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Prepared for
Colorado Springs Utilities

Submitted by
AECOM
Greenwood Village, Colorado
303-694-2770
October 2017

Coal Combustion Residuals (CCR) Landfill Groundwater Detection Monitoring Plan

Clear Spring Ranch
El Paso County, Colorado

Revision 0

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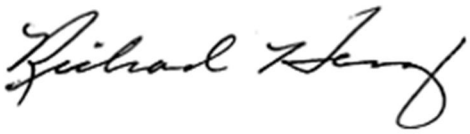
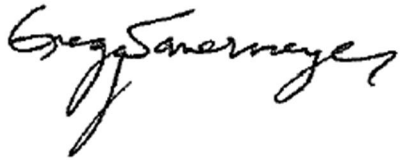
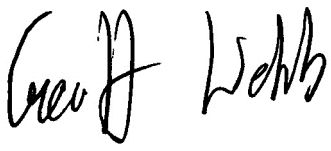


Prepared By
Richard Henry, Principal Hydrogeologist



Reviewed By
Gregg Somermeyer, P.E.



Approved By
Geoff Webb, Project Manager

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List of Acronyms

ANOVA	analysis of variance
CCR	coal combustion residuals
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
COC	chain-of-custody
CSR	Clear Spring Ranch
EPA	U.S. Environmental Protection Agency
MS/MSD	matrix spike/matrix spike duplicate
PVC	polyvinyl chloride
QA/QC	Quality assurance and quality control
RCRA	Resource Conservation and Recovery Act
TDS	total dissolved solids
USGS	U.S. Geological Survey
Utilities	Colorado Springs Utilities

Monitoring System Certification

Certification Statement 40 CFR § 257.91(f) – Design and Construction of a Groundwater Monitoring System for the existing Coal Combustion Residuals (CCR) Landfill, Clear Spring Ranch Solids Handling and Disposal Facility, El Paso County, CO, managed by the Colorado Springs Utilities.

I, Gregg Somermeyer, being a Registered Professional Engineer in good standing in the State of Colorado, do hereby certify, to the best of my knowledge, information, and belief, and in accordance with good engineering practice, that the design and construction of the groundwater monitoring system as included in Section 2.0 of the Groundwater Detection Monitoring Plan Revision 0, dated October 12, 2017, meets the requirements of 40 CFR § 257.91.

Gregg Somermeyer
October 12, 2017

Statistical Method Certification

Certification Statement 40 CFR § 257.93(f)(6) – Statistical Method for the Evaluation of Groundwater Monitoring Data for the existing Coal Combustion Residuals (CCR) Landfill, Clear Spring Ranch Solids Handling and Disposal Facility, El Paso County, CO, managed by the Colorado Springs Utilities.

I, Gregg Somermeyer, being a Registered Professional Engineer in good standing in the State of Colorado, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification is prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the statistical method selected for the groundwater monitoring system as included in Section 4.0 of the Groundwater Detection Monitoring Plan Revision 0, dated October 12, 2017, is appropriate for evaluating the groundwater monitoring data for the CCR management area. The statistical method selected to evaluate the groundwater monitoring data for the CCR Unit is identified and described in Section 4.0

Gregg Somermeyer
October 12, 2017

1 Introduction

1.1 Background

Clear Spring Ranch (CSR) is a 4,759-acre property located at the intersection of Interstate 25 and Ray Nixon Road, approximately 17 miles south of Colorado Springs (Figure 1). It was acquired in 1972 by the City of Colorado Springs on behalf of its enterprise Colorado Springs Utilities ("Utilities"). The primary land uses on the CSR property are those related to utility services: electric generation and transmission, water/wastewater treatment and delivery, and waste management.

Power generation at Utilities' Martin Drake and Ray Nixon Power Plants produces coal combustion residuals (CCR). Utilities places these residuals in the CCR Landfill (or "the Site") located in the southern part of CSR. Utilities' materials currently authorized for placement in the CCR Landfill include the following:

- Fly ash and bottom ash from the Drake and Nixon Power Plants,
- Flue gas desulfurization ("FGD" or "scrubber") waste from the Drake and Nixon Power Plants,
- Spent boiler cleaning sandblasting media from the Drake and Nixon Power Plants,
- Evaporator salt from the Zero Discharge Wastewater Treatment Plant,
- Cooling tower solids from the Birdsall Power Plant,
- Process Water Pond sediment from the Drake Power Plant,
- Storm Water Pond sediment from the Drake Power Plant,
- Dry sorbent injection residuals from the Drake Power Plant,
- EQ Basin sediment from the Nixon Power Plant
- Activated carbon injection residuals from the Drake and Nixon Power Plants, and
- Ash derived from the co-combustion of clean cellulosic biomass and coal at the Drake Power Plant.

The CCR Landfill is regulated by the Colorado Department of Public Health and Environment (CDPHE) – Hazardous Materials and Waste Management Division and the Local Governing Authority (i.e., El Paso County) under the Regulations Pertaining to Solid Waste Sites and Facilities (6 Code of Colorado Regulations 1007-2, Part 1) and El Paso County's Land Development Code. It is also regulated under the Final CCR Rule promulgated by the U.S. Environmental Protection Agency (EPA) under 40 Code of Federal Regulations (CFR) Part 257, Subtitle D of the Resource Conservation and Recovery Act (RCRA). The current extent of the CCR Landfill is shown on Figure 1.

1.2 Purpose

The purpose of this monitoring plan is to outline a detection monitoring program for the CCR Landfill that will be used to evaluate whether landfill operations are protective of groundwater. The detection monitoring program is intended to:

- Establish background concentrations in groundwater for constituents that could reasonably be expected to leach from the CCR material disposed in the landfill.
- Analyze groundwater samples collected on a routine basis from background monitoring wells and monitoring wells installed along the downgradient edge of the landfill.
- Establish the methodology used to evaluate whether a statistically significant increase in CCR indicator parameters above background levels has occurred from the landfill.
- Reduce the potential for CCR disposal activities to degrade water quality in the Fountain Creek Alluvial aquifer.

This monitoring plan has been prepared to meet detection monitoring requirements specified in 40 CFR §257.94.

2 Detection Monitoring Program

2.1 Site Hydrogeology

The CCR Landfill is located in Sand Canyon, a small, west-east trending topographic depression that is bounded to the north and south by outcrops of the Pierre Shale. Approximately 50 feet of Quaternary sediments have been deposited in the canyon. These sediments, referred to as the Piney Creek Alluvium, consist of horizontal layers of clay, silty clay, sand, and gravel. Most of the alluvium is poorly-sorted and fine-grained with silt-sized materials predominating. Bedding is poorly defined except for a thin layer of gravel near the base of the deposit. The Piney Creek Alluvium is saturated beneath the CCR Landfill and forms the uppermost water-bearing zone in Sand Canyon.

The CDPHE's Water Quality Control Commission, under Regulation 41 – The Basic Standards for Groundwater, has not established use classifications or site specific numerical standards for groundwater quality beneath the Site; other than applicable "Statewide" standards. Previously evaluated groundwater quality data suggests that groundwater up-gradient of and underlying the CCR Landfill has a total dissolved solids (TDS) concentration in excess of 10,000 mg/l. Regulation 41 - Section 41.4(B) describes the criteria that shall be used to identify classifications for ground water, and Section 41.4(B)(5)(a) indicates that when TDS levels are equal to or in excess of 10,000 mg/l, groundwater within the specified area shall be classified "Limited Use and Quality" (i.e., assuming concurrence that the criteria specified in Sections 41.4(B)(1-4) are not met). Limited Use and Quality is the lowest classification possible. Regulation 41 - Section 41.5 (B) does not list any numeric standards as applying to this classification, and the "Interim Narrative Standard" in Section 41.5(C)(6)(b)(i) is not applicable to unassigned groundwater having a TDS concentration in excess of 10,000 mg/l.

The Piney Creek Alluvium is underlain by approximately 3,500 to 4,000 feet of Pierre Shale that forms a hydraulic barrier between the alluvium and deeper water-bearing formations, if present. Groundwater within the Piney Creek Alluvium flows to the east-southeast along the top of the alluvium-Pierre Shale contact. Water level measurements indicate that the saturated thickness of the alluvial water-bearing zone ranges from approximately zero to 25 feet.

Approximately one mile east of the CCR Landfill, Sand Canyon intersects the north-south alluvial channel of Fountain Creek. The Fountain Creek Alluvium represents a productive aquifer that is primarily used for agricultural and industrial purposes near CSR. On a regional geologic map of the area (Scott et al., 1978), the Fountain Creek Alluvium is mapped as the same geologic unit as the Piney Creek Alluvium in Sand Canyon. However, groundwater quality in the two alluvial channels is markedly different, with much lower groundwater TDS concentrations occurring in the Fountain Creek aquifer.

The upgradient portion of Sand Canyon occupied by the CCR Landfill is isolated from the Fountain Creek aquifer by a retention dam installed by Utilities in 1978. The retention dam, located approximately 3,000 feet downgradient (east) of the landfill (Figure 2), has a bentonite core and is keyed into the Pierre Shale bedrock. It captures surface water runoff from the CCR Landfill and also restricts groundwater flow. The dam is not completely impermeable, however, and has experienced seepage issues in the past. An engineering study was conducted in 1994 to evaluate seepage through the dam and to recommend alternatives for improving its effectiveness (Haley and Aldrich, 1994). The recommended alternative was to install a bentonite barrier wall through the upgradient toe of the dam. Utilities installed the bentonite barrier in October 1994 and later added a French drain along the southern downgradient side of the dam to collect residual seepage water. The seepage intercepted by the French drain is pumped back to the upgradient side of the dam.

Collectively, the detection monitoring program, retention dam, and the French drain pump back system are the measures that Utilities has implemented to protect groundwater downgradient of the CCR Landfill. The detection monitoring program serves to identify potential releases from the landfill, while the retention dam and French drain are intended to prevent any releases that may occur from migrating in groundwater downgradient to the Fountain Creek alluvial aquifer.

2.2 Monitoring Well Network

The detection monitoring network for the CCR Landfill is depicted on Figure 2. It includes five background wells (CC-1, FC-1, FC-2, FC-3A, and FC-3B) that will be used to establish groundwater background concentrations, four downgradient wells (SC-10, SC-11, SC-12, and SC-13) along the eastern edge of the landfill, and one cross-gradient well (SC-14) on the south side of the landfill. Upgradient monitoring wells CC-1, FC-1, and FC-2 have been in service since 1993 and provide a long-term historical record of background constituent concentrations and variability. The remaining seven new wells were installed in 2016 to comply with the CCR Rule. The boring logs and construction diagrams for the wells included in the detection monitoring network are included in Appendix A.

The new monitoring wells were drilled using a hollow-stem auger rig to the contact between the Piney Creek Alluvium and underlying weathered and fractured Pierre Shale claystone. The wells were subsequently screened across the lower 10 feet of the alluvium using 2-inch diameter, 0.010-inch factory slotted polyvinyl chloride (PVC) screen and blank well casing. The locations, as well as the ground surface and the top of casing elevations, of the new wells were surveyed by a Colorado-licensed professional land surveyor. Table 1 summarizes well construction details for the CCR Landfill detection monitoring wells.

The initial plan for monitoring wells FC-3A and FC-3B was to install them upgradient of the CCR Landfill on the U.S. Army's Fort Carson property. However, after discussions with Fort Carson personnel, the Army would not grant permission to install new wells in this area (Gallegos 2015). Thus, monitoring points FC-3A and FC-3B were relocated to the southwest corner of the CCR Landfill, just inside Utilities property. These two new wells were constructed as a nested well pair with FC-3A installed in the Piney Creek alluvium and FC-3B installed in the Pierre Shale. The nested wells will provide data for evaluating how groundwater background concentrations may differ between the alluvium and shale bedrock.

2.3 Sampling Frequency

Wells in the CCR Landfill monitoring network were sampled approximately monthly to establish background concentrations for the Piney Creek Alluvium. The eight baseline sampling rounds began on June 22, 2016 and were completed on March 1, 2017 prior to the October 17, 2017 deadline established in the CCR Rule (40 CFR §257.94). Subsequently, detection monitoring will be performed semi-annually (Table 2).

2.4 Analytical Parameters

During the initial eight rounds of baseline detection monitoring, samples were collected from the CCR landfill wells and analyzed for the constituents listed in 40 CFR §257, Appendices III and IV. This list includes the general chemistry parameters pH and TDS; the anions chloride, fluoride, and sulfate; combined radium-226+228, and several metals as shown on Table 2. Groundwater samples were not field-filtered so that reported metals concentrations represent "total recoverable metals" as required by the CCR Rule. Since the initial detection monitoring has been completed, the analyte list will be reduced to the indicator parameters listed in Appendix III of 40 CFR §257. This shorter list, which includes boron, calcium, chloride, fluoride, sulfate, and TDS (Table 2), will remain the focus of detection monitoring until the CCR Landfill is closed or assessment monitoring is triggered. Groundwater pH will continue to be monitored as a field parameter. In addition, barium will be monitored to fulfill an agreement with the CDPHE (Foster and Zietlow 2015; Parisi 2015) regarding the use of water spray for dust suppression in lieu of daily cover.

2.5 Reporting

To comply with the CCR Rule, an Annual Groundwater Monitoring and Corrective Action Report will be prepared for the CCR Landfill after the eight rounds of baseline detection monitoring is completed. This initial report will be completed no later than January 31, 2018, and annually thereafter (Table 3). The annual reports will document the status of the detection monitoring program for the CCR Landfill, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and identify key activities for the upcoming calendar year. The annual report will be considered complete when it is placed in the facility operating record. Other information required to be included in the annual report is listed in 40 CFR §257.90.

3 Groundwater Sampling and Analysis

This section describes procedures that will be used at the Site for groundwater sampling and analysis.

3.1 Water Level Measurement

At the start of each monitoring event, Utilities will measure the depth-to-water in the detection monitoring wells prior to purging. Water levels will be measured within a period of time short enough to avoid temporal variations in groundwater elevation which could prevent an accurate determination of the groundwater flow rate and direction. The device used to measure water levels will be capable of achieving a measurement precision of ± 0.01 feet.

The procedure for measuring water levels in the detection monitoring wells is described below.

- Before any measurement is taken, the water level probe and cable should be properly decontaminated.
- The static water level depth of the well shall be measured using an electric water level indicator. The measuring point for all detection monitoring wells should be the top of the PVC or steel well casing. The measuring point will be marked by a notch or other mark in the casing. If no mark is present, measurements will be collected from the top of the north side of the casing.
- The static water level depth shall be written down on the field data sheet or field notebook, and immediately rechecked before the indicator is removed from the well.
- If needed, water levels will be compared with past measurements to help verify the readings during each water level measurement period.
- The water level depth below the measuring point (in feet) will be subtracted from the measuring point elevation to calculate the elevation of the static water level.

3.2 Sample Collection

Before collecting samples, detection monitoring wells will be purged until a minimum of three well casing volumes have been removed and field parameters have stabilized (i.e., temperature, pH, and conductivity), or until the well is pumped dry.

Well purging will begin by first removing the well cap and measuring the groundwater level and total depth as described in Section 3.1. These measurements will be used to calculate the volume of water (in gallons) in the well casing based on the water column height and casing diameter. The well casing volume will be multiplied by three to obtain the required cumulative amount of water to be removed from the well.

Once the purge volume has been calculated, well purging will be initiated using either a reusable bailer, disposable bailer, dedicated pump, or reusable pump. If a reusable bailer or pump is used, it will first be decontaminated; as will the ancillary equipment with the potential to contact groundwater (i.e., bailing cord, tubing, electrical lines, or safety cable). The purged groundwater will be directed to a 5-gallon bucket or other container of known volume to measure the cumulative amount of water removed from the well.

After evacuation of each well volume, the field sampler will measure the field parameters to confirm that the water chemistry is stabilizing. The sampler will also make note of the water color and clarity. Generally, temperature within 1° Celsius, pH within ± 0.1 units, and conductivity within ± 10 percent for consecutive readings indicate stable water chemistry. Field meters for measuring temperature, pH, and conductivity will be calibrated daily and operated according to the manufacturers' instructions.

Groundwater samples for laboratory analysis will be collected after the water level in the well has recovered to approximately 80% of its initial measured value. If well recovery is slow (i.e., recovery to approximately 80% of its initial measured value takes longer than 4 hours), samples will be obtained when sufficient water is available to fill the required sample bottles. If sufficient water for sampling is not available within 48 hours of well purging, the location will not be sampled during the specific monitoring event. Each well's recharge conditions will be included within the sampler's field notes.

The field sampler will don new disposable nitrile gloves for sampling and will fill the laboratory-supplied sample containers directly from the bailer or pump discharge line. Groundwater samples *will not* be field filtered. Sample containers should be filled with minimal turbulence and should not be overfilled to avoid spilling the sample preservative (where applicable). Groundwater samples will be collected in such a way as to minimize potential contamination to provide an accurate representation of groundwater constituent concentrations. Measures to help prevent contamination will include using dedicated sampling equipment, wearing a new pair of disposable gloves at each well, and decontaminating any reusable equipment (such as the water level indicator) between wells.

Field notes will be kept by sampling personnel either in a field log book or on groundwater sampling forms. The field notes will include sampler name(s), well identification numbers, the date and time, instrument calibration notes, water-level measurements, well purging volumes, well recharge conditions, and other notable site observations. These records will be maintained by Utilities personnel.

3.3 Sample Preservation and Shipment

Sample will be preserved as appropriate, and sample containers will be labeled and placed in appropriate shipping containers. Table 2 lists the required preservative for each analytical constituent per SW-846 (EPA 2014). Sample containers will be placed on ice / cold packs following sample collection and during transport to the laboratory. Other sample preservatives include nitric acid for metals and hydrochloric acid for mercury analysis. Prior to sample collection, the Laboratory will place the preservatives into the bottles used to contain the samples for metals and mercury analysis . Samples will be transported under chain-of-custody (COC) control to Colorado Springs Utilities Laboratory, a Colorado State Certified Laboratory, or shipped to an alternate appropriately certified laboratory.

3.4 Analytical Procedures

Detection monitoring samples will be analyzed for the constituents shown in Table 2. As discussed in Section 2.4, the complete Appendix III and IV analyte list presented in Table 2 only applies to the first eight baseline detection monitoring events; or if assessment monitoring is triggered. After October 2017, when the sampling frequency changes to semi-annual, Utilities will use the shorter Appendix III analyte list of boron, calcium, chloride, fluoride, sulfate, and TDS for detection monitoring. Groundwater pH will also continue to be monitored as a field parameter. In addition, barium will also be monitored to fulfill an agreement with the CDPHE (Foster and Zietlow 2015; Parisi 2015) regarding the use of water spray for dust suppression in lieu of daily cover.

Table 2 also lists the analytical method and sample preservative for each constituent. In general, Utilities will use EPA Methods 200.7 and 200.8 for metals analysis, EPA Method 1631 for mercury, EPA Method 300.0 for anions (i.e., chloride, fluoride, and sulfate), EPA Method 903.1 for combined radium-226+228 (EPA 2014), and Standard Methods 4500-HB for pH and 2540-C for TDS (APHA et al 1998).

3.5 Chain-of-Custody Control

Utilities standard COC procedures will be followed on all samples collected. Custody is recorded through a series of signatures on the COC form as sample possession changes from one person or organization to another. For each sample location, the sample name, date and time of collection, and requested analyses will be recorded on the COC form. The field sampler will provide the original COC form to the laboratory at the time of sample delivery. COC records will be maintained by Utilities Environmental Services Division.

Once samples are received at Colorado Springs Utilities Laboratory, each sample will be assigned a unique identifying number to facilitate accurate sample tracking. From there, sample information will be logged into the laboratory's computer information management system. Any samples being analyzed by a contract laboratory will be shipped under COC control in appropriate containers according to any applicable requirements of the analytical methods listed in Table 2.

3.6 Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures will be implemented in an effort to collect reliable and valid field and analytical data. The QA/QC program will include collecting field duplicate samples to assess error

associated with sample methodology and analytical procedures. At a minimum, one field duplicate will be collected per sampling event or per 20 samples, whichever is greater. One equipment blanks per sampling event will be collected when sampling equipment is re-used at multiple wells to assess the efficacy of equipment decontamination techniques. In addition, matrix spike/matrix spike duplicate (MS/MSD) samples will be used to monitor lab performance and the degree to which matrix interferences affect the reported concentration of an analyte. At least one MS/MSD will be collected for every 20 samples. A laboratory quality control report for each detection monitoring event will be provided by the lab and maintained by Utilities Environmental Services Division.

4 Statistical Methodology

4.1 Regulatory Guidance

Regulatory guidance provided in 40 CFR 257.90 specifies that a CCR groundwater monitoring program include selection of the statistical procedures to be used for evaluating groundwater quality data as required by 40 CFR 257.93. Groundwater quality monitoring data will be collected under the detection monitoring program outlined in this plan and includes collection and analysis of a minimum of eight independent samples for the background and downgradient compliance wells as required by 40 CFR 257.94(b). The initial eight rounds of detection monitoring samples will be analyzed for the constituents listed in 40 CFR 257 Appendices III and IV. Sampling and analysis was competed on May 9, 2017 which satisfies the October 17, 2017 deadline established by the EPA in the CCR Rule (40 CFR §257.94). Future detection monitoring samples will only be analyzed for 40 CFR 257 Appendix III constituents.

Per 40 CFR 257.93(h)(2), the initial eight sets of groundwater samples were statistically evaluated within 90 days after completing sampling and analysis on May 9, 2017, to determine if there were any statistically significant increases over background concentrations for the Appendix III constituents. These data were analyzed using one or more of the statistical methods outlined in 40 CFR 257.93(f) and 40 CFR 257.93(g). In determining whether a statistically significant increase has occurred, Utilities compared the constituent concentrations at the downgradient and the background wells from the initial eight rounds of detection monitoring data using the statistical approach described in Sections 4.2 and 4.3 below. Future detection or assessment monitoring data will also be compared using the statistical approach presented in Sections 4.2 and 4.3.

40 CFR 257.93(f) outlines the statistical methods available to evaluate groundwater monitoring data. The statistical test(s) chosen will be conducted separately for each constituent in each monitoring well and will be appropriate for the constituent data and their distribution. 40 CFR 257.93(g) provides performance standards, as appropriate, for the statistical test method selected.

Per 40 CFR 257.93(f)(6), Utilities must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification must include a narrative description of the statistical method(s) selected to evaluate the groundwater monitoring data.

Utilities must determine whether there has been a statistically significant increase over background for any of the Appendix III constituents at the downgradient wells within 90 days after completing the initial eight rounds of groundwater sampling and analysis (40 CFR 257.93(h)(2)). The results of this analysis will be used to determine whether the site will continue detection monitoring or whether assessment monitoring is required as discussed below.

Assessment monitoring is required per 40 CFR 257.95(a) whenever a statistically significant increase (SSI) over background has been detected for one or more of the constituents listed in 40 CFR 257 Appendix III. An assessment monitoring program also includes annual groundwater sampling and analysis (40 CFR 257.95(b)) for the constituents listed in 40 CFR 257 Appendix IV. The purpose of assessment monitoring is to determine if releases of CCR constituents have occurred.

The facility can return to detection monitoring once assessment monitoring results are at or below background for two consecutive assessment monitoring periods (40 CFR 257.95(e)). If the assessment monitoring demonstrates an exceedance of a groundwater protection standard defined under (40 CFR 257.95(h)) for any of the CCR constituents specified in 40 CFR 257 Appendix IV, an assessment of corrective measures must be initiated within 90 days (40 CFR 257.96(a)).

4.2 Statistical Analysis Approach

There is no single method of statistical analysis appropriate for each chemical dataset. It is most prudent to use a suite of statistical methods that are dependent on the data and their distributions. The statistical analyses can be based on an interwell and/or an intrawell approach. The statistical algorithms used for the interwell and intrawell

approaches are chosen based on the constituent data and their distributions as well as consideration of natural seasonally- or spatially-varying constituent concentrations.

The initial eight rounds of groundwater monitoring data were concurrently collected and analyzed for the 40 CFR 257 Appendices III and IV constituents. These data will be used to represent background groundwater quality for the CCR Landfill and to determine if the CCR Landfill has impacted downgradient groundwater quality. The initial eight rounds of groundwater sampling and analysis were completed on May 9, 2017, prior to the October 17, 2017 deadline established in the CCR Rule (40 CFR §257.94).

A preliminary, exploratory statistical analysis was conducted after the initial eight rounds of baseline data were obtained to assess the constituent data and determine the most appropriate statistical approach(es) for the data. The data were examined for outliers and the percentage of non-detect values to verify that the data collected are suitable for statistical analysis. The data were also examined using goodness-of-fit tests to determine the most appropriate statistical distribution, and time series plots and areal maps were used to determine if seasonal or spatial variations in constituent concentrations were present. Based on this preliminary evaluation of the data, an interwell statistical method was selected as appropriate for evaluating groundwater at the Site, as described in Section 4.3.

Per 40 CFR 257.93(h)(2), statistical analysis of all eight rounds of the initial groundwater monitoring data was completed within 90 days after completing groundwater sampling and analysis on May 9, 2017, to determine whether there has been a statistically significant increase over background for any Appendix III constituent.

4.3 Interwell Statistical Approach

Interwell tests compare the statistical differences between (upgradient) background and downgradient compliance wells. An interwell statistical approach will be used during detection monitoring for the following reasons:

- Sufficient data are available in the upgradient background wells, when grouped, to ensure adequate degrees of statistical power to detect real exceedances above background levels, and also reasonable control over the site-wide false positive rate (SWFPR) so that spurious exceedances have little chance of being identified.
- Although there is evident and significant spatial variation among most, if not all, of the Appendix III and IV constituents, it is unclear to what extent the similarly evident variation among the downgradient wells is due strictly to natural differences in groundwater quality and/or other factors unrelated to management of the CCR. Because of this uncertainty, an interwell comparison strategy appears to be initially more appropriate for the Site.
- The clear spatial variation among the upgradient wells will be leveraged to better estimate the overall range in natural and non-site-impacted background levels. Interwell statistical limits computed from the grouped upgradient background will incorporate this information and allow for accurate monitoring comparisons.

As a caveat to this approach, for constituents that occur naturally and vary substantially in concentration across the Site due to natural hydrogeologic or geochemical factors — thus, exhibiting significant spatial variability — an interwell testing scheme will not always be helpful. Constituent concentrations greater than background might be attributed to anthropogenic contamination using an interwell approach, when the differences are actually natural and due to locally varying distributions of groundwater constituents. In such cases, an intrawell approach may be warranted.

Furthermore, there is no requirement either in RCRA or the CCR Rule to use exactly the same statistical method or approach for every constituent. Depending on characteristics of the Site and data that are collected, a mix of interwell and intrawell tests may be warranted. At this site, the initial statistical screening suggests that interwell comparisons are most appropriate despite evident spatial variability. However, that conclusion could change as additional data are collected during future detection monitoring. If new information indicates that constituent concentrations remain relatively stable and that the existing spatial variation is unrelated to the CCR landfill, a modification of the statistical approach to intrawell testing may be recommended for one or more constituents.

Under an interwell statistical approach in detection monitoring, the actual statistical method(s) chosen will be determined based on the constituent data distribution (as outlined below), which in turn is influenced both by the percentage and pattern of non-detect measurements as well as the temporal stability of the concentration levels.

When (1) the percentage of non-detects is low to moderate (i.e., less than 50-60 percent), (2) the background data can be normalized (perhaps via a standard transformation), and (3) the results are stationary (i.e., stable over time), the following statistical methods are highly recommended by EPA (2009):

- Interwell control charts with retesting; or
- Parametric interwell prediction limit methods with retesting.

When the background data cannot be normalized (perhaps due to a large percentage of non-detects), but the data are stationary (i.e., stable over time), the following statistical method is recommended by EPA (2009):

- Non-parametric interwell prediction limits with retesting.

Note that the specific retesting method in each of these options will be chosen to account for the size of the well network, the amount of background data available, the number of constituents being monitored, the site-specific mix of intrawell and interwell tests, and the impact of these factors on the statistical power and accuracy of the test. At this site, the size of the grouped background wells relative to the number of downgradient wells to be tested on a semi-annual basis will enable use of a 1-of-2 retesting plan. This necessitates collection of a single independent resample at any location in which the initial routine measurement exceeds its respective statistical limit. A confirmed statistical exceedance will not be recorded unless both the initial measurement and resample value both exceed the statistical limit.

If the grouped background data are non-stationary and thus exhibit a clear trend, it will suggest that factors unrelated to the CCR landfill are impacting background groundwater quality. Three general scenarios will be considered:

- Older background data may no longer be representative of current site conditions and may need to be excluded from statistical calculations. In this case, the interwell statistical limits will be updated to include only the most representative background data.
- The compliance wells will be examined to see if similar trends are occurring downgradient. If so, a common trend component will be estimated across the site and removed from every well. The residual data will then be used to construct revised statistical limits and tested as described above.
- If the trend in upgradient background wells is not reflected in downgradient wells, further investigation may be needed to determine if the upgradient data still serve as a reasonable background with which to compare downgradient compliance measurements. If not, the statistical approach will be modified to an appropriate intrawell strategy.

Because of the decision matrix needed to establish the correct statistical approach, the background data for each constituent will be periodically screened prior to construction of new or revised statistical limits. This screening will examine the proportion and pattern of outliers and potential data anomalies (perhaps due to laboratory or field sampling factors), the presence or absence of statistically significant trends over time, the presence or absence of statistically significant outliers, and the identification of an appropriate statistical distribution. In particular, any confirmed background outliers will be excluded from statistical calculations, so as not to unduly bias the statistical limits.

5 Assessment Monitoring

5.1 Triggers and Timing

If through the statistical analyses discussed in Section 4.0, it becomes evident that a statistically significant increase over background has occurred for one or more of the detection monitoring 40 CFR 257 Appendix III constituents, Utilities will place documentation in the facility operating record indicating which constituents have shown an increase, and will forward this information to CDPHE and El Paso County. Utilities would then have two options for continued groundwater monitoring at the CCR Landfill.

- The first option would be to evaluate whether a source other than the CCR Landfill caused the statistically significant increase, or whether the increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.
- The second option would be to establish an assessment monitoring program for the CCR Landfill in accordance with 40 CFR 257.95. An assessment monitoring program also includes annual groundwater sampling and analysis for the constituents listed in 40 CFR 257 Appendix IV. The purpose of assessment monitoring is to determine if releases of CCR constituents have occurred from the landfill. If this option proves to be necessary, Utilities will place a notification in the facility operating record stating that an assessment monitoring program has been established. Utilities would be required to implement the assessment monitoring program within 90 days of confirming the statistically significant concentration increase.

Protocols that would be followed for each of these options are described in Sections 5.2 through 5.4 below.

5.2 Verification Resampling

Verification resampling is an integral component of the statistical method outlined in Section 4.3. Verification resampling provides a way to evaluate unexpected or errant sample results and can help avoid unnecessary entry into assessment monitoring. A verification resample would only be collected from the well(s) where an outlier or statistically significant concentration increase was observed, and only for the relevant analyte(s). The same sampling procedures used for detection monitoring would also be used for verification resampling. Utilities would take reasonable efforts to complete verification resampling within two weeks of identifying the need to resample. A statistically significant increase only is flagged when a verification sample confirms the initial result. A report documenting this action will be developed in accordance with requirements of 40 CFR §257.94.

5.3 Alternate Source Demonstration

In addition to verification resampling, Utilities may also choose to evaluate whether the statistically significant concentration increase was derived from another source besides the CCR Landfill. Such an evaluation, if warranted, may require specialized sample analyses to identify concentration inputs from other potential sources. Any report prepared as a result of this evaluation or as a result of verification sampling will be submitted to CDPHE and El Paso County, and will be entered into the facility operating record within 90 days of identifying the statistically significant concentration increase. The report will also be certified by a qualified groundwater scientist or professional engineer.

5.4 Assessment Monitoring Program

Assessment monitoring is required whenever a statistically significant increase over background has been detected for one or more of the constituents listed in 40 CFR §257 Appendix III. A routine monitoring sample result will only be considered valid if the verification sample result confirms a statistically significant increase over background values. If this situation occurs, the facility will implement an assessment monitoring program within 90 days of obtaining the verification resample result in accordance with 40 CFR 257.95. In assessment monitoring, the owner or operator of the CCR unit must sample and analyze the groundwater for all constituents listed in 40 CFR §257 Appendix IV (Table 2) within 90 days of a confirmed statistically significant increase over background, and annually thereafter. Within 90 days of obtaining the initial assessment monitoring results, and on at least a semiannual basis thereafter, resample all monitoring wells and conduct analyses for all parameters in 40 CFR §257 Appendix III and for those constituents in 40 CFR §257 Appendix IV that show a statistically significant increase over background in the initial assessment monitoring. All assessment monitoring results will be entered

into the facility operating record as required by 40 CFR §257.95. The facility can return to detection monitoring once assessment monitoring results are at or below background values for two consecutive assessment monitoring events.

6 Limitations

The signature of Consultant's authorized representative on this document represents that, to the best of Consultant's knowledge, information, and belief in the exercise of its professional judgment, it is Consultant's professional opinion that the aforementioned information is accurate as of the date of such signature. Any opinion or decisions by Consultant are made on the basis of Consultant's experience, qualifications, and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

7 References

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Tables

Table 1
Monitoring Well Construction Details
CCR Landfill Detection Monitoring Program
Colorado Springs Utilities Clear Springs Ranch

Well Name	Location Relative to Ash Landfill	Easting (feet)	Northing (feet)	Top of Casing Elevation (ft amsl)	Ground Surface Elevation (ft amsl)	Total Depth (ft bgs)	Well Screen Interval (ft bgs)	Well Screen Lithology
CC-1	Upgradient Well	3223490.00	1280702.88	5479	5476.6	38.0	33 - 38	Pierre Shale
FC-1	Upgradient Well	3223188.25	1283318.75	5487	5484.9	33.0	28 - 33	Silty Clay
FC-2	Upgradient Well	3223214.00	1282123.88	5483	5480.8	28.0	12.5 - 28	Silty Clay
FC-3A	Upgradient Well	3223409.73	1282807.37	5484.36	5481.95	34.8	14 - 34	Alluvium
FC-3B	Upgradient Well	3223416.43	1282806.09	5483.90	5481.54	55.1	45 - 55	Pierre Shale
SC-10	Downgradient Well	3226344.60	1283428.94	5447.75	5445.18	35.3	15 - 35	Alluvium
SC-11	Downgradient Well	3226374.64	1283151.69	5444.68	5441.94	30.7	10 - 30	Alluvium
SC-12	Downgradient Well	3226399.78	1282807.25	5444.52	5442.07	25.8	5 - 25	Alluvium
SC-13	Downgradient Well	3226375.83	1282422.79	5446.02	5443.74	23.2	5 - 22.5	Alluvium
SC-14	Cross-gradient Well	3225699.13	1282348.07	5450.38	5448.20	28.1	18 - 28	Alluvium

Notes:

Easting and northing are survey coordinates in Colorado State Plane, Central, NAD 83/86, US survey foot

ft amsl = feet above mean sea level

ft bgs = feet below ground surface

Table 2
Analytical Parameters, Methods, and Sampling Frequency
CCR Landfill Detection Monitoring Program
Colorado Springs Utilities Clear Springs Ranch

Constituent	Analytical Method[1]	Preservation	Sampling Frequency
Appendix III List - Constituents for Detection Monitoring			
Boron	EPA 200.7	≤ 6°C, Nitric Acid	Semi-Annual
Calcium	EPA 200.7	≤ 6°C, Nitric Acid	Semi-Annual
Chloride	EPA 300.0	≤ 6°C	Semi-Annual
Fluoride	EPA 300.0	≤ 6°C	Semi-Annual
pH	SM 4500-HB	≤ 6°C	Semi-Annual
Sulfate	EPA 300.0	≤ 6°C	Semi-Annual
Total Dissolved Solids	SM 2540-C	≤ 6°C	Semi-Annual
Appendix IV List - Constituents for Assessment Monitoring			
Antimony	EPA 200.8	≤ 6°C, Nitric Acid	Annual, Semi-Annual[3]
Arsenic	EPA 200.8	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Barium[2]	EPA 200.7	≤ 6°C, Nitric Acid	Semi-Annual
Beryllium	EPA 200.7	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Cadmium	EPA 200.7	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Chromium	EPA 200.7	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Cobalt	EPA 200.7	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Lead	EPA 200.8	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Lithium	EPA 200.7	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Mercury	EPA 1631	≤ 6°C, HCl	Annual, Semi-Annual
Molybdenum	EPA 200.7	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Radium-226+228	EPA 903.1	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Selenium	EPA 200.7	≤ 6°C, Nitric Acid	Annual, Semi-Annual
Thallium	EPA 200.8	≤ 6°C, Nitric Acid	Annual, Semi-Annual

Notes:

[1] EPA methods are from Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium - SW-846 (EPA 2014); SM methods are from Standard Methods for the Examination of Water and Wastewater (APHA et al. 1998).

[2] Barium will also be monitored as part of the detection monitoring program per an agreement with CDPHE regarding water spray for dust suppression.

[3] If assessment monitoring is triggered all Appendix IV constituents must be sampled annually. In addition, Appendix IV constituents that exceed background in the initial assessment monitoring sampling, must be sampled semi-annually, along with the Appendix III constituents

≤ 6°C = less than or equal to 6 degrees Celsius

HCl = Hydrochloric acid

TBD = To be determined. This constituent will only be sampled if assessment monitoring is required. Sampling frequency is semi-annual.

Table 3
Schedule for Annual Groundwater Monitoring and Corrective Action Report
CCR Landfill Detection Monitoring Program
Colorado Springs Utilities Clear Springs Ranch

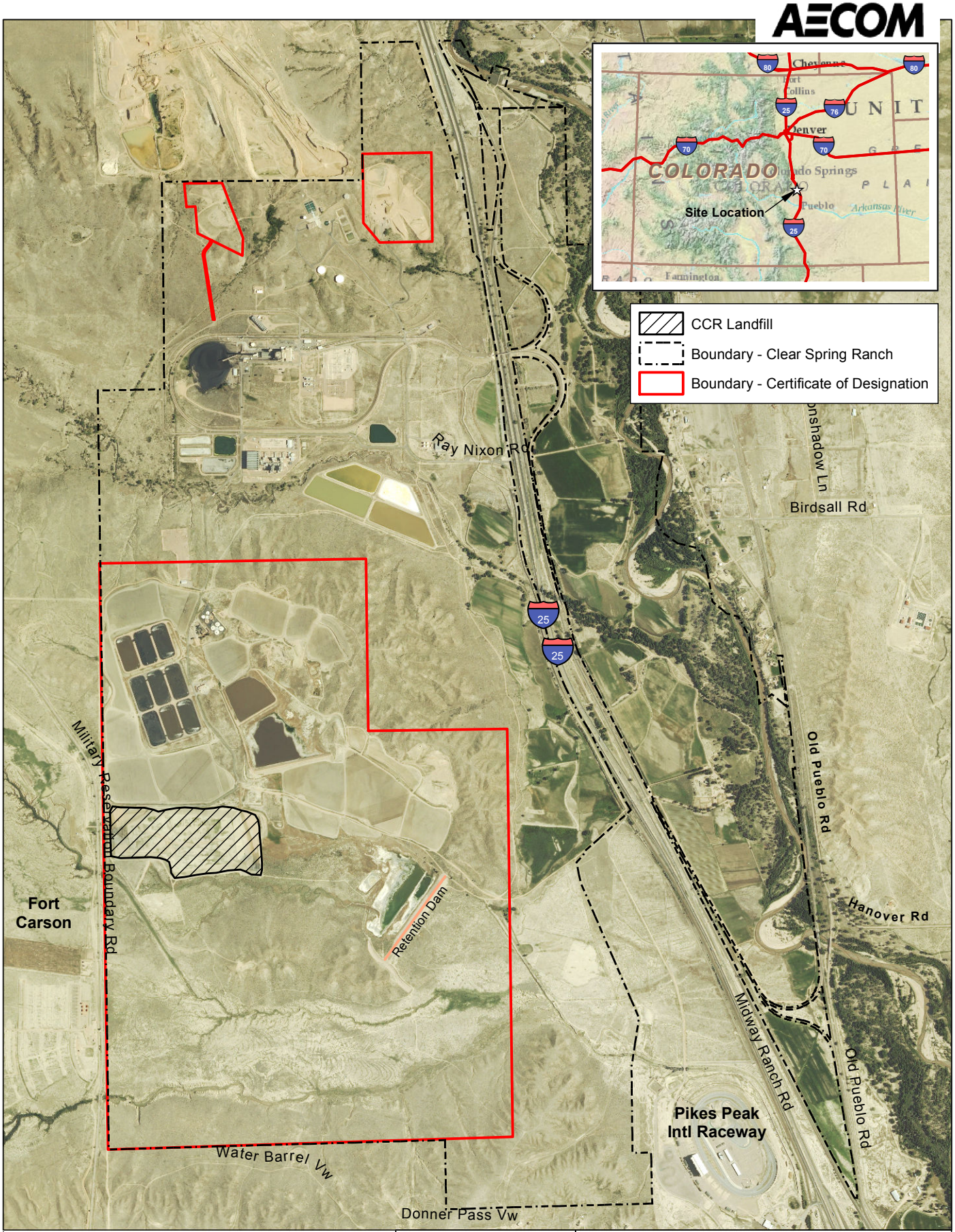
Year	Report Due Date	Report Required By	Report Submitted To
2017	January 31, 2018	CDPHE Solid Waste Regulations, EPA CCR Rule	CDPHE, El Paso County, Facility Operating Record
2018 and beyond	January 31 of the following year	CDPHE Solid Waste Regulations, EPA CCR Rule	CDPHE, El Paso County, Facility Operating Record

Notes:

CDPHE = Colorado Department of Public Health and Environment

CCR = Coal Combustion Residual

Figures



M:\DCS\Projects\ENV\60442000_CSU_Clear_Sprg_Rch\7.0_CAD_GIS\7.01_GIS_Maps\Fig01 Site Location.mxd

Job No.	60540110
Prepared By:	JLC
Date:	10/13/2017

Figure 1
Site Location Map
CCR Landfill Groundwater Monitoring Plan
Colorado Springs Utilities Clear Spring Ranch
Fountain, Colorado

AECOM

CCR Landfill Background Monitoring Well
CCR Landfill Compliance Monitoring Well
Retention Dam
CCR Landfill
Boundary - Clear Spring Ranch
Boundary - Certificate of Designation

0 600 Feet

N W E S

Job No.	60540110
Prepared By:	JLC
Date:	10/13/2017

Figure 2
Detection Monitoring Well Network
CCR Landfill Groundwater Monitoring Plan
Colorado Springs Utilities Clear Spring Ranch
Fountain, Colorado

M:\DCS\Projects\ENV\60442000_CSU_Clear_Sprg_Rch\7.0_CAD_GIS\7.01_GIS_Maps\Fig02 Ash Landfill GW Monitoring Network.mxd

Appendix A CCR Landfill Monitoring Well Completion Logs

Boring and Well Construction Log

Boring #:FC-3A
Sheet 1 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282807.37** Easting: **3223409.73**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5481.95**
Start Date & Time: **6/6/2016 10:40 AM**	Method: **Hollow Stem Auger**	Total Depth (ft): **34.75**
Finish Date & Time: **6/6/2016 15:25 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
	CB	NR	92	NM	0		CL	very stiff, 3.5 unconfined compressive strength (qu) tons per square foot (tsf), dark gray (10YR 4/1), LEAN CLAY, moist; non-plastic, noncohesive, with organic rootlets, no odor or staining	Cement
				NM				3.0 - AS ABOVE; no rootlets	
	CB	NR	85	NM	5			5.0 - AS ABOVE; hard > 4.0 qu (tsf), brown (10YR 4/3) with little calcite deposits	Medium Bentonite Chips
				NM					
	CB	NR	92	NM	10			10.0 - AS ABOVE; very stiff 3.0 qu (tsf), medium plasticity, cohesive	
				NM			CH	13.0 - very stiff 2.0 qu (tsf), dark grayish brown (10YR 4/2), FAT CLAY, moist; medium/high plasticity; cohesive, no odor or staining	2" PVC, Schedule 40, Riser Pipe
	CB	NR	100	NM	15			15.0 - AS ABOVE; dark grayish brown (10YR 5/2), massive, trace calcite deposits	
				NM					

Remarks and Datum Used: Monitoring well was completed with above-grade well protection, SS = 2" Split Spoon

Soil samples were not collected from soil boring FC-3A

NR = Not Recorded, CB = 5' Long, 4" Diameter Core Barrel

NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
19.12 TOIC 6/6/2016 15:07 PM

AECOM
6200 South Quebec Street
Greenwood Village, CO 80111
Direct: (303) 740-3916
Office: (303) 740-2600

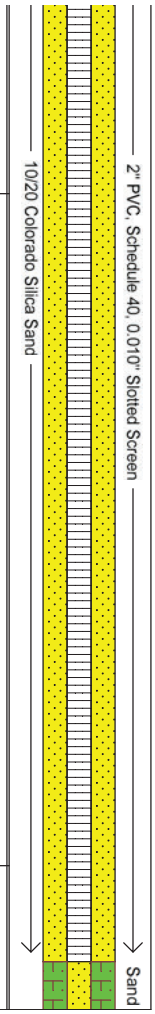
Boring and Well Construction Log

AECOM

Boring #:FC-3A
Sheet 2 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282807.37** Easting: **3223409.73**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5481.95**
Start Date & Time: **6/6/2016 10:40 AM**	Method: **Hollow Stem Auger**	Total Depth (ft): **34.75**
Finish Date & Time: **6/6/2016 15:25 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									Well Diagram
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	
					20			20.0 - AS ABOVE; soft 0.5 qu (tsf), wet, slow dilatency	
	CB	NR	72	NM			CL	22.0 - stiff 2.0 qu (tsf), yellowish brown, SANDY LEAN CLAY, moist/wet, slow dilatency, non-plastic, noncohesive, very fine to fine sand, alluvial	
				NM					
	CB	NR	90	NM	25			25.0 - AS ABOVE; little fine sand	
				NM				28.2 - AS ABOVE; gray (10YR 5/1), with gravel, slight mottled gray (10YR 5/1) and brownish yellow (10YR 6/8)	
	CB	NR	80	NM	30			30.0 - AS ABOVE; very stiff, some calcite deposits	
				NM			CLAY-STONE	32.5 - very stiff, dark gray (10YR 5/1) CLAYSTONE, moist, non-plastic, noncohesive, blocky, mottled brownish yellow and dark gray	
	SS	50	9"	NM				34.0 - Core Barrel Refusal	



Remarks and Datum Used:	**Monitoring well was completed with above-grade well protection, SS = 2" Split Spoon**	
AECOM **6200 South Quebec Street** **Greenwood Village, CO 80111** **Direct: (303) 740-3916** **Office: (303) 740-2600**	**Soil samples were not collected from soil boring FC-3A**	**Depth to Water Table (ft):**
	NR = Not Recorded, CB = 5' Long, 4" Diameter Core Barrel	**19.12 TOIC 6/6/2016 15:07 PM**
	NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing	

Boring and Well Construction Log

Boring #:FC-3B
Sheet 1 of 3

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282806.09** Easting: **3223416.43**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5481.54**
Start Date & Time: **6/10/2016 06:45 AM**	Method: **Hollow Stem Auger**	Total Depth (ft): **55.1**
Finish Date & Time: **6/10/2016 09:50 AM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
CB	NR	92		NM	0		CL	very stiff 3.5 unconfined compressive strength (qu) tons per square foot (tsf), dark gray (10YR 4/1), LEAN CLAY, moist; non-plastic, noncohesive, with organic rootlets, no odor or staining	Cement
				NM				3.0 - AS ABOVE; no rootlets	
CB	NR	85		NM	5			5.0 - AS ABOVE; hard > 4.0 qu (tsf), brown (10YR 4/3) with little calcite deposits	
				NM					
CB	NR	92		NM	10			10.0 - AS ABOVE; very stiff 3.0 qu (tsf), medium plasticity, cohesive	Medium Bentonite Chips
				NM			CH	13.0 - very stiff 2.0 qu (tsf), dark grayish brown (10YR 4/2), FAT CLAY, moist; medium/high plasticity; cohesive, no odor or staining	
CB	NR	100		NM	15			15.0 - AS ABOVE; dark grayish brown (10YR 5/2), massive, trace calcite deposits	
				NM					

Remarks and Datum Used: All information presented for 0 to 34.75 feet bgs was obtained from soil boring FC-3A.

Soil samples were not collected from soil boring FC-3B

NR = Not Recorded, CB = 5' Long, 4" Diameter Core Barrel

NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
39.32 TOIC 6/10/16 11:39 AM

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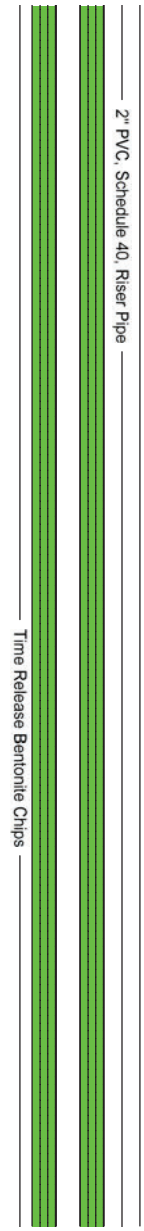
Office: (303) 740-2600

Boring and Well Construction Log

Boring #:FC-3B
Sheet 2 of 3

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282806.09** Easting: **3223416.43**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5481.54**
Start Date & Time: **6/10/2016 06:45 AM**	Method: **Hollow Stem Auger**	Total Depth (ft): **55.1**
Finish Date & Time: **6/10/2016 09:50 AM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
					20			20.0 - AS ABOVE; soft 0.5 qu (tsf), wet, slow dilatency	
	CB	NR	72	NM			CL	22.0 - stiff 2.0 qu (tsf), yellowish brown, SANDY LEAN CLAY, moist/wet, slow dilatency, non-plastic, noncohesive, very fine to fine sand, alluvial	
				NM	25			25.0 - AS ABOVE; little fine sand	
	CB	NR	90	NM				28.2 - AS ABOVE; gray (10YR 5/1), with gravel, slight mottled gray (10YR 5/1) and brownish yellow (10YR 6/8)	
				NM	30			30.0 - AS ABOVE; very stiff, some calcite deposits	
	CB	NR	80	NM			CLAY-STONE	(34.0-34.75') very stiff, dark gray (10YR 5/1) CLAYSTONE, moist, non-plastic, noncohesive, blocky, mottled brownish yellow and dark gray	
	SS	50	9"	NM				34.0 - Core Barrel Refusal	
					35			(34.75-40.0') "blind"drilled, no sampling	



Remarks and Datum Used: All information presented for 0 to 34.75 feet bgs was obtained from soil boring FC-3A.

Soil samples were not collected from soil boring FC-3B

NR = Not Recorded, CB = 5' Long, 4" Diameter Core Barrel

NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
39.32 TOIC 6/10/16 11:39 AM

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Boring and Well Construction Log

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Boring #:FC-3B
Sheet 3 of 3

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282806.09** Easting: **3223416.43**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5481.54**
Start Date & Time: **6/10/2016 06:45 AM**	Method: **Hollow Stem Auger**	Total Depth (ft): **55.1**
Finish Date & Time: **6/10/2016 09:50 AM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data					Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)					
	SS	50	3"	NM	40		SHALE	40.0 - hard, bluish gray (GLEY2 5/10B), SHALE, dry, non-plastic, platy, bedded to thinly bedded.	
								(40.26-45.0') "blind" drilled, no sampling	
	SS	50	2"	NM	45		SHALE	45.0 - hard, bluish gray (GLEY2 5/10B), WEATHERED SHALE, dry, non-plastc, platy, thinly bedded, with moist, dark gray, clay	
								(45.2-50.0') "blind" drilled, no sampling	
	SS	50	0.5"	NM	50		SHALE	50.0 - hard, bluish gray (GLEY2 5/10B), WEATHERED SHALE, dry, non-plastc, platy, thinly bedded, with moist, dark gray, clay	
								(50.4-55.0') "blind" drilled, no sampling	
	SS	50	1.5"	NM	55		SHALE	55.0 - hard, bluish gray (GLEY2 5/10B), WEATHERED SHALE, dry, non-plastc, platy, thinly bedded, with moist, dark gray, clay	

10/20 Colorado Silica Sand

2" PVC, Sch. 40, 0.010" Slotted Screen

Remarks and Datum Used:	**All information presented for 0 to 34.75 feet bgs was obtained from soil boring FC-3A.**
Soil samples were not collected from soil boring FC-3B	**Depth to Water Table (ft):**
NR = Not Recorded, CB = 5' Long, 4" Diameter Core Barrel	**39.32 TOIC 6/10/16 11:39 AM**
NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing	

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Office: (303) 740-2600

Boring and Well Construction Log

Boring #:SC-10
Sheet 1 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1283428.94** Easting: **3226344.60**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5445.18**
Start Date & Time: **6/9/2016 12:00 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **35.25**
Finish Date & Time: **6/9/2016 17:00 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									Well Diagram
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	
	CB	NR	85	NM	0		CL	very soft,brown (10YR 4/3), LEAN CLAY WITH GRAVEL, moist, non-plastic, noncohesive, organic rootlets	Cement
				NM				0.3 - AS ABOVE; very stiff >4.0 unconfined compressive strength (qu) tons per square foot (tsf), dark grayish brown (10YR 4/3)	
								2.5 - AS ABOVE; no rootlets	
					5				
	CB	NR	100	NM				5.0 - AS ABOVE; stiff 1.0 qu (tsf), medium/high plasticity, cohesive, massive	Medium Bentonite Chips
				NM					
	CB	NR	87	NM	10			10.0 - AS ABOVE; very stiff 3.0 qu (tsf)	2" PVC, Schedule 40, Riser Pipe
				NM			CH	13.0 - soft, dark grayish brown, FAT CLAY, wet, slow dilatency, medium/high plasticity, coshesive, no odor or staining	
					15				
	CB	NR	100	NM				15.0 - AS ABOVE; stiff 2.0 unconfined compressive strength (qu) tons per square foot (tsf), very dark gray (10YR 3/1)	
								17.5 - AS ABOVE; very stiff 2.5 qu (tsf), dark grayish brown (10YR 4/2), moist, medium plasticity, cohesive,	

Remarks and Datum Used: Monitoring well SC-10 was constructed with above-grade well protection; SS= Split-Spoon sampler

Soil samples were not collected from soil boring SC-10

NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel

NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
9.73 TOIC 6/10/2016 11:23 AM

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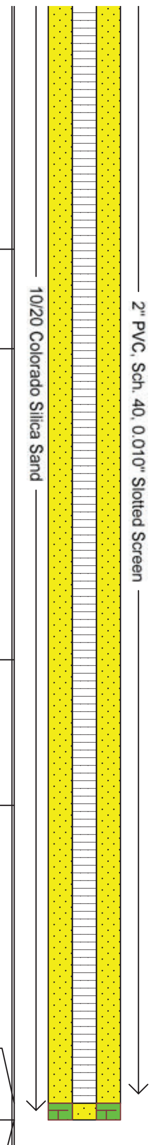
Boring and Well Construction Log

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1283428.94** Easting: **3226344.60**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5445.18**
Start Date & Time: **6/9/2016 12:00 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **35.25**
Finish Date & Time: **6/9/2016 17:00 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
				NM				~15% calcite deposit	
					20			19.75 - AS ABOVE; very soft 0.25 quf (tsf), high plasticity	
	CB	NR	98	NM					
							CL	22.1 - very soft, dark grayish brown (10YR 4/2), LEAN CLAY WITH SAND AND GRAVEL, wet, non-plastic, noncohesive, subangular gravel, fine to coarse sand, no odor or staining	
				NM			GP	23.6 - loose, dark grayish brown (10YR 4/2), POORLY GRADED GRAVEL, wet, fine to coarse sand, subangular gravel, no odor or staining	
					25			25.0 - AS ABOVE; with sand and clay	
	CB	NR	90	NM					
				NM			CLAY-STONE	28.3 - loose, dark grayish brown (10YR 4/2), WEATHERED CLAYSTONE, moist, blocky, with moist non-plastic clay and gravel,	
	SS	50	6"	NM	30			30.0 - Core Barrel Refusal	
								(30.5-35.0') "blind" drilled, no sampling	
					35			35.0 - hard >4.0 qu (tsf), gray, WEATHERED SHALE, dry, thinly bedded, massive	
	SS	50	3"	NM			SHALE	35.25 Feet BGS - End of Boring	



Remarks and Datum Used:	**Monitoring well SC-10 was constructed with above-grade well protection; SS= Split-Spoon sampler**
	Soil samples were not collected from soil boring SC-10
	NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel
	NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
9.73 TOIC 6/10/2016 11:23 AM

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Boring and Well Construction Log

Boring #:SC-11
Sheet 1 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1283151.69** Easting: **3226374.64**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5441.94**
Start Date & Time: **6/6/2016 16:00 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **30.66**
Finish Date & Time: **6/7/2016 10:30 AM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
	CB	NR	71	NM	0		CL	hard >4.0 unconfined compressive strength (qu) tons per square foot (tsf), brown (10YR 4/3), LEAN CLAY, moist, non-plastic, noncohesive, massive, little sand with organic rootlets, no odor or staining	Cement
				NM				1.0 - AS ABOVE; no rootlets	
								2.0 - AS ABOVE; white calcite deposit	
				NM				4.5 - AS ABOVE; stiff 1.5 qu (tsf), medium plasticity, cohesive	Medium Bentonite Chips
SC-11 (5'4"-6'0") 6/6/2016 16:30 PM, SEE COC	SS	3 5	6" 6"	NM	5		CH	5.0 - stiff 1.5 qu (tsf), brown (10YR 4/3), FAT CLAY, moist, high plasticity, cohesive, massive, trace calcite, no mottling, odor, or staining.	
	CB	NR	100	NM					
				NM					
					10			10.0 - AS ABOVE; dark grayish brown (10YR 4/2), no calcite deposits	
	CB	NR	100	NM					
				NM					
					15			15.0 - AS ABOVE; very soft <0.25 qu (tsf), brown (10YR 4/3), wet, slow dilatency, medium/high plasticity	2" PVC, Schedule 40, Riser Pipe

Remarks and Datum Used: Monitoring well SC-11 was constructed with above-grade well protection; SS= Split-Spoon sampler

California sampler was collected from SC-11 from 5'4" to 6'0"

NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel

NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
7.63 TOIC 6/7/16 12:52 PM

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Boring and Well Construction Log

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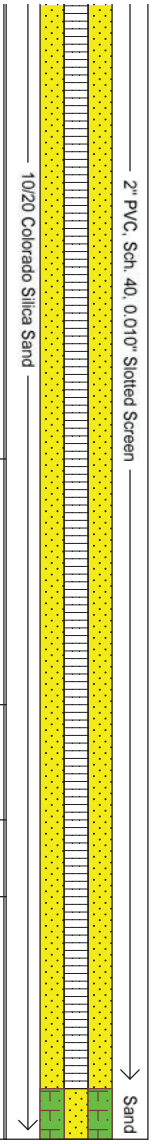
Boring #:SC-11
Sheet 2 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1283151.69** Easting: **3226374.64**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5441.94**
Start Date & Time: **6/6/2016 16:00 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **30.66**
Finish Date & Time: **6/7/2016 10:30 AM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
	CB	NR	100	NM				15.25 - medium 1.0 qu (tsf), brown (10YR 4/3), moist	
				NM				19.0 - AS ABOVE; very stiff 2.75 qu (tsf), mottled brown (10YR 4/3) and yellowish brown (10YR 5/8)	
					20				
	CB	NR	68	NM			SP	21.8 - very loose, brown (10YR 4/3), POORLY GRADED SAND WITH CLAY AND GRAVEL, wet, fine to coarse sand	
				NM					
					25				
	CB	NR	80	NM			CL	25.0 - stiff 1.5 qu (tsf), brown (10YR 4/3), SANDY LEAN CLAY WITH GRAVEL, wet, non-plastic, noncohesive, angular gravel	
							CH	26.5 - soft, brown (10YR 4/3), FAT CLAY, wet, high plasticity, cohesive, non mottling or staining	
				NM			CLAY-STONE	27.5 - stiff, dark gray (10YR 4/1), WEATHERED CLAYSTONE, moist, massive, blocky	
					30				
	SS	50	8"	NM				30.0 - Core Barrel Refusal	



Remarks and Datum Used:	Monitoring well SC-11 was constructed with above-grade well protection; SS= Split-Spoon sampler	
	California sampler was collected from SC-11 from 5'4" to 6'0"	Depth to Water Table (ft):
	NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel	7.63 TOIC 6/7/16 12:52 PM
	NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing	

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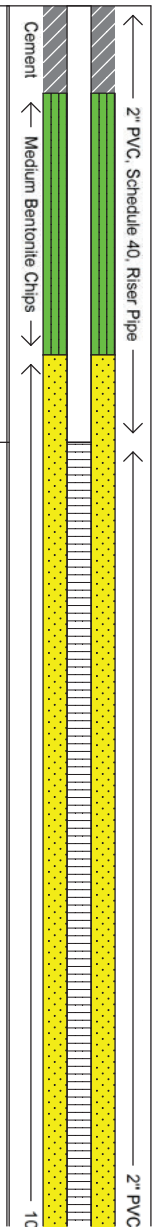
Boring and Well Construction Log

Boring #:SC-12
Sheet 1 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282807.25** Easting: **3226399.78**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5442.07**
Start Date & Time: **6/7/2016 11:00 AM**	Method: **Hollow Stem Auger**	Total Depth (ft): **25.83**
Finish Date & Time: **6/7/2016 15:10 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
	CB	NR	73	NM	0		CL	very stiff, brown (10YR 4/3), LEAN CLAY, moist, non-plastic, noncohesive, massive, with rootlets	
				NM				2.5 - AS ABOVE; no rootlets, little calcite deposits	
	CB	NR	72	NM	5		CH	5.0 - very soft <0.25 unconfined compressive strength (qu) tons per square foot (tsf), dark yellowish brown (10YR 4/4), FAT CLAY, moist, high plasticity, cohesive, massive, with fine sand	
				NM				7.5 - AS ABOVE; wet (7.5' to 7.7' bgs)	
	CB	NR	53	NM	10			10.0 - AS ABOVE; no mottling or calcite deposits	
				NM					



Remarks and Datum Used:	**Monitoring well SC-12 was constructed with above-grade well protection; SS= Split-Spoon sampler**
Soil samples were not collected at soil boring SC-12	**Depth to Water Table (ft):**
NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel	**7.55 TOIC 6/7/16 15:17 PM**
NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing	

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Boring and Well Construction Log

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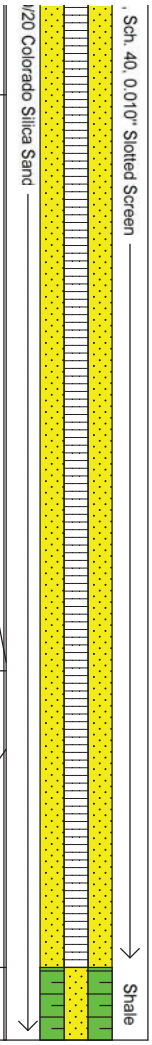
Boring #:SC-12
Sheet 2 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282807.25** Easting: **3226399.78**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5442.07**
Start Date & Time: **6/7/2016 11:00 AM**	Method: **Hollow Stem Auger**	Total Depth (ft): **25.83**
Finish Date & Time: **6/7/2016 15:10 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
					15		CL	15.0 - very soft <0.25 qu (tsf), brown (10YR 5/3), LEAN CLAY, wet, slow dilatency, medium plasticity, cohesive, massive	
	CB	NR	90	NM					
				NM				17.8 - AS ABOVE; sandy lean clay, non-plastic, noncohesive, mottled brown and brownish yellow (10YR 6/8)	
								18.2 - AS ABOVE; no sand	
					20			20.0 - AS ABOVE; with calcite deposit, massive, mottled brown (10YR 5/3) and gray (10YR 5/1)	
				NM			SP CL	21.5 - medium dense, brown, POORLY GRADED SAND WITH CLAY AND GRAVEL, wet, coarse gravel	
	CB	NR	83					21.6 - hard >4.0 qu (tsf), brown (10YR 4/3), LEAN CLAY WITH GRAVEL, moist, non-plastic, noncohesive, massive, mottled	
				NM			CLAY-STONE	22.5 - hard, dark gray, CLAYSTONE, moist, non-plastic, blocky, with trace sand	
					25				
	SS	50	10"	NM			SHALE	25.0 - hard, blue, SHALE, dry, platy, non-plastic, Core Barrel Refusal at 25 feet bgs	



Remarks and Datum Used: Monitoring well SC-12 was constructed with above-grade well protection; SS= Split-Spoon sampler

Soil samples were not collected at soil boring SC-12

NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel

NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
7.55 TOIC 6/7/16 15:17 PM

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Boring and Well Construction Log

Boring #:SC-13
Sheet 1 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282422.79** Easting: **3226375.83**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5443.74**
Start Date & Time: **6/7/2016 15:45 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **23.16**
Finish Date & Time: **6/8/2016 11:00 AM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
	CB	NR	83	NM	0		CL	hard >4.0 unconfined compressive strength (qu) tons per square foot (tsf), brown (10YR 4/3), LEAN CLAY, moist, non-plastic, noncohesive, with organic rootlets	Cement
				NM				1.5 - AS ABOVE; no organic rootlets	Medium Bentonite Chips
	CB	NR	75	NM	5		CH	5.0 - very soft 1.0 qu (tsf), brown (10YR 4/3), FAT CLAY, moist, high plasticity, cohesive, massive, trace calcite deposits	2" PVC, Schedule 40, Riser Pipe
				NM				7.5 - AS ABOVE; very soft < 0.25 qu (tsf)	
				NM	10		CL	10.7 - stiff 1.0 qu (tsf), brown (10YR 4/3), LEAN CLAY, wet, medium plasticity, cohesive, massive, mottled gray and brown, trace sand, alluvial deposition	

Remarks and Datum Used: **Monitoring well SC-13 was constructed with above-grade well protection; SS= Split-Spoon sampler**

Soil samples were not collected at soil boring SC-13

NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel

NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
8.57 TOIC 6/8/16 11:25 AM

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Boring and Well Construction Log

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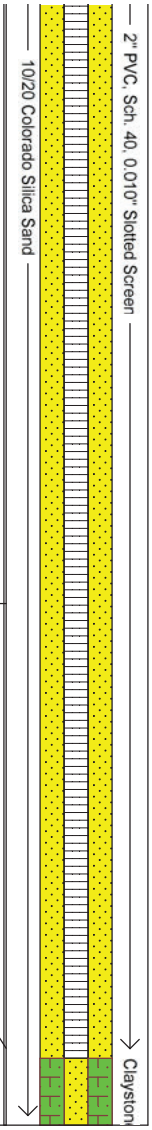
Boring #:SC-13
Sheet 2 of 2

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282422.79** Easting: **3226375.83**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5443.74**
Start Date & Time: **6/7/2016 15:45 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **23.16**
Finish Date & Time: **6/8/2016 11:00 AM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	Well Diagram
	CB	NR	100	NM				14.0 - AS ABOVE; soft 0.50 qu (tsf), non-plastic, noncohesive	
	CB	NR	95	NM	15			15.5 - AS ABOVE; medium 1.0 qu (tsf)	
				NM				17.0 - AS ABOVE; SANDY LEAN CLAY WITH GRAVEL,	
								17.8 - stiff, wet, slow dilatency, mottled brown (10YR 5/3) and yellowish brown (10YR 5/8), trace angular gravel	
							GP	18.0 - loose, brown POORLY GRADED GRAVEL WITH CLAY, wet, angular gravel, little fine to coarse sand	
	CB	NR	50	NM	20				
	SS	50	8"	NM			CLAY-STONE	22.4 - hard >4.0 qu (tsf), brown and gray, WEATHERED CLAYSTONE, moist, bedded, blocky, no odor or staining Core Barrel Refusal at 22.5 feet bgs.	



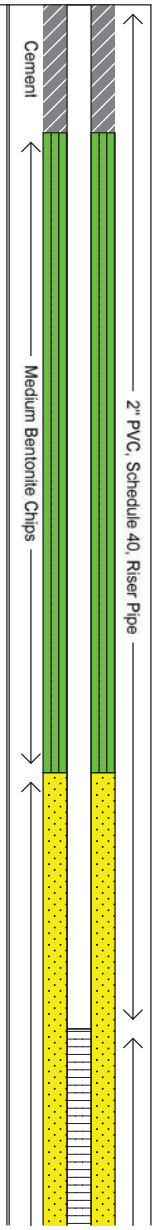
Remarks and Datum Used:	**Monitoring well SC-13 was constructed with above-grade well protection; SS= Split-Spoon sampler**	
AECOM **6200 South Quebec Street** **Greenwood Village, CO 80111** **Direct: (303) 740-3916** **Office: (303) 740-2600**	**Soil samples were not collected at soil boring SC-13**	**Depth to Water Table (ft):**
	NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel	**8.57 TOIC 6/8/16 11:25 AM**
	NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing	

Boring and Well Construction Log

Boring #:SC-14
Sheet 1 of 3

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282348.07** Easting: **3225699.13**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5448.20**
Start Date & Time: **6/10/2016 12:30 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **28.08**
Finish Date & Time: **6/10/2016 16:00 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data								Soil and Rock Description	Well Diagram
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol		
	CB	NR	82	NM	0		CL	hard >4.0 unconfined compressive strength (qu) tons per square foot (tsf), brown (10YR 4/2), LEAN CLAY, moist, non-plastic, noncohesive, with organic rootlets, no odor or staining	
				NM				2.75 - AS ABOVE; very stiff 2.75 qu (tsf), with calcite deposits	
								4.0 - AS ABOVE; decreasing calcite deposits	
SC-14 (5'4"-6'0") 6/10/2016 12:40 PM, SEE COC	SS	4	4" 4"	NM	5				
	CB	5	53	NM				6.0 - AS ABOVE; medium stiff, brown (10YR 4/3), low plasticity, cohesive, no calcite deposits	
				NM				7.5 - AS ABOVE; with ~10% calcite deposits	



Remarks and Datum Used: Monitoring well SC-14 was constructed with above-grade well protection; SS= Split-Spoon sampler

California sampler was collected from SC-14 from 5'4" to 6'0"

NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel

NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing

Depth to Water Table (ft):
9.16 TOIC 6/10/16 15:55 PM

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Boring and Well Construction Log

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Boring #:SC-14
Sheet 2 of 3

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282348.07** Easting: **3225699.13**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5448.20**
Start Date & Time: **6/10/2016 12:30 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **28.08**
Finish Date & Time: **6/10/2016 16:00 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									Well Diagram
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	
					10		CH	10.0 - soft, 0.5 qu (tsf), brown (10YR 4/3), FAT CLAY, moist, high plasticity, cohesive, massive, with 5% calcite deposits,	
	CB	NR	100	NM					
								12.2 - AS ABOVE; mottled brown (10YR 4/3) and gray (2.5Y 4/1), no calcite deposts	
				NM					
					15			14.9 - AS ABOVE; wet (visible water on soil)	
								15.1 - AS ABOVE; SANDY FAT CLAY, dark grayish brown (10YR 4/2)	
				NM					
	CB	NR	93						
							CL	18.0 - soft, dark grayish brown (10YR 4/2), SANDY LEAN CLAY, wet, non-plastic, nonocohesive, no odor or staining	
				NM					

10/20 Colorado Silica Sand

2" PVC, Sch. 40, 0.010" Slotted Screen

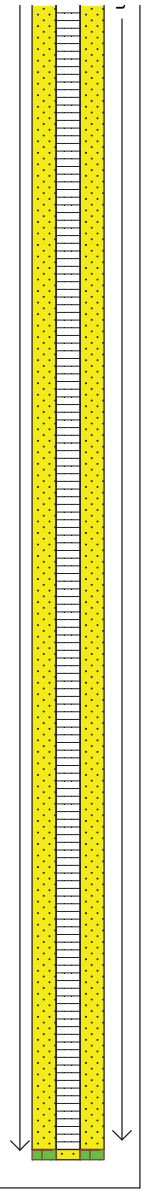
Remarks and Datum Used:	**Monitoring well SC-14 was constructed with above-grade well protection; SS= Split-Spoon sampler**	
AECOM 6200 South Quebec Street Greenwood Village, CO 80111 Direct: (303) 740-3916 Office: (303) 740-2600	**California sampler was collected from SC-14 from 5'4" to 6'0"**	**Depth to Water Table (ft):**
	NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel	**9.16 TOIC 6/10/16 15:55 PM**
	NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing	

Boring and Well Construction Log

Boring #:SC-14
Sheet 3 of 3

Project: **CSU Well Installation**	Contractor: **GDI Drilling Inc.**	Location: **Clear Springs Ranch, Fountain, CO**
Project #: **60506434.3**	Operator: **Dean & Eric Stedman**	Northing: **1282348.07** Easting: **3225699.13**
Client: **Colorado Springs Utilities**	Drill Rig Type: **Diedrich D-90 Truck Mount**	Surface Elevation (ft AMSL): **5448.20**
Start Date & Time: **6/10/2016 12:30 PM**	Method: **Hollow Stem Auger**	Total Depth (ft): **28.08**
Finish Date & Time: **6/10/2016 16:00 PM**	Boring ID: **8.5 inches**	Logged By: **Chris Ahrendt**

Sampling and Field Data									Well Diagram
Analytical Samples	Sample Type	Blows/ 6 inch	% Rec	PID (ppm)	Depth (ft.)	Lithology	USCS Symbol	Soil and Rock Description	
					20		SP	20.0 - very loose, dark yellowish brown (10YR 4/6), POORLY GRADED SAND, wet, fine to coarse sand, with trace fines and gravel	
				NM			CH	21.0 - soft 0.5 qu (tsf), FAT CLAY WITH SAND, wet, slow dilatency, high plasticity, cohesive	
							CL	21.5 - stiff, dark yellowish brown (10YR 4/6), LEAN CLAY, moist, low plasticity, with some gravel and weathered claystone, claystone is blocky	
CB	NR	47					SP	22.2 - loose, reddish brown (5YR 5/4), POORLY GRADED SAND WITH CLAY, wet, medium plasticity, cohesive, fine to coarse sand, trace gravel, no odor or staining	
				NM					
					25				
				NM			CH	25.5 - very soft 0.25 qu (tsf), dark grayish brown (10YR 4/2), FAT CLAY WITH SAND, wet, high plasticity, cohesive	
CB	NR	57							
				NM			CLAY-STONE	27.0 - hard, dark gray, WEATHERED CLAYSTONE, moist, with some soft clay and gravel, Core Barrel Refusal at 28.0 feet bgs	
							SHALE	28.0 - hard, SHALE, dry, non-plastic, noncohesive, laminated	
SS	50	1"		NM					



Remarks and Datum Used:	**Monitoring well SC-14 was constructed with above-grade well protection; SS= Split-Spoon sampler**	
AECOM **6200 South Quebec Street** **Greenwood Village, CO 80111** **Direct: (303) 740-3916** **Office: (303) 740-2600**	**California sampler was collected from SC-14 from 5'4" to 6'0"**	**Depth to Water Table (ft):**
	NR = Not Recorded, CB = 5' long, 4" Diameter Core Barrel	**9.16 TOIC 6/10/16 15:55 PM**
	NM = Not Measured, ft. TOIC = Feet from Top of Inner PVC Casing	

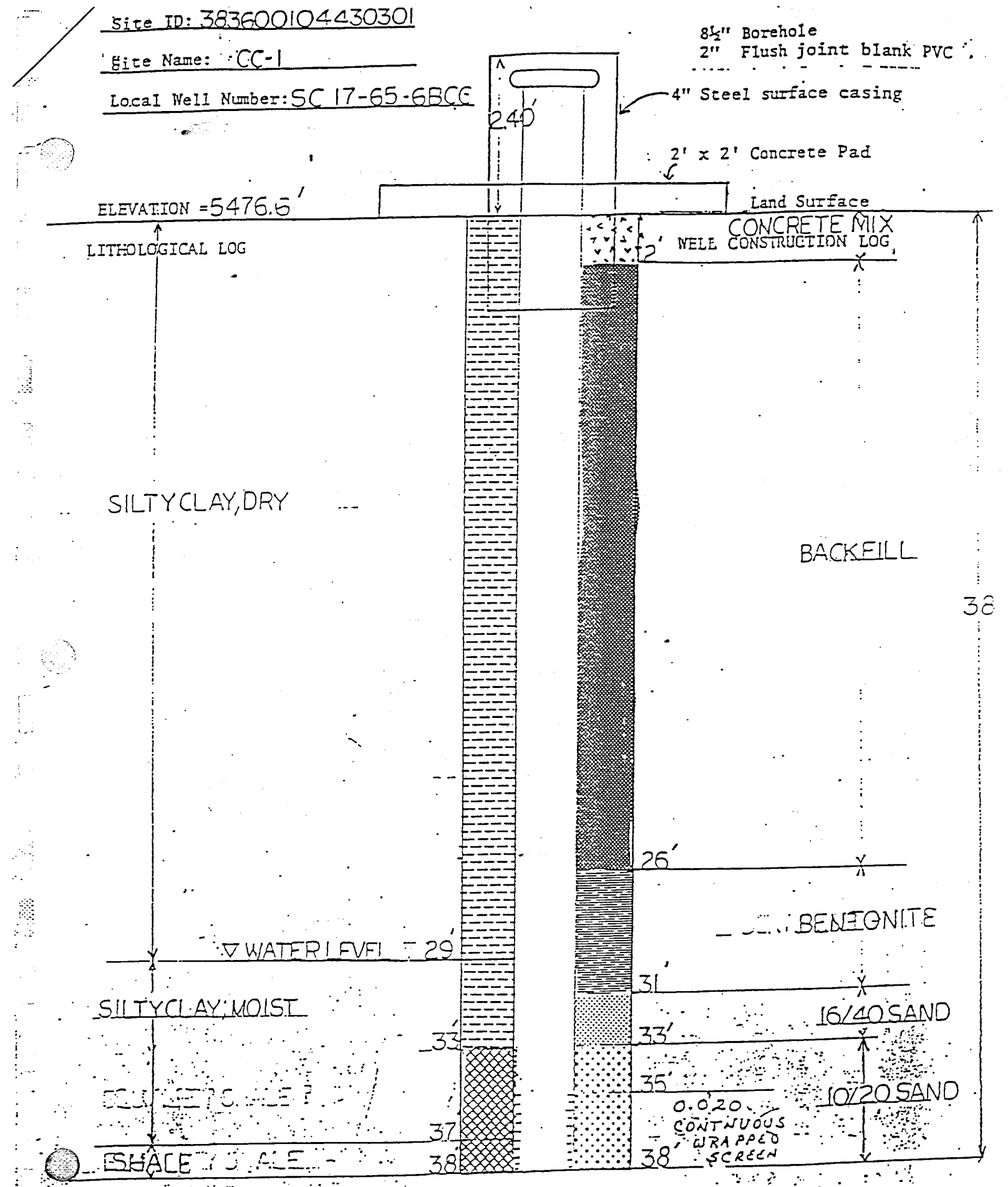

Site ID: 383600104430301
Site Name: CC-1
Local Well Number: SC 17-65-6BCC
8½" Borehole
2" Flush joint blank PVC
4" Steel surface casing
2' x 2' Concrete Pad
Land Surface
ELEVATION = 5476.6'
2.40'
LITHOLOGICAL LOG
WELL CONSTRUCTION LOG
CONCRETE MIX
2'
SILTY CLAY, DRY
BACKFILL
26'
BENTONITE
WATER LEVEL 29'
SILTY CLAY; MOIST
31'
16/40 SAND
33'
33'
35'
10/20 SAND
0.020 CONTINUOUS WRAPPED SCREEN
37'
38'
SHALE
38'

Figure 20.

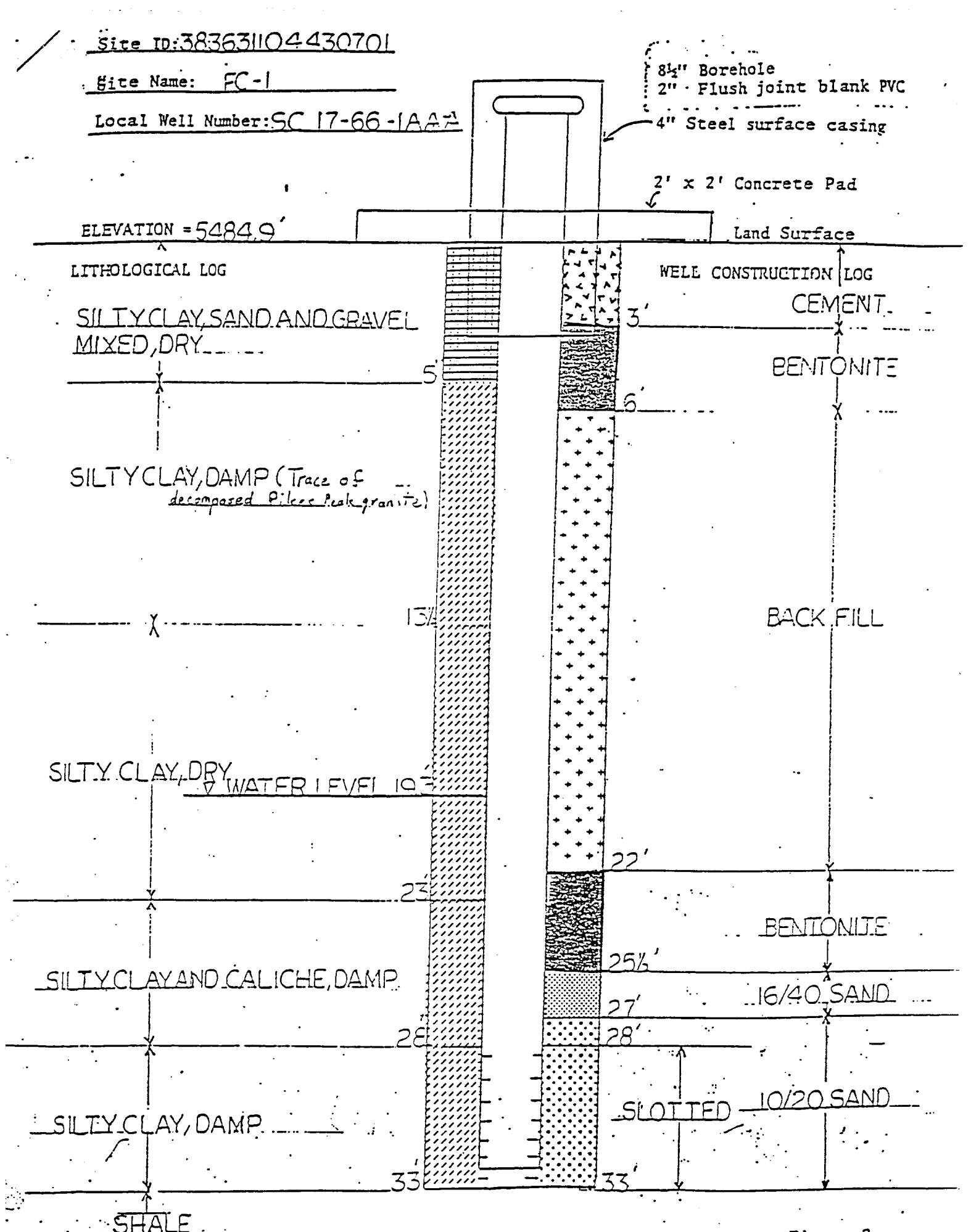

Site ID: 383631104430701
Site Name: FC-1
Local Well Number: SC 17-66-1AAA1
8¼" Borehole
2" Flush joint blank PVC
4" Steel surface casing
2' x 2' Concrete Pad
ELEVATION = 5484.9'
Land Surface
LITHOLOGICAL LOG
WELL CONSTRUCTION LOG
SILTY CLAY, SAND AND GRAVEL MIXED, DRY
5'
SILTY CLAY, DAMP (Trace of decomposed Pikes Peak granite)
13½'
SILTY CLAY, DRY
WATER LEVEL 19'
23'
SILTY CLAY AND CALICHE, DAMP
28'
SILTY CLAY, DAMP
33'
SHALE
CEMENT
3'
BENTONITE
6'
BACK FILL
22'
BENTONITE
25½'
16/40 SAND
27'
28'
SLOTTED
10/20 SAND
33'

Figure 2.

Site ID: 383621104430801

Site Name: FC-2

Local Well Number: SC 16-66-36 CA

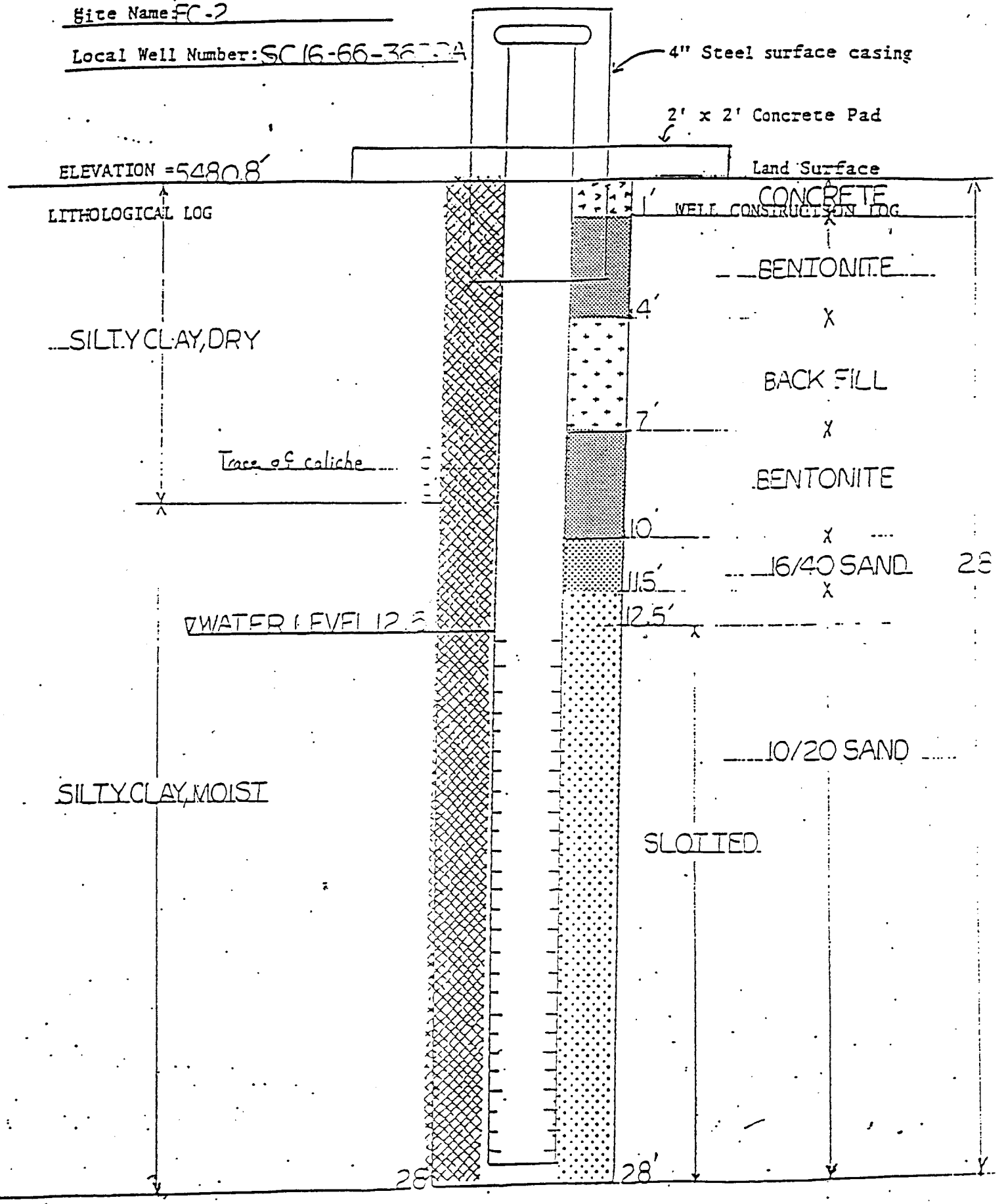


Figure 3.