CLOSE CONSULTING GROUP
Environmental Science & Engineering

January 21, 2019

Mr. Alex Alarcon
Plant Manager
GCC Rio Grande, Inc.
3372 Lime Road
Pueblo, CO 81004

RE: Pueblo Cement Plant and Limestone Quarry. DRMS Permit No. M-2002-004
2018 Annual Report on Groundwater Monitoring

Dear Mr. Alarcon:

This letter provides a report on groundwater monitoring activities completed at the GCC Rio Grande facility during 2018. Existing monitoring wells were checked or sampled during January, April, August, September and December 2018. Monitoring activities were performed either by GCC staff or by Close Consulting Group LLC (CCG) in conjunction with GCC staff. Monitoring was conducted pursuant to permit Technical Revision Numbers 3 and 6 (TR-03 and TR-06). The locations of existing site monitoring wells MW-005, MW-6 and MW-7 are shown on the Site Basemap figure in Attachment A.

MW-005 MONITORING

TR-03 was approved by the Colorado Division of Reclamation, Mining and Safety (DRMS) on March 20, 2013, with additional stipulations on schedule and reporting provided on April 17, 2013. TR-03 requires semi-annual attempts to sample MW-005 with notification of the mid-year monitoring event and submittal of results by January 31 of the following year. MW-005 has been dry since it was installed in 2008. MW-005 was checked by GCC staff on April 23 and August 7 and found to be dry both times. MW-005 was also checked by CCG and GCC staff on December 12, 2018 and found to be dry. The April and August attempts to sample MW-005 were reported to DRMS by GCC in letters dated April 24 and August 7, respectively (Attachment B).

MW-6 AND MW-7 MONITORING

Pursuant to TR-06, approved by DRMS on July 28, 2017, wells MW-6 and MW-7 were installed in December 2017, and monitored quarterly in 2018. Installation, development and initial (January 2018) sampling of MW-6 and MW-7 was documented in a report by CCG dated February 8, 2018 and submitted to DRMS by GCC with cover letter dated March 6, 2018.

As described in the above-referenced CCG report on well completions, MW-6 was completed as a Fort Hayes Limestone well in what was obviously a low water producing zone. The bottom of the well is at the base of the Fort Hayes, approximately 57 feet below ground surface. The drilling rig was then repositioned approximately 25 feet southwest of MW-6 with the original intention of installing MW-7 in the underlying Codell Sandstone. The lithology was essentially the same as that encountered in MW-6, until water was encountered in a water-producing fractured zone at approximately 47 feet below ground surface. Therefore, MW-7 was also completed as a Fort Hayes well at approximately the same depth as MW-6.

TR-06 requires quarterly monitoring of MW-6 and MW-7. The initial and subsequent 2018 quarterly monitoring activities and results for MW-6 and MW-7 are summarized below.

Well Sampling

After development by surging and bailing right after installation, new monitor wells MW-6 and MW-7 were secured and left undisturbed for 27 days before the initial sample collection on January 3, 2018. Additional quarterly monitoring events occurred on April 27, September 26, and December 12, 2018. The April and December events were conducted by CCG in conjunction with GCC staff. Preliminary April sampling results were transmitted to DRMS by GCC on May 7, 2018 (cover letter included in Attachment C). The September event was conducted by GCC and documented in a letter to DRMS dated November 19, 2018 (Attachment C). GCC reported that in September neither MW-6 or MW-7 yielded enough water after being purged to provide representative groundwater samples.

Monitoring and sample collection from MW-6 and MW-7 were performed applying guidance from Colorado Department of Public Health and Environment's (CDPHE's) Suggested Sampling Protocol for Ground Water Monitoring Wells. Prior to sample collection, the static water level and total depth were measured with an electronic water-sensing probe and results were used to calculate the wetted casing volume. The wells were purged and sampled using dedicated and disposable polyethylene bailers. After removal of each purge volume, field water quality parameters including pH, temperature, specific conductance were measured using a calibrated YSI Pro 1030 meter. Field parameters generally were measured in a minimum of three successive well casing volumes and until two or more field parameters stabilized (i.e., three successive readings within 10%), or the well was purged dry. Samples for dissolved metals analysis were field-filtered using a peristaltic pump and high capacity 0.45-micron filters.

During each monitoring event, MW-6 bailed dry before three casing volumes could be removed. During the January, April and December events, 2.6, 2.9 and 2.5 casing volumes were removed, respectively, before the well bailed dry. The well recharged an adequate amount after several hours to collect samples for all or most analytes. During September, GCC reported only 1.25 casing volumes could be removed and the well did not recharge sufficiently within 24 hours to collect an adequate or representative sample. Except for the September event, MW-7 yielded ample water for sample collection. For September, GCC staff reported two casing volumes were removed before MW-7 went dry, and it did not recover an adequate amount within 24 hours to sample.

Groundwater samples were immediately placed into clean, laboratory-supplied containers, labeled, logged onto a chain-of-custody form, and stored on ice for same-day hand delivery or overnight shipping delivery to Origins Laboratory, Inc. in Denver, Colorado for laboratory analysis in accordance with TR-06 (Colorado Agricultural Use Standards parameters). In addition, total dissolved solids (TDS) was analyzed when sample volume was adequate.

Information collected during groundwater sampling activities was recorded onto Groundwater Sampling Record forms, which are provided in Attachment D.

Water Quality Analyses

Field measurement and laboratory analytical results are summarized in Table 1, and full laboratory reports and chain of custody forms are provided in Attachment E. Samples were analyzed for the full suite analysis per TR-06 (Table 3, Colorado Agricultural Standards; CDPHE 2016) plus total dissolved solids, with some exceptions. During January, there was not adequate sample volume from MW-6 to analyze in the laboratory for pH, TDS, Fluoride and Nitrite. For the December analyses, TDS was not able to be reported for either MW-6 or MW-7 due to a lab error. The lab accidentally filtered all unpreserved volume that was remaining after the lab ran the anions for dissolved metals. This did not leave any remaining volume for the TDS analysis (Attachment E).

Discussion of Results

As shown in Table 1, the only analytical result elevated with respect to Colorado Agricultural Use Standards is manganese. As stated in the basis and purpose for Regulation 41 (CDPHE, WQCC 2016), the original agricultural manganese standard was derived from EPA's 1972 Water Quality Criteria ("Blue Book"), and addressed crop toxicity in acidic soils. In order to remain consistent with the 1972 criteria, as well as with Regulation No. 31, the Commission elected to add a footnote to specify that the agricultural manganese standard is only appropriate where irrigation water is applied to soils with pH values lower than 6.0.

Manganese, along with iron, are often elevated in shallow water wells naturally, and there is no conceptual rationale why the quarry would result in elevated concentrations of this parameter. Exposure of the fault zone could result in some oxygen infiltration to the subsurface that could result in reductions in manganese and iron through the formation of oxides and hydroxide minerals. Results of several analytes, including iron and manganese, were higher in initial samples and then decreased in subsequent samples. This could be due to the fresh oxygenation and/or residuals from initial well development.

Comparing MW-6 and MW-7 water quality results in Table 1, it is notable that field parameters for the wells are very similar. The pH for both wells is circumneutral. Differences between the two wells are noted mostly in iron and manganese, with iron higher in MW-7 and manganese higher in MW-6. The data suggest that the groundwater at these two closely spaced locations are of the same general origin, but because of the low hydraulic conductivity (i.e., lack of fracturing) at MW-6, there are some differences.

Given the distinctly different groundwater yields produced by closely spaced wells installed in the same stratigraphic interval, it is apparent that groundwater flow is dominated by fracturing and groundwater yield from the unfractured Fort Hays Limestone is relatively low even when adjacent to a productive facture system (possibly associated with the mapped fault). This suggests higher water yielding zones are not oriented sub-horizontally with bedding, but more vertically along the orientation of the fracturing. This finding downplays the importance of monitoring the Codell Sandstone, as it appears that the sub-vertical fault is the primary source of groundwater flowing across the site downgradient of the quarry panel. The fault is likely producing groundwater that is a composite of the units it transects (i.e., the Fort Hays and Codell).

We appreciate the opportunity to work with you on this project and look forward to addressing any questions about this report.

Sincerely,

Bence V. Close
Principal

Attachments:
Table 1 – Summary of 2018 Field and Laboratory Water Quality Results
Attachment A – Site Basemap
Attachment B – Correspondence with DRMS regarding MW-005 Monitoring
Attachment C – Correspondence with DRMS regarding MW-6 and MW-7 Quarterly Monitoring
Attachment D – Field Groundwater Sampling Records
Attachment E – Laboratory Analytical Reports

REFERENCES

Colorado Department of Public Health and Environment, Water Quality Control Commission, 2016. Regulation No. 41, The Basic Standards for Ground Water (5 CCR 1002-41), December 30.

Colorado Department of Public Health and Environment, Water Quality Control Division, Undated. Suggested Sampling Protocol for Ground Water Monitoring Wells.

Table 1

Summary of 2018 Field and Laboratory Water Quality Results

TABLE 1. SUMMARY OF 2018 FIELD AND LABORATORY WATER QUALITY RESULTS

GCC Rio Grande, Inc. - Pueblo

Parameter	CO State Std (Ag Use)	MW-6 Result	MW-6 Result	MW-6 Result	MW-7 Result	MW-7 Result	MW-7 Result	Min Detection Limit	Reporting Limit	Units	Lab Method
Date		1/3/2018	4/27/2018	12/12/2018	1/3/2018	4/27/2018	12/12/2018				
FIELD											
pH	6.5 - 8.5	6.95	7.20	7.39	6.86	6.85	6.90	--	--	pH units	--
Specific Conductance	--	4720	6200	6500	4765	5820	6093	--	--	uS	--
Temperature	--	14.0	16.3	14.9	15.0	15.0	14.0	--	--	deg C	--
LABORATORY											
pH	6.5 - 8.5	NA	7.22	7.40	7.35	6.66	6.86	--	--	pH units	EPA 9040C
Aluminum (d)	5000	636	ND	ND	1350	ND	ND	68	200	ug/L	6010C
Arsenic (d)	100	ND	ND	ND	9.49 (J)	ND	ND	5	30	ug/L	6010C
Beryllium (d)	100	ND	ND	ND	ND	ND	ND	1	5	ug/L	6010C
Boron (d)	750	633	654	624	461	441	446	15	50	ug/L	6010C
Cadmium (d)	10	ND	ND	ND	ND	ND	ND	1	5	ug/L	6010C
Chromium (d)	100	ND	ND	ND	ND	ND	ND	1	5	ug/L	6010C
Cobalt (d)	50	4.23 (J)	18.8	6.01	1.35 (J)	ND	ND	1	5	ug/L	6010C
Copper (d)	200	6.1 (J)	ND	ND	5.55 (J)	ND	ND	3	10	ug/L	6010C
Iron (d)	5000	474	55.6 (J)	ND	1390	249	242	30	100	ug/L	6010C
Lead (d)	100	ND	ND	3.99 (J)	ND	ND	ND	3.3	10	ug/L	6010C
Lithium (d)	2500	664	689	476	779	665	571	3	10	ug/L	6020A
Manganese (d)	200	591*	1140*	663*	201*	166	101	2	10	ug/L	6010C
Mercury (d)	10	ND	ND	ND	ND	ND	ND	0.067	0.2	ug/L	7470A
Nickel (d)	200	28.9	68.8	17.1	16.3	6.07	3.59 (J)	1.5	5	ug/L	6010C
Selenium (d)	20	ND	ND	6.19 (J)	ND	ND	ND	6	30	ug/L	6010C
Vanadium (d)	100	ND	ND	1.16 (J)	2.3 (J)	ND	ND	1	5	ug/L	6010C
Zinc (d)	2000	24.8	ND	8.99 (J)	26.7	ND	10.2	3.3	10	ug/L	6010C
Total Dissolved Solids	--	NS	5030	NA	5510	5270	NA	14.3	14.3	mg/L	EPA 160.1
Fluoride (d)	2	NS	ND	ND	0.415 (J)	ND	ND	1	1	mg/L	EPA 300.0
Nitrite (d)	10	NS	ND	ND	ND	ND	ND	1	1	mg/L	EPA 300.0
N Nitrite & Nitrate (d)	100	ND	ND	ND	ND	ND	ND	0.02	0.02	mg/L	EPA 353.2

Notes:

* Exceeds CO State Agricultural Use Standard

(d) = dissolved

(J) = Result reported greater than the detection limit but less than the reporting limit

ND = Not Detected above reporting limit

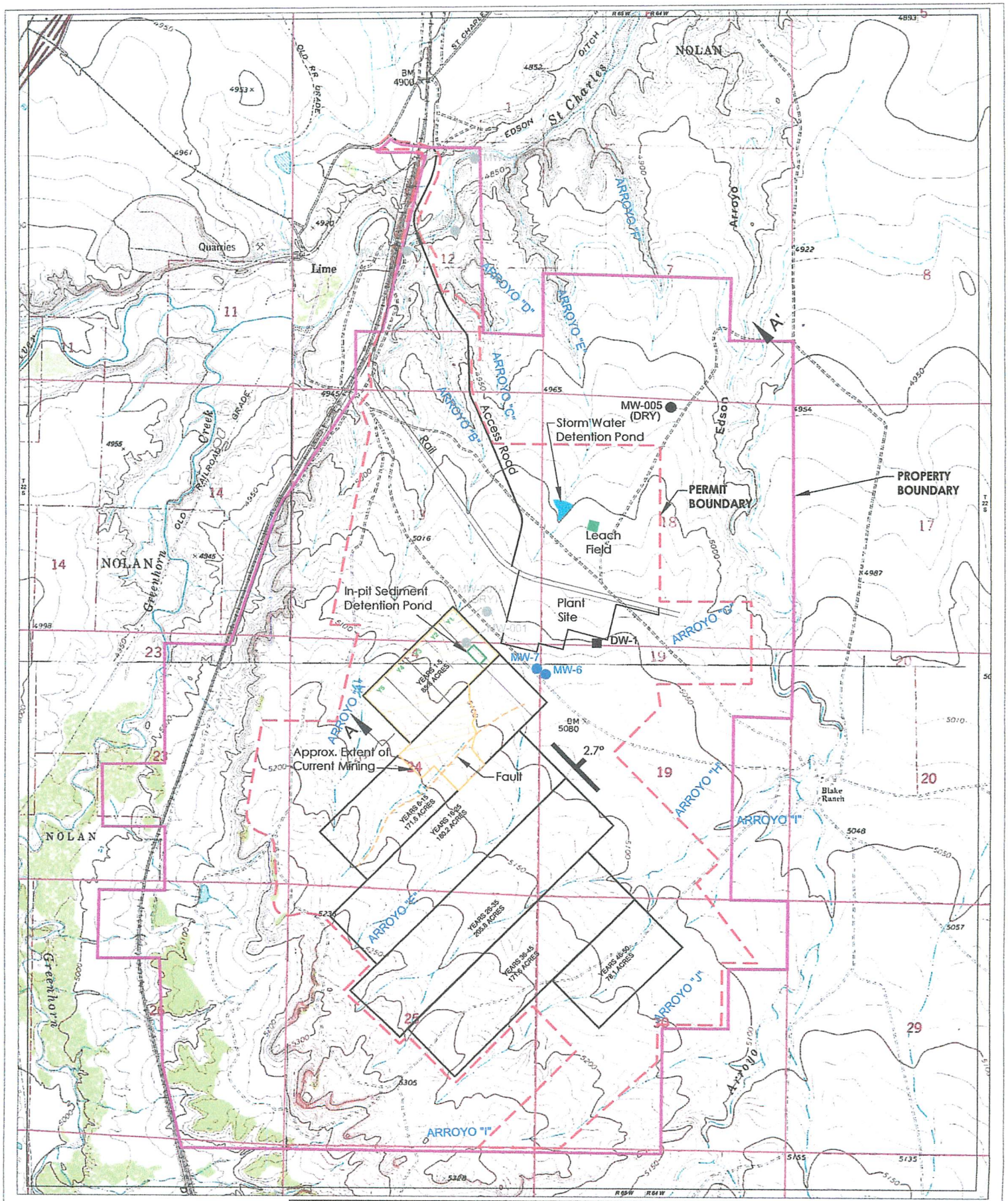
NA = Not Analyzed (lab error)

NS = Not Sufficient sample volume

Laboratory analyses by Origins Laboratory; Denver, CO

Attachment A

Site Basemap

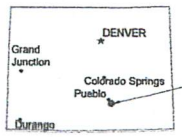


LEGEND

- MW-6 — MONITORING WELL INSTALLED 12/2017
- MW-001A — PLUGGED AND ABANDONED WELL
- MW-005 — ACTIVE MONITORING WELL
- DW-1 — ACTIVE PRODUCTION WELL
- 2.7° — STRIKE AND DEGREE DIP (BASE OF FORT HAYES)
- INFERRED FAULT TRACE
- NEW ACCESS ROAD
- RAILROAD SPUR
- PROPERTY BOUNDARY
- PERMIT BOUNDARY
- YEARS 1-5 — MINE PLAN- YEAR COMPLETED
- A — A' — GENERALIZED CROSS SECTION LOCATION (SEE FIGURE 2)

NORTH
Transverse Mercator Projection
1927 North American Datum
Zone 13
0 650 1300
Scale in Feet

COLORADO



GCC RIO GRANDE, INC.
PUEBLO CEMENT PLANT & LIMESTONE QUARRY
Pueblo County, Colorado

SITE BASEMAP

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JAN. 2018
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FIGURE 1