GROUND WATER QUALITY DISCHARGE PERMIT UGW270010

STATEMENT OF BASIS

Magnum Gas Storage, LLC
Holladay, UT

April 2018

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.

---

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)

Purpose

Magnum Gas Storage, LLC (Magnum) is constructing a natural gas storage facility in Millard County, Utah approximately 10 miles north of Delta. The Project entails solution mining natural gas storage caverns in a subsurface salt deposit for the purpose of storing natural gas. The resulting brine from the solution mining process is stored for evaporation in above ground earthen ponds with an operating volume of approximately 11,200 acre-feet. The Project lies within an approximately 321-acre site located on Utah School and Institutional Trust Lands Administration (SITLA) lands.

Ground Water Discharge Permit UGW270010 is issued to authorize the construction of two brine evaporation ponds and the installation of additional unconfined water table aquifer compliance monitoring wells. Magnum Gas Storage is the operator of the solution mining facility.

New Facilities

The following new facilities will be regulated under this Permit including the associated Best Available Technology (BAT), Protection Levels (Table 2) and requirements for monitoring: Brine Evaporation Ponds 3 and 4.

The pond footprint area three feet below the crest of the berm is approximately 152 acres in Brine Pond 3 and 125 acres in Brine Pond 4. The brine evaporation ponds are constructed using a combination of excavation into the ground surface and the construction of elevated berms. Berms would have an external height of 51 to 57 feet above the ground level, with internal excavation depths of 31 to 67 feet, depending on undisturbed land contours.

The brine evaporation ponds are constructed with a composite liner system consisting of and 80-mil high density polyethylene (HDPE) liner primary liner and a 60-mil high density polyethylene secondary liner. The liners will be separated by either 130-mil raised drainage studs or a 250-mil geonet geomembrane layer drainage gap between the primary and secondary HDPE liners to route leakage to a sump.

Each pond will have two leak detection recovery systems. The Leak Collection Recovery System (LCRS) sumps will collect any water between the primary and secondary liners and pump it to the pond surface. The Process Component Monitoring System (PCMS) – collection piping and a leak detection sump will be constructed in the soil under the secondary liner of the brine evaporation pond. The brine ponds are designed as a zero-discharge system; both the LCRS and PCMS sumps and pumps are designed to capture and return the maximum calculated leakage flow rates back to the surface of the brine ponds.

BAT Performance Monitoring

Best available technology monitoring will include minimum vertical freeboard and maximum allowable leakage rate monitoring. These performance standards are based on the precedence of previous ground water discharge permits and *Action Leakage Rates For Leak Detection Systems* (USEPA, Office of Solid Waste, January 1992).

Minimum Vertical Freeboard. A minimum of 36 inches of vertical freeboard shall be maintained to ensure total containment of solution mining liquids.

Maximum Allowable Leakage Rate. The leak detection system is the primary compliance monitoring point because it is the early warning system that demonstrates protection of ground water quality. The estimated maximum liner leakage rate was established by standard engineering practice using the method described in *Equations for Calculating the Rate of Liquid Migration through Composite Liners due to Geomembrane Defects* (Giroud, 1997). Based on a pond water surface area of approximately 152 acres, the maximum allowable leakage rate through the primary HDPE liner is 441 gallons per minute for Brine Pond 3 and 359 gallons per minute for Brine Pond 4 (125 acres water surface area).

Maximum Allowable Head. The maximum allowable head imposed on the secondary HDPE liner and leak detection sump will be determined following system construction. Any fluids collected in the leak detection sump will be pumped back to the brine evaporation pond. As long as the leak detection system complies with the BAT performance standards of the permit, the facility is compliant. In the event that the leak detection system has flows or heads that exceed the BAT performance standards of the permit, a BAT failure exists and the permittee will be required to regain BAT by a number of solutions including identifying and repairing the BAT failure..

Potential Impacts to Ground Water

Potential impacts to ground water have been minimized by employing best available technology for the brine evaporation ponds. The Division of Water Quality will provide periodic onsite inspections during construction and operation of the facilities described above. The Brine Evaporation Pond Operating will ensure that the facility is operated in accordance with design specifications and will also ensure that any early indications of facility problems will be detected early and resolved. In addition to BAT performance monitoring, ground water quality monitoring of the water table aquifer will be conducted in monitoring wells to determine if ground water quality has been impacted by leakage from the brine evaporation ponds.

Geologic Description

Regional. The brine evaporation ponds are situated over a subsurface salt deposit in the Sevier – Black Rock Desert in the Basin and Range physiographic province of Utah. The mountains that surround the basin of the Sevier Desert are composed of a variety of consolidated sedimentary, metamorphic and igneous rock. The basin is underlain by deposits that consist primarily of semi-consolidated and unconsolidated sediments of Tertiary and Quaternary age. The basin-fill includes sand, silt, clay and gravel deposited as alluvial fans, stream alluvium, mudflows, lacustrine (lake) sediments and deltas. The basin fill also contains scattered basalt flows and tuffs of late Tertiary and Quaternary age. Tertiary and Quaternary basin-fill deposits are over 7,000 feet thick. Oligocene and Miocene basin-fill sediments contained evaporate deposits. Through time, evaporites in the area flowed to form a salt dome.

The soil profile at the site consists of three units. The upper unit is comprised of fine-grained glacial lacustrine deposits consisting of deep-water calcareous silts and may contain younger alluvium up to 10 feet thick. The upper unit is underlain by pre-Lake Bonneville alluvium consisting of sand and sandy gravel beds. The lower unit consists of alluvium, silt and sandy silt deposited in large low-gradient alluvial fans, river terraces, and abandoned river channels on the river delta. This unit ranges up to 30 feet in thickness.

Hydrogeology

The principal regional groundwater system is the unconsolidated basin-fill deposits that formed from erosion of the surrounding mountains and were laid down by streams, lakes, and mudflows. These regional deposits consist of interbedded and lenticular deposits of clay, silt, sand, gravel and boulders. The regional depositional processes created alternating and interfingering layers and lenses with regional horizontal and vertical heterogeneity. Differences in sorting and grain size influence local permeability and storage capacity, which can vary greatly depending on the nature of local depositional processes. Sediments are generally coarser near the mountain front and grade finer towards the valley centers. Stream channel deposits are coarser and better sorted than alluvial fan and mudflow deposits that generally occur at the base of steep drainages. Vast lakes that occupied the valleys many thousands of years ago deposited interbedded clay and finegrained sands. Rivers flowing into these lakes formed coarse-grained delta deposits near the ancient lake shore, such as near the mouth of Leamington Canyon.

Recharge to the principal groundwater aquifer system (basin-fill deposits) in the Sevier Desert occurs by stream infiltration along mountain fronts, subsurface inflow from consolidated rocks of mountain areas, subsurface inflow from adjoining basins, seepage from rivers, canals, reservoirs and unconsumed irrigation. Groundwater generally flows from recharge areas near the mountains on the northeast and east of the Sevier Desert toward discharge areas in the central and western parts of the area.

Aquifers in the area have been clearly defined using data collected during the installation of multiple wells constructed in the region around the Magnum site, including Magnum's MH-1 Test Well (constructed in 2009). The unconfined water table aquifer is located above the shallow artesian aquifer and is generally confined to the upper 50 to 150 feet, the shallow artesian aquifer to depths of about 150 to 700 feet, and the deep artesian aquifer between about 700 to 1,400 feet (the bottom of historically drilled wells). A previously undefined deeper confined aquifer (defined as the basement aquifer) is located at depths greater than 1,400 feet.

Ground Water Quality

Ground Water Classification. In accordance with UAC R317-6-3.5 and ground water quality data provided in the permit application which includes ground water in in area waters source wells and nearby groundwater compliance wells, is classified as Class II Drinking Water Quality Ground Water in the deeper aquifers. The shallow water table aquifer underlying the evaporation ponds has not been tested yet. As required in Part I.H.1 of the permit, an accelerated background monitoring program will be completed by the permittee to collect data for calculating well-specific background ground 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 II Protection Levels. In accordance with UAC R317-6-4.5, Class II ground water will be protected for use as drinking water or other similar beneficial use with conventional treatment prior to use. Class II 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 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.

c. 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 0.25 times the ground water quality standard, or the limit of detection.

COMPLIANCE SCHEDULE

- Ground Water Compliance Sampling in new wells

  Compliance Monitoring wells shall be installed in accordance with R317-6-6.4.C.2 and R317-6-6.9A. The purposes of the Compliance Monitoring Wells include (i) obtaining additional baseline data regarding the aquifers, hydrogeological conditions, and background water quality; and (ii) establishing suitable points of compliance for the Permit.

- Final Closure Plan. In the event that the permittee decides to discontinue its operations at the facility the permittee shall notify the Director of such a decision and submit a Final Closure Plan within 180 days prior to the closure of the facility.

Permit Application Documents

The following documents are considered part of the ground water quality discharge permit application and will be kept as part of the administrative file.

1. Magnum Gas Storage Brine Evaporation Ponds #3 and #4 Ground Water Discharge Permit Application Supporting Documents, prepared and submitted Magnum Gas Storage and ATC Group Services, November 17, 2017.
2. Underground Injection Control Permit UTU-27-AP-718D759, issued to Magnum Solution Mining, LLC, by Erica Brown Gaddis, Director of the Utah Water Quality Board, October 30, 2017.