STATE OF COLORADO

Lennberg - DNR, Patrick <patrick.lennberg@state.co.us>

GCC Pueblo TR-08 MW Installation Report

1 message

Amy Veek <aveek@gcc.com> Tue, Apr 12, 2022 at 10:03 AM
To: "Lennberg - DNR, Patrick" <patrick.lennberg@state.co.us>
Cc: Landon Beck <lbeck@resourcehydrogeologic.com>, Vance Sarah <svance@gcc.com>, Alarcon Alejandro <aalarcon@gcc.com>

Good Morning Patrick,

Please see attached for the monitoring well installation report pursuant to TR-08 for GCC Rio Grande's Pueblo Plant (M-2002-004).

Let me know if you have any questions or concerns regarding this report.

Thanks,

Amy

Amy Veek

Environmental Engineer

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GCC Rio Grande Pueblo Plant TR-08 Monitoring Wells Installation Report

Submitted to:

GCC Rio Grande, Inc.

Date:

April 1, 2022

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RESOURCE HYDROGEOLOGIC SERVICES

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INTRODUCTION

This report documents installation of environmental monitoring wells at the GCC Pueblo plant and limestone quarry (GCC or Pueblo Plant) in 2021 under Technical Revision 8 (TR-08) to the Colorado Division of Reclamation, Mining and Safety (CDRMS) mine permit M-2002-004.

GCC commits to monitoring the new wells discussed in this report per the existing standards for compliance groundwater monitoring as established in TR-07, which is the current groundwater sampling and analysis plan (SAP). The SAP includes analysis of major ions, which was initiated for compliance groundwater samples beginning in 2021Q2. Furthermore, GCC commits to refining the proposed point-of-compliance (POC) monitoring wells, MW-13 (Fort Hayes limestone) and MW-14 (Codell sandstone), based on their presumed downgradient location with respect to the Pueblo Plant operations layout. This selection shall be officially proposed by GCC following a minimum of one year (four quarters) of routine monitoring and analysis. Because routine quarterly monitoring of all existing site monitoring wells, including the new wells discussed in this report, was ongoing in 2022Q1, this POC designation is expected to be proposed for CDRMS acceptance in the 2022 Annual Groundwater Report.

PURPOSE

The purpose of the Pueblo Plant 2021 Monitoring Well Installation Program was to continue to install environmental monitoring wells to characterize groundwater quality and quantity in the mined horizon and underburden to support permitting efforts with CDRMS under mining permit M-2002-004. This work is now in the second phase of installation after delays in 2020 due to COVID-19. The first phase was completed in February 2020 as the single bedrock monitoring well installation of MW-8 to screen the Codell sandstone to fulfill Technical Revision TR-06, which has allowed groundwater data collection in the time since and has supported the evaluation of potential hydraulic communication between the Fort Hayes limestone member of the Niobrara Formation and the underlying Codell sandstone member of the Carlile Formation. This work was documented in a technical memorandum by Resource Hydrogeologic Services, Inc. (RHS) titled “GCC Rio Grande Pueblo Cement Plant Monitoring Well MW-8 Installation” dated March 27, 2020. Groundwater data collected from MW-8 compliments groundwater data from the two adjacent Fort Hayes monitoring wells, MW-6 and MW-7, installed in December 2017.

The second phase of installation is the subject of this report. The purpose was to install six permanent bedrock monitoring wells and potentially one permanent unconsolidated colluvium monitoring well, if warranted, at three additional locations at the Pueblo Plant to increase the spatial distribution of site water quality monitoring and allow for the determination of groundwater gradient and flow direction. This basic hydrogeologic characterization effort is expected to support future recommendations towards meeting operational and environmental monitoring goals.

The primary objective of each permanent monitoring well was to provide a dedicated access point for measuring groundwater levels and to collect groundwater samples that accurately represent groundwater conditions at discrete intervals in the target geologic unit. To successfully achieve this objective, it was necessary to fulfill the following criteria:

1. Construct each well with minimum disturbance to the geologic formation.
2. Construct each well of materials that are compatible with the anticipated geochemical and chemical environment.
3. Properly complete each well in the desired monitoring zone.
4. Adequately seal each well annulus with materials that will not interfere with the collection of representative water quality samples.
5. Sufficiently develop each well to remove any air or water introduced associated with drilling, allow well filter pack to properly re-sort, and generally ensure unobstructed flow through the well.

In addition to appropriate construction details, each monitoring well was designed in concert with the overall goals of the monitoring program. Key factors that were considered include the following, with specific considerations to the Pueblo Plant groundwater monitoring program italicized:

1. Intended purpose of each well – *documentation of groundwater presence, if present then documentation of water level and water quality through quarterly monitoring over time utilizing the approved and current compliance groundwater laboratory suite and methodologies for comparative purposes against existing Pueblo Plant monitoring wells as adopted in the Sampling and Analysis Plan (SAP), per Technical Revision TR-07. GCC will evaluate how to best monitor each proposed well for the long-term following construction and development and commits to submitting a subsequent TR for approval to revise the SAP appropriately. Additionally, GCC committed to continue (GCC started in 2021, quarter two) to have all compliance groundwater samples, as well as for those monitoring wells proposed here, analyzed for major ions to supplement the current TR-07 Table 1 GCC groundwater analytical parameters until the aforementioned subsequent TR to modify the SAP is approved by CDRMS.*
2. Placement of each well to achieve accurate water levels and/or representative water quality samples – *proper design and installation methods to prevent groundwater from inadvertently migrating to strata above or below the target interval*.
3. Adequate wellbore diameter to accommodate appropriate tools for well development, water quality sampling devices, and aquifer testing equipment – *primarily a nominal 2-inch downhole surge block for development and nominal 2-inch environmental sampling bailer or pump as needed*.

4. Surface protection at each well to assure no alteration of the structure or impairment of the data collected from the well – *locking wellhead and bollard posts which are the same as the existing Pueblo Plant monitoring wells MW-5, MW-6, MW-7, and MW-8*.

MONITORING WELL INSTALLATION DOCUMENTATION

Work was conducted by RHS to support the Pueblo Plant monitoring well installations. This included well design, materials specification, Colorado Division of Water Resources (CDWR) monitoring well permitting, drilling and completion service solicitation and coordination, coordination of underground utility locates/clearance services for drill sites, coordination of professional surveying services, as well as project coordination, as needed, with CDRMS and ongoing Pueblo Plant operations.

MONITORING WELL PERMITTING

RHS, as the authorized agent of GCC, submitted the appropriate CDWR monitoring well permit applications (GWS-46 forms) for each planned monitoring well and obtained the corresponding permits to construct in advance of mobilization for drilling and completion activities. Following the monitoring well installation program, the required CDWR Well Construction and Yield Estimate Reports (GWS-31 forms) were submitted by RHS to CDWR, per CDWR regulations. The CDWR permit documentation can be accessed at https://dwr.state.co.us/Tools/WellPermits by using either the permit number or receipt number as the search criteria, found in **Table 1**.

MONITORING WELL LOCATIONS

Phase II monitoring well locations were selected and completed for three areas, as shown in **Figure 1**. MW-9 and MW-10 are upgradient (presumed based on formation dip) of the existing and planned mine panels to allow baseline groundwater condition monitoring. MW-11 and MW-12 are immediately downgradient of mine panels 3 and 4, and MW-13 and MW-14 are downgradient of all mine panels and the plant, in the northeast portion of the mine permit area. The latter location is considered the current POC location, based on formation dip direction, until four quarters of static water levels are collected and interpreted for all site groundwater monitoring wells, which will allow for a more informed POC selection. The MW-15 location was not utilized for a monitoring well installation as the target unconsolidated soils were not found to be wet or even damp while drilling the adjacent MW-13 and MW-14 boreholes. This contingency was specified in the Work Plan approved as TR-08.

Each new monitoring location consists of two wells completed in the two target intervals, in a tightly spaced straight line "twinned" configuration with surface spacing distance of approximately 20 feet. The orientation of each twinned-well location is at a bearing of approximately 45° in line with formation dip direction with the shallowest well to the southwest (upgradient) and deepest well to the northwest (downgradient).

Locations were surveyed by the GCC-contracted professional surveyor, Clark Land Surveying, Inc. (Clark), in advance of mobilization of the drilling and completion effort. This process was part of the underground utility clearance, but also confirmed all planned monitoring well locations were inside of the CDRMS mine permit boundary and, in the case of the presumed upgradient monitoring well location (MW-9/MW-10), outside of the southwest extent of the mine panels 3 and 4. GCC committed to a 300-foot mining setback from this location to prevent future disturbance to monitoring in TR-08. A follow-up survey of the as-built monitoring wells was also conducted by Clark, with emphasis on high accuracy elevation in order to allow future reliable plotting of the potentiometric groundwater elevation data across the facility, thus allowing the determination of groundwater gradient and flow direction. Clark also surveyed the existing monitoring wells MW-5, MW-6, MW-7, and MW-8. The as-built survey data for all Pueblo Plant wells is given in **Table 1**.

Monitoring Well Design

As-built monitoring well construction information for all existing Pueblo Plant monitoring wells, including the recently constructed wells documented in this report, is given in **Table 1**. These designs, as given in the TR-08 Work Plan, followed industry standard practice with the as-built construction determined by the professional judgement of the RHS field hydrogeologist and based on site-specific conditions. Well design was industry standard 2-inch PVC monitoring wells, installed for the purpose of monitoring groundwater level and water quality of the specified intervals identified during drilling and subsurface documentation at the planned monitoring well locations. **Figure 1** shows the as-built monitoring well locations.

Borehole Drilling & Monitoring Well Installation

The field hydrogeologist from RHS directed the GCC-contracted drill crew, HRL Compliance Solutions, Inc. (HRL), with respect to specific target formation depths and collected and documented geologic samples generated by rotary cuttings. Monitoring well installations were completed to the following specifications:

1. 12-inch hollow-stem augers drilled through the unconsolidated colluvium until bedrock refusal to effectively set temporary casing through this interval with the auger inner diameter allowing the bedrock borehole diameter to create a minimum 2-inch annulus between the borehole wall and the screen/casing per 2 CCR 402-2 State of Colorado Water Well Construction Rules, which for this project utilizing nominal 2-inch schedule 40 screen and casing was 6-3/8-inches. Air rotary hammer (with no water injection) drilled 6-3/8-inch hole (6-1/4-inch bit) from surface through the Fort Hayes limestone at the subject locations. From surface to total drilled depth, RHS collected and documented cuttings grab samples at 5-foot intervals or otherwise at significant lithology changes. The lithology encountered at each borehole is given in **Figures 2 through 7**. Planned air lift production testing through the blooey line to determine Fort Hayes groundwater production

rate via portable flume or bucket-and-stopwatch method was not viable as only one borehole, MW-14, was wet during drilling. And that groundwater was only produced as a mist. Therefore, RHS could not collect standard field water quality parameters (temperature, pH, specific conductance) for any of the boreholes during drilling or ahead of well installation. For the Fort Hayes monitoring wells, borehole drilling was then complete so well installation continued from step 3 below.

2. Air rotary hammer (with no water injection) advanced 6-3/8-inch borehole from the base of the Fort Hayes limestone into the Codell sandstone until either penetrating significant additional groundwater in the Codell or otherwise through the entire Codell sandstone member (thickness found to be 10 to 27 feet). As no boreholes produced water during drilling of the Codell, no flow rate or water quality information could be obtained at that time.

3. Installed 2-inch schedule 40 PVC environmental flush joint screen (FJT) (0.020-inch factory-machined slot) from total depth to near the top of either the Fort Hayes or the Codell, as appropriate for the location, hanging in tension from a casing clamp resting on the top of the hollow-stem auger extending above ground surface. Blank FJT 2-inch schedule 40 PVC was extended from the top of the screen section to 2-1/2 feet above ground surface. Stainless steel bow spring environmental centralizers were placed at the bottom and top of each screen section and then every 20 feet to surface. All tubulars and centralizers arrived to site new, bagged and boxed.

4. Installed 10-20 silica sand pack from total depth to 3 feet above the top of the screen section via surface pour, with continuous depth tagging to the level specified by the RHS hydrogeologist. Bentonite seal placement was accomplished by pouring two 5-gallon pails of 3/8-inch coated bentonite pellets via surface pour, hydrating with potable water as necessary since the boreholes were not holding water. The remaining annular seal up to ground surface was placed by pouring 3/8-inch chip bentonite from surface, hydrating with potable water as necessary. Continuous depth tagging was employed to ensure materials bridging did not occur or if they did it was caught soon enough to remedy.

5. Installed the appropriate 5-foot length by 4-inch square locking environmental monitoring well head protector set in 3-foot by 3-foot by 4-inch-thick cement pad with 4-inch diameter by 6-foot length steel pipe protective bollards cemented in-place offset at each pad corner. Each wellhead and bollard was painted high-visibility yellow and the wellhead were clearly labeled by the well name welded on the top cap prior to arriving onsite. The well names are MW-9, MW-10, MW-11, MW-12, MW-13, MW-14.

The as-built construction summary data, including location survey at ground surface and top of PVC casing for all wells is given in **Table 1**. The as-built monitoring well construction diagrams for each well are presented in **Figures 2 through 7.** Photos of all twinned monitoring well locations are provided as **Figures 8 through 10.**

There were two notable exceptions to the installation specifications above; the drilling methodology at MW-10 and the screen installation at MW-13. Both exceptions were made in the field by RHS with consultation with GCC, to address site-specific field conditions, which are discussed below.

Monitoring location MW-10 is upgradient of current and future mining, per the TR-08 Work Plan. There was interest in collecting adequate rock sample at this location to potentially conduct whole rock chemical analysis and leachate testing, which would support the hydrogeochemical characterization of the mined Fort Hayes limestone, interburden strata and the underburden Codell sandstone. Although this coring task was not a requirement, GCC had an expressed goal to collect core samples during the monitoring well installation program. To accomplish this, HQ (3.78") wireline core drilling was planned in lieu of air rotary drilling from top of bedrock to total depth (base of Codell sandstone). However, the GCC-contracted drilling company had tooling issues onsite with their wireline core drilling system and therefore the core hole was not drilled. MW-10 was thus drilled and completed per the methodology described above for all of the other monitoring wells, which was hollow stem auger drilling to bedrock, then switching to rotary air hammer to total borehole depth. It is interesting to note that the Fort Hayes limestone was neither encountered during rotary air hammer drilling at the MW-10 location, nor the adjacent MW-9 location, which is interpreted as the result of paleo-erosion in the arroyo. The uppermost bedrock encountered at this location was the Codell sandstone, which was completed as MW-9. MW-10 was completed in the member immediately below the Codell sandstone, which is the Blue Hills shale. The installation of MW-10 in the Blue Hills shale will allow for characterization of upgradient baseline conditions of the quarry floor rock to a greater extent with respect to potential vertical groundwater potentiometric and chemical gradients.

The second monitoring well that deviated from the original specifications due to site-specific conditions was MW-13. While completing the filter pack at the adjacent MW-14, significant time was consumed placing the material to the prescribed depth due to repeated annular sand bridges which required repeated potable water wash-downs or otherwise displacing the bridges with tremie pipe. Rather than attempt the same process with a much longer screen section (40 feet at MW-13 versus 15 feet at MW-14), schedule 40 PVC pre-pack screens were utilized with same 0.02-inch slot size and 10-20 grade silica sand. To hold the bentonite seal and annular seal in place above the screen section, a centralized 6-inch diameter foam bridge plug topped with 7-inch diameter rubber shale basket was installed immediately above the uppermost pre-packed screen section, as shown in **Figure 6**.

Monitoring Well Development

All new and existing wet Pueblo Plant monitoring wells were developed. The developments were batched into three groups to minimize mobilization/standby time. MW-9, MW-10, MW-11, MW-12, and MW-13 were developed in November 2021. MW-14 was developed in December 2021. The existing MW-6, MW-7, and MW-8 were developed in January 2022. MW-5 continued to be dry so was not developed. Well development was conducted by RHS no sooner than 24 hours following curing of annular bentonite seals and surface cement pad. Standard monitoring well development procedures were followed utilizing nominal 2-inch surge block with foot valve driven by a wellhead inertial pump (Waterra Hydrolift II) on new HDPE tubing to remove fines and properly distribute the annular filter pack. Water quality field parameters were monitored by the RHS field hydrogeologist during this process with emphasis in monitoring and reduction of turbidity over time as fine-grained materials generated during the drilling process are removed through the wellbore. The field parameters recorded during the developments are given in **Table 2**. As all Pueblo Plant monitoring wells can be considered low-yield, groundwater production by development exceeded the sustainable yield for each well. As a result, the wells required addition of potable water to help flush the fine-grained materials from the well bores at surface. Care was taken to not introduce too much potable water that would escape into the screened formations and potentially dilute near-term water quality. As such, the monitoring well development process was performed with sufficient time in advance (minimum 7 weeks) of initial compliance groundwater monitoring conducted in late March 2022.

One exception to the Waterra Hydrolift II development methodology, as described above, was at MW-14. Because this well is kinked in the blank casing section of the wellbore, reducing the wellbore inner diameter to approximately 1.1 inches at approximately 76.6 feet depth measured from the top of PVC casing, the nominal 2-inch surge block could not pass the kink to reach the total well depth of 207.85 feet measured from the top of PVC casing. The alternative development methodology utilized 1-inch outer diameter FJT pipe with a 5-foot length jetting assembly at bottom. The development pipe string was run into the wellbore and potable water was pumped through the string from surface allowing the high-pressure jets to work the screen section up and down. The potable water returns to surface carried and flushed-out the fine-grained material from the wellbore, however this rendered measured field water quality parameters invalid with respect to their representation of the screened formation quality. As this 15-foot length screened interval was very low-yield, observations by RHS were that the volume introduced to the well was consistent with the volume that was flushed from the well so significant potable water dilution into the screened formation was not expected. Note that the kink in the MW-14 wellbore will not compromise the ability to obtain future compliance groundwater samples as a dedicated 1-inch diameter QED T1300 bladder pump has already been successfully installed to near the bottom of the well and it function tested properly.

Following development, all wells were documented to have significantly improved turbidity, with "hard-tag" total depth measurements. This indicated no sediment remained in the wellbores, as the water level indicator allowed RHS to distinctly feel its steel probe knock against the PVC wellbore bottom cap.

TABLES

Table 1. GCC Pueblo Plant existing monitoring well construction, all wells

Monitoring Well ID	Year Installed	CDWR Receipt Number	CDWR Permit Number	UTM NAD 83 Zone 13N Easting (meters)	UTM NAD 83 Zone 13N Northing (meters)	Elevation - Top of PVC Casing - Water Level Measuring Point (ft)	Elevation - Ground Surface at Wellhead Cement Pad (ft)	Well Diameter (in)	Well Casing Material	Total Well Completion Depth (ftbgs)	Screened Interval (ftbgs)	Screened Filter Pack Interval (ftbgs)	Screened Interval Formation
MW-5	2008	3632233	278490	533304.305	4217575.554	4966.65	4964.39	2	SCH 40 PVC	25.00	9.0-24.0	8.0-25.0	Colluvium/Unconsolidated
MW-6	2018	3690376A	312701	533308.582	4217579.756	5064.14	5061.62	2	SCH 40 PVC	56.40	30.9-56.4	28.0-56.7	Fort Hayes Limestone
MW-7	2018	3690376B	312702	534710.190	4219189.212	5063.75	5061.09	2	SCH 40 PVC	56.10	30.6-56.1	27.5-57.0	Fort Hayes Limestone
MW-8	2020	3696266	316170	534714.843	4219193.313	5062.90	5060.74	2	SCH 40 PVC	63.10	58.1-62.9	57.0-64.3	Codell Sandstone
MW-9	2021	10013525	323005	535148.659	4221153.094	5256.09	5253.97	2	SCH 40 PVC	40.30	30.0-40.0	20.9-42.0	Codell Sandstone
MW-10	2021	10013526	323006	535153.271	4221157.369	5255.82	5253.60	2	SCH 40 PVC	80.30	50.0-80.0	47.0-81.5	Blue Hills Shale
MW-11	2021	10013527	323007	534405.485	4219710.530	5084.30	5082.09	2	SCH 40 PVC	70.00	39.6-69.6	36.6-70.6	Fort Hayes Limestone
MW-12	2021	10013528	323008	534407.927	4219719.209	5083.94	5081.64	2	SCH 40 PVC	86.50	76.2-86.2	73.1-86.6	Codell Sandstone
MW-13	2021	10013529	323009	534401.520	4219714.939	4990.11	4987.93	2	SCH 40 PVC	175.33	135.0-175.0	135.0-175.0	Fort Hayes Limestone
MW-14	2021	10013530	323010	535242.397	4221415.851	4989.92	4987.81	2	SCH 40 PVC	205.33	190.0-205.0	187.0-206.0	Codell Sandstone

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Table 2. GCC Pueblo Plant monitoring well development data, all wells

Monitoring Well ID	Year Installed	Date Developed	Development Methodology	Development Field Sample Temperature (C)	Development Field Sample pH (S.U.)	Development Field Sample Specific Conductance (µS/cm)	Development Field Sample Oxygen Reduction Potential (mV)	Development Field Sample Dissolved Oxygen (mg/L)	Development Field Sample Turbidity (NTU)	Total Well Completion Depth (ftbgs)	Screened Interval (ftbgs)	Screened Interval Formation
MW-5	2008	NA - dry	NA - dry	NA - dry	NA - dry	NA - dry	NA - dry	NA - dry	NA - dry	25.00	9.0-24.0	Colluvium/Unconsolidated
MW-6	2018	1/31/2022	Waterra Hydrolift II	12.9	7.13	8770	60.4	3.00	220	56.40	30.9-56.4	Fort Hayes Limestone
MW-7	2018	2/1/2022	Waterra Hydrolift II	12.1	7.30	8833	65.5	3.84	9	56.10	30.6-56.1	Fort Hayes Limestone
MW-8	2020	1/31/2022	Waterra Hydrolift II	14.6	7.32	9478	-98.0	2.60	290	63.10	58.1-62.9	Codell Sandstone
MW-9	2021	11/6/2021	Waterra Hydrolift II	22.5	7.33	6022	107.6	4.27	95	40.30	30.0-40.0	Codell Sandstone
MW-10	2021	11/6/21-11/7/21	Waterra Hydrolift II	16.4	7.96	2896	-5.3	4.87	90	80.30	50.0-80.0	Blue Hills Shale
MW-11	2021	11/7/2021	Waterra Hydrolift II	19.8	7.39	2822	-175.7	0.94	140	70.00	39.6-69.6	Fort Hayes Limestone
MW-12	2021	11/7/2021	Waterra Hydrolift II	22.4	7.67	2588	73.4	7.03	5	86.50	76.2-86.2	Codell Sandstone
MW-13	2021	11/8/21-11/9/21	Waterra Hydrolift II	14.2	8.70	3390	-231.0	3.00	170	175.33	135.0-175.0	Fort Hayes Limestone
MW-14	2021	12/16/2021	Hydro-jetting*	NA-diluted	NA-diluted	NA-diluted	NA-diluted	NA-diluted	NA-diluted	205.33	190.0-205.0	Codell Sandstone

*Hydro-jetting development methodology immediately dilutes wellbore with potable water so field parameters not representative of the screened formation.
All wells constructed of 2-inch schedule 40 PVC

FIGURES

Figure 1. GCC Pueblo monitoring well location map.

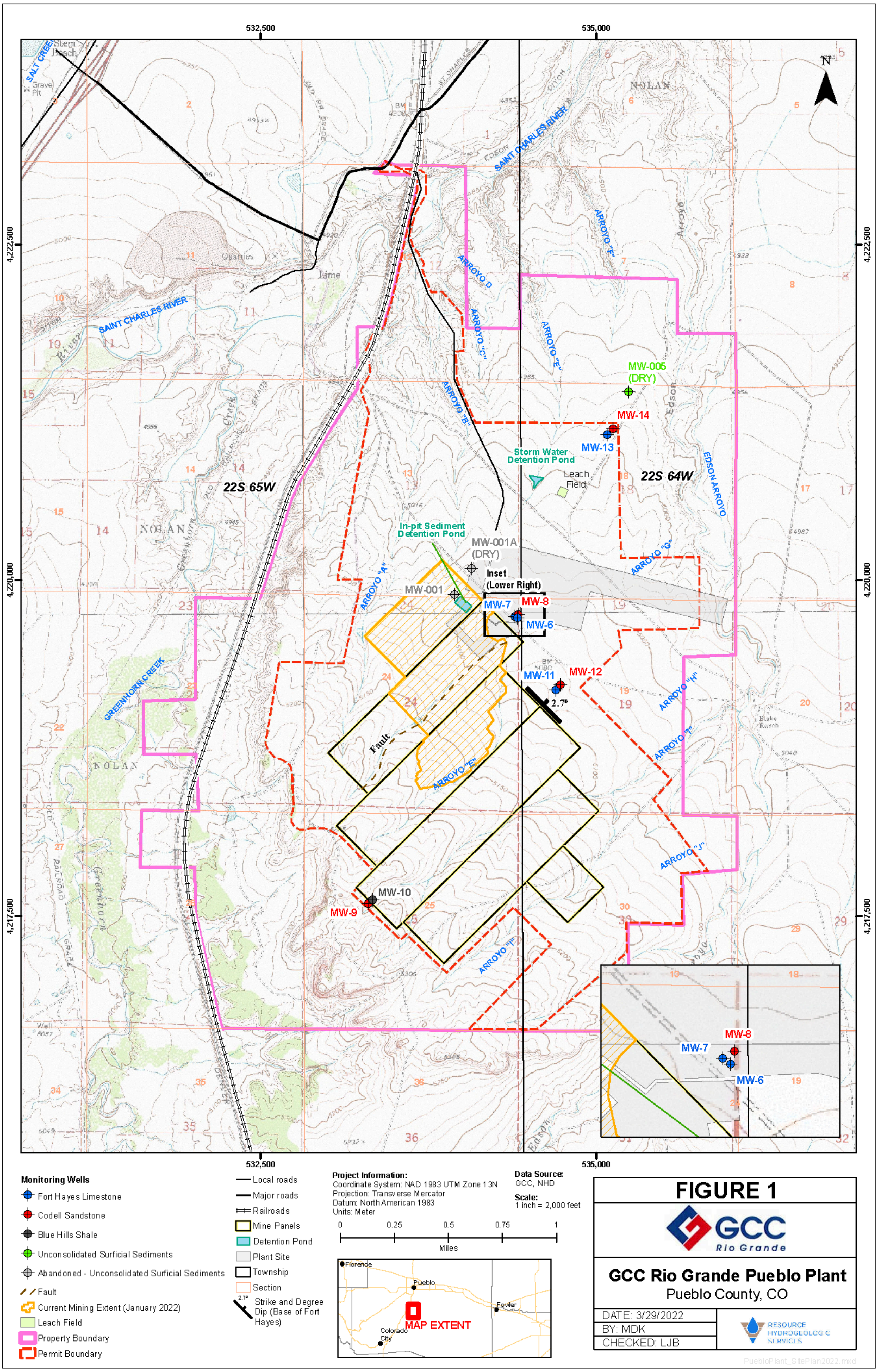
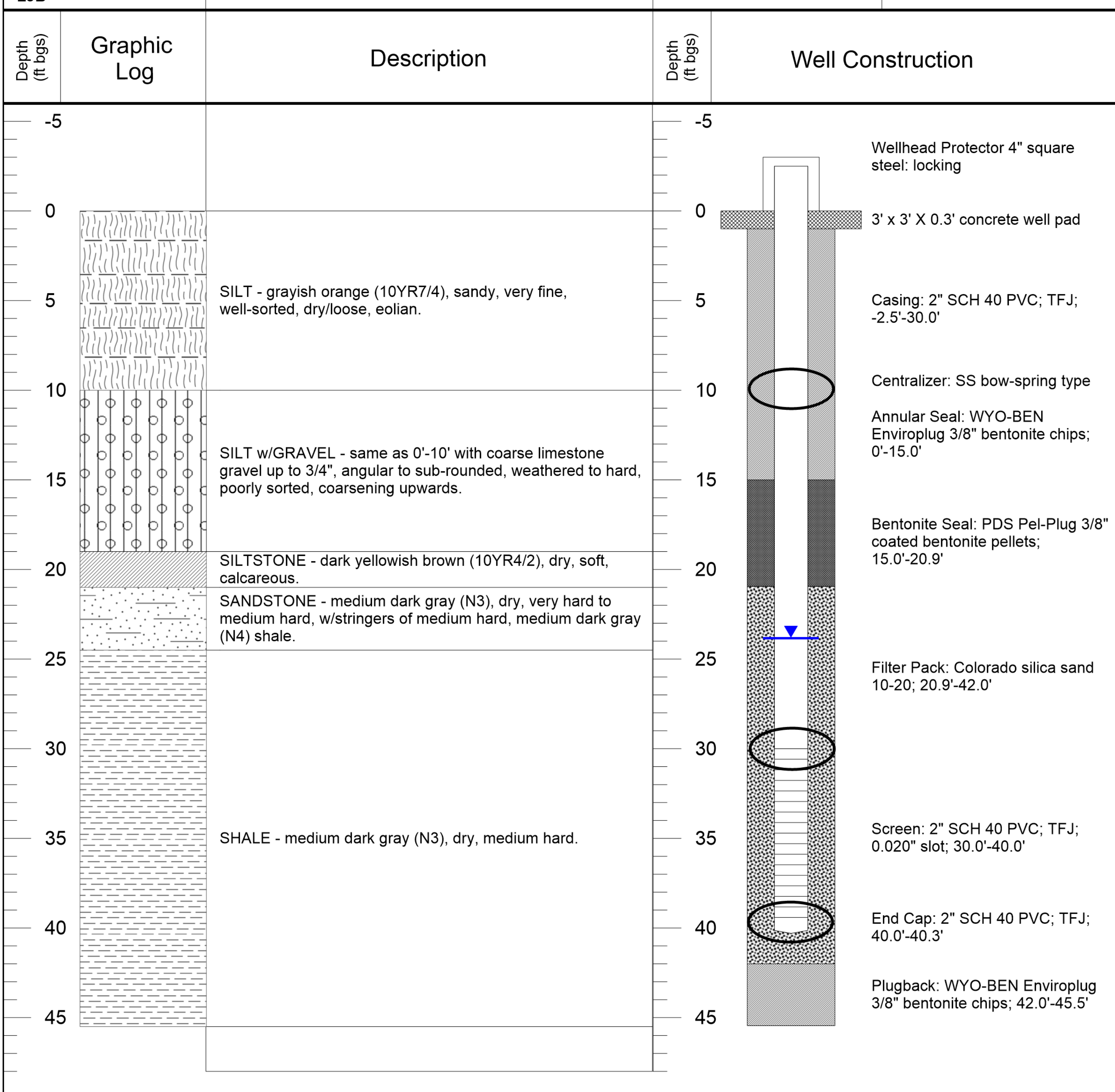


Figure 2. GCC Pueblo MW-9 lithology and well completion diagram.

RESOURCE HYDROGEOLOGIC SERVICES	PROJECT: **GCC RIO GRANDE PUEBLO PLANT**	BORING ID: **MW-9**	
	LOCATION: **PUEBLO COUNTY, COLORADO**	WELL ID: **MW-9**	
	DRILLING CONTRACTOR: **HRL COMPLIANCE SOLUTIONS**	NORTHING (UTM NAD 83): **535148.6587**	EASTING (UTM NAD 83): **4221153.0941**
	DRILLING EQUIPMENT: **DIEDRICH D-90**	GROUND SURFACE ELEV.: **5253.97 FT AMSL**	TOC PVC ELEVATION: **5256.09 FT AMSL**
	DRILLING METHOD: **HOLLOW-STEM AUGER TO ROTARY AIR HAMMER**	TOTAL WELL DEPTH: **40.3 FT BGS**	DEPTH TO WATER: **23.84 FT BGS**
LOGGED BY: **LJB**	SAMPLING METHOD: **5' INTERVAL ROTARY CUTTINGS GRAB SAMPLES**	DATE STARTED: **27 AUGUST 2021**	DATE COMPLETED: **28 AUGUST 2021**



NOTES: Centralizers placed at 10', 30', 40'. Dry drilling method, well dry upon completion with water coming in after approximately 1 week. All bentonite hydrated with potable water. Well developed with Waterra Hydrolift 2 inertial pump & surge block on new poly tubing on 11/6/2021.

Figure 3. GCC Pueblo MW-10 lithology and well completion diagram.

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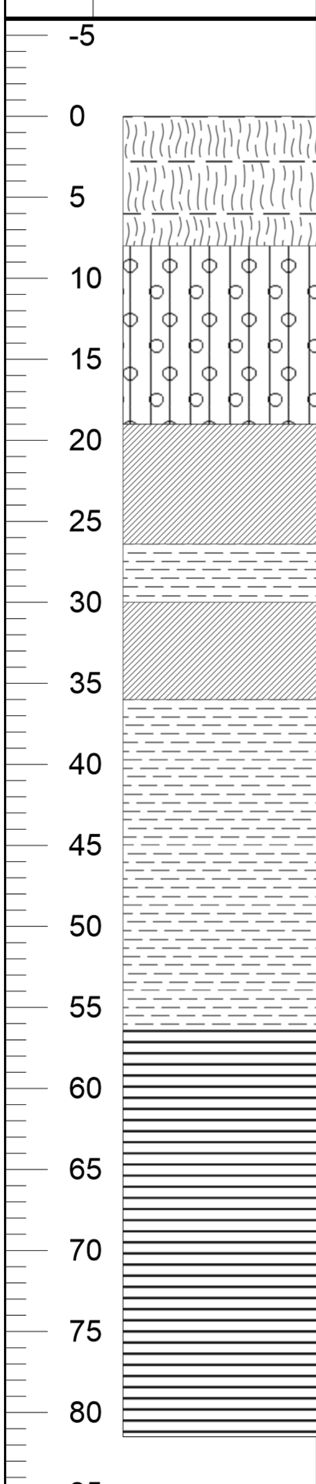
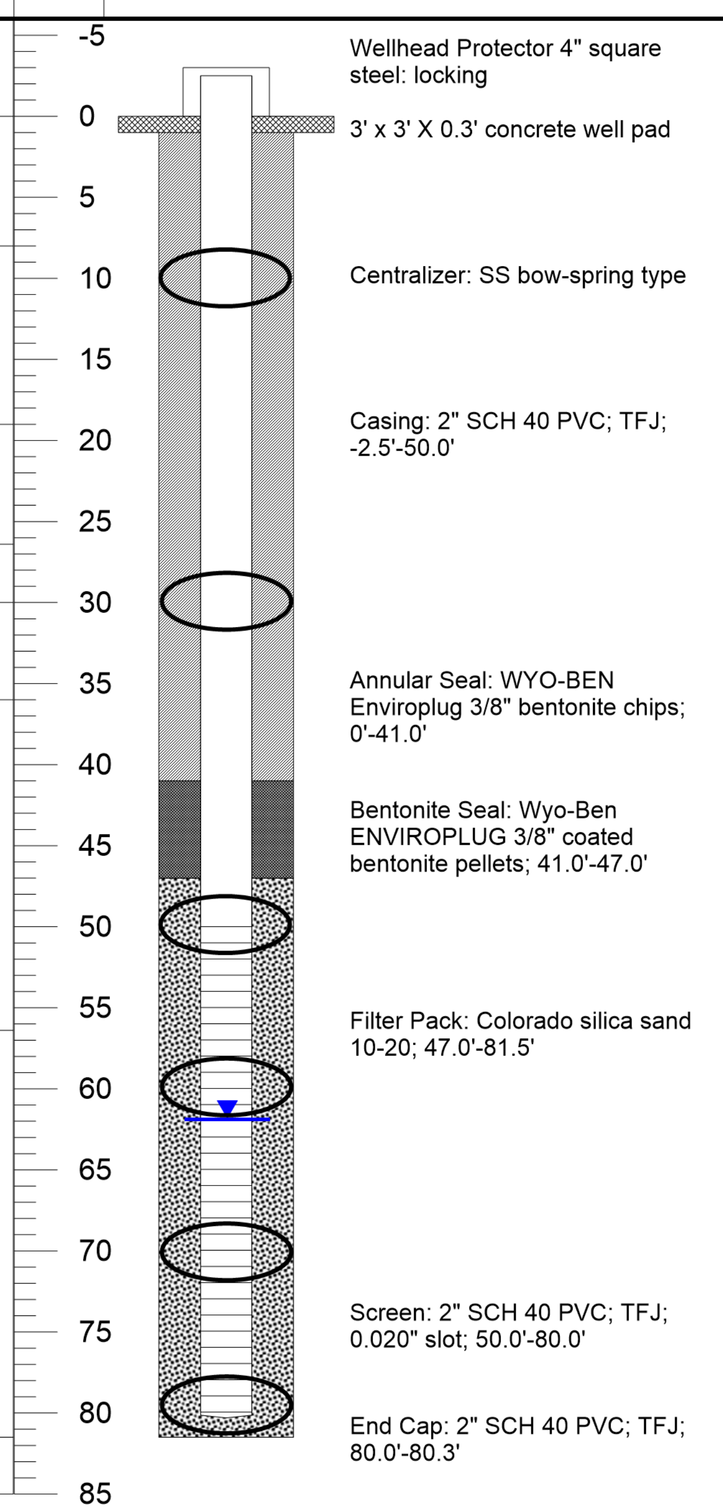
PROJECT: GCC RIO GRANDE PUEBLO PLANT	BORING ID: MW-10	
LOCATION: PUEBLO COUNTY, COLORADO	WELL ID: MW-10	
DRILLING CONTRACTOR: HRL COMPLIANCE SOLUTIONS	NORTHING (UTM NAD 83): 535153.2708	EASTING (UTM NAD 83): 4221157.3692
DRILLING EQUIPMENT: DIEDRICH D-90	GROUND SURFACE ELEV.: 5253.60 FT AMSL	TOC PVC ELEVATION: 5255.82 FT AMSL
DRILLING METHOD: HOLLOW-STEM AUGER TO ROTARY AIR HAMMER	TOTAL WELL DEPTH: 80.3 FT BGS	DEPTH TO WATER: 61.89 FT BGS
LOGGED BY: LJB / SAMPLING METHOD: 5' INTERVAL ROTARY CUTTINGS GRAB SAMPLES	DATE STARTED: 25 AUGUST 2021	DATE COMPLETED: 28 AUGUST 2021

Depth (ft bgs)	Description
0–8	SILT - moderate yellowish brown (10YR5/4), dry/loose eolian deposit, very fine, well-sorted.
8–19	SILT w/GRAVEL - same as 0'-8' with coarse limestone gravel up to 2", sub-angular, weathered to hard, poorly sorted, coarsening downwards.
19–26.5	SILTSTONE - medium gray (N5), dry, soft to medium hard with highly weathered, fractured, competent to friable limestone (possible boulder) from 19'-19.5'.
26.5–30	SHALE - medium dark gray (N4), dry, soft to medium hard.
30–36	SILTSTONE - medium light gray (N4), dry, very hard, calcareous, with dry, hard, medium light gray (N5) thin limestone interbeds
36–56.5	SHALE - medium dark gray (N4), dry, soft to medium hard.
56.5–81.5	SHALE - black (N1), carbonaceous, dry, hard with thin medium dark gray (N4), dry, medium hard shale interbeds.

Graphic Log



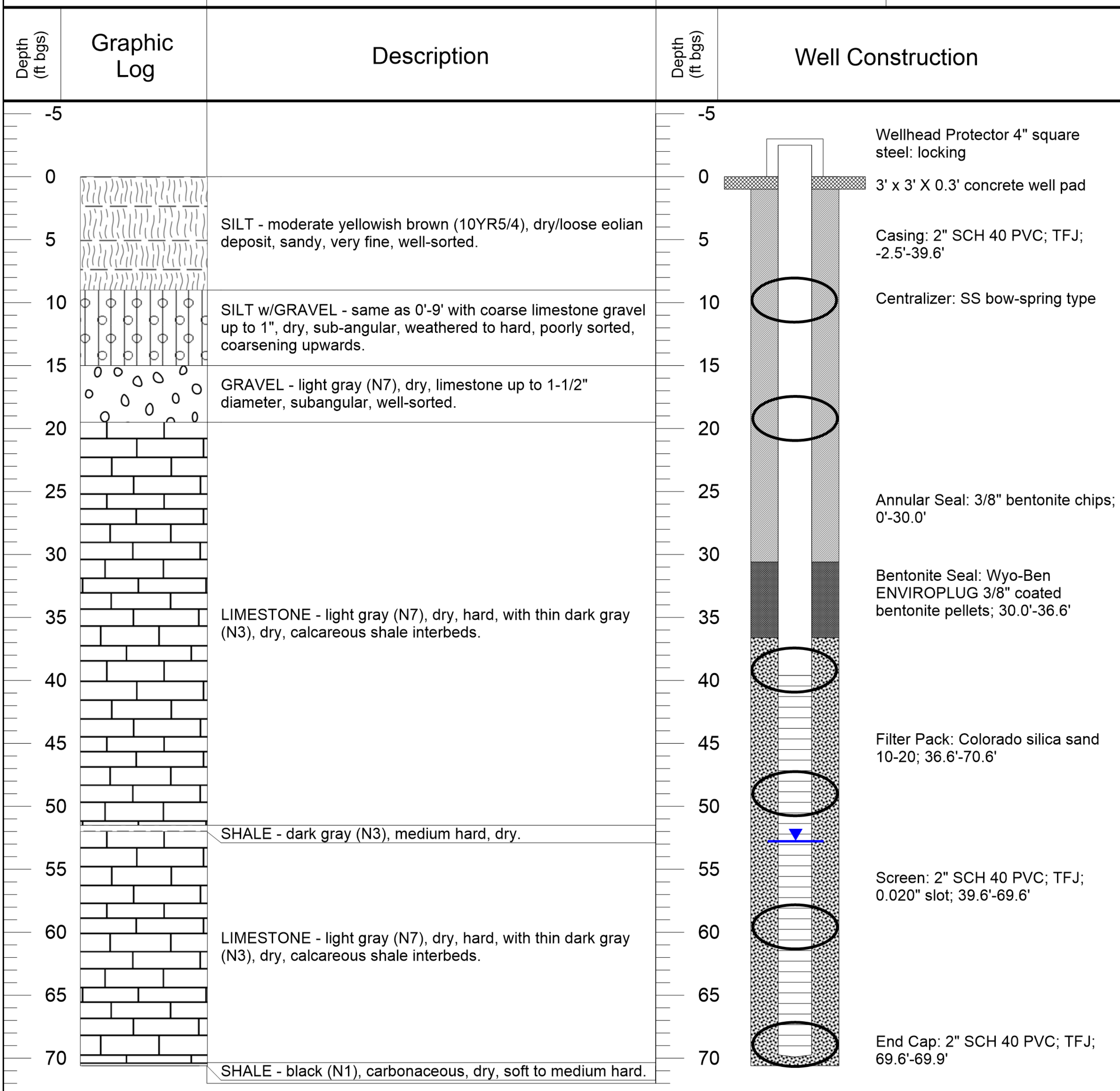
Well Construction



NOTES: Centralizers placed at 10', 30', 50', 60', 70', 80'. Dry drilling method, well dry upon completion with water coming in after approximately 1 week. All bentonite hydrated with potable water. Well developed with Waterra Hydrolift 2 inertial pump & surge block on new poly tubing on 11/6/2021-11/7/2021.

Figure 4. GCC Pueblo MW-11 lithology and well completion diagram.

RESOURCE HYDROGEOLOGIC SERVICES	PROJECT: **GCC RIO GRANDE PUEBLO PLANT**	BORING ID: **MW-11**	
	LOCATION: **PUEBLO COUNTY, COLORADO**	WELL ID: **MW-11**	
	DRILLING CONTRACTOR: **HRL COMPLIANCE SOLUTIONS**	NORTHING (UTM NAD 83): **534405.4851**	EASTING (UTM NAD 83): **4219710.5297**
	DRILLING EQUIPMENT: **DIEDRICH D-90**	GROUND SURFACE ELEV.: **5082.09 FT AMSL**	TOC PVC ELEVATION: **5084.30 FT AMSL**
	DRILLING METHOD: **HOLLOW-STEM AUGER TO ROTARY AIR HAMMER**	TOTAL WELL DEPTH: **70.0 FT BGS**	DEPTH TO WATER: **52.76 FT BGS**
LOGGED BY: **LJB**	SAMPLING METHOD: **5' INTERVAL ROTARY CUTTINGS GRAB SAMPLES**	DATE STARTED: **24 AUGUST 2021**	DATE COMPLETED: **26 AUGUST 2021**

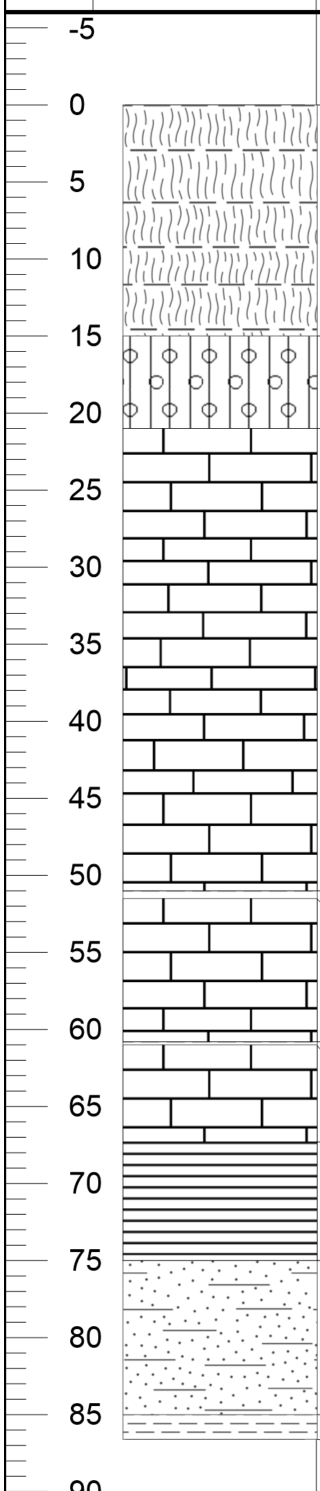


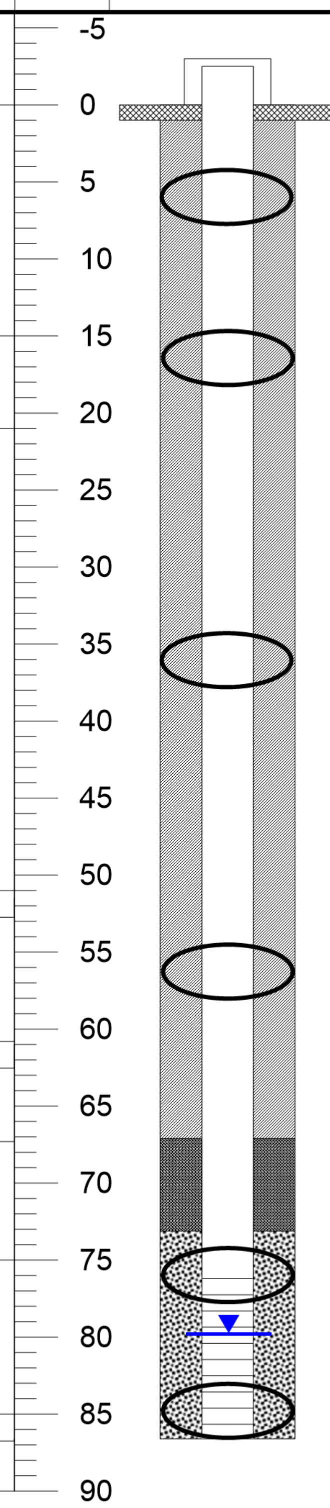
NOTES: Centralizers placed at 9', 19', 39', 49', 59', 69'. Dry drilling method, well dry upon completion with water coming in after approximately 1 week. All bentonite hydrated with potable water. Well developed with Waterra Hydrolift 2 inertial pump & surge block on new poly tubing on 11/7/2021.

Figure 5. GCC Pueblo MW-12 lithology and well completion diagram.

RESOURCE HYDROGEOLOGIC SERVICES	PROJECT: **GCC RIO GRANDE PUEBLO PLANT**	BORING ID: **MW-12**	
	LOCATION: **PUEBLO COUNTY, COLORADO**	WELL ID: **MW-12**	
	DRILLING CONTRACTOR: **HRL COMPLIANCE SOLUTIONS**	NORTHING (UTM NAD 83): **534407.9271**	EASTING (UTM NAD 83): **4219719.2092**
	DRILLING EQUIPMENT: **DIEDRICH D-90**	GROUND SURFACE ELEV.: **5081.64 FT AMSL**	TOC PVC ELEVATION: **5083.94 FT AMSL**
	DRILLING METHOD: **HOLLOW-STEM AUGER TO ROTARY AIR HAMMER**	TOTAL WELL DEPTH: **86.5 FT BGS**	DEPTH TO WATER: **79.79 FT BGS**
LOGGED BY: **LJB**	SAMPLING METHOD: **5' INTERVAL ROTARY CUTTINGS GRAB SAMPLES**	DATE STARTED: **22 AUGUST 2021**	DATE COMPLETED: **26 AUGUST 2021**

Depth (ft bgs)	Graphic Log	Description
0–15		SILT - moderate yellowish brown (10YR5/4), dry/loose eolian deposit, sandy, very fine, well-sorted.
15–21		SILT w/GRAVEL - same as 0'-15' with coarse limestone gravel up to 1", dry, sub-angular, weathered to hard, poorly sorted, coarsening upwards.
21–51		LIMESTONE - light gray (N7), dry, hard, with thin dark gray (N3), dry, calcareous shale interbed at 31'.
51–53		SHALE - dark gray (N3), medium hard, dry.
53–60.5		LIMESTONE - same as 21'-51'.
60.5–62		SHALE - dark gray (N3), dry, medium hard.
62–67		LIMESTONE - same as 21'-51' with pyrite.
67–75		SHALE - black (N1), carbonaceous, dry, calcareous with thin interbeds of limestone.
75–85		SANDSTONE - dark gray (N3), dry, very fine, medium hard, non-calcareous
85–87		SHALE - dark gray (N3), dry, medium hard.





Well Construction:

- Wellhead Protector 4" square steel: locking
- 3' x 3' X 0.3' concrete well pad
- Casing: 2" SCH 40 PVC; TFJ; -2.5'-76.2'
- Centralizer: SS bow-spring type
- Annular Seal: 3/8" bentonite chips; 0'-67.1'
- Bentonite Seal: Wyo-Ben ENVIROPLUG 3/8" coated bentonite pellets; 67.1'-73.1'
- Filter Pack: Colorado silica sand 10-20; 73.1'-86.6'
- Screen: 2" SCH 40 PVC; TFJ; 0.020" slot; 76.2'-86.2'
- End Cap: 2" SCH 40 PVC; TFJ; 86.2'-86.5'

NOTES: Centralizers placed at 6',16', 36', 56', 76', 86'. Dry drilling method, well dry upon completion with water coming in after approximately 1 week. All bentonite hydrated with potable water. Well developed with Waterra Hydrolift 2 inertial pump & surge block on new poly tubing on 11/7/2021.

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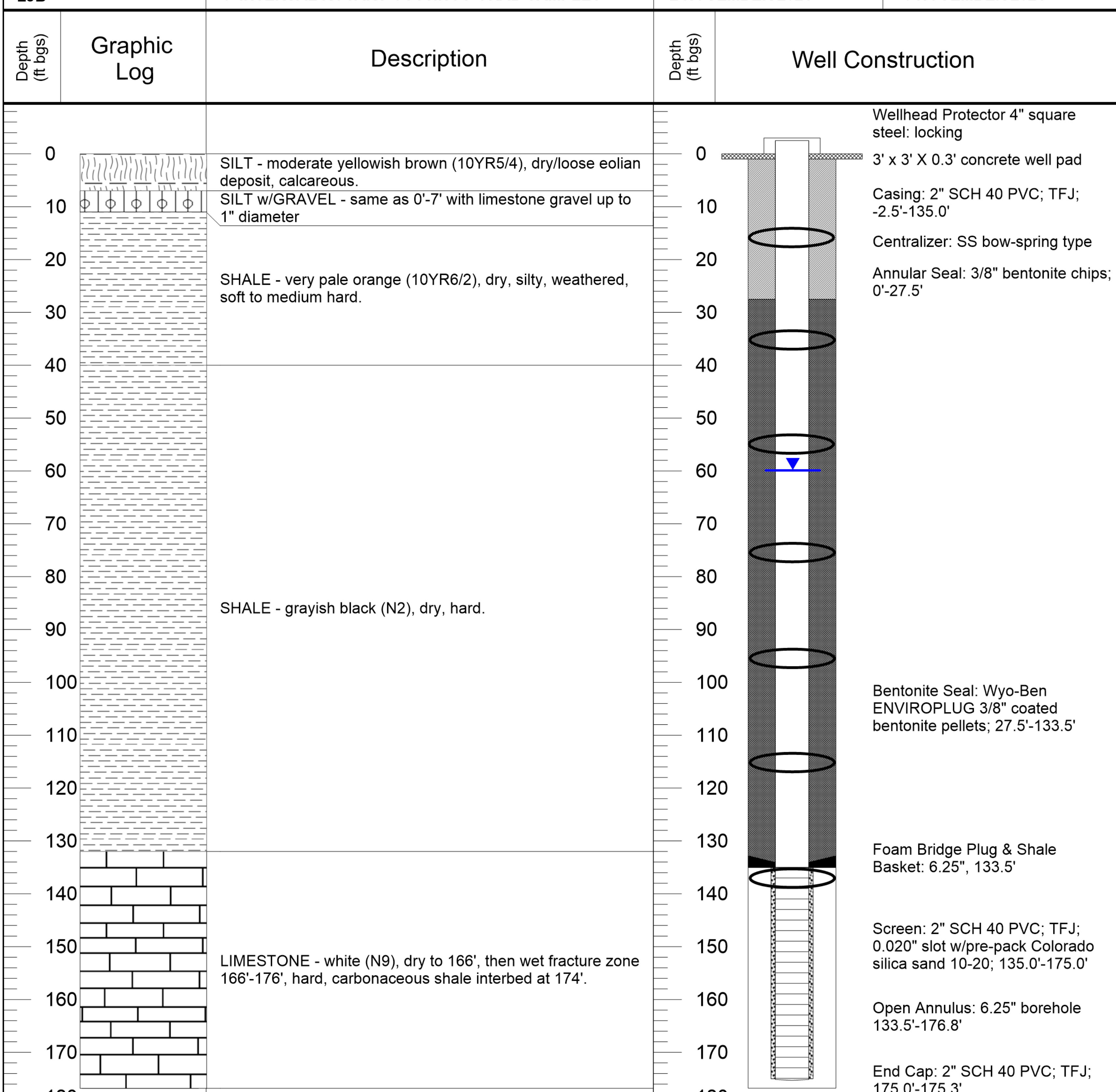
Figure 6. GCC Pueblo MW-13 lithology and well completion diagram.

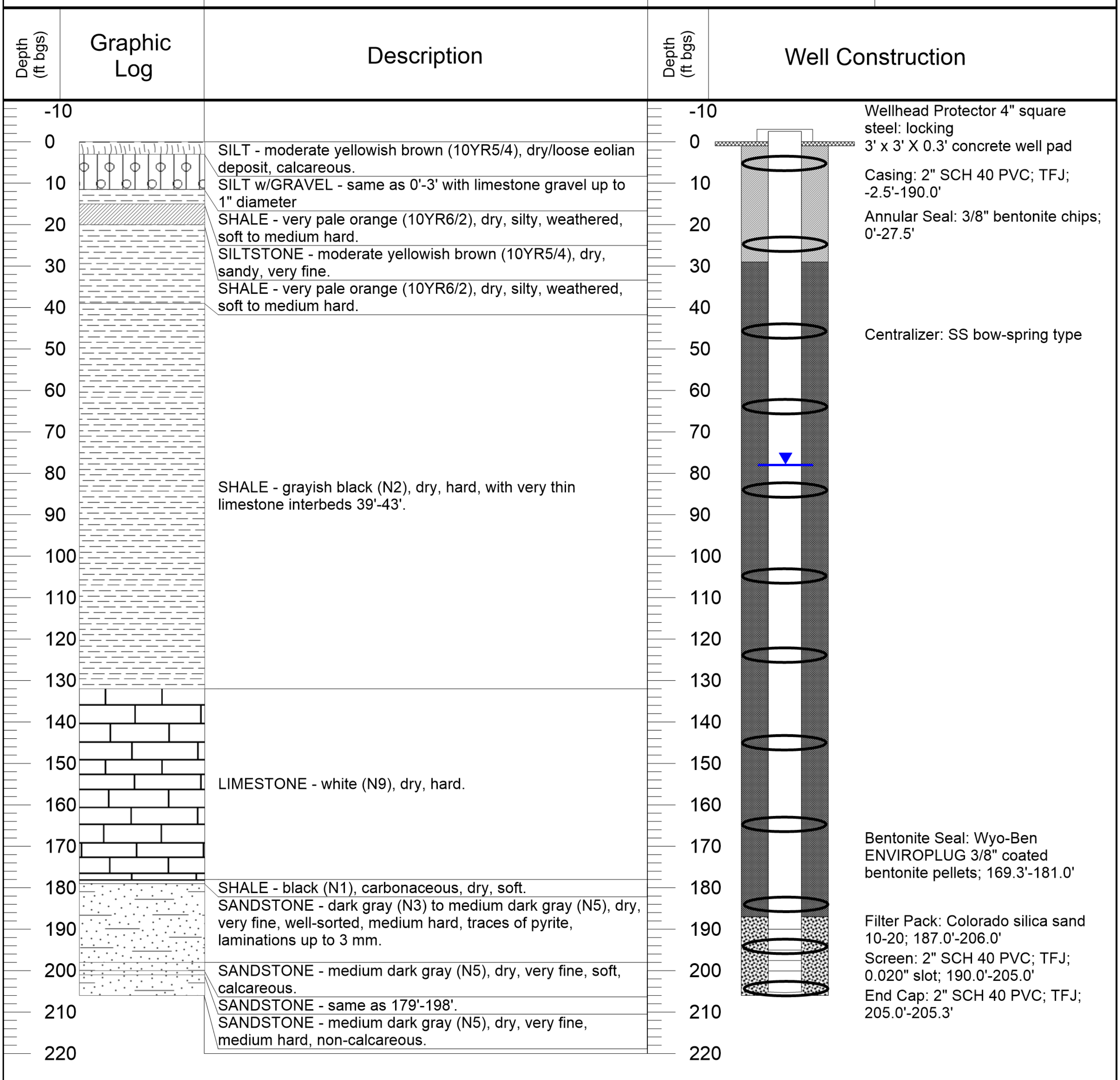
RESOURCE HYDROGEOLOGIC SERVICES	PROJECT: **GCC RIO GRANDE PUEBLO PLANT**	BORING ID: **MW-13**	
	LOCATION: **PUEBLO COUNTY, COLORADO**	WELL ID: **MW-13**	
	DRILLING CONTRACTOR: **HRL COMPLIANCE SOLUTIONS**	NORTHING (UTM NAD 83): **534401.5203**	EASTING (UTM NAD 83): **4219714.9385**
	DRILLING EQUIPMENT: **DIEDRICH D-90**	GROUND SURFACE ELEV.: **4987.93 FT AMSL**	TOC PVC ELEVATION: **4990.11 FT AMSL**
	DRILLING METHOD: **HOLLOW-STEM AUGER TO ROTARY AIR HAMMER**	TOTAL WELL DEPTH: **175.3 FT BGS**	DEPTH TO WATER: **59.90 FT BGS**
LOGGED BY: **LJB**	SAMPLING METHOD: **5' INTERVAL ROTARY CUTTINGS GRAB SAMPLES**	DATE STARTED: **2 NOVEMBER 2021**	DATE COMPLETED: **6 NOVEMBER 2021**



NOTES: Centralizers placed at 15', 35', 55', 75', 95', 115', 134'. Dry drilling method, borehole intersected 1st water from fracture at 166'. All bentonite hydrated with potable water. Pre-pack screen used due to difficulty placing conventional filter pack sand. 6.25" foam bridge plug & shale basket installed on blank casing just above screen at 133.5' Well developed with Waterra Hydrolift 2 inertial pump & surge block on new poly tubing on 11/8/2021-11/9/2021.

Figure 7. GCC Pueblo MW-14 lithology and well completion diagram.

RESOURCE HYDROGEOLOGIC SERVICES			
	PROJECT: **GCC RIO GRANDE PUEBLO PLANT**	BORING ID: **MW-14**	
	LOCATION: **PUEBLO COUNTY, COLORADO**	WELL ID: **MW-14**	
	DRILLING CONTRACTOR: **HRL COMPLIANCE SOLUTIONS**	NORTHING (UTM NAD 83): **535242.3970**	EASTING (UTM NAD 83): **4221415.8508**
	DRILLING EQUIPMENT: **DIEDRICH D-90**	GROUND SURFACE ELEV.: **4987.81 FT AMSL**	TOC PVC ELEVATION: **4989.92 FT AMSL**
	DRILLING METHOD: **HOLLOW-STEM AUGER TO ROTARY AIR HAMMER**	TOTAL WELL DEPTH: **205.3 FT BGS**	DEPTH TO WATER: **78.00 FT BGS**
LOGGED BY: **LJB**	SAMPLING METHOD: **5' INTERVAL ROTARY CUTTINGS GRAB SAMPLES**	DATE STARTED: **19 AUGUST 2021**	DATE COMPLETED: **6 NOVEMBER 2021**



NOTES: Centralizers placed at 5', 25', 45', 65', 85', 105', 125', 145', 165', 185', 195', 205'. Dry drilling method, borehole intersected 1st water from fracture at 166'. All bentonite hydrated with potable water. Well kinked (reduced inner diameter from 2.0" to approx 1.1") at 76.6' bgs during installation. Well developed by continuous hydro-jetting through 3/4" FJT pipe with potable water on 12/16/21.

Figure 8. GCC Pueblo MW-9 & MW-10 surface completions looking northeast. MW-9 nearest, MW-10 furthest.

Figure 9. GCC Pueblo MW-11 & MW-12 surface completions looking northeast. MW-11 nearest, MW-12 furthest.

Figure 10. GCC Pueblo MW-13 & MW-14 surface completions looking north. MW-13 nearest/left, MW-14 furthest/right.