GROUND WATER QUALITY DISCHARGE PERMIT UGW170005

STATEMENT OF BASIS

Prolific Mining Corporation
Hanksville, UT

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Introduction

The Division of Water Quality (DWQ) under the authority of the Utah Ground Water Quality Protection Rules [1](Ground Water Rules) issues ground water discharge permits to facilities which have a potential to discharge contaminants to ground water[2]. As defined by the Ground Water Rules, such facilities include mining operations.[3] The Ground Water Rules are based on an anti-degradation strategy for ground water protection as opposed to non-degradation; therefore, discharge of contaminants to ground water may be allowed provided that current and future beneficial uses of the ground water are not impaired and the other requirements of Rule 317-6-6.4.A are met.[4] Following this strategy, ground water is divided into classes based on its quality[5]; and higher-quality ground water is given greater protection[6] due to the greater potential for beneficial uses. DWQ has developed permit conditions consistent with R317-6 and appropriate to the nature of the mined materials, facility operations, maintenance, best available technology[7] (BAT) and the hydrogeologic and climatic conditions of the site, to ensure that the operation would not contaminate ground water.

Basis for Permit Issuance

Under Rule 317-6-6.4A, DWQ may issue a ground water discharge permit if:

1) The applicant demonstrates that the applicable class TDS limits, ground water quality standards protection levels and permit limits established under R317-6-6.4E will be met;
2) The monitoring plan, sampling and reporting requirements are adequate to determine compliance with applicable requirements;
3) The applicant is using best available technology to minimize the discharge of any pollutant; and
4) There is no impairment of present and future beneficial uses of ground water.

Purpose

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[1] Utah Admin. Code Rule 317-6
[2] https://deq.utah.gov/ProgramsServices/programs/water/groundwater/docs/2008/08Aug/GWQP_PermitInfo.pdf
[3] Utah Admin Code Rule 317-6-6.1A
[4] Preamble to the Ground Water Quality Protection Regulations of the State of Utah, sec. 2.1, August, 1989
[5] Utah Admin. Code Rule 317-6-3
[6] Utah Admin. Code Rule 317-6-4
[7] Utah Admin. Code Rule 317-6-1(1.3)

Prolific Mining Corporation (PMC) is evaluating the feasibility of conducting a mining operation in the Bromide Basin in Garfield County, Utah. The project is south of Mt. Ellen on approximately 60 acres of patented claims within the Bromide Basin. Surrounding land uses are unpatented mining claims and Bureau of Land Management (BLM) managed areas.

PMC has been actively exploring the Bromide Basin since 2009, primarily in historic underground mine workings. The host rock is composed primarily of a feldspar porphyry with varying values of quartz and minor amounts of natural metals. The mining objective is to recover four different product streams from the ore:

- magnetics from a Low Intensity Magnetic Separator;
- gravity recoverable heavy minerals;
- bulk flotation concentrate consisting of sulfide minerals, oxide minerals and silicates; and
- clean feldspar (plant tailings).

Each of these product streams are collected with the intent of developing a process to produce saleable, value added concentrates, metals or spec feldspar, thereby not generating any waste rock to remain on-site.

Beginning in 2017, PMC subcontracted a drilling company to collect data to generate a 3-dimensional model of the ore body that will guide future mining activities, including the site plan and layout moving forward.

A proof of concept mill has been constructed on-site to process existing ore stockpiles to develop the processes generating the products listed above. If successful, it is anticipated a full-scale mill will be constructed off-site for long-term mining operations. The exploratory drilling program is anticipated to continue through the end of 2018. While the exploratory phase of this project is occurring, active mining and milling are not taking place.

Ground Water Discharge Permit UGW170005 is being issued to establish requirements for construction plans, specifications, BAT performance standards, mine operation and monitoring, and closure procedures for all activities at the site that have the potential to impact ground water. A compliance schedule is included in Part I.J of the permit establishing deadlines and summarizing requirements for each submittal.

New Facilities

New facilities anticipated to be constructed under this Permit include a process water pond serving the proof-of-concept mill, and mining operations. Plans and specifications for these projects are required to be submitted under the compliance schedule, Part I.J of the permit. Ancillary facilities that may be necessary to support mining operations in the future will require a modification to the permit as needed.

BAT Performance Monitoring

Best available technology monitoring will be established after review of the construction drawings and specifications submitted for each facility, and in the BAT Monitoring Plan required under Part I.J.4 of the permit.

Potential Impacts to Ground Water

The Division of Water Quality will provide periodic onsite inspections during construction and operation of the mine activities. Monitoring of surface water in Crescent Creek as well as flows from three historic mine adits will establish baseline water quality monitoring until ground water monitoring wells have been established per the Mining Operation and Monitoring Plan required under Part I.J.3 of the permit.

Geologic Description

There is limited information available for the stratigraphy near the Prolific Mine. There are no groundwater wells or reliable borehole information in an approximate 10 to 20-mile radius. It is assumed, based on regional geology, that the lithology is intrusive rock followed by the Mancos Shale Formation, Morrison Formation, Summerville Formation, Entrada Formation, and the Carmel Formation. Below is a discussion of the regional sedimentary layers beginning with the youngest formations or units:

- Generally, the Henry Mountain intrusion is composed of Diorite Porphyry stocks, byamaliths and sills. The Diorite occurs as a light gray igneous rock, medium to fine grained with occurrences of xenoliths and quarts/magnetite veins. The age of the rock is 1.2 to 1.5 million years old and the depth varies depending on the location. In the Bromide Basin, the thickness of the intrusive rock is approximately 1,000 to 1,500 feet thick.
- The Mancos Formation is composed of five members; Masuk, Emery Sandstone, Blue Gate, Ferron Sandstone and Tunuk. The units are generally composed of alternating layers of carbonaceous and sandy shale and thin to thick-bedded sandstone. The Mancos formation is approximately 2,800 to 3,700 feet thick.
- The Dakota Sandstone varies as friable to quarzitic coarse grains and fluvial sandstone with minor interbedded carbonaceous shale and impure coal. The thickness ranges from 0 to 125 feet thick, but mainly occurs as discontinuous lenses.
- The Morrison Formation is composed of two members named the Brushy Basin Shale and the Salt Wash Sandstone. The Brushy Basin Shale is composed of bentonitic mudstone with cross-bedded sandstone and conglomerate lenses. The Salt Wash Sandstone is cross-bedded fine to coarse grained sandstone with thin interbedded conglomerates and massive gypsum at some locations. The Morrison Formation is approximately 0 to 400 feet thick, but near the Henry Mountains the occurrence is closer to 200 feet thick.

- The Summerville Formation is composed of thin bedded siltstone, mudstone and sandstone. The approximate thickness is 100 to 300 feet which extends around the Henry Mountains.
- The Entrada Sandstone is a thick bedded fine-grained sandstone with a substantial amount of clay and ranges in thicknesses from 300 to 800 feet.
- The Carmel Formation in this region is primarily limestone with interbedded siltstone and sandstone approximately 200 to 250 feet thick.
- The Navajo Sandstone surrounding the Henry Mountains at surface is not very prominent until some distance away. The structure contours of the Navajo Sandstone indicate it is at depth in the Bromide Basin of approximately 6,000 feet below ground suface (Weiss 1987). The Navajo Sandstone is mainly comprised of fine grained eolian sandstone with a calcareous cement.

Hydrogeology

The Henry Mountains surrounding Mt. Ellen and the Bromide Basin are in a hydrological area of approximately 1,000 square miles, bounded by Escalante Canyon on the west, the Fremont and the Dirty Devil Basin on the east and northeast, and the Colorado River on the south.

The climate in the area ranges from arid to semiarid. At lower altitudes, annual precipitation is less than 6-inches/year; in the mountains the annual precipitation can exceed 20-inches per year. Precipitation is quite variable; some snow or rain results from winter storms in November through April; and the rest results from summer thunderstorms (Weiss 1987).

There is very little hydrologic or hydrogeologic information for the Prolific Mine area of the Bromide Basin. However, recent exploration activities in the Bromide Basin have identified certain localities of groundwater approximately 80 feet bgs and 600 feet bgs in separate fracture zones.

Regionally, the Morrison, Entrada and Navajo Formations contain principal aquifers within the Mt. Ellen and Bromide Basin; the Navajo Sandstone is the most significant and deeper aquifer system. The three formations are underlain with less permeable layers which include shales, silicified sandstones, metamorphosed rocks and other intrusive formations which create artificial perched aquifers and frequent spring horizons at or near the impermeable layers. The Summerville Confining unit underlies the Morrison Formation, the Carmel Formation underlies the Entrada Sandstone, and the Chinle Formation underlies the Navajo Formation, part of the Glen Canyon Group (Blanchard, 1986).

For most of the region surrounding the Henry Mountains, faulting and folding are considered the main factors affecting hydraulic conductivity in the area. The intrusive rocks underlying the Henry Mountains create impermeable boundaries, and the sandstones are upturned and probably unsaturated except on the lower part of the domes (Blanchard, 1986). Fractures in the Henry Mountains area are common in the groundwater-containing formations and affect water infiltration and inter-formational water movement (Weiss, 1987). Locally, on the east-northeast facing slopes of the Henry Mountains where Bromide Basin is situated, groundwater movement is assumed to follow with local topography and near-surface intrusive formations, moving away from the peaks (Blanchard, 1986), and generally to the southeast.

The headwaters of Crescent Creek begin in the Bromide Basin at nearly 10,800 feet above mean sea level. Crescent Creek flows in an easterly direction in the basin bottom following the topography. Crescent Creek continues to flow out of Bromide Basin, onto alluvial/fluvial sediments near the base of the mountains; the creek continues in an easterly direction and eventually flows over the steeply dipping Mancos Shale, Dakota Sandstone, Morrison Formation, Summerville and the Entrada Sandstone respectively. Crescent Creek flows year-round but is frozen in the winter months at higher elevations; and flows at low volumes near the base of the mountains. During the spring months, Crescent Creek flow is at its highest due to snow melt between March and June.

In the Henry Mountains area, the Navajo sandstone is the most utilized aquifer, and most of the wells in the area are completed in the Navajo sandstone, although the Entrada sandstone is also utilized (Blanchard, 1986). The estimated saturated thickness of the Navajo varies from 250 to 1,000 feet. The saturated thickness of the Wingate is estimated at 250 feet. The hydraulic conductivity is estimated at 3-3.5 feet/day in the Navajo, 1 foot/day in the Wingate, and less than 1 foot/day in the Entrada (Blanchard, 1986). The aquifer storage varies with the saturated thickness and is estimated between 16,000 and 64,000 acre-feet per square mile (Blanchard, 1986).

Recharge to the aquifer occurs by infiltration of precipitation into the aquifer from areas where the permeable formations are exposed at the surface. Recharge of the sandstones in the Henry Mountains area occurs by downward movement of water from overlying formations on the flanks of the mountains, where those formations are significantly fractured (Weiss, 1987 and Blanchard, 1986).

Ground Water Quality

Ground water in the area is not classified. Until ground water monitoring wells have been installed to collect site-specific data, DWQ assumes the uppermost aquifer is Class IA pristine ground water as defined in UAC R317-6-3.

A total of five surface sampling locations have been identified in Part I.C of the permit to be used as monitoring locations until wells are installed. Two of the sampling locations are located in Crescent Creek, which flows through the area, and three sampling locations monitor flow from historic mine adits, and are believed to represent shallow ground water at the site. As required in Part I.J.6 of the permit, an accelerated background monitoring program will be completed by the permittee to collect data for calculating monitoring location-specific background water quality statistics. After securing Director approval of the Accelerated Background Monitoring Report, background concentrations may be adjusted in accordance with the reopener provision in Part IV.N of the permit.

Class IA Protection Levels. In accordance with UAC R317-6-4.2, Class IA ground water will be protected to the maximum extent feasible from degradation due to facilities that discharge or would probably discharge to ground water. Class IA protection levels are established in accordance with the following criteria in UAC R317-6-4.2B:

a. Total dissolved solids (TDS) may not exceed the greater of 1.25 times the background concentration or the background plus two standard deviations.

b. When a contaminant is not present in a detectable amount as a background concentration, the concentration of the pollutant may not exceed the greater of 0.1 times the ground water quality standard, or the limit of detection.

c. When a contaminant is present in a detectable amount as a background concentration, the concentration of the pollutant may not exceed the greater of 1.25 times the background concentration, 0.25 times the ground water quality standard, or background plus two standard deviations; however, in no case will the concentration of a pollutant be allowed to exceed the ground water quality standard.

Compliance Schedule

1. 90-days prior to operating the onsite proof of concept mill, but no later than December 31, 2018, PMC shall submit a Closure Plan for the two existing unpermitted process water ponds for Director review and approval.

2. 90-days prior to operating the onsite proof of concept mill, PMC shall submit an application for a construction permit for a process water pond in accordance with R317-1-2.

3. 180-days prior to conducting mining operations, PMC shall submit a Mining Operation and Monitoring Plan for Director review and approval.

4. BAT Monitoring Plan. The Permittee shall submit a BAT monitoring plan for Director review and approval prior to commencement of mining activities or construction of any facilities described in this permit. The plan will include all procedures and methods sufficient to establish BAT performance standards for each operation listed in Part I.D of the permit.

5. Water Quality Monitoring and QA/QC Plan. The Permittee shall submit a Water Quality Monitoring and QA/QC Plan for Director review and approval within 180-days of the effective date of this permit.

6. Accelerated Background Monitoring Program and Report

   The Permittee shall conduct an accelerated background monitoring program by collecting at least eight samples from each monitoring location over a one-year period to determine background water quality and variability of the laboratory water quality parameters listed in Part I.F.1.d. of the permit.

7. Closure Plan – at least one year prior to ceasing mining operations, the Permittee shall submit for approval by the Director a Final Closure Plan that addresses all aspects of mine closure that are related to or have an impact on water quality including, but not limited to, removal and reclamation of process water ponds, management of ground water in mine workings, ground water monitoring after site closure, capping of acid generating waste rock, etc.

References

Blanchard, Paul., 1986, *Ground-Water Conditions in the Lake Powell Area, Utah*: US Geological Survey

Weiss, Emanuel,. 1987, *Ground-Water Flow in the Navajo Sandstone in parts of Emery, Grand, Carbon, Wayne, Garfield, and Kane Counties, Southeast Utah*, U.S. Geological Survey