GCC Energy
"Safety as a Value"
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GCC Energy, LLC
6473 County Road 120
Hesperus, CO 81326

December 29, 2017

State of Colorado
Division of Reclamation, Mining & Safety
1313 Sherman St.

Attn: Rob Zuber, Environmental Protection Specialist II

Re: Permit #C-1981-035, King II Mine
Annual Hydrologic Report 2017

Dear Mr. Zuber,

Please find enclosed "2017 King I & II Mines Annual Hydrology Report to the Colorado Division of Reclamation, Mining & Safety", for water year 2017, prepared by Resource Hydrogeologic Services, Inc. of Durango, Colorado.

Please contact Tom Bird at 970.385.4528 x 6503, or Sarah Vance at 505.286.6026, with questions or comments.

Sincerely,

Tom Bird

Manager of Coal Services
GCC Energy, LLC

2017 King I & II Mines Annual Hydrology Report to the Colorado Division of Reclamation, Mining & Safety

Submitted to:
GCC Energy, LLC

Date:
December 26, 2017

Resource Hydrogeologic Services, Inc.
101 W. 11th St. #103
Durango, CO 81301
Tel: (970) 764-4920
Email info@resourcehydrogeologic.com

RESOURCE HYDROGEOLOGIC SERVICES

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INTRODUCTION

The Annual Hydrology Report is completed at the conclusion of each year to compile and interpret hydrologic data related to GCC Energy's King I and II Mine operations. This satisfies a requirement of the Colorado Department of Reclamation, Mining and Safety (CDRMS) Mining Permit C-1981-035. In 2016, Technical Revision 26 (TR-26) to Permit C-1981-035 was approved which included expansion of hydrologic monitoring in number of locations, frequency of observations, laboratory analyses performed and field parameters collected. Additionally, to best support these efforts, GCC Energy (GCC) maintains a quality assurance/quality control (QA/QC) program to:

- Conduct GCC compliance staff training on water quality sampling for all GCC monitoring locations, equipment and methodologies, with detailed written procedures for each monitoring location provided
- Collect all water quality field data with an industry-standard multi-parameter device with electronic data deliverable (EDD) output for all field and calibration data
- Collect all water quality field monitoring data on standardized sampling logs specific to surface water, groundwater and spring/seep sampling locations which are scanned and reviewed by third party, Resource Hydrogeologic Services (RHS) within one week of sampling
- Implement industry-standard, 10% random QA/QC lab sample submittals for duplicate and field blank water quality samples
- Utilize EDDs produced by the contract environmental analytical laboratory for all data analyses
- Compile and manage all water quality data in a geo-referenced Microsoft Access database

HYDROLOGIC MONITORING

HYDROLOGIC MONITORING LOCATIONS

Thirteen new compliance hydrologic monitoring locations were added in 2017 and are listed below:

Hay Gulch Alluvial Monitoring Well

- MW-HGA-4

Bedrock Cluster Monitoring Wells

- MW-1-C, MW-1-A, MW-1-MI
- MW-2-C, MW-2-A, MW-2-MI
- MW-3-C, MW-3-A, MW-3-MI
- MW-4-C, MW-4-A, MW-4-MI

MW-HGA-4 was installed as a conventional 2-inch PVC monitoring well screened from approximately 8 to 43 feet below ground surface. It is located about a half-mile upgradient in Hay Gulch from the King I Mine facilities at the confluence with Roberts Canyon. The purpose of this groundwater monitoring location is to obtain and monitor water level and quality data sufficiently upgradient from any potential historical mining impacts from the King I Mine.

Bedrock monitoring wells were installed at four locations in 2017 to meet the requirements of TR-26. At each of the four locations the wells were completed in three discrete intervals in order to collect water quantity and quality information from the mining overburden (Cliff House Sandstone, designated "C"), the mined interval (A-seam of the upper Menefee Formation, designated "A") and the underburden (upper Menefee Formation referred to as Menefee Interburden as it is between the A-seam and B-seam, and where present, designated "MI"). Each cluster is oriented in-line with the approximate direction of strata dip (210°), spaced 20 feet apart, with the MI wells upgradient, C wells downgradient, and A wells in the middle. The MW-1 location is north and sufficiently upgradient of any current or previous King II Mine workings and thus allows monitoring of baseline conditions. The MW-2 location is south and downgradient of future King II Mine workings and allows monitoring of baseline conditions now, as well as future performance monitoring as mining begins to the north and upgradient of this location. The MW-3 and MW-4 locations are to the southwest of current and future King II Mine workings and shall allow performance monitoring during mining operations. These clustered bedrock monitoring wells are constructed as conventional 2-inch PVC, with the exception of the MW-2-C well which was installed as a 7" open hole completion (steel surface casing installed and cemented to about 41 feet) to allow for future video logging documentation of water inflow location(s), should the Cliff House Formation ever contribute water at this location.

The following compliance hydrologic monitoring locations were continued in 2017:

- Hay Gulch Ditch Upgradient
- Hay Gulch Ditch Downgradient
- Wiltse Well
- Well #1 Upgradient
- Well #2 Downgradient

Figure 1 shows the 2017 compliance hydrologic monitoring locations (18) and their relation to the King I and II Mines.

HYDROLOGIC MONITORING DATA COLLECTION

Hydrologic monitoring data collection was expanded in 2017 in number of locations as indicated in the previous section. Protocols for establishing new hydrologic monitoring locations, as initiated in 2016, were continued for these locations. The frequency of field parameter monitoring for new locations is monthly for a one-year period, following the CDRMS "Guidelines for the Collection of Baseline Water Quality and Overburden Geochemistry Data" (1984). The initial monthly field parameter monitoring schedule is intended to more fully characterize any potential seasonal variation in the hydrologic system. Field parameters are collected with an In-Situ SmarTROLL multi-parameter sonde at all location types, utilizing an industry-standard low-flow cell system for the monitoring wells. The specific field parameters monitored during each event are given in **Tables 1, 2, and 3.**The purpose of the expanded analytical suite was to collect water quality data in line with the CDRMS "Guidelines for the Collection of Baseline Water Quality and Overburden Geochemistry Data" (1984), which were adopted in TR-26. Water samples are collected quarterly at compliance monitoring locations for laboratory analysis. This baseline data collection period is intended to characterize the pre-mining environmental conditions in order to shape the long-term monitoring plan appropriately to evaluate potential mining effects on the hydrologic system. As such, this is intended as a one-year, four-quarter period to evaluate seasonal changes that may occur over a typical year. These laboratory analytical suites are approved by CDRMS in TR-26 and are presented as **Tables 1, 2 and 3,** by water source type. When reviewing the parameter lists, it is important to note the red highlighted parameters, which were added to the pre-2016 compliance list as part of the one-year baseline period for these monitoring locations.

All wet bedrock cluster monitoring wells are instrumented with industry-standard low-flow bladder pump groundwater sampling systems. The pumps are set to the approximate depth of the well screen mid-points for the A and MI wells, and set to near bottom of the C wells to allow for micro-purge sampling methodology. The dry bedrock cluster wells (MW-2-C, MW-2-A, MW-2-MI) are not instrumented with any groundwater sampling pumps and are monitored for water level only.

Other notable updates to the GCC hydrologic monitoring program in 2017 include a modified sampling methodology at the Well #2 Downgradient and MW-HGA-4. Each well was originally sampled using a standard environmental bailer; since 2005 in the case of Well #2 Downgradient and since December 2012 at MW-HGA-4. Each well was instrumented with a dedicated 12-volt electric submersible pump ahead of the 2017Q2 sampling event in June, allowing industry-standard low-flow sampling methodology.

HYDROLOGIC MONITORING DATA ANALYSIS

This 2017 annual hydrologic report presents all previous monitoring and new well data from 2017 in tables at the end of the document. A summary of water quality analyses from the Hay Gulch irrigation ditch (surface water), alluvial wells in Hay Gulch and some regional domestic wells (groundwater) was presented in the GCC 2015 Annual Hydrology Report. The 2016 report focused on water sampling on the mining property. In 2017 a number of new wells were installed in bedrock and alluvium to support a Probable Hydrologic Consequences report (PHC, 2017) and Cumulative Hydrological Impacts Assessment report (CHIA, 2017), and these have been added to routine quarterly monitoring. Graphical depictions of major ion chemistry are presented in the figures section.

Surface water has been sampled in the irrigation ditch at locations above and below the King I and II Mines, and alluvial groundwater in four wells (one new). Bedrock groundwater monitoring now covers one surface seep from the base of the Cliff House Sandstone and 12 wells in four clusters of bedrock wells with completions in, above and below the mined (A) coal seam.

Analytical data from all 2017 sampling is presented in summary tables in the **Attachment**. Full laboratory reports are not included here as they have been submitted to CDRMS quarterly following each sampling event. Full laboratory reports can also be found at:

http://www.gccenergy.net/water_monitoring_results.php

SURFACE WATER

The Hay Gulch Ditch is a year-round diversion from 0.5 to 1.5 cubic feet per second (360 to 1,100 acre-feet/year) from the La Plata River into the gulch, which is otherwise an intermittent drainage that flows only during storms. Ditch water applied to irrigation infiltrates from spreader dikes and infiltrates the alluvium, and return flows in the parallel, unlined channel are collected in lower Hay Gulch which is tributary to the La Plata River, and near the confluence with the lower La Plata River. It is not clear that irrigation return flows are actually able to re-enter the lined ditch at any point, but most are collected by the natural channel. The Huntington Ditch and Pipeline also divert water from the upper La Plata River to a collection point in Hay Gulch for use by the King II Mine, which water that is consumed (in evaporation) by the mine principally for dust control with no waste or return flow.

Mine facilities have stormwater containment berms and culverts directing stormwater to a sediment pond, which would be sampled if a storm event filled it sufficiently to allow this.

The surface water sample collection locations are shown in **Figure 1**. **Figure 2** compares water quality analyses in 2016 and 2017 samples collected in the ditch upstream (upgradient) and downstream (downgradient) of the King I and II Mine facilities. The upstream ditch water contains concentrations of total dissolved solids (TDS, the top of the stacked bars) that are less than 300 mg/L, and the downstream ditch water contains highly variable concentrations of TDS, ranging from 100 mg/L, to 700 mg/L. In several sampling events (March, 2016; June, 2016; June, 2017) upgradient and downgradient concentrations are similar, but in others (September, 2016; November, 2016 and March, 2017) total concentrations are significantly greater in the downgradient samples; and in the September, 2017 samples the total concentrations are significantly less in the downgradient sample. These observations suggest some irrigation water does in fact return to the lined ditch and increase total dissolved concentrations along this reach. The apparent reversal in September, 2017, when TDS is shown as decreasing along the reach, may well reflect misidentified samples. Concentrations of sulfate and chloride are greater in the downstream ditch water, especially during the fall and winter months. Measured pH of the ditch water indicates slightly alkaline to alkaline (pH 7.8 to 8.7) conditions, with concentrations of nitrate, total organic carbon, and trace metals all below the applicable drinking water standards for samples collected from the Hay Gulch ditch.

ALLUVIAL GROUNDWATER

Major ion concentrations in water samples collected from four alluvial wells in September, 2017, are shown in Stiff diagrams in **Figure 3**. Stiff diagrams represent concentrations in milli-equivalents per liter, which are calculated from analyzed mass concentrations, ionic weight and valence, and present negative cations to the right and positive anions to the left; in this schema, a molar solution of sodium sulfate would have 23 gm of Na and 48 gm sulfate, one equivalent of each.

The four sampling locations are shown in **Figure 1**. The Wiltse well is close to the historical King I Mine portal, the Well #1 Upgradient is roughly halfway between the Wiltse well and the mouth of the side gulch in which the King II Mine facilities are located, and the Well #2 Downgradient is in Hay Gulch downstream the King II Mine facilities. New well MW-HGA-4 is located in Hay Gulch, above the King II portal, and at the confluence of Roberts Gulch; it was sampled in June and September of 2017. Coal grains were observed in the drill cuttings from this well, which may account for greater observed concentrations of sulfate at this location. Thin coal seams are also evident in hillslopes near the King I and King II mine portals. Concentrations of sodium have also been spatially variable.

Major ion concentrations in these wells have not changed significantly over 2016-2017. A plot of sulfate and total dissolved solids in the Wiltse well in **Figure 4** (updated through 2017) shows variation in these parameters over a twenty year period, demonstrating that there are long term variations, probably due to climatic variation (wet/dry periods), in the alluvial groundwater composition. There is no consistent increase in dissolved constituent concentrations (total or particular) in the direction of flow (down valley), as observed in previous hydrology reports. No trace elements exceed drinking water criteria in any of these alluvial wells.

In general, the alluvial groundwater in Hay Gulch is not used for drinking water, mostly because the sulfate is naturally elevated in some wells and emetic even for stock. Most alluvial water samples exceeded the total dissolved solids drinking water standard of 500 mg/L. Concentrations of nitrate and nitrite were less than the drinking water standard of 10 mg/L. However, traces of nitrate and nitrite up to 1 mg/L in some well samples can be attributed to infiltration of stock urine (cattle). Two trace metals, iron and manganese were detected in alluvial groundwater samples. These may derive from the weathering of iron sulfide (pyrite) in the Mesaverde Group strata. When pyrite is oxidized by infiltrating, oxygenated water, it yields sulfate, iron and trace metals which are also present. The iron tends to drop out of solution as iron oxides, but the manganese may persist over longer distances. Manganese left behind on sandstone cliffs by evaporation forms the blue-black coating characteristic of many southwest bluffs. All other trace metals (aluminum, arsenic, cadmium, lead, mercury, molybdenum, selenium, uranium and zinc) were reported to be at concentrations below drinking water standards. Concentrations of total organic carbon, an indicator parameter of wastewater, disinfection or fertilizer impacts, were reported to be less than 4 mg/L in all alluvial groundwater samples.

An assessment of the CDRMS-permitted waste rock refuse pile at the King I Mine facility was presented in 2017 in a report prepared by RHS titled "Geochemical Materials Analysis, King I and II Mines, La Plata County Colorado" and is on file with CDRMS. Coal mine waste rock typically contains roof and floor rock (overburden and underburden) which commonly has several percent of pyrite or iron sulfide, which can generate sulfate in oxygenated water in contact with these materials. The report showed no significant generation of oxidation products other than slightly elevated iron and manganese in spoil, and no discernible impacts of waste pile leachates on alluvial groundwater. No trace metal concentrations exceeded drinking water criteria.

Groundwater levels at the four alluvial monitoring wells were measured and documented per CDRMS compliance requirements at the time of each sampling event. The groundwater hydrograph for these wells over the entire period of historical record in **Figure 6** shows fairly substantial seasonal variability at all three wells over time which is not only related to variability in precipitation but also subject to the variability in flood irrigation cycles of Hay Gulch irrigated pasture. Groundwater levels measured at the Wiltse well before 2009 may have been impacted by pumping during operation and subsequent decommissioning of the King I Mine. This is shown as more pronounced variability on the order of 10 foot annual level range from 2002-2009. However, groundwater levels have been stable for the period of record. Current King I and II Mine operations have not withdrawn Hay Gulch alluvial groundwater for purposes other than routine water quality monitoring since 2009, nor discharged any fluids to Hay Gulch, and therefore do not impact Hay Gulch alluvial groundwater levels.

BEDROCK GROUNDWATER

Four clusters of bedrock monitoring wells were installed in 2017 at locations shown in Figure 1, with wells at each location open in the "A" coal seam, roof and floor (designated A, C and MI intervals). These were first sampled when completed, when not dry; sampling events are summarized in **Table 4**.

Major ion compositions were consistent between samples in each well, and Stiff diagrams representing those major ion compositions are presented in Figure 5, which were included in the 2017 CHIA report. Wells at the MW-3 site have all been dry. Coal wells (mined "A" seam) all show similar water quality, whereas roof and floor water samples do not, indicating lack of hydrological continuity in those intervals and minor variations in bedrock composition.

Tabulated bedrock water quality data show no trace element concentrations exceed water use criteria, though none of these wells could supply sufficient water for any human or agricultural purpose.

RECOMMENDATIONS

With comprehensive review of the expanded baseline parameter list results and increased frequency of monitoring for the nearly two-year period during 2016-2017 for the existing compliance Hay Gulch Ditch locations and alluvial wells, no trace metals or minor constituents to be significant with respect to water quality have been observed. This considers drinking water standards, although naturally occurring major ion concentrations (specifically TDS, sulfate) disqualify the alluvial aquifer as a primary drinking water source. Given the spatial variation in water quality does not suggest any contamination of the alluvial aquifer by mining activity; it is proposed that revised hydrologic monitoring parameters and frequency be adopted for these locations already subjected to the expanded baseline monitoring protocol.

RHS recommends a reduction in monitoring frequency of these locations to bi-annual (twice yearly) to coincide with the high and low flow periods. This will best utilize GCC resources to capture the overall seasonal variability as the maximum and minimum wetting cycles. Based on hydrologic monitoring data collected to date, the two ideal months to conduct future long-term bi-annual compliance monitoring are April and October. This recommendation was given in the 2016 Annual Hydrology Report, however due to a very busy GCC hydrologic monitoring program expansion in 2017, discussion between CDRMS, GCC and RHS on this matter has not yet occurred.

RHS recommends a reduction in monitored parameters subjected to analytical laboratory testing, while keeping the field parameter list the same as the baseline suites. The proposed long-term compliance water quality parameter lists are given as **Table 5**. To summarize the parameter revision for the three lists:

GCC GW Compliance

- Remove Silica (SiO_2) – Comparison of TDS vs. sum of ions has been accomplished and this parameter is no longer of interest with respect to monitoring for potential hydrologic impacts from GCC or other historic mining impacts.
- Remove Mercury (Hg) – Four quarterly sample analyses for all wells have all shown non-detect results so baseline characterization has been accomplished.
- Remove Total Nitrogen as Nitrate-Nitrite – This parameter is useful to interpret and distinguish agricultural impacts from blasting explosive impacts to groundwater in surface coal mining operations. King II is an underground mine and GCC has not used nor plans to use explosives in their operations. Four quarterly sample analyses for all wells have established baseline total nitrogen as nitrate-nitrite.
- Remove Ammonia (NH_3) – This parameter was only intended for one-time collection during the baseline period to establish absence. This parameter is useful to interpret and distinguish agricultural impacts from blasting explosive impacts to groundwater in surface coal mining operations. King II is an underground mine and GCC has not used nor plans to use explosives in their operations.
- Remove Phosphate (PO_4 as P) - This parameter was only intended for one-time collection during the baseline period to establish absence. This parameter is useful to interpret and distinguish possible impacts of general agriculture use versus fertilizer use for vegetation reclamation at surface coal mines. King II is an underground mine and GCC has not used nor plans to use any significant phosphate products.

GCC S&S Compliance

- Remove Silica (SiO_2) – Comparison of TDS vs. sum of ions has been accomplished and this parameter is no longer of interest with respect to monitoring for potential hydrologic impacts from GCC or other historic mining impacts.
- Remove Mercury (Hg) – Four quarterly sample analyses for Seep-1 have all shown non-detect results so baseline characterization has been accomplished.
- Remove Total Nitrogen as Nitrate-Nitrite – This parameter is useful to interpret and distinguish agricultural impacts from blasting explosive impacts to groundwater in surface coal mining operations. King II is an underground mine and GCC has not used nor plans to use explosives in their operations. Four quarterly sample analyses for Seep-1 have established baseline total nitrogen as nitrate-nitrite, which is interpreted to be a result of wildlife activity.
- Remove Ammonia (NH_3) – This parameter was only intended for one-time collection during the baseline period to establish absence. This parameter is useful to interpret and distinguish agricultural impacts from blasting explosive impacts to groundwater in surface coal mining operations. King II is an underground mine and GCC has not used nor plans to use explosives in their operations.
- Remove Phosphate (PO_4 as P) - This parameter was only intended for one-time collection during the baseline period to establish absence. This parameter is useful to interpret and distinguish possible impacts of general agriculture use versus fertilizer use for vegetation reclamation at surface coal mines. King II is an underground mine and GCC has not used nor plans to use any significant phosphate products.

GCC SW Compliance

- Remove Silica (SiO_2) – Comparison of TDS vs. sum of ions has been accomplished and this parameter is no longer of interest with respect to monitoring for potential hydrologic impacts from GCC or other historic mining impacts.
- Remove Mercury (Hg) – Four quarterly sample analyses for the two Hay Gulch Ditch sites have all shown non-detect results so baseline characterization has been accomplished.
- Remove Total Nitrogen as Nitrate-Nitrite – This parameter is useful to interpret and distinguish agricultural impacts from blasting explosive impacts to groundwater in surface coal mining operations. King II is an underground mine and GCC has not used nor plans to use explosives in their operations. Four quarterly sample analyses for the two Hay Gulch Ditch sites have established baseline total nitrogen as nitrate-nitrite.
- Remove Ammonia (NH_3) – This parameter was only intended for one-time collection during the baseline period to establish absence. This parameter is useful to interpret and distinguish agricultural impacts from blasting explosive impacts to groundwater in surface coal mining operations. King II is an underground mine and GCC has not used nor plans to use explosives in their operations.
- Remove Phosphate (PO_4 as P) - This parameter was only intended for one-time collection during the baseline period to establish absence. This parameter is useful to interpret and distinguish possible impacts of general agriculture use versus fertilizer use for vegetation reclamation at surface coal mines. King II is an underground mine and GCC has not used nor plans to use any significant phosphate products.
- Remove Oil and Grease – Four quarterly sample analyses for the two Hay Gulch Ditch sites have all shown non-detect results so baseline characterization has been accomplished.

RHS recommends continuing water sample collection and analysis of the GCC GW Baseline suite for the bedrock cluster monitoring wells established in 2017, until four quarters have been assessed. Provided that silica, mercury, nitrate/nitrite, ammonia and phosphate are insignificant through that four quarters of monitoring, the analytical suite for samples from these locations shall thenceforth convert to the proposed long-term compliance water quality parameter list as given in **Table 5**.

TABLES

Table 1.

GCC Surface Water Baseline Water Quality Parameter Suite (GCC SW Baseline)

Parameter	Units	Justification for Addition	Comments
Potassium (K)	***mg/L***	***Rounding out major ion constituents with K, Cl will allow for better interpretation with trilinear plotting***	
Chloride (Cl^-)	***mg/L***		
Calcium (Ca^{+2})	mg/L		
Magnesium (Mg^{+2})	mg/L		
Sodium (Na^+)	mg/L		
Sulfate (SO_4)	mg/L		
Alkalinity, as $CaCO_3$	mg/L		
Silica (SiO_2)	***mg/L***	***Allows comparison of TDS vs. sum of major ions***	
Manganese (Mn)	mg/L		
Fluoride (F)	***mg/L***	***Secondary ion that has been identified with minor potential nuisance value***	
Iron (Fe)	mg/L		
Aluminum (Al)	***mg/L***	***Trace metals commonly associated with coal mining impacts***	
Arsenic (As)			
Cadmium (Cd)			
Copper (Cu)			
Lead (Pb)			
Mercury (Hg)			
Molybdenum (Mo)			
Selenium (Se)			
Zinc (Zn)			
Uranium (U)	***mg/L***	***DRMS request via HGCAP***	
Hardness, as $CaCO_3$	mg/L		
Bicarbonate, as $CaCO_3$	mg/L		
Carbonate, as $CaCO_3$	mg/L		
Hydroxide, as $CaCO_3$	mg/L		
Total Nitrogen as Nitrate-Nitrite	***mg/L***	***Distinguish fertilizer and/or stock impacts***	
Ammonia (NH_3)	***mg/L***	***Distinguish fertilizer and/or stock impacts***	***1-time only with field kit to establish absence, SW and Alluvial GW only in 2016Q4***
Phosphate (PO_4 as P)	***mg/L***	***Distinguish fertilizer and/or stock impacts***	***1-time only to establish absence, SW and Alluvial GW only in 2016Q4***
Sodium Adsorption Ratio (SAR)	***mg/L***	***Measure of suitability for agricultural irrigation***	
Oil & Grease	***mg/L***	***Indication of background/upstream impacts***	
pH (lab)	SU		
Total Dissolved Solids (TDS)	mg/L		
Total Suspended Solids (TSS)	***mg/L***	***Provides mass of particulates causing turbidity***	
Total Organic Carbon (TOC)	***mg/L***	***Surrogate parameter for coal mining impacts***	
Temperature (field)	°C		
pH (field)	***SU***	***Allows comparison of field vs. lab measurements, key for proper Bicarb, Carb, Hydroxide calculations***	
Specific Conductivity (field)	mS/cm		
Oxygen Reduction Potential (ORP) (field)	***mV***	***To predict states of chemical speciation of water, i.e. dissolved metals***	
Dissolved Oxygen (DO) (field)	***mg/L***	***General water quality parameter to document available oxygen***	
Flow Rate (field, ditch only)	cfs		

Notes:
New analytes in bold, italicized red text
mg/L = milligrams per liter
SU = standard units
mS/cm millisiemens per centimeter
cfs = cubic feet per second
mV = milivolt

Table 2.

GCC Groundwater Baseline Water Quality Parameter Suite (GCC GW Baseline)

Parameter	Units	Justification for Addition	Comments
Potassium (K)	***mg/L***	***Rounding out major ion constituents with K, Cl will allow for better interpretation with trilinear plotting***	
Chloride (Cl$^-$)	***mg/L***		
Calcium (Ca^{+2})	mg/L		
Magnesium (Mg^{+2})	mg/L		
Sodium (Na^+)	mg/L		
Sulfate (SO_4)	mg/L		
Alkalinity, as $CaCO_3$	mg/L		
Silica (SiO_2)	***mg/L***	***Allows comparison of TDS vs. sum of major ions***	
Manganese (Mn)	mg/L		
Fluoride (F)	***mg/L***	***Secondary ion that has been identified with minor potential nuisance value***	
Iron (Fe)	mg/L		
Aluminum (Al)	***mg/L***	***Trace metals commonly associated with coal mining impacts***	
Arsenic (As)			
Cadmium (Cd)			
Copper (Cu)			
Lead (Pb)			
Mercury (Hg)			
Molybdenum (Mo)			
Selenium (Se)			
Zinc (Zn)			
Uranium (U)	***mg/L***	***DRMS request via HGCAP***	
Hardness, as $CaCO_3$	mg/L		
Bicarbonate, as $CaCO_3$	mg/L		
Carbonate, as $CaCO_3$	mg/L		
Hydroxide, as $CaCO_3$	mg/L		
Total Nitrogen as Nitrate-Nitrite	***mg/L***	***Distinguish fertilizer and/or stock impacts***	
Ammonia (NH_3)	***mg/L***	***Distinguish fertilizer and/or stock impacts***	***1-time only to establish absence, SW and Alluvial GW only in 2016Q4***
Phosphate (PO_4 as P)	***mg/L***	***Distinguish fertilizer and/or stock impacts***	***1-time only to establish absence, SW and Alluvial GW only in 2016Q4***
pH (lab)	SU		
Total Dissolved Solids (TDS)	mg/L		
Total Organic Carbon (TOC)	***mg/L***	***Surrogate parameter for coal mining impacts***	
Temperature (field)	°C		
pH (field)	***SU***	***Allows comparison of field vs. lab measurements, key for proper Bicarb, Carb, Hydroxide calculations***	
Specific Conductivity (field)	mS/cm		
Oxygen Reduction Potential (ORP) (field)	***mV***	***To predict states of chemical speciation of water, i.e. dissolved metals***	
Depth to Water (field, wells only)	ft		

Notes:
New analytes in bold, italicized red text
mg/L = milligrams per liter
SU = standard units
mS/cm millisiemens per centimeter
ft = feet
mV = milivolt

Table 3.

GCC Spring & Seep Baseline Water Quality Parameter Suite (GCC S&S Baseline)

Parameter	Units	Justification for Addition	Comments
Potassium (K)	***mg/L***	***Rounding out major ion constituents with K, Cl will allow for better interpretation with trilinear plotting***	
Chloride (Cl^-)	***mg/L***		
Calcium (Ca^{+2})	mg/L		
Magnesium (Mg^{+2})	mg/L		
Sodium (Na^+)	mg/L		
Sulfate (SO_4)	mg/L		
Alkalinity, as $CaCO_3$	mg/L		
Silica (SiO_2)	***mg/L***	***Allows comparison of TDS vs. sum of major ions***	
Manganese (Mn)	mg/L		
Fluoride (F)	***mg/L***	***Secondary ion that has been identified with minor potential nuisance value***	
Iron (Fe)	mg/L		
Aluminum (Al)	***mg/L***	***Trace metals commonly associated with coal mining impacts***	
Arsenic (As)			
Cadmium (Cd)			
Copper (Cu)			
Lead (Pb)			
Mercury (Hg)			
Molybdenum (Mo)			
Selenium (Se)			
Zinc (Zn)			
Uranium (U)	***mg/L***	***DRMS request via HGCAP***	
Hardness, as $CaCO_3$	mg/L		
Bicarbonate, as $CaCO_3$	mg/L		
Carbonate, as $CaCO_3$	mg/L		
Hydroxide, as $CaCO_3$	mg/L		
Total Nitrogen as Nitrate-Nitrite	***mg/L***	***Distinguish fertilizer and/or stock impacts***	
Ammonia (NH_3)	***mg/L***	***Distinguish fertilizer and/or stock impacts***	***1-time only with field kit to establish absence, SW and Alluvial GW only in 2016Q4***
Phosphate (PO_4 as P)	***mg/L***	***Distinguish fertilizer and/or stock impacts***	***1-time only to establish absence, SW and Alluvial GW only in 2016Q4***
Sodium Adsorption Ratio (SAR)	***mg/L***	***Measure of suitability for agricultural irrigation***	
pH (lab)	SU		
Total Dissolved Solids (TDS)	mg/L		
Total Organic Carbon (TOC)	***mg/L***	***Surrogate parameter for coal mining impacts***	
Temperature (field)	°C		
pH (field)	***SU***	***Allows comparison of field vs. lab measurements, key for proper Bicarb, Carb, Hydroxide calculations***	
Specific Conductivity (field)	mS/cm		
Oxygen Reduction Potential (ORP) (field)	***mV***	***To predict states of chemical speciation of water, i.e. dissolved metals***	
Flow Rate (field, spring/seep only)	gpm		

Notes:
New analytes in bold, italicized red text
mg/L = milligrams per liter
SU = standard units
mS/cm millisiemens per centimeter
gpm = gallons per minute
mV = milivolt

Table 4. Lab Samples Collected from Bedrock Cluster Monitoring Wells, 2017

	Cliff House Overburden (C wells)	Menefee A-seam Coal (A wells)	Menefee Interburden-Floor (MI wells)
MW-1 cluster	June, Sept	June, Sept	June (dry in Sept)
MW-2 cluster	Dry	dry	dry
MW-3 cluster	Mar, June, Sept	Mar, June, Sept	Mar, June, Sept
MW-4 cluster	Mar, June, Sept	Mar, June, Sept	Mar, June, Sept

Table 5. Proposed long-term compliance water quality parameter suites (Groundwater, Spring & Seep, Surface Water)

GCC Groundwater Compliance Water Quality Parameter Suite (GCC GW Compliance)

Parameter	Units
Potassium (K)	mg/L
Chloride (Cl^-)	mg/L
Calcium (Ca^{+2})	mg/L
Magnesium (Mg^{+2})	mg/L
Sodium (Na^+)	mg/L
Sulfate (SO_4)	mg/L
Alkalinity, as $CaCO_3$	mg/L
Manganese (Mn)	mg/L
Fluoride (F)	mg/L
Iron (Fe)	mg/L
Aluminum (Al)	mg/L
Arsenic (As)	mg/L
Cadmium (Cd)	mg/L
Copper (Cu)	mg/L
Lead (Pb)	mg/L
Molybdenum (Mo)	mg/L
Selenium (Se)	mg/L
Zinc (Zn)	mg/L
Uranium (U)	mg/L
Hardness, as $CaCO_3$	mg/L
Bicarbonate, as $CaCO_3$	mg/L
Carbonate, as $CaCO_3$	mg/L
Hydroxide, as $CaCO_3$	mg/L
pH (lab)	SU
Total Dissolved Solids (TDS)	mg/L
Total Organic Carbon (TOC)	mg/L
Temperature (field)	°C
pH (field)	SU
Specific Conductivity (field)	mS/cm
Oxygen Reduction Potential (ORP) (field)	mV
Depth to Water (field, wells only)	ft

Notes:
New analytes in bold, italicized red text
mg/L = milligrams per liter
SU = standard units
mS/cm millisiemens per centimeter
ft = feet
mV = milivolt

GCC Spring & Seep Compliance Water Quality Parameter Suite (GCC S&S Compliance)

Parameter	Units
Potassium (K)	mg/L
Chloride (Cl^-)	mg/L
Calcium (Ca^{+2})	mg/L
Magnesium (Mg^{+2})	mg/L
Sodium (Na^+)	mg/L
Sulfate (SO_4)	mg/L
Alkalinity, as $CaCO_3$	mg/L
Manganese (Mn)	mg/L
Fluoride (F)	mg/L
Iron (Fe)	mg/L
Aluminum (Al)	mg/L
Arsenic (As)	mg/L
Cadmium (Cd)	mg/L
Copper (Cu)	mg/L
Lead (Pb)	mg/L
Molybdenum (Mo)	mg/L
Selenium (Se)	mg/L
Zinc (Zn)	mg/L
Uranium (U)	mg/L
Hardness, as $CaCO_3$	mg/L
Bicarbonate, as $CaCO_3$	mg/L
Carbonate, as $CaCO_3$	mg/L
Hydroxide, as $CaCO_3$	mg/L
Sodium Adsorption Ratio (SAR)	mg/L
pH (lab)	SU
Total Dissolved Solids (TDS)	mg/L
Total Organic Carbon (TOC)	mg/L
Temperature (field)	°C
pH (field)	SU
Specific Conductivity (field)	mS/cm
Oxygen Reduction Potential (ORP) (field)	mV
Flow Rate (field, spring/seep only)	gpm

Notes:
New analytes in bold, italicized red text
mg/L = milligrams per liter
SU = standard units
mS/cm millisiemens per centimeter
gpm = gallons per minute
mV = milivolt

GCC Surface Water Compliance Water Quality Parameter Suite (GCC SW Compliance)

Parameter	Units
Potassium (K)	mg/L
Chloride (Cl^-)	mg/L
Calcium (Ca^{+2})	mg/L
Magnesium (Mg^{+2})	mg/L
Sodium (Na^+)	mg/L
Sulfate (SO_4)	mg/L
Alkalinity, as $CaCO_3$	mg/L
Manganese (Mn)	mg/L
Fluoride (F)	mg/L
Iron (Fe)	mg/L
Aluminum (Al)	mg/L
Arsenic (As)	mg/L
Cadmium (Cd)	mg/L
Copper (Cu)	mg/L
Lead (Pb)	mg/L
Molybdenum (Mo)	mg/L
Selenium (Se)	mg/L
Zinc (Zn)	mg/L
Uranium (U)	mg/L
Hardness, as $CaCO_3$	mg/L
Bicarbonate, as $CaCO_3$	mg/L
Carbonate, as $CaCO_3$	mg/L
Hydroxide, as $CaCO_3$	mg/L
Sodium Adsorption Ratio (SAR)	mg/L
pH (lab)	SU
Total Dissolved Solids (TDS)	mg/L
Total Suspended Solids (TSS)	mg/L
Total Organic Carbon (TOC)	mg/L
Temperature (field)	°C
pH (field)	SU
Specific Conductivity (field)	mS/cm
Oxygen Reduction Potential (ORP) (field)	mV
Dissolved Oxygen (DO) (field)	mg/L
Flow Rate (field, ditch only)	cfs

Notes:
New analytes in bold, italicized red text
mg/L = milligrams per liter
SU = standard units
mS/cm millisiemens per centimeter
cfs = cubic feet per second
mV = milivolt

FIGURES

Figure 1. GCC 2017 hydrologic monitoring locations

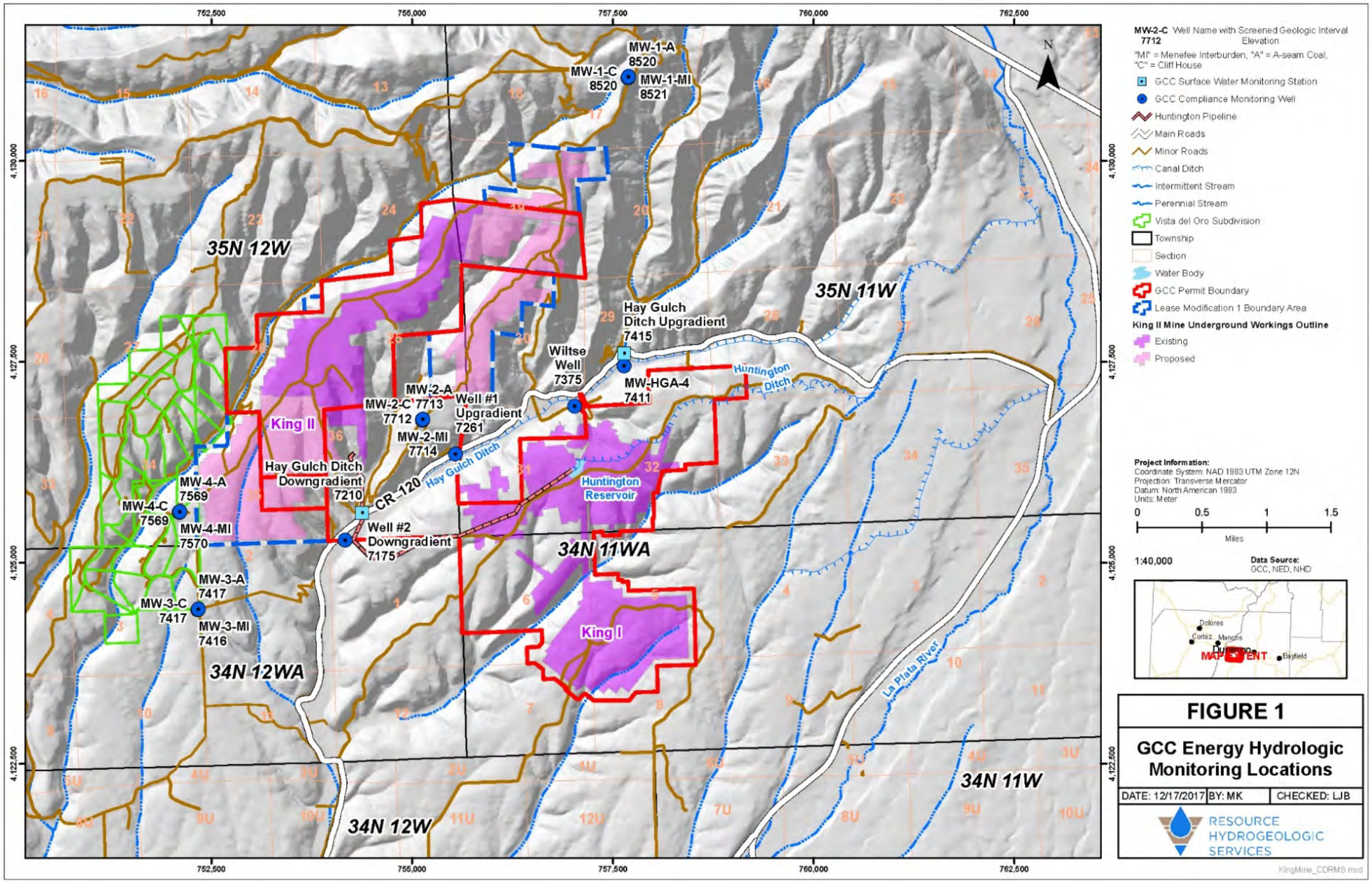


Figure 2. Comparison of major ions in water analyses in Hay Gulch Ditch samples collected upstream and downstream of King I & II Mines, 2016 through 2017

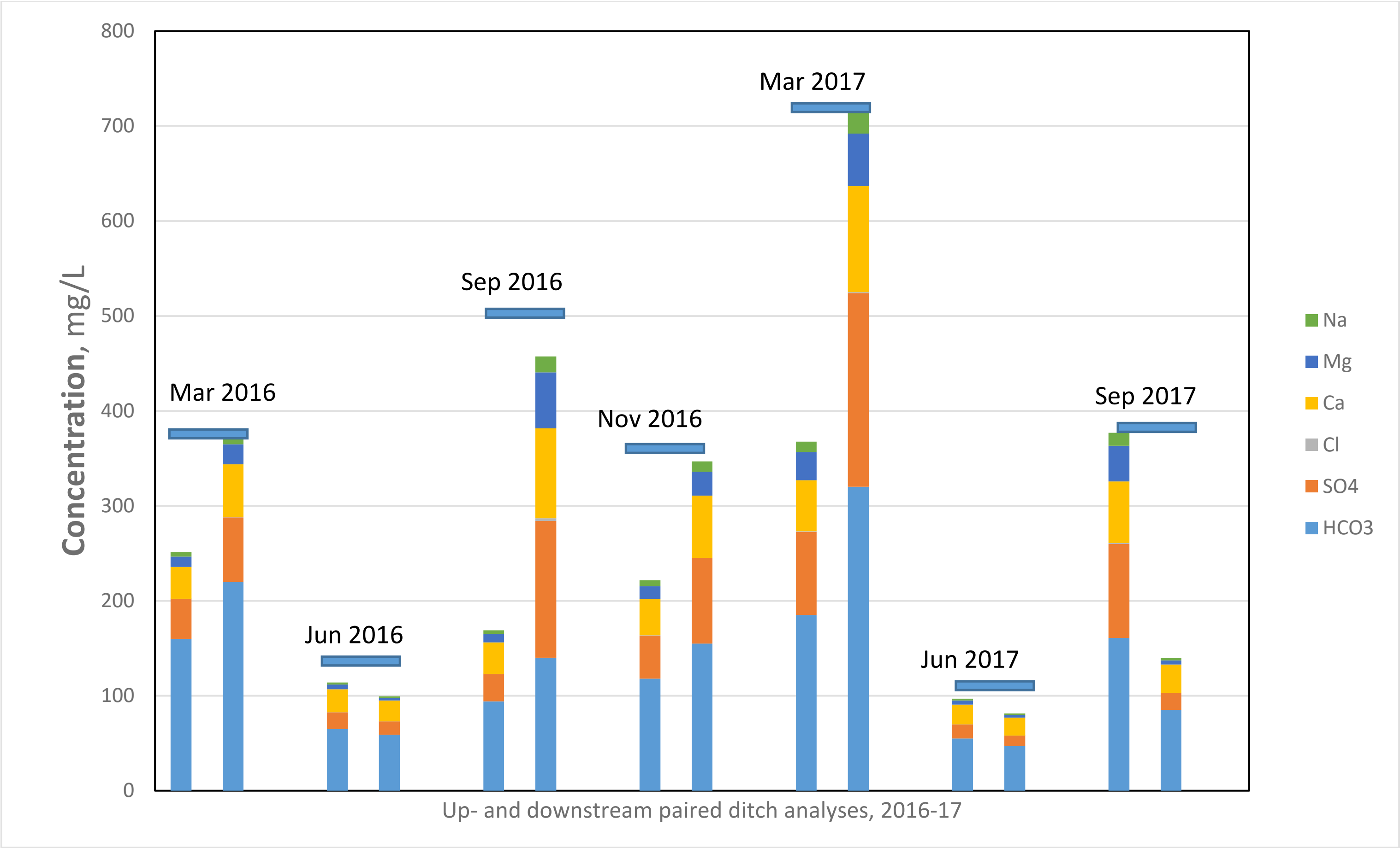


Figure 3. Comparison of major ion concentrations in alluvial monitoring wells in Hay Gulch (Stiff diagrams representing concentrations in milli-equivalents per liter)

Figure 4. TDS and sulfate in the Wiltse well, 1982 through 2017.

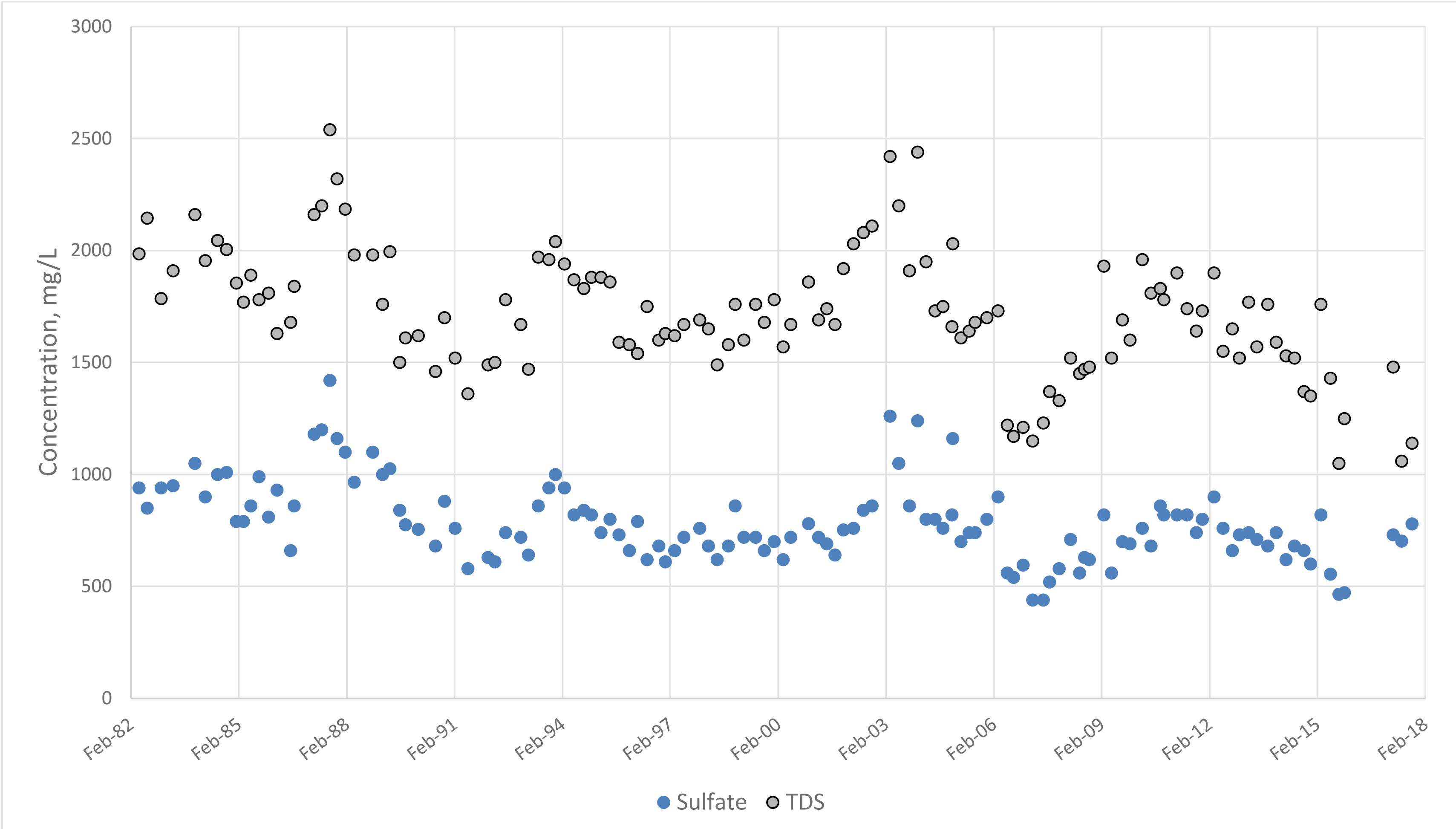


Figure 5. Stiff diagrams of major ion compositions in bedrock wells, by cluster location

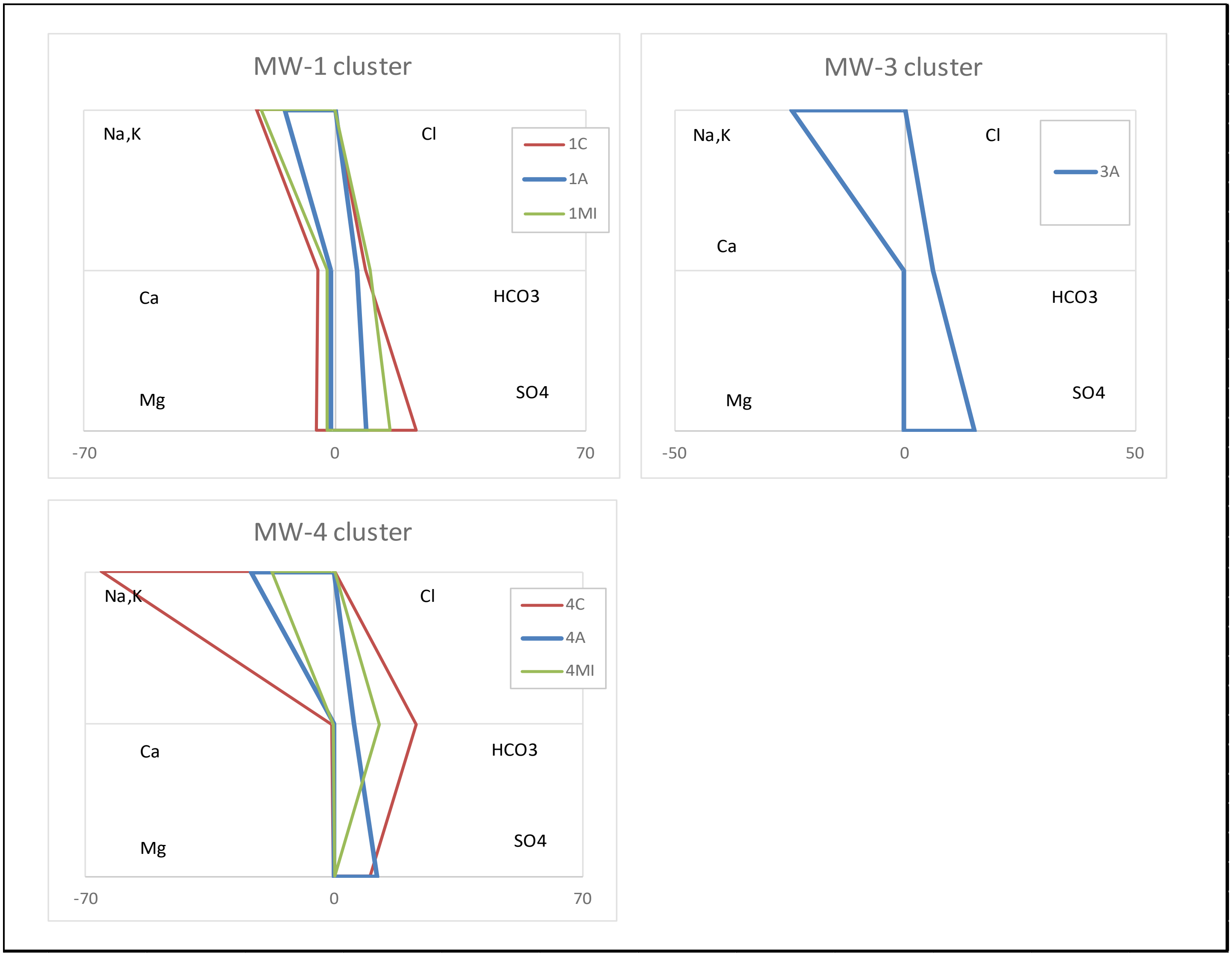
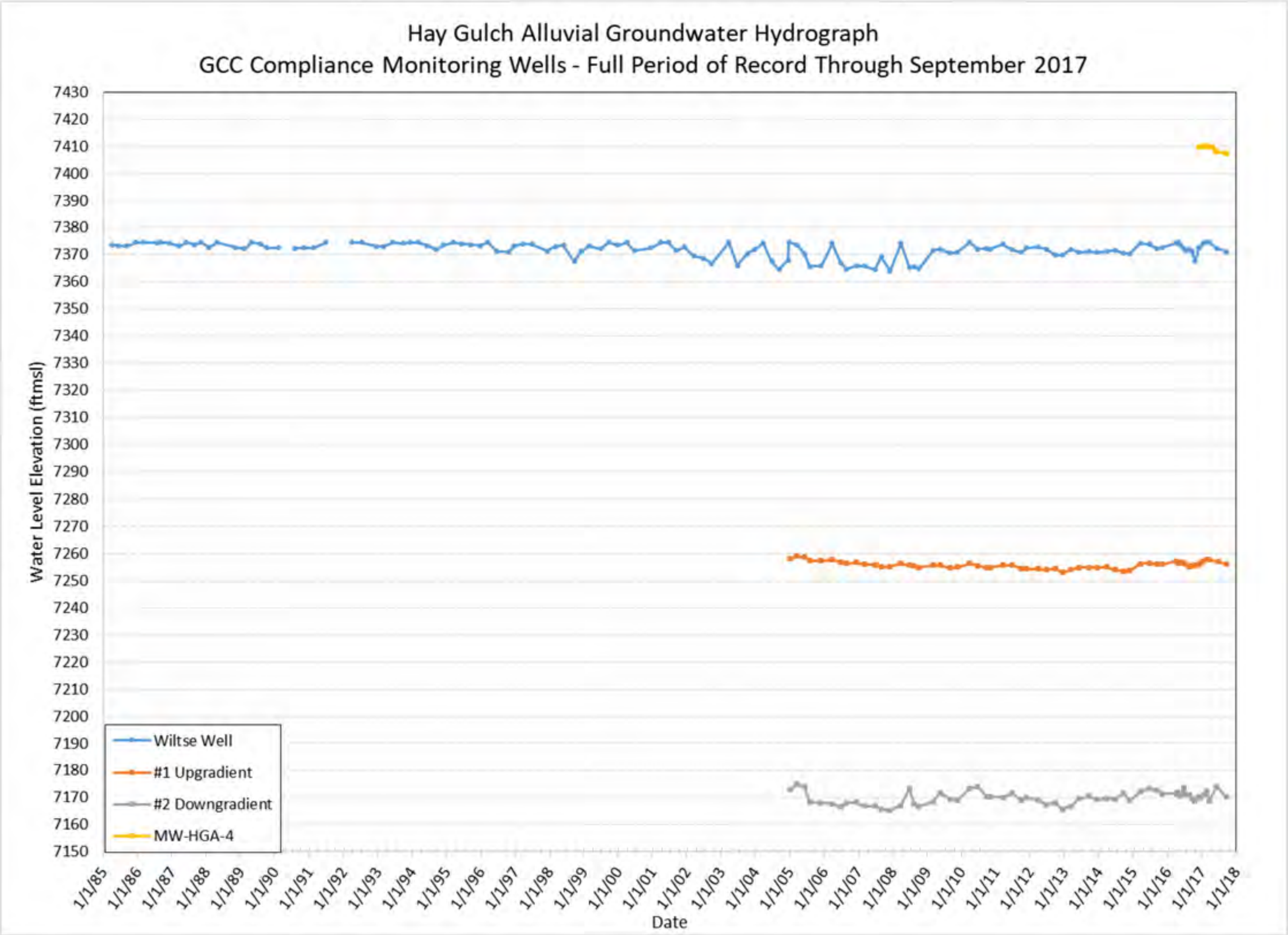


Figure 6. Hay Gulch Alluvium Groundwater Hydrograph



ATTACHMENT - GCC Hydrologic Monitoring Data Summary Tables

RESOURCE
HYDROGEOLOGIC
SERVICES

Location Name	Year	Q	Month	Sample Date	Lab Analysis (Y/N)	Field Parameters: Flow Rate (cfs)	Temperature (deg C)	pH (SU)	Specific Conductance (µS/cm)	Oxygen Reduction Potential (mV)	Dissolved Oxygen (mg/L)
Hay Gulch Ditch Upgradient	2016	Q1	3	03/31/16	Y	0.70	9.8	7.75	247	76.4	8.12
Hay Gulch Ditch Upgradient	2016	Q2	4	04/22/16	N	0.99	20.9	8.27	323	114.7	6.35
Hay Gulch Ditch Upgradient	2016	Q2	5	05/26/16	N	1.22	11.3	7.95	197	97.2	8.03
Hay Gulch Ditch Upgradient	2016	Q2	6	06/23/16	Y	1.56	21.1	8.15	141	51.6	5.96
Hay Gulch Ditch Upgradient	2016	Q3	7	07/20/16	N	0.99	20.8	8.24	189	53.6	6.48
Hay Gulch Ditch Upgradient	2016	Q3	8	08/25/16	N	0.99	16.8	8.26	207	82.8	6.86
Hay Gulch Ditch Upgradient	2016	Q3	9	09/21/16	Y	1.07	14.93	8.47	233.2	72.5	7.2
Hay Gulch Ditch Upgradient	2016	Q4	10	10/19/16	N	0.95	16.39	8.19	210.2	105.9	4.73
Hay Gulch Ditch Upgradient	2016	Q4	11	11/29/16	Y	NM	5.86	8.79	257.9	92.4	6.71
Hay Gulch Ditch Upgradient	2016	Q4	12	12/13/16	N	1.02	6.97	8.58	233.7	116.3	6.1
Hay Gulch Ditch Upgradient	2017	Q1	1	01/26/17	Y	NA	1.52	8.2	686.6	66.3	10.59
Hay Gulch Ditch Upgradient	2017	Q1	2	02/27/17	N	0.82	4.73	8.69	455	-12	8.96
Hay Gulch Ditch Upgradient	2017	Q1	3	03/22/17	Y	0.28	10.69	8.77	453.5	-10.6	6.89
Hay Gulch Ditch Upgradient	2017	Q2	6	06/28/17	Y	2.69	20.21	8.88	106.2	23.8	4.79
Hay Gulch Ditch Upgradient	2017	Q3	9	09/21/17	Y	NM	19.72	8.39	549.4	86.1	6.73

Location Name	Sample Date	Lab Analytical Results: Hardness as CaCO3 (mg/L)	pH (Lab) (SU)	Total Dissolved Solids (Lab) (mg/L)	Total Suspended Solids (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Alkalinity, Total (mg/L)	Alkalinity, Bicarbonate (mg/L)	Alkalinity, Carbonate (mg/L)	Alkalinity, Hydroxide (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Sulfate as SO4 (mg/L)	Total Organic Carbon (TOC) (mg/L)	Oil & Grease (mg/L)	Nitrate/ Nitrite as N (mg/L)	Ammonia as N (mg/L)	Ortho-Phosphate as P (mg/L)	Sodium Adsorption Ratio (SAR) (no unit)
Hay Gulch Ditch Upgradient	03/31/16	128	8.17	170	30.0	33.5	10.9	4.46	<1	160	160	<10	<10	5.77	0.213	42.1	1.41	<5	<0.02	NA	NA	0.17
Hay Gulch Ditch Upgradient	04/22/16																					
Hay Gulch Ditch Upgradient	05/26/16																					
Hay Gulch Ditch Upgradient	06/23/16	80.9	8.04	75	117	24	5.08	2.19	<1	65	65	<10	<10	2.07	0.208	17.7	1.6	<5	0.028	NA	NA	0.1
Hay Gulch Ditch Upgradient	07/20/16																					
Hay Gulch Ditch Upgradient	08/25/16																					
Hay Gulch Ditch Upgradient	09/21/16	119	8.16	165	17.0	33.0	9.01	3.90	1.35	98.0	94.0	<10	<10	4.32	0.223	29.0	2.21	<5	<0.020	NA	NA	0.16
Hay Gulch Ditch Upgradient	10/19/16																					
Hay Gulch Ditch Upgradient	11/29/16	152	8.19	180	4.8	38.4	13.7	6	<1.00	118	118	<10.0	<10.0	7.92	0.208	45.3	1.14	<5.00	<0.020	NA	NA	0.21
Hay Gulch Ditch Upgradient	12/13/16																					
Hay Gulch Ditch Upgradient	01/26/17	NA	NA	415	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.100	<0.0500	NA
Hay Gulch Ditch Upgradient	02/27/17																					
Hay Gulch Ditch Upgradient	03/22/17	257	8.34	285	2.50	53.6	29.8	10.9	1.75	185	185	<10.0	<10.0	22.7	0.215	87.7	2.49	<5.00	0.053	NA	NA	0.30
Hay Gulch Ditch Upgradient	06/28/17	69.2	8.06	65.0	63.5	20.8	4.21	1.97	<1.00	55.0	55.0	<10.0	<10.0	1.76	0.195	15.0	1.15	<5.00	<0.020	NA	NA	0.10
Hay Gulch Ditch Upgradient	09/21/17	316	8.22	390	2.00	64.9	37.5	13.8	2.15	177	161	16.0	<10.0	30.8	0.265	99.0	1.90	<5.00	0.045	NA	NA	0.34

Location Name	Sample Date	Aluminum (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Manganese (mg/L)	Mercury (mg/L)	Molybdenum (mg/L)	Selenium (mg/L)	Silica (Si02) (mg/L)	Silicon (mg/L)	Uranium (mg/L)	Zinc (mg/L)	Radium 226 (pCi/L)	Radium 228 (pCi/L)
Hay Gulch Ditch Upgradient	03/31/16	<0.05	<0.0005	<0.0001	0.0006	<0.05	<0.0005	0.0059	<0.0002	<0.0005	<0.001	7.78	3.64	0.0002	<0.001	<0.4	<0.8
Hay Gulch Ditch Upgradient	04/22/16																
Hay Gulch Ditch Upgradient	05/26/16																
Hay Gulch Ditch Upgradient	06/23/16	<0.05	<0.0005	<0.0001	0.0011	<0.05	<0.0005	0.0035	<0.0002	0.0009	<0.001	8.23	3.85	0.0001	<0.001	NA	NA
Hay Gulch Ditch Upgradient	07/20/16																
Hay Gulch Ditch Upgradient	08/25/16																
Hay Gulch Ditch Upgradient	09/21/16	<0.05	<0.0005	<0.0001	0.0011	<0.05	<0.0005	0.0043	<0.0002	0.0007	<0.001	10.5	4.89	0.0002	<0.001	NA	NA
Hay Gulch Ditch Upgradient	10/19/16																
Hay Gulch Ditch Upgradient	11/29/16	<0.050	<0.0005	<0.0001	0.0005	<0.050	<0.0005	0.0047	<0.0002	0.0008	<0.0010	9.71	4.54	0.0003	<0.0010	NA	NA
Hay Gulch Ditch Upgradient	12/13/16																
Hay Gulch Ditch Upgradient	01/26/17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hay Gulch Ditch Upgradient	02/27/17																
Hay Gulch Ditch Upgradient	03/22/17	<0.050	0.0005	<0.0001	0.0008	<0.050	<0.0005	0.0070	<0.0002	0.0006	0.0023	9.04	4.23	0.0003	0.0022	NA	NA
Hay Gulch Ditch Upgradient	06/28/17	<0.050	<0.0005	<0.0001	0.0013	<0.050	<0.0005	0.0024	<0.0002	0.0009	<0.0010	7.71	3.60	0.0001	<0.0020	NA	NA
Hay Gulch Ditch Upgradient	09/21/17	<0.050	0.0009	<0.0001	0.0006	<0.050	<0.0005	0.0098	<0.0002	0.0012	<0.0010	9.45	4.42	0.0006	<0.0040	NA	NA

Notes & Definitions

Q	calendar quarter
Y/N	yes or no
cfs	cubic feet per second
deg C	degrees Celsius
SU	standard pH units
µS/cm	microsiemens per centimeter
mV	millivolts
mg/L	milligram per liter
pCi/L	picocuries per liter
NM	not measured (field)
NA	not analyzed (lab)

"<" values denote that the quantification of that analyte is below the reporting level for the analytical laboratory, acceptable by environmental water quality laboratory industry standards.

Total alkalinity is measured by titration with hydrochloric acid to a set pH point, reporting this value as an equivalent amount of calcium carbonate. This value is then partitioned into bicarbonate, carbonate and hydroxide depending on the initial pH of the sample solution, each components reported as equivalent CaCO3.

Industry standard Quality Assurance/Quality Control (QA/QC) protocol are followed for this hydrologic monitoring program by both GCC Energy and the contracted environmental water quality analytical laboratories. QA/QC results are not shown in this table.

						Field Parameters						Lab Analytical Results																																				
Location Name	Year	Q	Month	Sample Date	Lab Analysis	Flow Rate	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Dissolved Oxygen	Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Total Suspended Solids	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Oil & Grease	Nitrate/ Nitrite as N	Ammonia as N	Ortho-Phosphate as P	Sodium Adsorption Ratio (SAR)	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc	Radium 226	Radium 228
					Y/N	cfs	deg C	SU	µS/cm	mV	mg/L	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	no unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	pCi/L
Hay Gulch Ditch Downgradient	2016	Q1	3	03/31/16	Y	1.05	11.80	8.57	429	57.5	7.85	226	8.42	270	27.3	55.5	21.1	8.69	1.49	220	220	<10	<10	9.40	0.244	68.1	1.53	<5	<0.02	NA	NA	0.25	<0.05	0.0005	<0.0001	0.0004	<0.05	<0.0005	0.0039	<0.0002	<0.0005	<0.001	8.96	4.19	0.0004	<0.001	<0.4	<0.8
Hay Gulch Ditch Downgradient	2016	Q2	4	04/22/16	N	1.16	17.6	8.55	530	105.9	7.65																																					
Hay Gulch Ditch Downgradient	2016	Q2	5	05/26/16	N	1.13	10.90	8.14	297	33.2	8.71																																					
Hay Gulch Ditch Downgradient	2016	Q2	6	06/23/16	Y	NM	21.90	8.14	116	32.5	5.99	67.8	8.13	55	18	21.9	3.15	1.57	<1	59	59	<10	<10	1.26	0.195	13.5	1.4	<5	0.026	NA	NA	0.03	<0.05	<0.0005	<0.0001	0.0016	<0.05	<0.0005	0.0044	<0.0002	0.0008	<0.001	7.48	3.5	0.0001	0.0021	NA	NA
Hay Gulch Ditch Downgradient	2016	Q3	7	07/20/16	N	1.06	21.30	8.55	308	68.6	6.73																																					
Hay Gulch Ditch Downgradient	2016	Q3	8	08/25/16	N	1.14	18.80	8.37	257	38.4	5.56																																					
Hay Gulch Ditch Downgradient	2016	Q3	9	09/21/16	Y	NM	16.11	8.30	1182.9	18.7	6.81	480	8.25	630	4.20	94.7	59.1	16.8	4.48	220	140	80.0	<10	97.9	0.244	144	3.48	<5	0.027	NA	NA	0.33	<0.05	0.0015	<0.0001	0.0012	<0.05	<0.0005	0.0059	<0.0002	0.0013	0.0026	11.8	5.51	0.0006	0.0013	NA	NA
Hay Gulch Ditch Downgradient	2016	Q4	10	10/19/16	N	0.76	11.79	8.36	420.1	88.6	7.09																																					
Hay Gulch Ditch Downgradient	2016	Q4	11	11/29/16	Y	NM	7.02	8.64	421.4	117.5	6.54	267	8.24	320	12.4	65.5	25.2	10.7	1.46	225	155	70	<10.0	12	0.227	89.5	1.65	<5.00	<0.020	NA	NA	0.28	<0.050	0.0006	<0.0001	0.0005	<0.050	<0.0005	0.0063	<0.0002	0.0007	<0.0010	10.9	5.11	0.0006	0.0012	NA	NA
Hay Gulch Ditch Downgradient	2016	Q4	12	12/13/16	N	NM	6.59	8.06	727.7	155.2	7.21																																					
Hay Gulch Ditch Downgradient	2017	Q1	1	01/26/17	Y	NM	7.17	7.28	677.9	147.6	7.62	NA	NA	640	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.100	<0.0500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hay Gulch Ditch Downgradient	2017	Q1	2	02/27/17	N	0.79	5.01	8.06	987.4	-15.5	9.82																																					
Hay Gulch Ditch Downgradient	2017	Q1	3	03/22/17	Y	0.25	12.7	9.00	16.9	137.8	5.58	503	8.15	615	12.7	112	54.6	22.5	2.33	320	320	<10.0	<10.0	31.9	0.224	204	2.31	<5.00	<0.020	NA	NA	0.44	<0.050	0.0006	<0.0001	0.0004	<0.050	<0.0005	0.0112	<0.0002	<0.0005	0.0022	12.2	5.70	0.0009	<0.0020	NA	NA
Hay Gulch Ditch Downgradient	2017	Q2	6	06/28/17	Y	0.343	17.63	8.53	114.3	185.3	6.44	59.1	7.98	65.0	3.00	19.0	2.86	1.49	<1.00	47.0	47.0	<10.0	<10.0	<1.00	0.290	11.3	2.16	<5.00	<0.020	NA	NA	0.08	<0.050	0.0005	<0.0001	0.0020	<0.050	<0.0005	0.0009	<0.0002	0.0009	<0.0010	6.80	3.18	0.0001	<0.0020	NA	NA
Hay Gulch Ditch Downgradient	2017	Q3	9	09/21/17	Y	NM	18.72	8.66	163.5	48.0	7.13	91.4	7.98	80.0	<0.500	29.5	4.31	2.37	<1.00	85.0	85.0	<10.0	<10.0	1.54	0.227	17.9	0.932	<5.00	<0.020	NA	NA	0.11	<0.050	0.0006	<0.0001	0.0013	<0.050	<0.0005	0.0010	<0.0002	0.0011	<0.0010	8.53	3.99	0.0002	<0.0040	NA	NA

Notes & Definitions

Q	calendar quarter
Y/N	yes or no
cfs	cubic feet per second
deg C	degrees Celsius
SU	standard pH units
µS/cm	microsiemens per centimeter
mV	millivolts
mg/L	milligram per liter
pCi/L	picocuries per liter
NM	not measured (field)
NA	not analyzed (lab)

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						Field Parameters							Lab Analytical Results										
Location Name	Year	Q	Month	Sample Date	Lab Analysis	Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Wiltse Well	2016	Q1	3	03/31/16	Y	150.0	5850	0.35	6.70	7.22	2043	105.6	990	7.22	1580	197	121	95.9	4.64	460	440	20.0	<10
Wiltse Well	2016	Q2	4	04/27/16	N	38.5	4228	0.00	8.80	7.32	1633	17.9											
Wiltse Well	2016	Q2	5	05/25/16	N	23.4	4229	0.85	10.40	7.34	1805	20.1											
Wiltse Well	2016	Q2	6	06/23/16	Y	18.6	3686	2.15	10.70	7.26	1768	38.5	1050	7.34	1480	208	128	75.2	4.56	500	500	<10	<10
Wiltse Well	2016	Q3	7	07/19/16	N	19.9	2844	2.99	11.50	7.26	1478	26.9											
Wiltse Well	2016	Q3	8	08/24/16	N	17.3	2979	2.60	12.10	7.24	1602	20.0											
Wiltse Well	2016	Q3	9	09/20/16	Y	15.8	2637.4	3.32	11.47	7.22	1941	28.6	1030	7.29	1520	206	126	80.7	4.90	470	470	<10	<10
Wiltse Well	2016	Q4	10	10/24/16	N	16.95	2724.47	6.85	10.95	7.22	1937	21.6											
Wiltse Well	2016	Q4	11	11/29/16	Y	10.64	2991.59	1.90	9.11	7.32	2014	13.7	963	7.36	1520	186	121	82.4	4.42	450	450	<10.0	<10.0
Wiltse Well	2016	Q4	12	12/13/16	N	18.05	2915.96	1.95	8.79	7.29	2036	20.9											
Wiltse Well	2017	Q1	1	01/18/17	Y	39.53	3594.71	0.30	7.56	7.20	2262	3.2	NA	NA	1680	NA	NA	NA	NA	NA	NA	NA	NA
Wiltse Well	2017	Q1	2	02/27/17	N	39.59	3579.79	0.00	7.20	7.17	2276	18.3											
Wiltse Well	2017	Q1	3	03/21/17	Y	39.59	3559.92	0.00	7.53	7.12	2085	6.0	1040	7.22	1480	205	128	110	4.61	410	410	<10.0	<10.0
Wiltse Well	2017	Q2	6	06/13/17	Y	NM	2979.63	2.05	10.34	7.41	1869	13.3	1060	7.46	1510	211	129	87.5	4.79	445	445	<10	<10
Wiltse Well	2017	Q3	9	09/28/17	Y	18.32	2712.36	3.40	11.29	7.27	2074	19.5	1140	7.30	1680	219	143	80.7	4.62	510	510	<10.0	<10.0

		Lab Analytical Results																						
Location Name	Sample Date	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Ammonia as N	Ortho-Phosphate as P	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc	Radium 226	Radium 228
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	pCi/L
Wiltse Well	03/31/16	81.0	0.285	671	3.54	0.456	NA	NA	<0.05	<0.0025	<0.0005	0.0018	0.100	<0.0025	0.673	<0.0002	<0.0025	<0.005	13.9	6.51	0.0029	0.0156	0.7 +/- 0.1	<0.8
Wiltse Well	04/27/16																							
Wiltse Well	05/25/16																							
Wiltse Well	06/23/16	76.3	<0.5	595	4.1	0.891	NA	NA	<0.05	<0.0025	<0.0005	0.0024	<0.05	<0.0025	0.857	<0.0002	<0.0025	<0.005	16.1	7.53	0.0021	0.0364	NA	NA
Wiltse Well	07/19/16																							
Wiltse Well	08/24/16																							
Wiltse Well	09/20/16	62.3	<0.5	656	3.15	1.08	NA	NA	<0.05	0.0005	<0.0005	0.0020	0.060	<0.0025	0.756	<0.0002	0.0017	0.0013	16.4	7.67	0.0023	0.0301	NA	NA
Wiltse Well	10/24/16																							
Wiltse Well	11/29/16	70.1	0.3	676	3.02	0.965	NA	NA	<0.050	0.0008	<0.0001	0.0038	0.136	<0.0005	0.608	<0.0002	0.0016	0.0023	14.3	6.69	0.0026	0.0269	NA	NA
Wiltse Well	12/13/16																							
Wiltse Well	01/18/17	NA	NA	NA	NA	NA	<0.100	<0.100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wiltse Well	02/27/17																							
Wiltse Well	03/21/17	72.5	<0.500	731	3.40	0.492	NA	NA	<0.050	0.0009	<0.0001	0.0023	0.286	<0.0005	0.440	<0.0002	0.0016	0.0027	14.7	6.85	0.0024	0.0194	NA	NA
Wiltse Well	06/13/17	72.5	0.332	702	3.54	1.07	NA	NA	<0.1	0.0006	<0.0001	0.0019	0.161	<0.0005	0.797	<0.0002	0.0021	0.0019	15.5	7.22	0.0021	0.026	NA	NA
Wiltse Well	09/28/17	68.7	<0.500	779	3.34	1.80	NA	NA	<0.050	0.0005	<0.0001	0.0025	<0.050	<0.0005	0.881	<0.0002	0.0021	0.0016	16.1	7.54	0.0021	0.0208	NA	NA

Notes & Definitions

Q	calendar quarter
Y/N	yes or no
gpm	gallons per minute
gal	gallons
ft bgs	feet below ground surface
deg C	degrees Celsius
SU	standard pH units
µS/cm	microsiemens per centimeter
mV	millivolts
mg/L	milligram per liter
pCi/L	picocuries per liter
NM	not measured (field)
NA	not analyzed (lab)

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RESOURCE HYDROGEOLOGIC SERVICES

Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV
Well #1 Upgradient	2016	Q1	3	03/30/16	Y	1.5	306	4.40	8.80	7.77	1224	-123.1
Well #1 Upgradient	2016	Q2	4	04/27/16	N	7.9	522	5.07	13.10	7.57	1199	-162.2
Well #1 Upgradient	2016	Q2	5	05/26/16	N	7.1	870	4.60	11.90	7.46	1284	-142.5
Well #1 Upgradient	2016	Q2	6	06/23/16	Y	5.8	297	4.95	14.20	7.6	1246	-185.4
Well #1 Upgradient	2016	Q3	7	07/19/16	N	7.1	280	5.55	14.10	7.69	1226	-156.6
Well #1 Upgradient	2016	Q3	8	08/24/16	N	7.4	284	6.30	12.70	7.59	1143	-196.8
Well #1 Upgradient	2016	Q3	9	09/21/16	Y	6.8	288	6.03	12.54	7.67	1176	-140.6
Well #1 Upgradient	2016	Q4	10	10/24/16	N	7.5	300	5.73	12.58	7.77	1223	-148.9
Well #1 Upgradient	2016	Q4	11	11/30/16	Y	9.3	280	5.69	10.64	7.72	1280	-152.9
Well #1 Upgradient	2016	Q4	12	12/14/16	N	7.5	295	5.08	11.27	7.68	1305	-141.0
Well #1 Upgradient	2017	Q1	1	01/18/17	Y	7.7	298	4.30	10.90	7.60	1392	-143.6
Well #1 Upgradient	2017	Q1	2	02/27/17	N	7.5	297	3.80	10.41	7.67	1415	-125.6
Well #1 Upgradient	2017	Q1	3	03/22/17	Y	8.2	291	3.82	11.24	7.67	1351	-132.2
Well #1 Upgradient	2017	Q2	6	06/28/17	Y	7.0	286	4.50	11.85	7.59	1159	-201.0
Well #1 Upgradient	2017	Q3	9	09/28/17	Y	7.1	259	5.51	11.84	7.60	1162	-176.9

Location Name	Sample Date	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Ammonia as N	Ortho-Phosphate as P
		mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Well #1 Upgradient	03/30/16	230	7.73	760	44.0	29.1	199	3.00	610	570	40.0	<10	4.33	0.347	90.1	2.54	<0.02	NA	NA
Well #1 Upgradient	04/27/16																		
Well #1 Upgradient	05/26/16																		
Well #1 Upgradient	06/23/16	306	7.57	745	59.7	38.2	196	3.15	660	660	<10	<10	6.12	<0.5	108	3.3	<0.02	NA	NA
Well #1 Upgradient	07/19/16																		
Well #1 Upgradient	08/24/16																		
Well #1 Upgradient	09/21/16	216	7.58	735	42.4	26.7	210	3.01	620	620	<10	<10	4.30	0.353	83.8	2.8	<0.02	NA	NA
Well #1 Upgradient	10/24/16																		
Well #1 Upgradient	11/30/16	271	7.59	725	51.7	34.5	189	3.01	615	615	<10.0	<10.0	4.44	0.337	117	3.18	<0.200	NA	NA
Well #1 Upgradient	12/14/16																		
Well #1 Upgradient	01/18/17	NA	NA	810	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.975	<0.100
Well #1 Upgradient	02/27/17																		
Well #1 Upgradient	03/22/17	391	7.46	775	75.7	49.1	167	3.30	640	640	<10.0	<10.0	4.53	0.337	156	3.84	<0.020	NA	NA
Well #1 Upgradient	06/28/17	277	7.74	725	54.0	34.6	189	3.00	585	585	<10.0	<10.0	4.32	0.362	97.4	5.82	<0.400	NA	NA
Well #1 Upgradient	09/28/17	215	7.66	705	41.6	27.1	203	3.09	670	670	<10.0	<10.0	6.21	<0.500	74.0	2.84	<0.400	NA	NA

Location Name	Sample Date	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc	Radium 226	Radium 228
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	pCi/L
Well #1 Upgradient	03/30/16	<0.05	<0.0005	<0.0001	0.0035	1.20	<0.0005	0.267	<0.0002	<0.0005	<0.001	13.8	6.45	<0.0001	<0.001	<0.4	<0.8
Well #1 Upgradient	04/27/16																
Well #1 Upgradient	05/26/16																
Well #1 Upgradient	06/23/16	<0.05	<0.0005	<0.0001	0.003	1.51	<0.0005	0.344	<0.0002	<0.0005	<0.001	15.2	7.12	0.0021	<0.001	NA	NA
Well #1 Upgradient	07/19/16																
Well #1 Upgradient	08/24/16																
Well #1 Upgradient	09/21/16	<0.05	<0.0005	<0.0001	0.0021	0.946	<0.0005	0.221	<0.0002	<0.0005	<0.001	14.8	6.94	<0.0001	0.0023	NA	NA
Well #1 Upgradient	10/24/16																
Well #1 Upgradient	11/30/16	<0.050	<0.0005	<0.0001	0.0041	1.64	<0.0005	0.312	<0.0002	0.0005	<0.0010	12.9	6.05	0.0002	0.0301	NA	NA
Well #1 Upgradient	12/14/16																
Well #1 Upgradient	01/18/17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Well #1 Upgradient	02/27/17																
Well #1 Upgradient	03/22/17	<0.050	0.0009	<0.0001	0.0020	2.01	<0.0005	0.491	<0.0002	<0.0005	0.0245	14.2	6.64	0.0002	<0.0020	NA	NA
Well #1 Upgradient	06/28/17	<0.050	<0.0005	<0.0001	0.0020	1.34	<0.0005	0.315	<0.0002	<0.0005	<0.0010	14.9	6.94	0.0001	<0.0020	NA	NA
Well #1 Upgradient	09/28/17	<0.050	<0.0005	<0.0001	0.0030	0.101	<0.0005	0.202	<0.0002	<0.0005	<0.0010	14.3	6.68	0.0001	<0.0020	NA	NA

Notes & Definitions

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deg C	degrees Celsius
SU	standard pH units
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mV	millivolts
mg/L	milligram per liter
pCi/L	picocuries per liter
NM	not measured (field)
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						Field Parameters							Lab Analytical Results																																	
Location Name	Year	Q	Month	Sample Date	Lab Analysis	Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Ammonia as N	Ortho-Phosphate as P	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc	Radium 226	Radium 228
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	pCi/L
Well #2 Downgradient	2016	Q1	3	03/30/16	Y	0.5	7.0	3.69	6.30	7.58	899	-9.4	444	7.63	685	72.2	63.9	22.2	2.04	342	338	<10	<10	35.8	0.230	129	3.34	0.042	NA	NA	0.156	0.0008	<0.0001	0.0004	0.081	<0.0005	0.497	<0.0002	0.0014	<0.001	11.6	5.42	0.0013	0.0034	<0.4	<0.8
Well #2 Downgradient	2016	Q2	4	04/21/16	N	0.5	6.4	3.17	10.10	7.60	867	-13.7																																		
Well #2 Downgradient	2016	Q2	5	05/25/16	N	0.5	6.7	4.25	13.50	7.60	804	-35.7																																		
Well #2 Downgradient	2016	Q2	6	06/23/16	Y	0.5	7.0	1.42	18.40	7.64	600	-66.9	314	7.66	470	54.9	43.1	16.5	2.1	280	280	<10	<10	6.8	0.298	70	14	<0.02	NA	NA	<0.05	0.0015	<0.0001	0.0005	0.085	<0.0005	0.54	<0.0002	0.0022	<0.001	14.7	6.89	0.0007	<0.001	NA	NA
Well #2 Downgradient	2016	Q3	7	07/19/16	N	0.5	6.4	4.17	19.80	7.68	369	-112.1																																		
Well #2 Downgradient	2016	Q3	8	08/24/16	N	0.5	6.0	4.17	14.00	7.73	815	-76.3																																		
Well #2 Downgradient	2016	Q3	9	09/20/16	Y	0.5	6.0	5.50	14.13	7.53	877	-88.3	452	7.48	525	75.9	63.8	19.8	2.16	380	380	<10	<10	27.4	0.272	114	2.64	<0.02	NA	NA	<0.05	0.0010	<0.0001	0.0003	0.118	<0.0005	0.354	<0.0002	0.0024	<0.001	12.8	5.97	0.0015	0.0010	NA	NA
Well #2 Downgradient	2016	Q4	10	10/19/16	N	NM	6.0	6.40	13.29	7.66	881	-82.0																																		
Well #2 Downgradient	2016	Q4	11	11/30/16	Y	7.2	6.0	4.7	10.36	7.66	904	-72.7	432	7.55	495	72.7	60.8	20.7	2.05	380	380	<10.0	<10.0	26.2	0.256	117	3.4	0.089	NA	NA	<0.050	0.0013	<0.0001	0.0051	<0.050	0.0078	0.359	<0.0002	0.0025	0.0011	11.9	5.55	0.0016	0.0311	NA	NA
Well #2 Downgradient	2016	Q4	12	12/14/16	N	2	6.0	5.00	12.40	7.71	872	-81.1																																		
Well #2 Downgradient	2017	Q1	1	01/26/17	Y	NA	8.0	3.95	6.98	7.57	908	-66.8	NA	NA	545	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.100	<0.0500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Well #2 Downgradient	2017	Q1	2	02/27/17	N	NA	7.5	2.74	4.44	7.68	1193	-55.7																																		
Well #2 Downgradient	2017	Q1	3	03/22/17	Y	NA	6.0	6.35	8.43	7.78	921	-67.0	485	7.72	635	81.0	68.7	21.8	1.94	375	375	<10.0	<10.0	23.3	0.228	153	3.52	<0.020	NA	NA	<0.050	0.0009	<0.0001	0.0007	0.213	<0.0005	0.384	<0.0002	0.0021	0.0045	10.9	5.12	0.0014	<0.0020	NA	NA
Well #2 Downgradient	2017	Q2	6	06/13/17	Y	NM	8.0	0.95	17.05	7.56	633	-54.3	352	7.6	415	60.9	48.5	16.1	2.22	285	285	<10	<10	7.11	0.313	75.2	3.56	<0.02	NA	NA	<0.05	0.0017	<0.0001	0.0002	<0.05	<0.0005	0.259	<0.0002	0.0025	<0.001	15.5	7.23	0.0008	<0.002	NA	NA
Well #2 Downgradient	2017	Q3	9	09/21/17	Y	NM	8.0	4.85	12.13	7.66	852	-53.7	378	7.51	525	64.8	52.6	17.0	1.64	395	395	<10.0	<10.0	19.0	0.263	98.4	2.61	<0.020	NA	NA	<0.050	0.0006	<0.0001	0.0004	<0.050	<0.0005	0.307	<0.0002	0.0021	<0.0010	13.0	6.08	0.0013	<0.0040	NA	NA

Notes & Definitions

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gpm	**gallons per minute**
gal	**gallons**
ft bgs	**feet below ground surface**
deg C	**degrees Celsius**
SU	**standard pH units**
µS/cm	**microsiemens per centimeter**
mV	**millivolts**
mg/L	**milligram per liter**
pCi/L	**picocuries per liter**
NM	**not measured (field)**
NA	**not analyzed (lab)**

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RESOURCE HYDROGEOLOGIC SERVICES

Location Name	Year	Q	Month	Sample Date	Lab Analysis	Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential
						Field Parameters						
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV
MW-HGA-4	2016	Q4	12	12/12/16	Y	0.5	2.1	0.73	7.31	7.29	1284	-72.1
MW-HGA-4	2017	Q1	1	01/26/17	Y	NM	3.0	0.57	4.76	7.36	1257	-86.6
MW-HGA-4	2017	Q1	2	02/28/17	N	NM	3.0	0.60	6.44	7.40	1201	-105.1
MW-HGA-4	2017	Q1	3	03/22/17	Y	NM	2.1	0.83	8.14	7.41	1155	-104.4
MW-HGA-4	2017	Q2	4	04/27/17	N	NM	NM	0.94	7.21	7.33	1153	-74.5
MW-HGA-4	2017	Q2	5	05/31/17	N	NM	2.1	2.06	9.86	7.36	1113	-91.3
MW-HGA-4	2017	Q2	6	06/13/17	Y	NM	2.0	2.53	8.37	7.40	1055	-134.7
MW-HGA-4	2017	Q3	7	07/27/17	N	NM	2.0	3.25	8.61	7.36	1099	-137.6
MW-HGA-4	2017	Q3	8	08/16/17	N	NM	2.0	2.65	8.81	7.35	1050	-131.0
MW-HGA-4	2017	Q3	9	09/21/17	Y	NM	2.1	3.31	9.00	7.33	1124	-139.5

Location Name	Sample Date	Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Ammonia as N
		Lab Analytical Results																
		mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-HGA-4	12/12/16	724	7.30	855	147	86.7	19.5	2.02	545	545	<10.0	<10.0	10.9	0.577	240	4.43	<0.020	NA
MW-HGA-4	01/26/17	NA	NA	770	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.498
MW-HGA-4	02/28/17																	
MW-HGA-4	03/22/17	611	7.17	710	118	76.7	27.4	2.13	465	465	<10.0	<10.0	8.75	0.485	229	4.54	<0.020	NA
MW-HGA-4	04/27/17																	
MW-HGA-4	05/31/17																	
MW-HGA-4	06/13/17	616	7.31	715	121	76.6	28.6	2.11	415	415	<10	<10	7.95	0.506	192	4.35	<0.02	NA
MW-HGA-4	07/27/17																	
MW-HGA-4	08/16/17																	
MW-HGA-4	09/21/17	522	7.25	750	102	64.9	24.9	1.75	465	465	<10.0	<10.0	8.96	0.517	205	4.69	<0.020	NA

Location Name	Sample Date	Ortho-Phosphate as P	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-HGA-4	12/12/16	NA	0.423	0.0030	<0.0001	0.0006	3.71	<0.0005	4.07	<0.0002	0.0013	<0.0010	22.3	10.4	0.0010	0.0039
MW-HGA-4	01/26/17	<0.0500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-HGA-4	02/28/17															
MW-HGA-4	03/22/17	NA	<0.050	0.0029	<0.0001	0.0008	7.29	<0.0005	2.78	<0.0002	0.0024	0.0030	16.8	7.86	0.0004	0.0046
MW-HGA-4	04/27/17															
MW-HGA-4	05/31/17															
MW-HGA-4	06/13/17	NA	<0.05	0.0028	<0.0001	0.0002	7.32	<0.0005	2.37	<0.0002	0.0027	<0.001	18	8.41	0.0004	<0.002
MW-HGA-4	07/27/17															
MW-HGA-4	08/16/17															
MW-HGA-4	09/21/17	NA	<0.050	<0.0005	<0.0001	0.0004	0.378	<0.0005	2.03	<0.0002	0.0028	<0.0010	16.5	7.72	0.0004	<0.0040

Notes & Definitions

Q	calendar quarter
Y/N	yes or no
gpm	gallons per minute
gal	gallons
ft bgs	feet below ground surface
deg C	degrees Celsius
SU	standard pH units
µS/cm	microsiemens per centimeter
mV	millivolts
mg/L	milligram per liter
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NM	not measured (field)
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RESOURCE HYDROGEOLOGIC SERVICES

Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV
MW-1-C	2017	Q2	6	06/07/17	Y	NM	5	216.50	15.96	7.52	2446	74.3
MW-1-C	2017	Q3	7	07/18/17	N			dry				
MW-1-C	2017	Q3	8	08/23/17	N			dry				
MW-1-C	2017	Q3	9	09/07/17	N			dry				
MW-1-C	2017	Q3	9	09/26/17	Y	NM	NM	216.59	12.86	7.17	2725	77.4

Location Name	Sample Date	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N
		mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-1-C	06/07/17	498	8.35	2020	96.0	62.8	506	11.4	530	530	<10.0	<10.0	24.2	1.59	1090	4.56	<2.00
MW-1-C	07/18/17																
MW-1-C	08/23/17																
MW-1-C	09/07/17																
MW-1-C	09/26/17	1290	7.36	2440	234	172	242	3.81	700	700	<10.0	<10.0	6.97	0.864	1350	2.84	<0.400

Location Name	Sample Date	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-1-C	06/07/17	<0.050	0.0029	<0.0001	0.0088	<0.050	<0.0005	0.0744	<0.0002	0.0164	0.0136	10.6	4.94	0.0500	0.0293
MW-1-C	07/18/17														
MW-1-C	08/23/17														
MW-1-C	09/07/17														
MW-1-C	09/26/17	<0.050	0.0016	<0.0001	0.0085	<0.050	<0.0005	0.0853	<0.0002	0.0049	0.0012	16.6	7.77	0.0044	0.0294

Notes & Definitions

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SU	**standard pH units**
µS/cm	**microsiemens per centimeter**
mV	**millivolts**
mg/L	**milligram per liter**
pCi/L	**picocuries per liter**
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						Field Parameters							Lab Analytical Results																													
Location Name	Year	Q	Month	Sample Date	Lab Analysis	Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-1-A	2017	Q2	6	06/07/17	Y	NM	12.75	215.42	17.72	7.78	1362	-34.6	124	7.74	975	24.7	15.1	324	1.98	375	375	<10.0	<10.0	2.75	0.268	427	5.03	<0.200	<0.050	<0.0005	<0.0001	0.0043	0.128	<0.0005	0.0260	<0.0002	0.0007	<0.0010	12.3	5.74	0.0004	0.0270
MW-1-A	2017	Q3	7	07/18/17	N			dry																																		
MW-1-A	2017	Q3	8	08/23/17	N			dry																																		
MW-1-A	2017	Q3	9	09/07/17	N	NM	NM	215.54	10.74	7.35	1555	-54.7																														
MW-1-A	2017	Q3	9	09/26/17	Y	NM	NM	216.33	9.73	7.38	1563	-46.5	133	7.35	1080	25.8	16.7	329	2.02	450	450	<10.0	<10.0	2.16	0.245	432	1.36	<0.400	<0.050	<0.0005	<0.0001	0.0057	0.367	<0.0005	0.0218	<0.0002	0.0010	<0.0010	11.9	5.56	0.0002	0.0088

Notes & Definitions

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Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters						
						Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV
MW-1-MI	2017	Q2	6	06/07/17	Y	NM	19.5	259.99	15.8	8.00	2032	160.5
MW-1-MI	2017	Q3	7	07/18/17	N			dry				
MW-1-MI	2017	Q3	8	08/23/17	N	NM	NM	258.29	11.83	7.94	2137	65.7
MW-1-MI	2017	Q3	9	09/26/17	N*	NM	NM	258.34	21.73	7.86	2119	61.4

Location Name	Sample Date	Lab Analytical Results														
		Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)
		mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-1-MI	06/07/17	231	8.14	1520	46.7	27.9	470	2.55	600	600	<10.0	<10.0	7.69	1.14	739	5.14
MW-1-MI	07/18/17															
MW-1-MI	08/23/17															
MW-1-MI	09/26/17															

Location Name	Sample Date	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-1-MI	06/07/17	0.103	<0.050	0.0029	<0.0001	0.0067	<0.050	0.0010	0.0445	<0.0002	0.0796	0.0028	11.6	5.44	0.0505	1.52
MW-1-MI	07/18/17															
MW-1-MI	08/23/17															
MW-1-MI	09/26/17															

Notes & Definitions

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mg/L	milligram per liter
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* Not enough sample water volume to obtain lab sample, only field parameters collected

RESOURCE HYDROGEOLOGIC SERVICES

Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-2-C	2017	Q1	3	03/30/17	N			dry																																		
MW-2-C	2017	Q2	6	06/07/17	N			dry																																		
MW-2-C	2017	Q3	7	07/18/17	N			dry																																		
MW-2-C	2017	Q3	8	08/23/17	N			dry																																		
MW-2-C	2017	Q3	9	09/26/17	N			dry																																		

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						Field Parameters							Lab Analytical Results																													
Location Name	Year	Q	Month	Sample Date	Lab Analysis	Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-2-A	2017	Q1	3	03/30/17	N			dry																																		
MW-2-A	2017	Q2	6	06/07/17	N			dry																																		
MW-2-A	2017	Q3	7	07/18/17	N			dry																																		
MW-2-A	2017	Q3	8	08/23/17	N			dry																																		
MW-2-A	2017	Q3	9	09/26/17	N			dry																																		

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Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV
MW-2-MI	2017	Q1	3	03/30/17	N			dry				
MW-2-MI	2017	Q2	6	06/07/17	N			dry				
MW-2-MI	2017	Q3	7	07/18/17	N			dry				
MW-2-MI	2017	Q3	8	08/23/17	N			dry				
MW-2-MI	2017	Q3	9	09/26/17	N			dry				

Location Name	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-2-MI																														
MW-2-MI																														
MW-2-MI																														
MW-2-MI																														
MW-2-MI																														

Notes & Definitions

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mg/L	milligram per liter
pCi/L	picocuries per liter
NM	not measured (field)
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Industry standard Quality Assurance/Quality Control (QA/QC) protocol are followed for this hydrologic monitoring program by both GCC Energy and the contracted environmental water quality analytical laboratories. QA/QC results are not shown in this table.

Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Dissolved Oxygen
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L
MW-3-C	2017	Q1	3	03/27/17	Y	0.5	20	304.21	10.45	8.61	3549	-129.0	2.54
MW-3-C	2017	Q2	6	06/30/17	Y	NM	1.5	296.30	12.85	8.57	3588	-87.2	NM
MW-3-C	2017	Q3	7	07/27/17	N	NM	NM	296.93	13.13	8.51	3815	-137.5	NM
MW-3-C	2017	Q3	8	08/24/17	N	NM	NM	296.87	12.51	8.46	4112	-128.8	NM
MW-3-C	2017	Q3	9	09/28/17	Y	NM	NM	297.43	11.80	8.44	4351	-149.9	NM

Location Name	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)
	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-3-C	14.4	8.5	2130	3.60	1.31	796	3.47	1490	1360	130	<10.0	182	4.89	73.4	10.6
MW-3-C	11.8	8.48	2360	2.87	1.12	890	3.24	1570	1480	90.0	<10.0	330	4.94	73.5	58.5
MW-3-C															
MW-3-C															
MW-3-C	15.1	8.35	3070	3.50	1.55	1100	4.01	1690	1650	40.0	<10.0	477	4.52	46.4	219

Location Name	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-3-C	<0.020	<0.050	0.0115	<0.0001	0.0109	<0.050	0.0085	0.0091	<0.0002	0.0143	0.0233	7.82	3.66	0.0091	0.375
MW-3-C	<0.400	<0.100	0.0088	<0.0010	0.0147	<0.050	<0.0050	0.0188	<0.0002	0.0291	0.0121	8.86	4.14	0.0102	<0.0200
MW-3-C															
MW-3-C															
MW-3-C	<0.400	<0.050	0.0098	<0.0010	0.0174	<0.050	<0.0050	0.0178	<0.0002	0.0241	0.0149	9.16	4.28	0.0137	<0.0200

Notes & Definitions

Q	calendar quarter
Y/N	yes or no
gpm	gallons per minute
gal	gallons
ft bgs	feet below ground surface
deg C	degrees Celsius
SU	standard pH units
µS/cm	microsiemens per centimeter
mV	millivolts
mg/L	milligram per liter
pCi/L	picocuries per liter
NM	not measured (field)
NA	not analyzed (lab)

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RESOURCE HYDROGEOLOGIC SERVICES

Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Dissolved Oxygen
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L
MW-3-A	2017	Q1	3	03/27/17	Y	0.5	30	297.35	11.72	8.82	2535	-269.0	2.49
MW-3-A	2017	Q2	6	06/30/17	Y	NM	1.5	298.24	13.17	8.75	2446	-101.5	NM
MW-3-A	2017	Q3	7	07/18/17	N	NM	NM	297.45	19.46	8.56	2115	-55.3	NM
MW-3-A	2017	Q3	8	08/24/17	N	NM	NM	298.24	12.57	8.67	2524	-87.4	NM
MW-3-A	2017	Q3	9	09/28/17	Y	NM	NM	298.11	12.32	8.72	2470	-142.3	NM

Location Name	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N
	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-3-A	7.53	8.63	1630	2.00	0.616	566	1.72	530	380	150	<10.0	16.1	0.464	729	3.52	<0.100
MW-3-A	12.6	8.69	1670	3.67	0.823	585	2.02	470	470	<10.0	<10.0	17.4	0.488	802	10.0	<0.100
MW-3-A																
MW-3-A																
MW-3-A	12.6	8.53	1630	3.63	0.859	589	2.04	500	440	60.0	<10.0	18.5	0.535	840	7.26	<0.020

Location Name	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-3-A	<0.050	0.0025	<0.0001	0.0061	<0.050	<0.0005	0.0042	<0.0002	0.0005	0.0577	10.1	4.70	0.0002	0.0031
MW-3-A	<0.050	<0.0025	<0.0005	0.0081	<0.050	<0.0025	0.0251	<0.0002	0.0274	<0.0050	10.9	5.10	0.0040	<0.0100
MW-3-A														
MW-3-A														
MW-3-A	<0.050	<0.0025	<0.0005	0.0080	<0.050	<0.0025	0.0194	<0.0002	0.0091	<0.0050	11.6	5.41	0.0051	<0.0100

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RESOURCE HYDROGEOLOGIC SERVICES

Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Dissolved Oxygen
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L
MW-3-MI	2017	Q1	3	03/27/17	Y	0.5	19	304.49	10.03	9.34	1907	-87.0	7.68
MW-3-MI	2017	Q2	6	06/30/17	Y	NM	1.5	241.15	12.55	8.94	1699	-54.5	NM
MW-3-MI	2017	Q3	7	07/18/17	N	NM	NM	240.46	22.02	8.46	1402	-26.4	NM
MW-3-MI	2017	Q3	8	08/16/17	N	NM	NM	240.53	12.88	8.90	1598	-108.2	NM
MW-3-MI	2017	Q3	9	09/28/17	Y	NM	NM	240.46	11.04	8.74	1737	-107.3	NM

Location Name	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)
	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-3-MI	4.85	8.95	1550	1.32	0.374	420	2.15	740	510	230	<10.0	8.66	0.952	165	8.34
MW-3-MI	8.73	8.75	1120	2.32	0.714	430	2.21	675	555	120	<10.0	10.1	1.34	241	14.8
MW-3-MI															
MW-3-MI															
MW-3-MI	9.02	8.72	1140	2.34	0.775	440	1.93	700	600	100	<10.0	10.7	1.26	247	10.9

Location Name	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-3-MI	<0.020	<0.050	0.0134	<0.0001	0.0055	<0.050	0.0024	0.0022	<0.0002	0.0061	0.0013	7.97	3.73	0.0049	0.0405
MW-3-MI	<0.020	0.102	0.0167	<0.0005	0.0058	<0.100	<0.0025	0.0058	<0.0002	0.0211	<0.0050	8.18	3.82	0.0084	<0.0100
MW-3-MI															
MW-3-MI															
MW-3-MI	<0.020	<0.050	0.0131	<0.0005	0.0065	<0.050	<0.0025	0.0033	<0.0002	0.0148	<0.0050	9.05	4.23	0.0140	<0.0100

Notes & Definitions

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mg/L	milligram per liter
pCi/L	picocuries per liter
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RESOURCE HYDROGEOLOGIC SERVICES

Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters							
						Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Dissolved Oxygen
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L
MW-4-C	2017	Q1	3	03/30/17	Y	NM	7	328.33	13.31	8.33	3792	57.3	NM
MW-4-C	2017	Q2	6	06/29/17	Y	NM	1.5	314.05	17.40	7.62	5944	20.3	NM
MW-4-C	2017	Q3	7	07/27/17	N	NM	NM	309.87	12.67	7.68	5997	-101.5	NM
MW-4-C	2017	Q3	8	08/23/17	N	NM	NM	306.86	12.03	7.70	5885	-111.2	NM
MW-4-C	2017	Q3	9	09/28/17	Y	NM	NM	303.96	13.86	7.69	5813	-103.7	NM

Location Name	Lab Analytical Results																													
	Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-4-C	46.3	7.61	3230	13.6	2.99	908	4.38	1250	1250	<10.0	<10.0	181	1.29	534	30	<2.00	<0.050	0.0059	<0.0001	0.0125	<0.050	<0.0005	0.0269	<0.0002	0.0526	0.0248	9.85	4.61	0.0297	0.0156
MW-4-C	55.9	7.77	4050	13.7	5.26	1510	5.71	2360	2360	<10.0	<10.0	550	2.04	487	6.42	<0.500	<0.050	0.0119	<0.0010	0.0243	<0.050	<0.0050	0.0772	<0.0002	0.115	0.0231	12.6	5.88	0.121	0.0265
MW-4-C																														
MW-4-C																														
MW-4-C	38.9	7.79	3750	9.15	3.90	1490	6.07	2780	2780	<10.0	<10.0	587	2.17	70.2	5.08	<0.400	<0.050	0.0128	<0.0010	0.0221	<0.050	<0.0050	0.0554	<0.0002	0.0138	0.0214	12.9	6.02	0.0984	<0.0200

Notes & Definitions

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Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Dissolved Oxygen
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L
MW-4-A	2017	Q1	3	03/29/17	Y	NM	19	338.60	15.61	8.61	2163	28.6	NM
MW-4-A	2017	Q2	6	06/30/17	Y	NM	1.5	334.96	16.83	8.29	2053	54.0	NM
MW-4-A	2017	Q3	7	07/19/17	N	NM	1.5	335.59	25.50	8.55	1876	60.2	NM
MW-4-A	2017	Q3	8	08/23/17	N	NM	NM	334.79	17.63	7.98	2096	61.7	NM
MW-4-A	2017	Q3	9	09/28/17	Y	NM	>1	334.81	11.91	8.41	2180	-8.6	NM

Location Name	Sample Date	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride
		mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-4-A	03/29/17	9.16	8.2	1470	2.23	0.871	515	1.57	635	635	<10.0	<10.0	9.56	<0.400
MW-4-A	06/30/17	9.85	8.40	1470	2.43	0.916	537	1.75	560	560	<10.0	<10.0	9.66	<0.400
MW-4-A	07/19/17													
MW-4-A	08/23/17													
MW-4-A	09/28/17	7.77	8.36	1450	1.76	0.823	513	1.63	630	590	40.0	<10.0	10.3	<0.500

Location Name	Sample Date	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-4-A	03/29/17	594	6.63	0.035	<0.050	0.0016	<0.0001	0.0053	<0.050	0.0014	0.0044	<0.0002	0.0009	0.0016	10.2	4.75	0.0016	0.269
MW-4-A	06/30/17	588	11.7	<0.020	<0.050	<0.0025	<0.0005	0.0093	<0.050	<0.0025	0.0063	<0.0002	0.0275	<0.0050	10.6	4.97	<0.0005	0.0319
MW-4-A	07/19/17																	
MW-4-A	08/23/17																	
MW-4-A	09/28/17	783	3.52	<0.020	<0.050	<0.0025	<0.0005	0.0076	<0.050	<0.0025	0.0044	<0.0002	<0.0025	<0.0050	9.99	4.67	<0.0005	<0.0100

Notes & Definitions

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Y/N	yes or no
gpm	gallons per minute
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µS/cm	microsiemens per centimeter
mV	millivolts
mg/L	milligram per liter
pCi/L	picocuries per liter
NM	not measured (field)
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Location Name	Year	Q	Month	Sample Date	Lab Analysis	Field Parameters: Purge Flow Rate	Total Purged	Depth to Water	Temperature	pH	Specific Conductance	Oxygen Reduction Potential	Dissolved Oxygen
					Y/N	gpm	gal	ft bgs	deg C	SU	µS/cm	mV	mg/L
MW-4-MI	2017	Q1	3	03/30/17	Y	NM	0.5	378.20	14.97	9.08	1581	155.2	NM
MW-4-MI	2017	Q2	6	06/16/17	Y	NM	6.5	330.15	14.64	8.91	1668	64.7	NM
MW-4-MI	2017	Q3	7	07/27/17	N	NM	NM	330.94	12.86	8.78	1731	9.8	NM
MW-4-MI	2017	Q3	8	08/23/17	N	NM	NM	330.85	12.50	8.79	1708	35.2	NM
MW-4-MI	2017	Q3	9	09/28/17	Y	NM	>1	330.81	11.37	8.76	1784	-29.6	NM

Location Name	Lab Analytical Results: Hardness as CaCO3	pH (Lab)	Total Dissolved Solids (Lab)	Calcium	Magnesium	Sodium	Potassium	Alkalinity, Total	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, Hydroxide	Chloride	Fluoride	Sulfate as SO4	Total Organic Carbon (TOC)	Nitrate/ Nitrite as N
	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-4-MI	5.43	8.83	1160	1.53	0.392	408	1.46	965	775	190	<10.0	2.18	4.72	17.4	2.64	<0.020
MW-4-MI	8.71	8.59	1170	2.32	0.707	458	<2.00	915	825	90.0	<10.0	7.50	5.02	64.7	6.49	<0.020
MW-4-MI																
MW-4-MI																
MW-4-MI	7.07	8.63	1180	1.88	0.579	449	1.73	1100	880	220	<10.0	8.78	5.09	76.6	8.58	<0.020

Location Name	Aluminum	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Selenium	Silica (Si02)	Silicon	Uranium	Zinc
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-4-MI	<0.050	0.0099	<0.0001	0.0059	<0.050	0.0010	0.0020	<0.0002	0.0020	<0.0010	7.27	3.40	0.0043	0.113
MW-4-MI	<0.100	0.0220	<0.0001	0.0058	<0.100	<0.0005	0.0066	<0.0002	0.0160	0.0012	8.01	3.75	0.0126	0.0697
MW-4-MI														
MW-4-MI														
MW-4-MI	<0.050	0.0131	<0.0005	0.0071	<0.050	<0.0025	0.0081	<0.0002	0.0127	<0.0050	8.80	4.11	0.0184	<0.0100

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