67.8
5 Shaft	5-Shaft	25-Dec-96		624							381	788		184			3.95	3.3			
5 Shaft	5-Shaft	28-Feb-97						4799				1680				0.14	3.6	3.6	8480	4300	
5 Shaft	5-Shaft	13-Mar-97						4532				1690					4.4	3.8	7750	4090	
5 Shaft	5-Shaft	14-Apr-97						4190				1660					4.58	3.9	7920	3920	
5 Shaft	5-Shaft	27-May-97						4680				1450						3.1	6710	3670	
5 Shaft	5-Shaft	10-Jun-97						5440				1370						2.9	9980	5250	
5 Shaft	5-Shaft	01-Jul-97						5070				1250					2.8	2.9	8710	4870	
5 Shaft	5-Shaft	14-Aug-97						4480				1380					3	3	7050	4860	
5 Shaft	5-Shaft	19-Sep-97						4560				1460					3.1	3	6790	4190	
5 Shaft	5-Shaft	07-Oct-97						4680				1550					2.94	3	6660	3750	
5 Shaft	5-Shaft	05-Nov-97						4470				1580		142			2.65	3.3	7190	3770	
5 Shaft	5-Shaft	13-Dec-97						4610			379	1540					3.4	3.4	6910	3920	57.6
5 Shaft	5-Shaft	25-Jan-98		588				4050		9.8	391	1530		147		0.23		3.5	6900	3800	61.9
5 Shaft	5-Shaft	22-Feb-98		553				4470		9.63	418	1580		160		0.14		3.7	6930	3750	67
5 Shaft	5-Shaft	18-Apr-98		573				2980		7.3	445	1550		167		-0.1		3.8	6800	3700	53.9
5 Shaft	5-Shaft	20-May-98		515				4270		10	355	1390		131		0.21		3.1	6320	3550	69
5 Shaft	5-Shaft	30-Jun-98		817				4410		25	539	1210		116		2.58		2.8	8560	4510	41.8
5 Shaft	5-Shaft	30-Jul-98		550						13.4	302			95.2		1.1		2.9		3410	44.9
5 Shaft	5-Shaft	26-Aug-98		525				4250		10.7	301			115		0.84	2.3	2.9		3620	48.5
5 Shaft	5-Shaft	25-Sep-98		523				4310		11	336			116		0.73	2.52	3.1		3410	
5 Shaft	5-Shaft	12-Feb-02															3				
5 Shaft	5-Shaft	05-Feb-03															0				33.8
5-Shaft	5-Shaft	25-Jul-06	-0.02	456						9.88	308			78.8		1.12	3.2	2.9	5370	3150	33.8
5-Shaft	5-Shaft	01-Aug-06	-0.01	494						10.4	313			79.5		1.14	3.2	2.9	5650	3120	32.2
5-Shaft	5-Shaft	08-Aug-06	-0.01	470						9.43	299			77.7		1.06		2.9	5410	30	
5-Shaft	5-Shaft	12-Sep-09		466				3400		9.67	307	1090		67.7			3.1	3.1	5230		30.9
5 Shaft	5 Shaft 1996 to 2009 36 events	**MIN**	-0.02	-0.05	0	0.631	-0.001	2980	0	7.3	299	275	0.008	-0.02	0	-0.1	0	2.8	5230	30	-0.02
		MAX	0.0003	940	0	0.631	-0.001	5440	0	35.8	544	1690	0.008	260	0	3.76	4.58	3.9	9980	5250	667
		AVERAGE	-0.010	631		0.63	-0.001	4458		13.23	376	1385	0.008	138.83		1.00	2.94	3.17	7066	3756	83.81
		Number of Analyses	4	23	0	1	1	18	0	13	16	18	1	24	0	13	25	28	20	22	22

Notes:
1. Negative numbers indicate non-detect result at detection limit represented by absolute value of concentration listed (may skew average concentrations calculated)
2. All units in mg/L unless otherwise noted

Table T-E-6
Collected Water - Analytical Data Summary

SiteNbr	Site Description / Location	SampleDate	Ag, Diss mg/l	Al, Diss mg/l	As, Diss mg/l	Cd, Diss mg/l	CN, Tot_ mg/l	Cond, Lab umho	Cr, TR mg/l	Cu, Diss mg/l	Fe, Diss mg/l	Hardness mg/l	Pb, Diss mg/l	Mn, Diss mg/l	Hg, Total mg/l	Mo, Diss mg/l	pH, Field su	pH, Lab su	TDS, mg/l	SO4, Diss mg/l	Zn, Diss mg/l
ESC	East Side Channel	9/16/2010		207	-0.001	0.0631				3	134		0.0015	30.3	-0.0002	0.63		2.9	3950	2100	7.68
ESC	East Side Channel	9/30/2010		198	-0.001	0.0535				2.4	123		0.0025	25	-0.0002	0.45		3.1	3860	1900	7.53
ESC	East Side Channel	10/14/2010		197	-0.001	-0.0002				0.002	149		-0.0002	26.2	-0.0002	0.75		3.0	3580	1640	7.51
ESC	East Side Channel	10/28/2010		177	-0.001	0.0454				2.2	147		0.0009	23.1	-0.0002	0.47		3.1	3420	1760	7.42
ESC	East Side Channel	11/11/2010		182	-0.0005	0.0524				2.37	133		0.0006	24.1	-0.0002	0.84		3.0	3660	1650	8.6
ESC	East Side Channel	11/23/2010		187	-0.001	0.0391				2.06	164		0.0075	25.3	-0.0002	0.7		3.1	3520	1520	7.16
ESC	East Side Channel	12/9/2010		181	-0.0005	0.0518				2.29	140		0.0007	24.8	-0.0002	0.78		3.1	3380	1470	7.21
ESC	East Side Channel 2010 7 events	**MIN**	0	177	-0.001	-0.0002	0	0	0	0.002	123	0	-0.0002	23.1	-0.0002	0.45	0	2.9	3380	1470	7.16
		MAX	0	207	-0.0005	0.0631	0	0	0	3	164	0	0.0075	30.3	-0.0002	0.84	0	3.1	3950	2100	8.6
		AVERAGE		190	-0.0009	0.0436				2.05	141		0.0019	25.54	-0.0002	0.66		3	3624	1720	7.59
		Number of Analyses	0	7	7	7	0	0	0	7	7	0	7	7	7	7	0	7	7	7	7
MD	McNulty Dump	15-Feb-96		710							73			77							
MD	McNulty Dump	20-Feb-96		700							61			67							
MD	McNulty Dump	29-Apr-96		636							60.3			72.4			3.15			5650	
MD	McNulty Dump	19-Jun-96	0.0003	367		0.3	-0.001			3.91	139		-0.001	30.6		0.37	3.13	6.85	3980		15.9
MD	McNulty Dump	16-Jul-96		541							437			48.9			3.15				
MD	McNulty Dump	15-Aug-96		710							119			64.6			2.72				
MD	McNulty Dump	12-Sep-96		617							118			63.7			2.47				
MD	McNulty Dump	10-Oct-96		821							96.1	9310		73.1			3.12	2.98			35.2
MD	McNulty Dump	13-May-97						2870				481					3.8	3.2	3110	1960	
MD	McNulty Dump	28-Jun-97						4090				1400					2.5	2.9	5940	3480	
MD	McNulty Dump	07-Aug-97						5190				1950					2.91	3	7440	4960	
MD	McNulty Dump	21-Sep-97						5660				2240					2.87	3	8510	5050	
MD	McNulty Dump	07-Oct-97						4510				1690					2.85	3.1	6200	3480	
MD	McNulty Dump	05-Nov-97						4350				1770		67.1			2.6	3.1	6500	3720	
MD	McNulty Dump	13-Dec-97						4590			89	1760					1.7	3.1	6700	3950	
MD	McNulty Dump	20-May-98		242				2310		3.2	25.2	784		25		-0.02		3.3	2580	1520	10.7
MD	McNulty Dump	30-Jun-98		385				3060		6.1	134	1040		33.1		0.28		2.9	4110	2320	15.7
MD	McNulty Dump	30-Jul-98		519						6.5	122			42.5		0.2		3		2970	19.5
MD	McNulty Dump	26-Aug-98		625				4320		7.9	134			53.9		0.19	2.02	3		3630	24.8
MD	McNulty Dump	25-Sep-98		687				4650		9.2	137			65.6		0.16	2.81	3		4120	30.5
MD	McNulty Dump	14-Apr-02															3.6				
MD	McNulty Dump 1996 to 2002 21 events	**MIN**	0.0003	242	0	0.3	-0.001	2310	0	3.2	25.2	481	-0.001	25	0	-0.02	1.7	2.9	2580	1520	10.7
		MAX	0.0003	821	0	0.3	-0.001	5660	0	9.2	437	9310	-0.001	77	0	0.37	3.8	6.85	8510	5650	35.2
		AVERAGE	0.0003	582		0.30	-0.001	4145		6.14	125	2243	-0.001	56.04		0.20	2.84	3.32	5507	3601	21.76
		Number of Analyses	1	13	0	1	1	11	0	6	14	10	1	14	0	6	16	14	10	13	7
ROBINSON LAKE SEEPS	Robinson Lake Seeps	9/2/2010		-0.03	-0.0005	0.0002				0.0011	-0.02		-0.0001	3.59	-0.0002	2.34		8.2	1180	690	-0.01
ROBINSON LAKE SEEPS	Robinson Lake Seeps	9/16/2010		-0.03	-0.0005	0.0003				0.0013	-0.02		-0.0001	3.34	-0.0002	2.36		8.1	1250	740	-0.01
ROBINSON LAKE SEEPS	Robinson Lake Seeps	9/30/2010		-0.03	-0.0005	0.0001				0.001	-0.02		0.0001	3.4	-0.0002	2.29		8.1	1290	700	-0.01
ROBINSON LAKE SEEPS	Robinson Lake Seeps	10/14/2010		0.07	-0.0005	0.0002				0.0013	-0.02		-0.0001	2.78	-0.0002	1.93		7.9	1180	670	0.06
ROBINSON LAKE SEEPS	Robinson Lake Seeps	10/28/2010		0.12	-0.0005	0.0003				0.0014	-0.02		-0.0001	2.99	-0.0002	1.68		7.9	1100	660	0.02
ROBINSON LAKE SEEPS	Robinson Lake Seeps	11/23/2010		0.04	-0.0005	0.0002				0.0011	-0.02		-0.0001	4.47	-0.0002	1.8		7.8	1240	680	0.01
ROBINSON LAKE SEEPS	Robinson Lake Seeps	12/9/2010		0.08	-0.0005	0.0003				0.0024	-0.02		-0.0001	6.2	-0.0002	2.37		7.9	1300	750	-0.01
ROBINSON LAKE SEEPS	Robinson Lake Seeps	12/21/2010		0.08	-0.0005	0.0002				0.0018	-0.02	786	-0.0001	3.75	-0.0002	1.69		7.6	1070		-0.01
ROBINSON LAKE SEEPS	Robinson Lake Seeps	1/6/2011		-0.03	-0.0005	0.0001				0.0013	-0.02		-0.0001	5.85	-0.0002	2.27		7.7	1210	710	-0.01
ROBINSON LAKE SEEPS	Robinson Lake Seeps	1/20/2011		0.06	-0.0005	0.0002				0.0012	0.05		-0.0001	6.17	-0.0002	2.35		7.8	1240	720	-0.01
ROBINSON LAKE SEEPS	Robinson Lake Seeps 2010 to 2011 11 events	**MIN**	0	-0.03	-0.0005	0.0001	0	0	0	0.001	-0.02	786	-0.0001	2.78	-0.0002	1.68	0	7.6	1070	660	-0.01
		MAX	0	0.12	-0.0005	0.0003	0	0	0	0.0024	0.05	786	0.0001	6.2	-0.0002	2.37	0	8.2	1300	750	0.06
		AVERAGE		0.03	-0.0005	0.0002				0.0014	-0.01	786	-0.0001	4.20	-0.0002	2.11		7.92	1215	704	0.00
		Number of Analyses	0	11	11	11	0	0	0	11	11	1	11	11	11	11	0	11	11	10	11
SWW	Storke Waste Water	21-Jul-07						1360				714					5.6	6.2	1230	700	
SWW	Storke Waste Water	15-Sep-07						1320				735					5.7	6.4	1110	680	15.4
SWW	Storke Waste Water	9/12/2009										648					6.2	6.4	1030		
SWW	Storke Waste Water	9/2/2010		18.1	-0.0005	0.0115				0.1269	0.24		-0.0001	9.22	-0.0002	0.49		6.3	1050	640	2.55
SWW	Storke Waste Water	9/16/2010		18.3	-0.0005	0.0115				0.1501	0.15		0.0004	9.57	-0.0002	0.52		6.4	1080	610	2.44
SWW	Storke Waste Water	9/30/2010		16.7	-0.0005	0.0114				0.1274	-0.02		0.0003	9.43	-0.0002	0.54		6.4	1040	600	2.36
SWW	Storke Waste Water	10/14/2010		13.9	-0.0005	0.01				0.0955	-0.02		0.0001	9.23	-0.0002	0.51		6.5	1030	600	2.24
SWW	Storke Waste Water	10/28/2010		12.9	0.0009	0.0042				0.0068	7.03		0.0004	10.9	-0.0002	3.31		6.5	1020	580	1.15
SWW	Storke Waste Water	11/11/2010		11.7	-0.0005	0.0084				0.0405	0.16		-0.0001	8.78	-0.0002	1.35		6.7	1000	610	1.66
SWW	Storke Waste Water	11/23/2010		10.9	-0.0005	0.0086				0.0597	-0.02		-0.0001	8.66	-0.0002	1.13		6.7	1040	600	1.52
SWW	Storke Waste Water	12/9/2010		10.7	-0.0005	0.0085				0.0612	-0.02		-0.0001	8.36	-0.0002	1.07		6.7	1020	590	1.58
SWW	Storke Waste Water	12/21/2010		9.68	-0.0005	0.0077				0.0509	-0.02	678	-0.0001	7.68	-0.0002	1		6.7	990		1.47
SWW	Storke Waste Water	1/6/2011		7.77	-0.0005	0.0076				0.0337	-0.02		-0.0001	7.85	-0.0002	0.93		6.9	980	620	1.68
SWW	Storke Waste Water	1/20/2011		7.22	-0.0005	0.0074				0.0272	-0.02		-0.0001	7.32	-0.0002	0.9		7.0	960	580	1.4
SWW	Storke Waste Water 2007 to 2011 14 events	**MIN**	0	7.22	-0.0005	0.0042	0	1320	0	0.0068	-0.02	648	-0.0001	7.32	-0.0002	0.49	5.6	6.2	960	580	1.15
		MAX	0	18.3	0.0009	0.0115	0	1360	0	0.1501	7.03	735	0.0004	10.9	-0.0002	3.31	6.2	7.0	1230	700	15.4
		AVERAGE		12.53	-0.0004	0.0088		1340		0.0709	0.68	694	0.0000	8.82	-0.0002	1.07	5.83	6.56	1041	618	2.95
		Number of Analyses	0	11	11	11	0	2	0	11	11	4	11	11	11	11	3	14	14	12	12

Notes:
1. Negative numbers indicate non-detect result at detection limit represented by absolute value of concentration listed (may skew average concentrations calculated)
2. All units in mg/L unless otherwise noted

Climax Mine Pit Dewatering System
Submitted with Revised Environmental Protection Plan as Technical Revision 24
September 2014

Project Overview

As described in the Climax Environmental Protection Plan (EPP), the 5-Shaft Pump Station and Storke Pipeline are used to convey impacted snow melt and storm water that infiltrates into the open pit area and collects in the underground mine workings. The Climax mine plan will result in deepening the open pit to below the elevation of the 5-Shaft pumps. When this occurs, Climax will need to replace the current 5-Shaft Pump Station with an in-pit dewatering system to convey impacted storm water to the Climax water treatment system.

The pit dewatering system will consist of a pumping station located at the bottom of the open pit that will convey water to booster stations and up to the rim of the open pit. This water will then be conveyed by gravity flow to the Sludge Densification Plan for stage one metals treatment. The pump station and boosters will be powered by an electrical transmission line.

Construction of the system could begin as early at 2015, depending on the timing of mine development, so that Phase 1 Dewatering is functional by 2017. The pit dewatering facilities will be entirely within the boundaries of the open pit except for the power lines to the system and the conveyance from the pit to the water treatment system. In the event of leakage, all pit water will either be contained to the open pit or to the Camp Area drainage system that reports to the East Side Channel (an Environmental Protection Facility described in the EPP).

Dewatering System Description

The various components of the pit dewatering system are shown schematically on drawings CMDW-2, CMDW-3, CMDW-4, CMDW-5, CMDW-6, and CMDW-12. This is a preliminary design that could be modified to some degree based on site-specific conditions and/or changes in mine plans. Climax also does not intend to use diesel pumps at this time and instead will use electrical lines for power. Under the current mine plan and knowledge of site conditions, the dewatering system will consist of the following:

<u>Phase 1 Dewatering</u>

- Dewatering in Phase 1 will use a floating barge with two or more 75 HP pumps. The barge will be commissioned at each mined "drop-cut" of the pit sump when the new bench is established, drainage has stabilized, and a settling sump can be built.
- A skid-mounted booster station with three 300 HP vertical turbine can pumps and associated surge tanks. That booster station will also be convertible in later years to either a floating barge or a fixed wet-well pump station, and is therefore called the Hybrid Booster Station. The hybrid booster will have a dual-feed capability so that discharges from the barge and other sources such as the 600 mining level can be combined and pumped to Booster Station E.

Climax Molybdenum
A Freeport-McMoRan Company

Climax Mine
Highway 91 - Fremont Pass
Climax, CO 80429
Phone (719) 486-7718
Fax (719) 486-2251

Hand Delivered

October 6, 2014

Mr. Eric Scott
Division of Reclamation, Mining and Safety
Department of Natural Resources
1313 Sherman St. Room 215
Denver, Colorado 80203

RE: Climax Mine, Permit No. M-1977-493, Technical Revision 24 – Environmental Protection Plan Updates and Preliminary Pit Dewatering System Design

Dear Mr. Scott:

This letter is to request Technical Revision #024 (TR-24) to the Climax Mine Reclamation Permit (M-77-493). TR-24 consists of an updated Environmental Protection Plan (EPP) and a preliminary design for a proposed pit dewatering system.

The updated EPP (R3) is based on the 2011 EPP (R2) approved by DRMS as TR-18 and essentially contains the same information as TR-18, but with updated information to reflect current site conditions. The key updates to EPP R3 include the following:

- Updated designated chemical list (mill reagents) in Section T-3 and new MSDSs in Appendix T-B
- Updated description of Property Discharge Water Treatment Plant as an Environmental Protection Facility (EPF) in the Tenmile Creek watershed.
- Addition of pit dewatering system as an EPF in the Tenmile Creek watershed
- Updated figures in the Water Quality Monitoring Plan (WQMP) showing new monitoring well locations, and new monitoring well logs in WQMP Appendix A
- Updated language describing facilities in EPP narratives to reflect that Climax is a fully operational

Much of TR-18 remains intact in EPP R3 and is referenced throughout the updated version. Although some of the narrative of the WQMP is updated to reflect current conditions, the only substantive changes are the new figures and well logs. The monitoring schedule, analytical parameters, numeric protection levels, and data review and reporting described in TR-18 remain the same.

Enclosed is a hard copy of the TR-24 documents (EPP R3 and description of the pit dewatering system) and the $1,006.00 fee applicable to a 112d operation. Please feel free to contact me at 719-486-7584 if you need any additional information.

Sincerely,

Raymond Lazuk
Environmental Manager

Enc.

- The 600 mining level will be used as a major drainage network to bring water from the sources to the Hybrid Booster Station. The 6IV raise, located near the currently lowest point of the pit, can be tapped with short boreholes and the flow connected directly into the suction of the Hybrid Booster Station pumps.
- Booster Station E will be constructed at the northeast corner of the pit and will use 200 HP horizontal split case pumps. Booster E will be larger than the Hybrid Booster Station but will be unitized construction that can be deployed and moved using a mobile crane and low-boy carrier. It will receive water from the hybrid booster station and pump the water to a location on the north side of the pit from where it can flow by gravity to the water treatment system. All of the interconnecting pipe will be 24-inch diameter High Density Polyethylene (HDPE) pipe with varying wall thicknesses designed for the appropriate head pressure.
- The discharge pipelines will not be buried because they will have to be moved and extended in subsequent years. A temperature monitoring and draining system will be incorporated into the design to prevent freezing during the winter. In the event of power loss during the winter the lines will be drained to prevent freezing.

Phase 2 Dewatering

A third booster station will be added in year 2019 or 2020 due to increased depth of the open pit and resulting increase in pumping head. The mining sequence in that time period also is such that Booster Station E can be shut-down, moved and re-commissioned without interrupting the system operation. The following describes Phase 2 dewatering to accommodate the increased depth and static head:

- Booster Station A will be constructed at a permanent location on the south end of the open pit. It will be identical to Booster E (constructed in Phase 1) except for the size of pumps. It will house three 150 HP horizontal split case pumps, associated surge control tanks, and the drain-back system to control freezing. Booster Station A will pump to the "5-way intersection" on the west rim of the open pit, from which the flow can be delivered by gravity for treatment.
- When Booster A has been commissioned the Hybrid Booster Station will be capable of pumping from the sump to Booster A, and Booster E can be shut down and moved to its Booster D location.
- Booster E will be moved to its final position at the elevation of the 600 mining level at the south side of the open pit and renamed as Booster D. When the move is completed the sequence of pumping will be from the barge to the Hybrid Booster Station, to Booster D, and finally to Booster A.
- When Booster D is commissioned the discharge from the Hybrid Booster Station will be to Booster D and its discharge head will be significantly reduced (until Phase 3). The pumps on the Hybrid Booster Station can be modified from four to two stages and the motors reduced from 300 HP to only 100 HP.
- During Phase 2 mining the discharge pipelines must be moved and lengthened several times as the mine is expanded northward. The pipelines will remain on the surface to facilitate those pipeline expansions and for any future modifications.

Phase 3 Dewatering

During Phase 3 Dewatering the principal change to the system will be moving the Hybrid Booster station and the barge lower as the mine is deepened until the final elevation of approximately 10,300 is reached. The pumps on the Hybrid Booster Station will require more power as the pumping head increases. Additional stages and larger motors will be added as needed, until they are once again four stage pumps with 300 HP motors, as in Phase 1. Booster Stations A and D will not require significant changes, except that Booster D may need to move about 150 feet south as the west side of the pit is widened.

QA/QC and EPF Certification

In general, the QA/QC program will consist of construction observation, inspection of materials for use in construction, and appropriate field testing during construction to ensure that work is conducted and completed in accordance with the project-specific design and technical specifications. Upon completion of each Phase, Climax will provide final as-built drawings of the system and the EPF certification by a Professional Engineer.

Post Mining Considerations

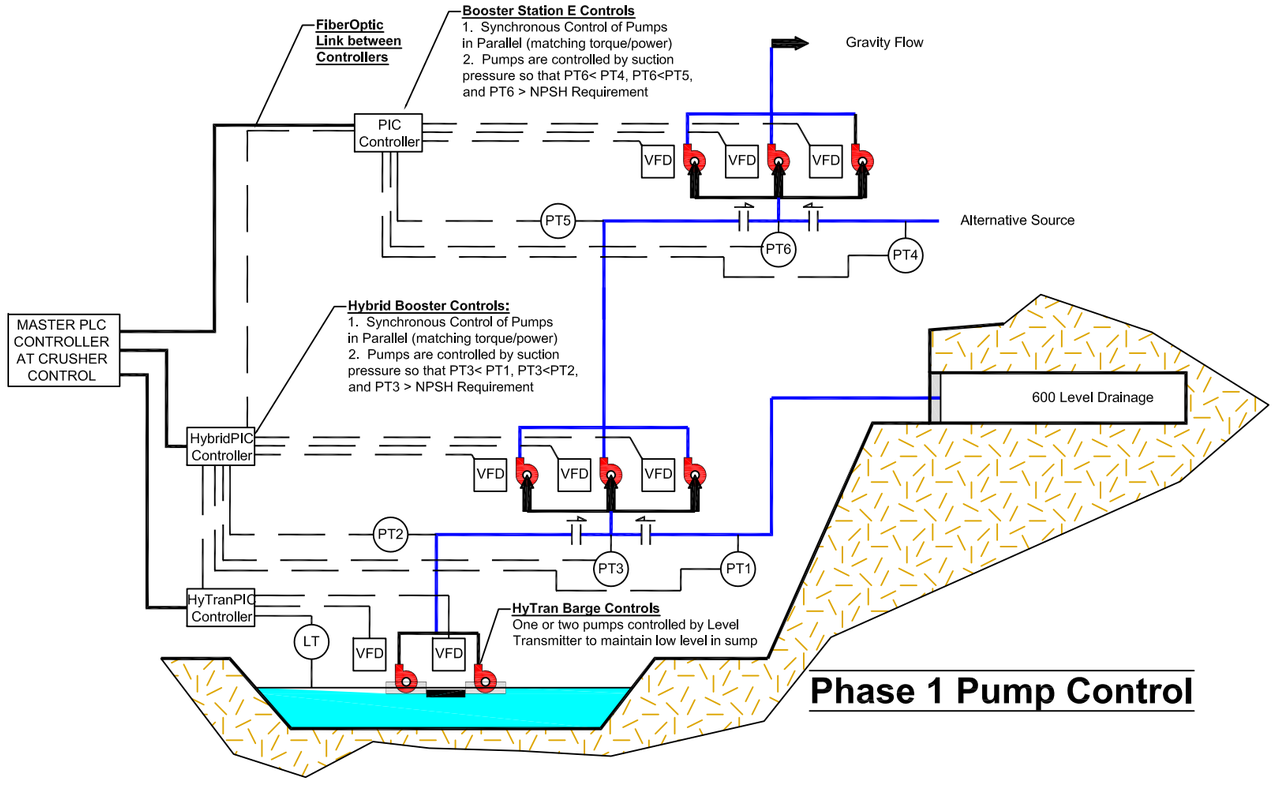
The primary consideration at closure is the elevation and amount of water in the post-mining pit lake. The elevation of water in 5 Shaft is maintained below 11,080 to maintain the water table within the low permeability bedrock behind the Mosquito Fault to prevent seepage of mine water into alluvium within the Arkansas River basin. The hydrogeology of the area is described further in the EPP. Therefore, after mining ceases, impacted water will have to be maintained below that elevation. AM-06 to the Climax Reclamation Permit shows a pit lake at an elevation of approximately 10,700.

The hydraulic connection between the open pit and 5 Shaft occurs through mine workings at the 10,870 elevation. Therefore, a pit lake at this elevation would preclude water flow from the open pit to 5 Shaft. After mining ceases, it also may be possible to maintain a higher pit lake elevation with some pit water reporting to the workings connected to 5 Shaft while still maintaining the necessary hydrological separation between the underground workings and the alluvium associated with the Arkansas River basin.

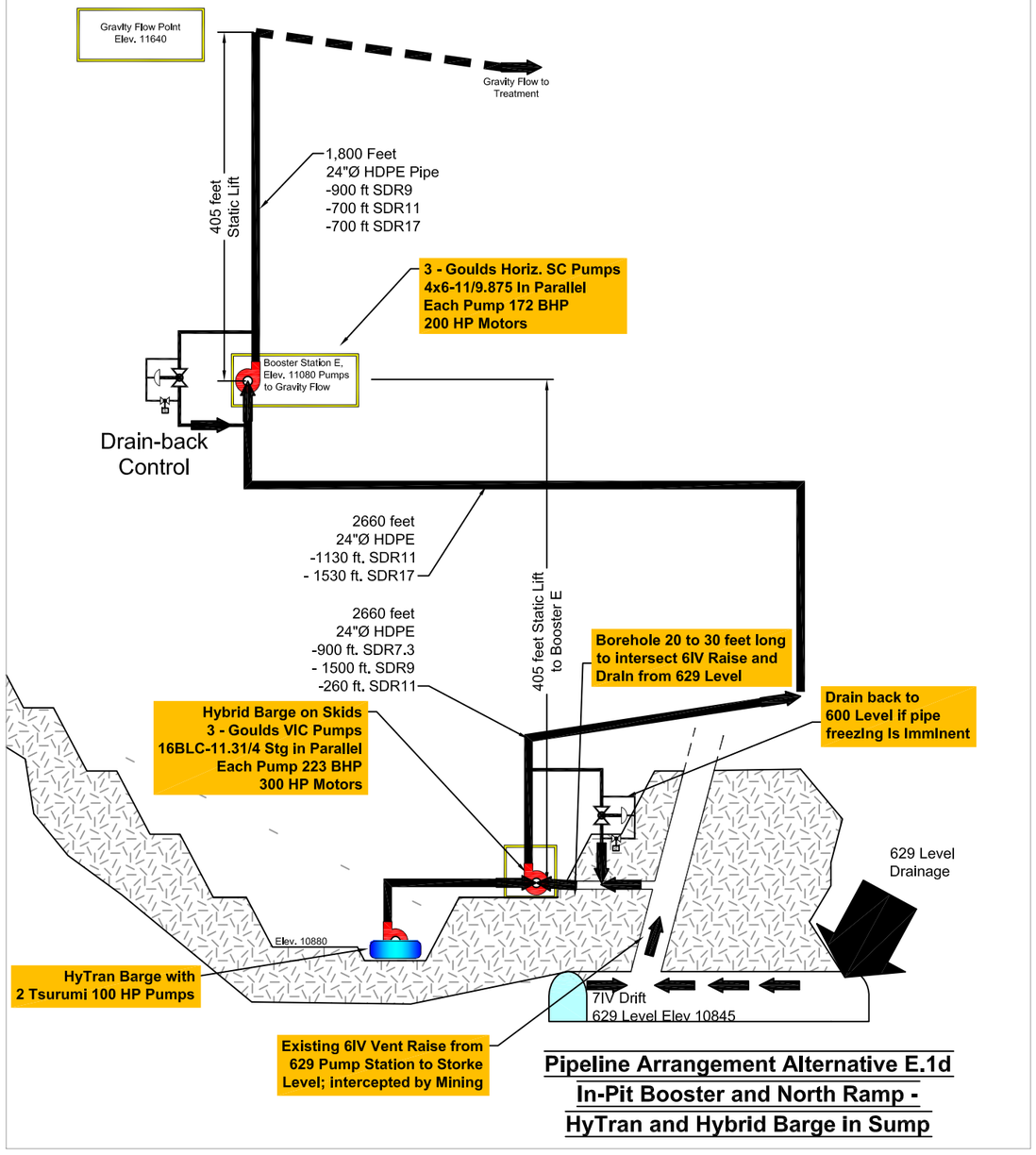
The preliminary design of the pit dewatering system enables post-mining maintenance of the pit lake at any elevation between the final pit sump at the approximate 10,300 elevation and the 11,080 elevation. The booster stations and particularly the Hybrid Booster Station can be moved to any position along the pit haul ramp and therefore to any selected elevation. Upon mine closure, it also may be beneficial to convert the Hybrid Booster Station to a floating barge or a fixed, wet-well pump station by placing it on a flotation structure or concrete foundation.

Attached Drawings

CMDW-2, CMDW-3, CMDW-4, CMDW-5, CMDW-6, and CMDW-12



2 Proposed Pump Control System



1 Pumping System Schematic - Phase I

REVISIONS NO.	DATE	MADE BY	CKD. BY	REMARKS
1	May 2014	SDS		Original Issue
2	August 2014	SDS		Added Drawing Number for Final Publication

PRINT RECORD — ISSUED / REV. NO. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | DRAWING NO.

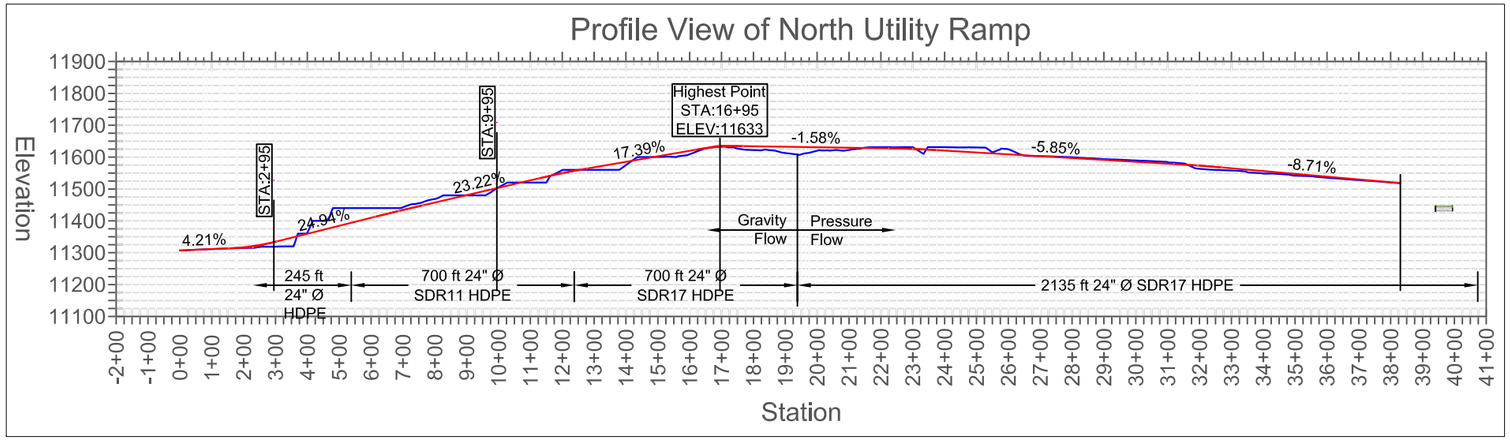
REFERENCE DWGS — DRAWING NO. | REFERENCE

Steffens and Associates, Inc. — Water Resources – Environmental – Mining Engineering — Golden CO 80403 – 303.278.1551 – steffensdm@msn.com
Behrent Engineering Co. — Electrical Engineering — Lakewood CO – 303.985.6888

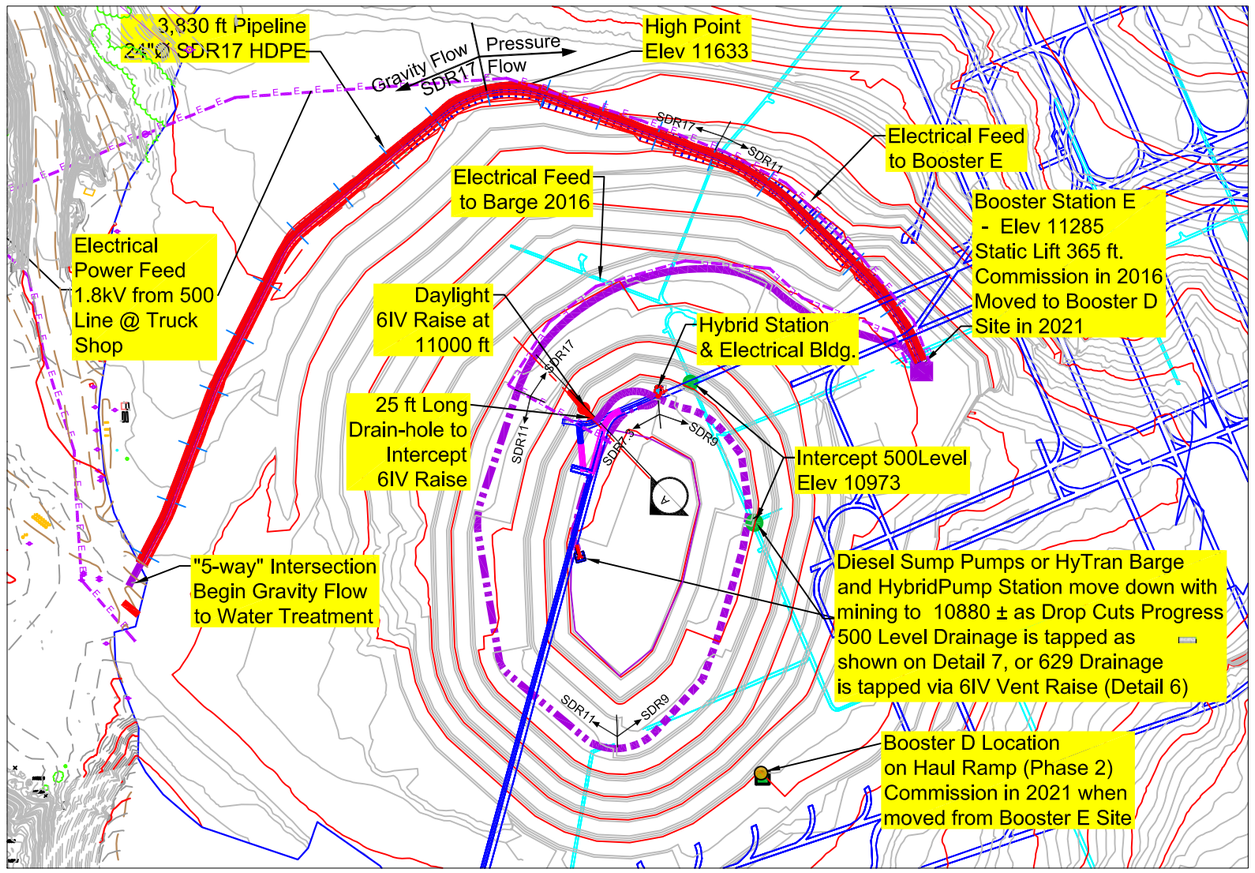
Mine Dewatering Alternatives
Pumping System Before 2019
Mine Phase I - Alternative E.1d
System Schematic and Pump Control

Climax Mine
Climax CO at Fremont Pass

MADE BY		SCALE
VLS/SDS	Sept 2013	None
ACCEPTED BY		DRAWING NO.
...		CMDW-2 1
CHECKED BY		
SDS		



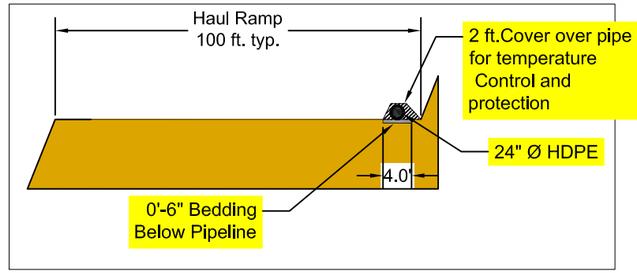
2 Phase I-North Utility Ramp Profile
Profile View
1"=200'



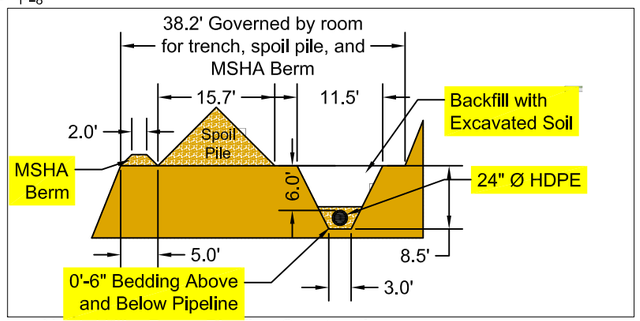
1 Phase I Pipeline Alignments and North Utility Ramp
Plan View
1"=200'

PIPELINE LEGEND

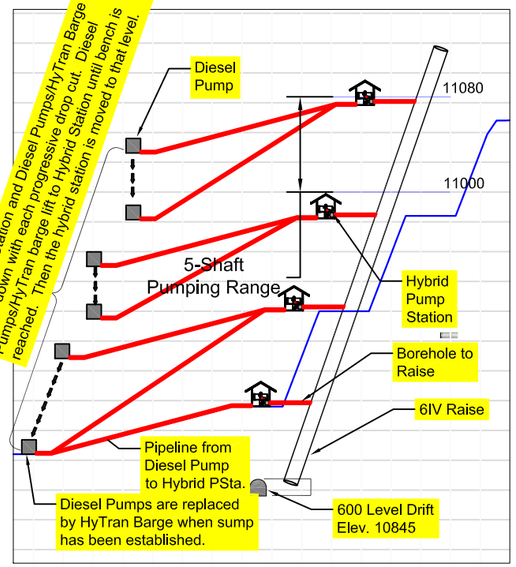
Phase I	Pipe Wall and Pressure Rating
	24"Ø HDPE SDR17 (100 psi)
	24"Ø HDPE SDR11 (160 psi)
	24"Ø HDPE SDR9 (200 psi)
	24"Ø HDPE SDR7.3 (255 psi)



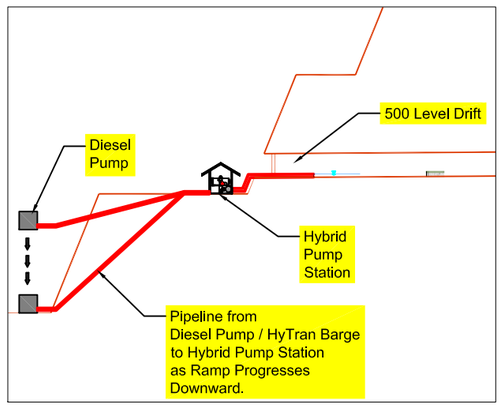
4 Haul Road Pipeline Construction
Section View
1"=8'



3 North Utility Ramp Pipeline Construction
Section View
1"=8'



6 6IVRaise With Respect to Mine Sump - 2016-2019
Section View
No Scale



5 Tap into 500 Level Drainage Drift (Alternative to 6IV Raise)
Section View
No Scale

Steffens and Associates, Inc.
Water Resources - Environmental - Mining Engineering
Golden CO 80403 - 303.216.1101 - steffensinc@msn.com

Behrent Engineering Co.
Electrical Engineering
Lakewood CO - 303.345.8868

REVISIONS

NO.	DATE	MADE BY	CKD. BY	REMARKS
1	September 2013	SDS		Original Concept
2	2/17/2014	SDS		Added Notes for Tapping Into 629 Level drainage via 6IV Vent Drift
3	3/2/14	SDS		Added Electrical Power 13.8 Feeders
4	5/20/14	SDS		Added Details for Connection to Drain Levels. Revised for Exposed Pipelines
5	August 2014	SDS		General clean-up and change drawing number for final publication
6				
7				

PRINT RECORD

ISSUED \ REV. NO.	1	2	3	4	5	6	7	8	9	DRAWING NO.

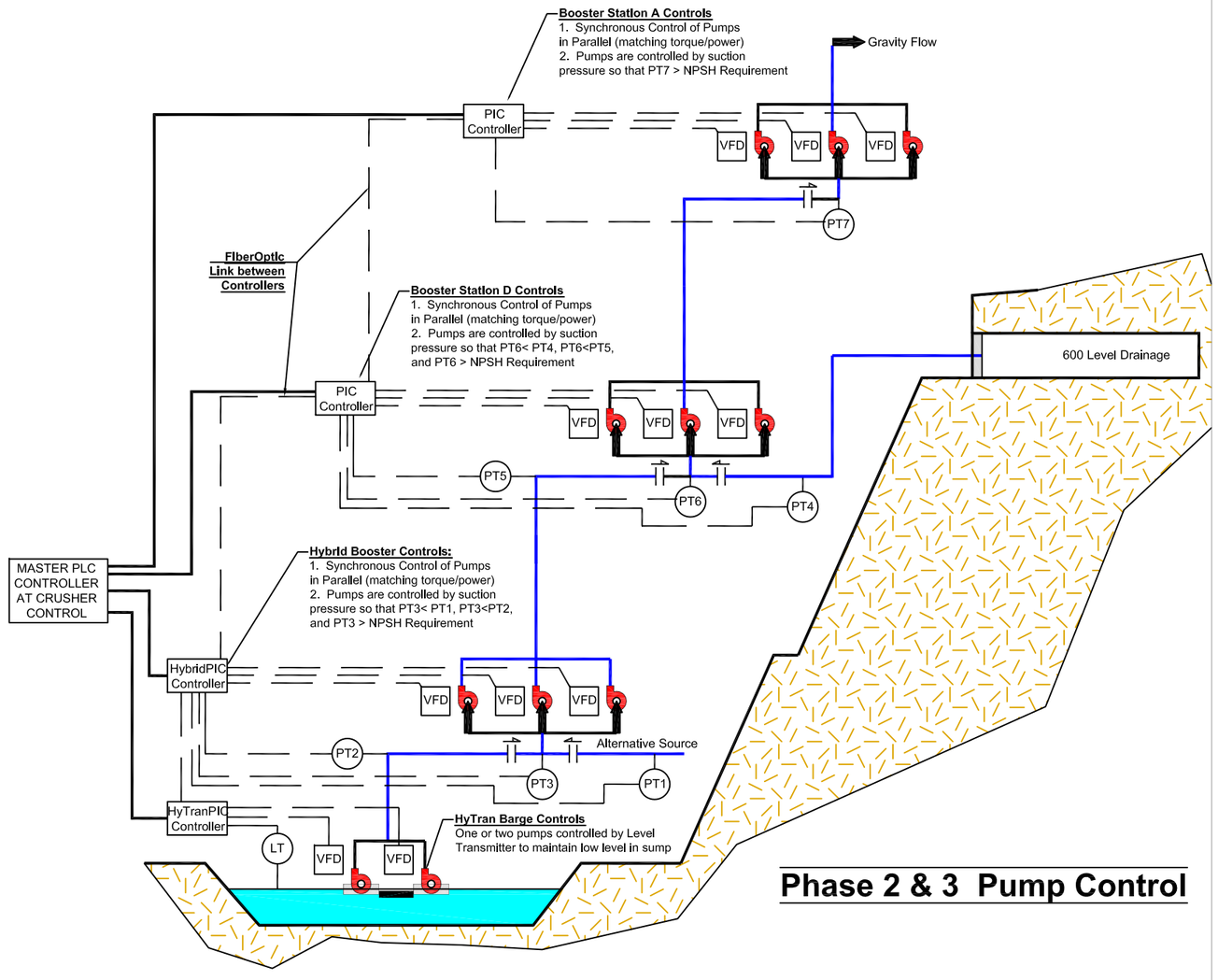
REFERENCE DWGS

DRAWING NO.	REFERENCE
SK1	Pipeline Moves and Replacements
SK4	Phase II Booster Alternatives
SK5	Phase III Booster Alternatives
SK6	Pit Sump Barge-Plan & Profiles
SK7	Booster Station-Pump Building
SK8	Booster Station-Electrical Building
SK9	Booster Station-Site Layout

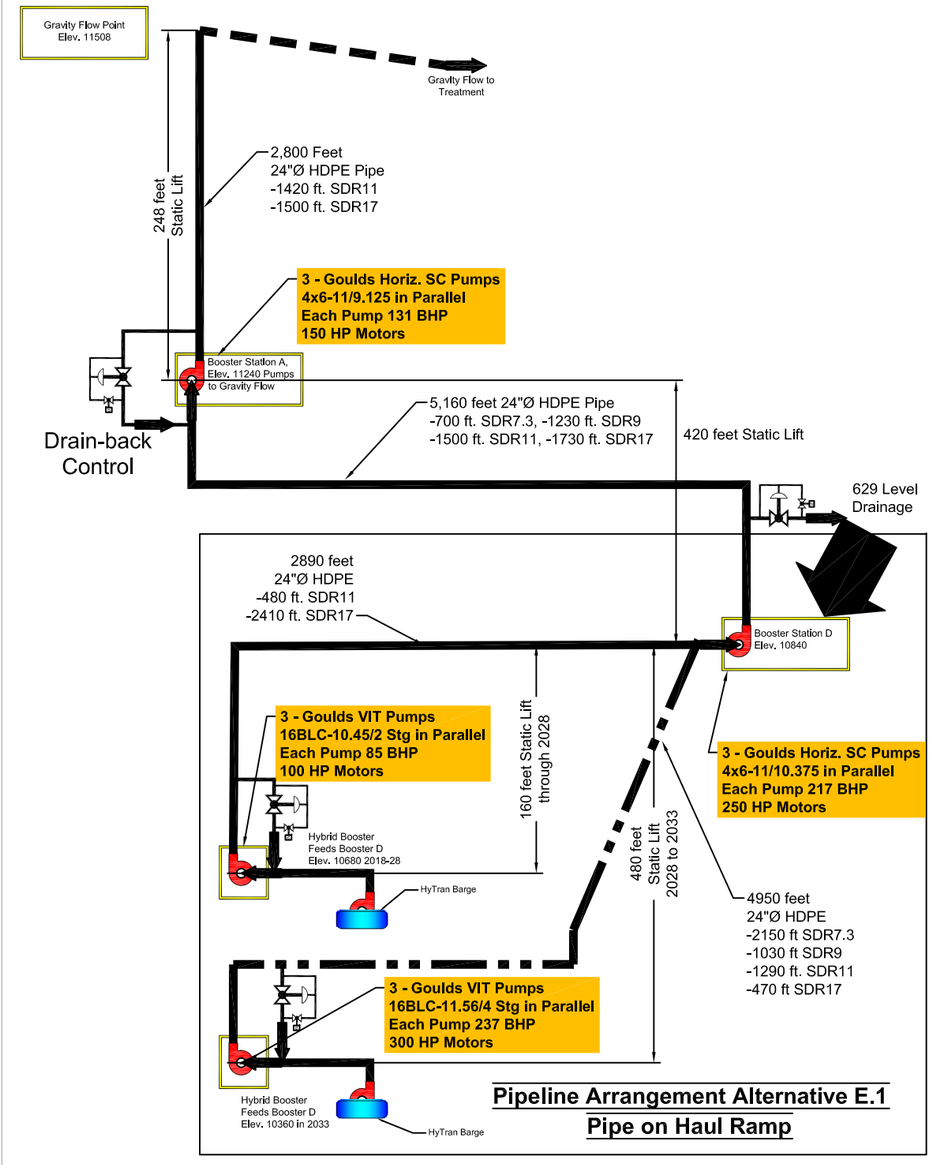
Mine Dewatering Alternatives
Mining Phase I Pumping System
Booster Station E, Hybrid PS, and Pipelines
Plans, Profiles, and Earthwork Volume

Climax Mine
Climax CO at Fremont Pass

MADE BY	SCALE
VLS/SDS	Sept 2013 / Noted
ACCEPTED BY	
...	
CHECKED BY	DRAWING NO.
SDS	CMDW-3 4



2 Proposed Pump Control System



1 Pumping System Schematic - Phase I

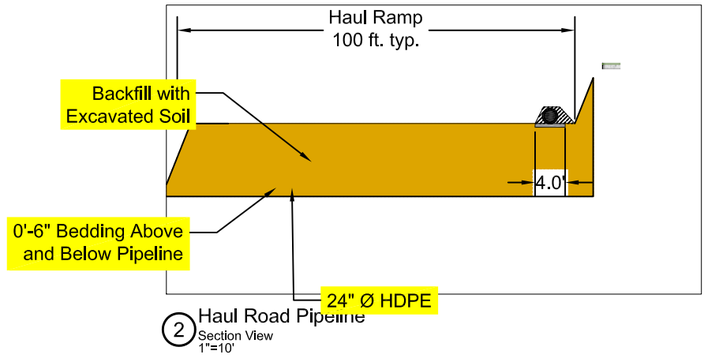
REVISIONS	NO.	DATE	MADE BY	CKD. BY	REMARKS
	1	May 2014	SDS		Original Issue
	2	August 2014	SDS		Added Drawing Number for Final Publication

PRINT RECORD	ISSUED	REV. NO.	1	2	3	4	5	6	7	8	9	DRAWING NO.

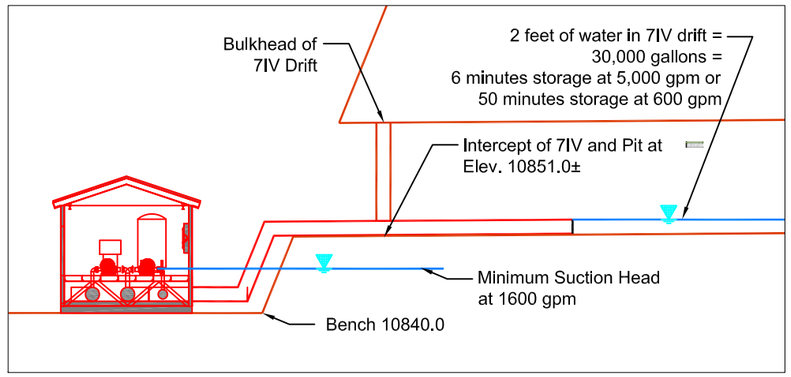
REFERENCE DWGS	DRAWING NO.	REFERENCE

Steffens and Associates, Inc. — Water Resources - Environmental - Mining Engineering — Golden CO 80403 - 303.216.1951 - steffensinc@msn.com
Behrent Engineering Co. — Electrical Engineering — Lakewood CO - 303.940.8950

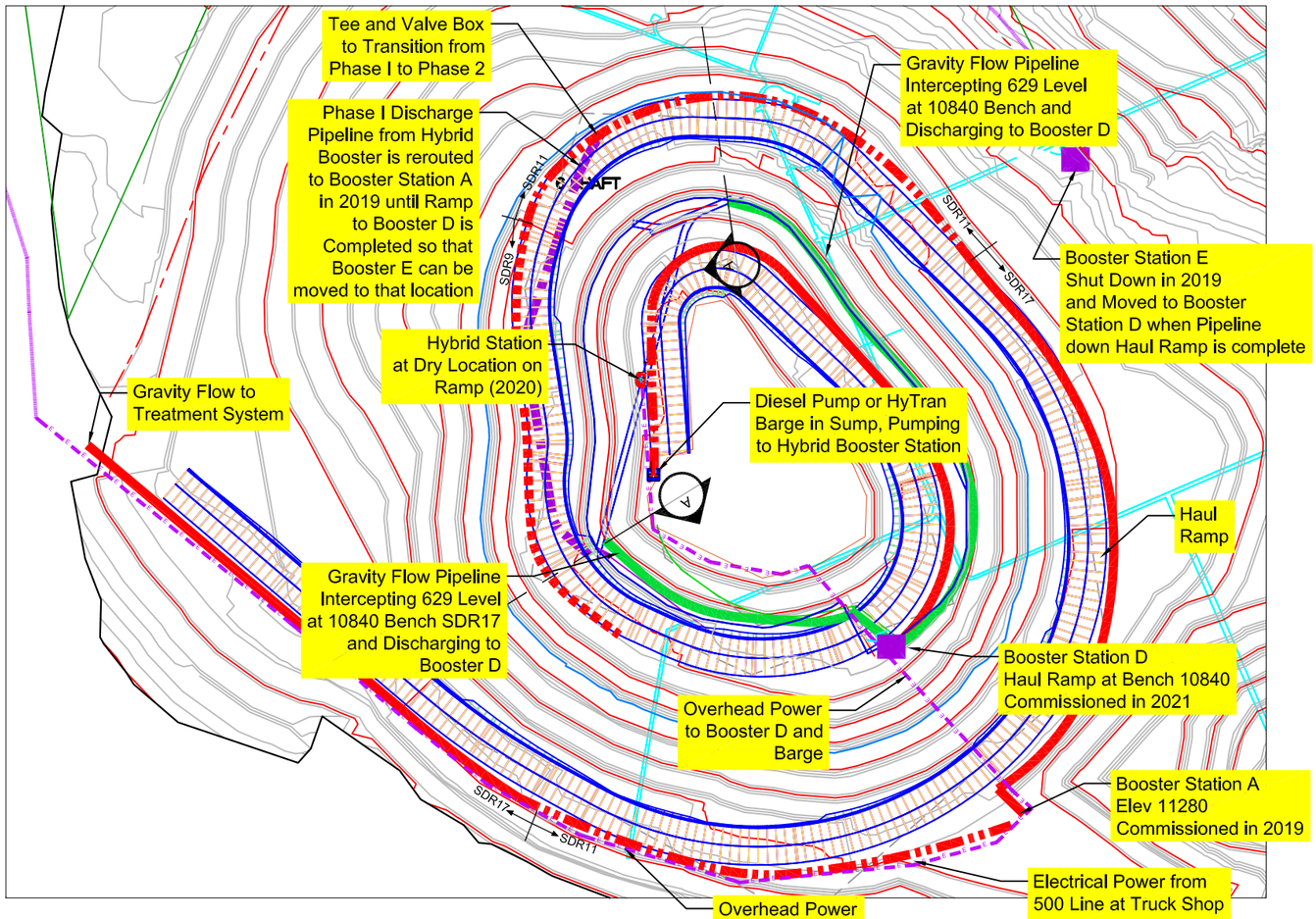
Mine Dewatering Alternatives	Climax Mine — Climax CO at Fremont Pass		
Pumping System After 2019	MADE BY: VLS/SDS	Sept 2013	SCALE: None
Mine Phase I - Alternative E.1d	ACCEPTED BY: ---		DRAWING NO. CMDW-4 1
System Schematic and Pump Control	CHECKED BY: SDS		



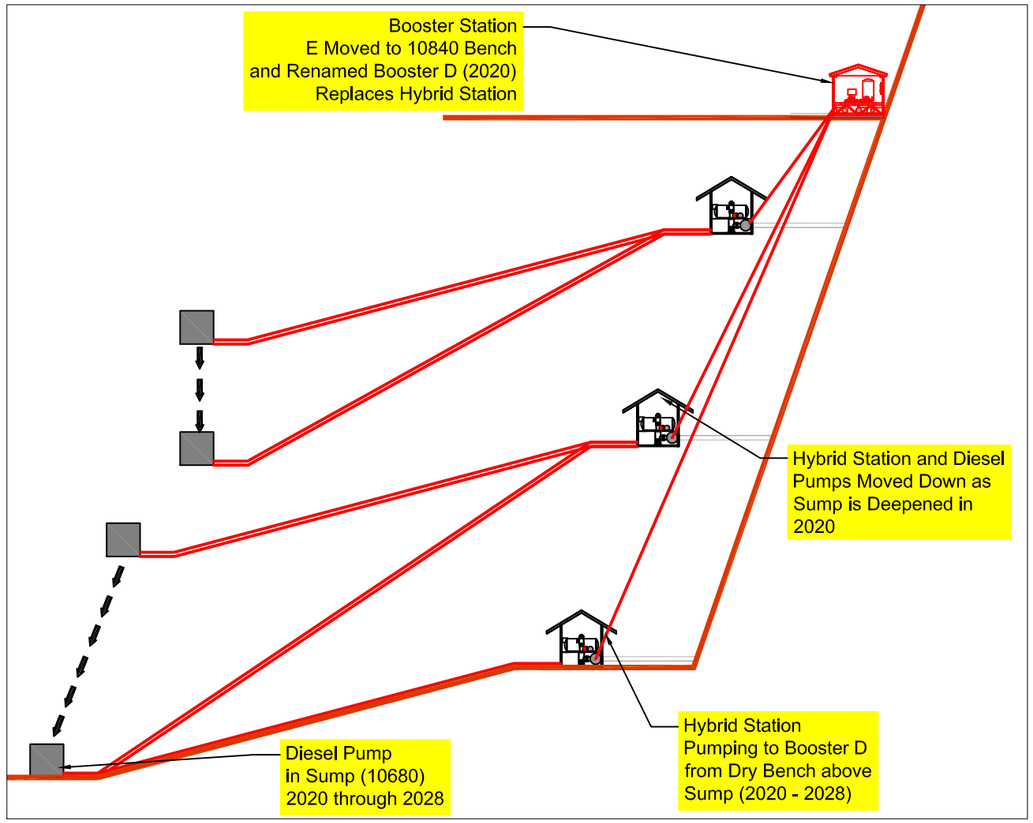
2 Haul Road Pipeline
Section View
1"=10'



3 600 Level Interception
Section A (Two Places)
No Scale



1 Phase 2 Pipeline Alignments
Plan View
1"=200'



4 Sump to 10840 Bench - Phase II
Profile
No Scale

PIPELINE LEGEND

Phase 2	Phase I	Pipe Wall and Pressure Rating
		24"Ø HDPE SDR17 (100 psi)
		24"Ø HDPE SDR11 (160 psi)
		24"Ø HDPE SDR9 (200 psi)
		24"Ø HDPE SDR7.3 (255 psi)

Steffens and Associates, Inc.
Water Resources - Environmental - Mining Engineering
Golden CO 80402 - 303.278.1001 - steffensinc@msn.com

Behrent Engineering Co.
Electrical Engineering
Lakewood CO - 303.985.6060

REVISIONS

NO.	DATE	MADE BY	CKD. BY	REMARKS
1	September 2013	SDS		Original Concept
2	2/17/2014	SDS		Added Notes about Shotcrete & Rock Bolts, Clarified Alternatives E.1 and E.2
3	3/2/14	SDS		Added Overhead 13.8 kV Electrical Power Feed
4	August 2014	SDS		Cleaned up some notes and changed drawing number for final publication
5				
6				
7				

PRINT RECORD

ISSUED \ REV. NO.	1	2	3	4	5	6	7	8	9	DRAWING NO.

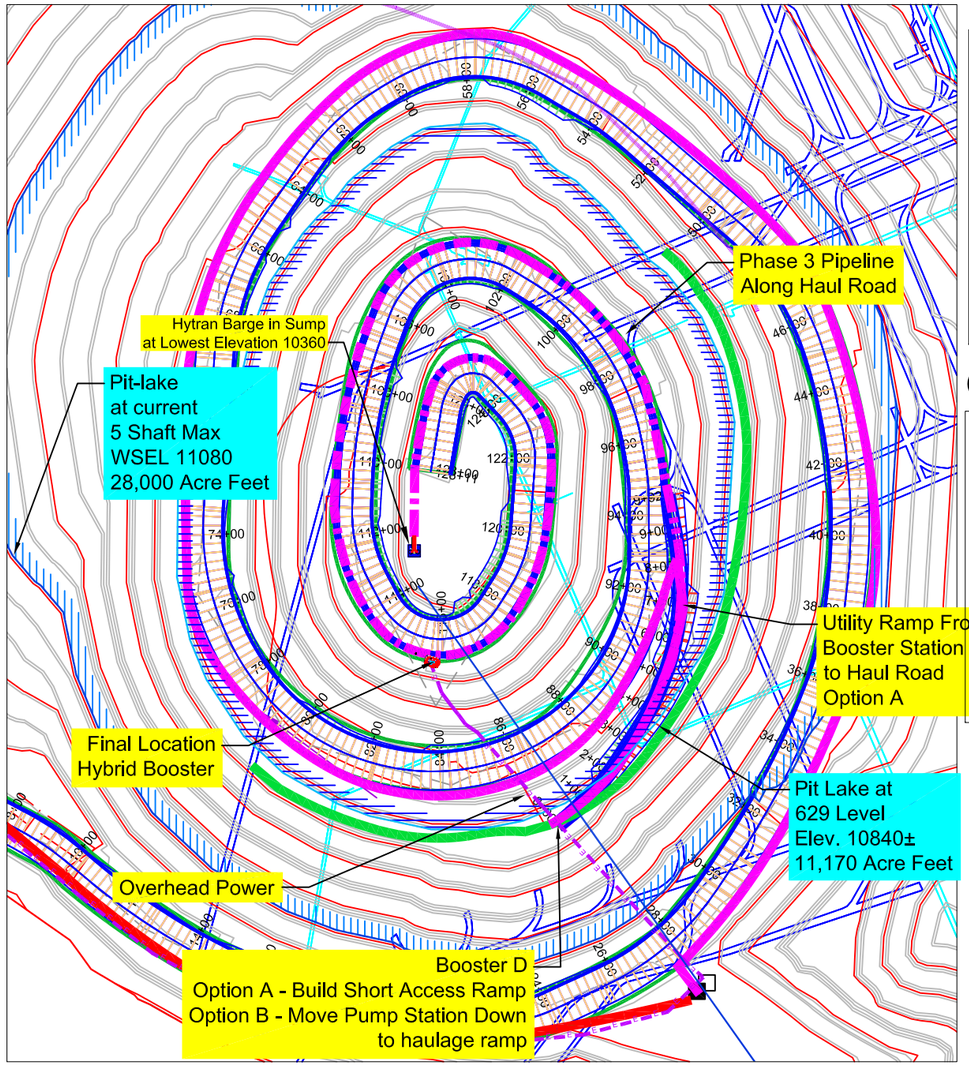
REFERENCE DWGS

DRAWING NO.	REFERENCE
SK1	Pipeline Moves and Replacements
SK4	Phase II Booster Alternatives
SK5	Phase III Booster Alternatives
SK6	Pit Sump Barge-Plan & Profiles
SK7	Booster Station-Pump Building
SK8	Booster Station-Electrical Building
SK9	Booster Station-Site Layout

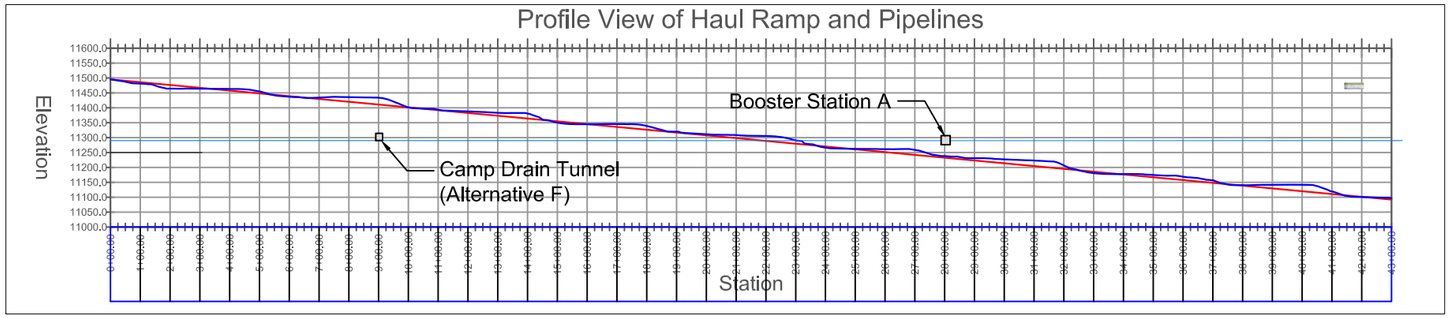
Mine Dewatering Alternatives
Phase II Pumping System
Plans and Profiles
Alternative E.1d

Climax Mine
Climax CO at Fremont Pass

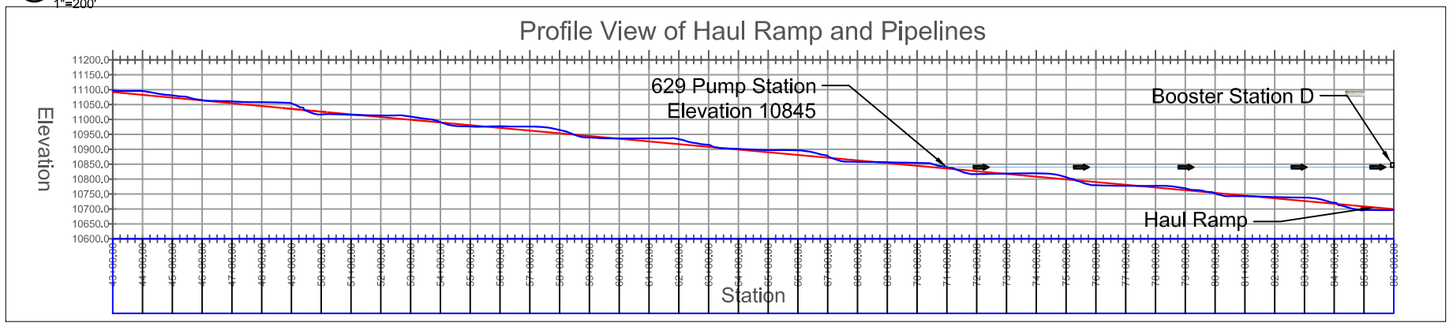
MADE BY		SCALE
VLS/SDS	Sept 2013	Noted
ACCEPTED BY		DRAWING NO.
...		CMDW-5
CHECKED BY		3
SDS		



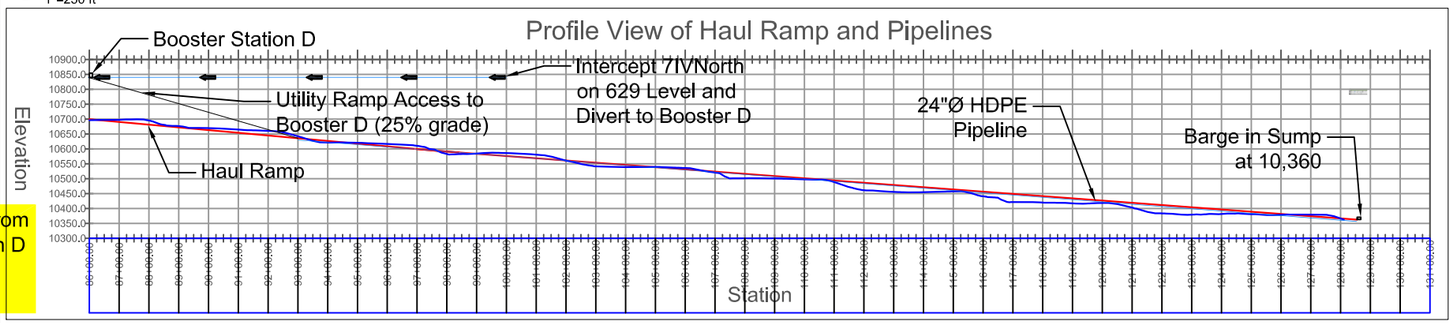
1 Phase 3 Pipeline Alignments and Utility Ramps
Plan View
1"=200'



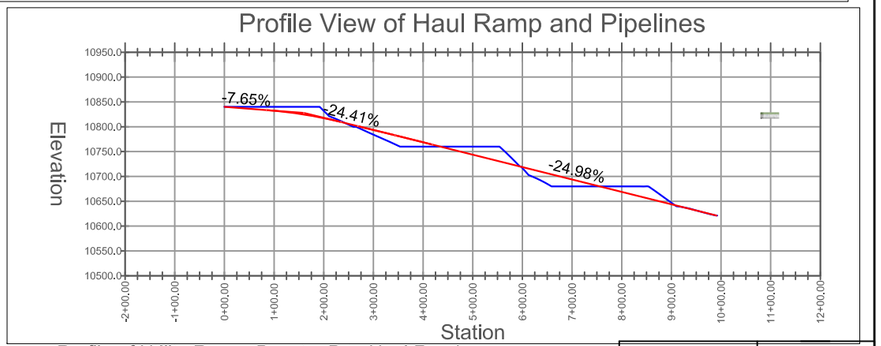
5 Phase 3 - Profile of Haul Ramp - Gravity flow Point to Station43+00
Profile View
1"=200'



4 Phase 3 - Profile of Haul Ramp - Sta. 43+00 to Booster D
Profile View
1"=250 ft



3 Phase 3 - Profile of Haul Ramp - Booster D to Sump
Profile View
1"=200'



2 Profile of Utility Ramp, Booster D to Haul Road
Plan View
1"=200'

PIPELINE LEGEND

Phase 2	Phase 3	Pipe Wall and Pressure Rating
		24"Ø HDPE SDR17 (100 psi)
		24"Ø HDPE SDR11 (160 psi)
		24"Ø HDPE SDR9 (200 psi)
		24"Ø HDPE SDR7.3 (255 psi)

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Electrical Engineering
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REVISIONS

NO.	DATE	MADE BY	CKD. BY	REMARKS
1	September 2013	SDS		Original Concept
2	August 2014	SDS		General Clean-up and change drawing number for final publication

PRINT RECORD

ISSUED / REV. NO.	1	2	3	4	5	6	7	8	9	DRAWING NO.

REFERENCE DWGS

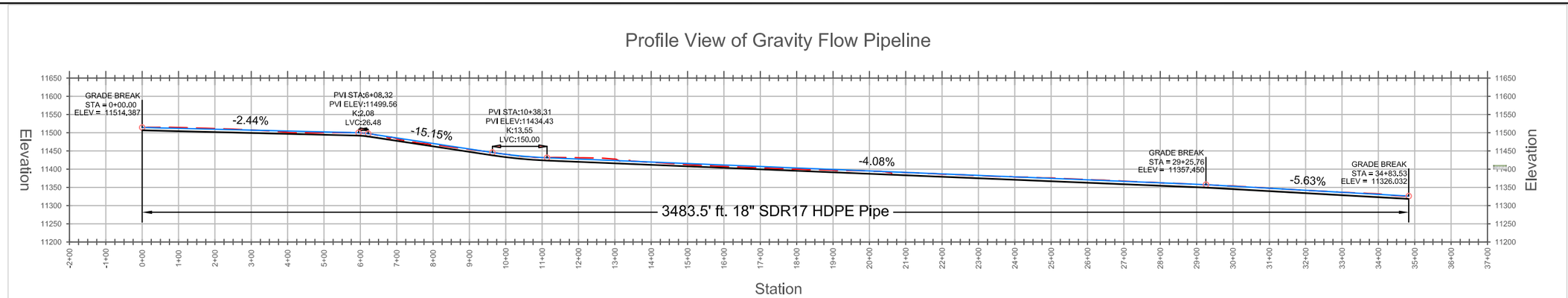
DRAWING NO.	REFERENCE

Mine Dewatering Alternatives
Mine Phase 3 - Pipelines and Pump Stas.
Plans and Profiles
Alternative E.1d - End of Mining

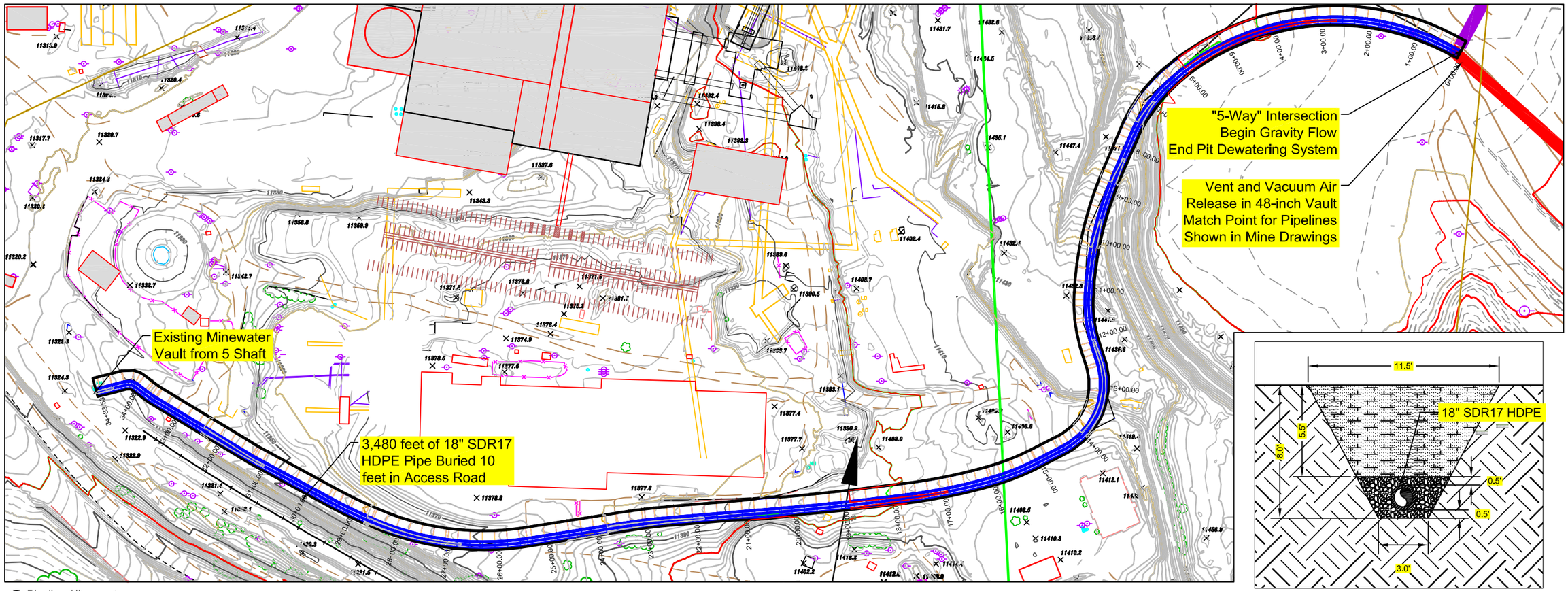
Climax Mine
Climax CO at Fremont Pass

MADE BY	SCALE
VLS/SDS	Sept 2013 / Noted
ACCEPTED BY: ...	
CHECKED BY: SDS	

DRAWING NO. CMDW-6 (1)



2 Pipeline Profile
Profile View
1"=150 ft



1 Pipeline Alignment
Plan View
1"=100 ft

3 Cross-Section of Pipeline Trench
Section
1"=3 ft

Baur & Associates	Steffens and Associates, Inc.	Behrent Engineering Co.
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REVISIONS

NO.	DATE	MADE BY	CKD. BY	REMARKS
1	September 2013	SDS		Original Concept
2	August 2014	SDS		General clean-up and change drawing number for final publication
3				
4				
5				
6				
7				

PRINT RECORD

ISSUED / REV. NO.	1	2	3	4	5	6	7	8	9	DRAWING NO.

REFERENCE DWGS

DRAWING NO.	REFERENCE

Mine Dewatering Alternatives	**Climax Mine** Climax CO at Fremont Pass		
Gravity Flow System to Treatment	MADE BY VLS/SDS	Sept 2013	SCALE Noted
Plan and Profile	ACCEPTED BY •••		DRAWING NO. CMDW-12 1
All Alternatives	CHECKED BY SDS		