Appendix B

Subsurface Investigation

HYDROGEOLOGIC AND GEOTECHNICAL INVESTIGATION FOR HORIZONTAL EXPANSION OF THE AMERICAN ENVIRONMENTAL LANDFILL

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CERTIFICATION

This Hydrogeologic and Geotechnical Investigation Report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the plan discussed, and it has been prepared in accordance with good engineering practice including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

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1.0 INTRODUCTION

This hydrogeological report documents the investigation conducted for the Tier III Major Permit Modification Application at the American Environmental, Inc. Landfill (AEL). The investigation was designed to meet the requirements of Title 252 Oklahoma Department of Environmental Quality (ODEQ) chapter 515, "Management of Solid Waste." The investigation followed the ODEQ-approved Work Plan (SCS, November 2020) and the specific references to ODEQ Regulation 252:515 are included within the applicable subsection titles of this report.

1.1 BACKGROUND

American Environmental, Inc. owns and operates the AEL located at 207 North 177th West Avenue, within Sections 35 and 36 of Township 20 North, Range 10 East of the Indian Meridian (Wekiwa USGS Topographic Quadrangle) in Osage County, Oklahoma. The landfill operates under Permit No. 3557021 issued by the Oklahoma Department of Environmental Quality (ODEQ).

The current landfill has a permit boundary of approximately 222 acres, 150 of which are currently in operation. The proposed landfill horizontal expansion area is approximately 203 acres located north and west of the existing permit boundary. Therefore, following approval of a Tier III permit modification, in accordance with the Oklahoma Department of Environmental Quality (ODEQ), Oklahoma Administrative Code (OAC) 252:4-7-60, the landfill permit boundary will be comprised of approximately 425 acres. The proposed horizontal expansion area will be utilized for a municipal solid waste (MSW) disposal area. A site location map is presented in **Figure 1.1.** The layout of the landfill facility including the proposed horizontal expansion area and existing conditions, is presented in **Figure 1.2**.

Surface elevations at the Site range from approximately 720 to 900 feet above mean sea level. Two drainage ways transect the subject site from north to the south for approximately 1-mile before joining the Arkansas River.

1.2 WORKPLANS AND APPROVALS

A Drilling Work Plan was submitted to ODEQ for approval in November 2020 per ODEQ regulation 252:515-7-4. ODEQ approved the Drilling Work Plan on November 19, 2020. This Drilling Work Plan included the name, address, and telephone number of the owner/operator, the consulting firm, and the person in charge of the project. In addition, the following maps were included in the Drilling Work Plan as per regulation 252:515-7-4:

- General location map, flood plan map, and quadrangle topographic map in accordance with OAC 252:515-3-52
- Existing contour map in accordance with OAC 252:515-3-55, showing the locations, estimated elevations and total depths of any proposed or existing borings on site
- Site-specific maps showing any wetlands, fault areas, seismic impact zones, and alluvium or terrace deposits and their recharge areas
- Drawings of proposed piezometers and/or monitoring wells to demonstrate their construction will be in accordance with the requirements of the OWRB (OAC 252:515-7-3)

As outlined in the Drilling Work Plan, the locations and depths of the borings were completed in accordance with OAC 252:515-7-4(b)(3)&(4). The Drilling Work Plan along with the ODEQ approval letter are included as **APPENDIX A** of this report.

On May 6, 2021, a letter was submitted to DEQ to request an alternate sampling method for collecting soil and/or rock samples at five-foot intervals. Prior to the submittal of this letter, 22 of the 42 borings had been advanced and collection of soil and/or rock samples have been obtained utilizing methodologies approved in the OAC 252:515-7-35 and in the DEQ approved work plan dated November 2020. Additionally, all of the proposed borings that were converted to piezometers were included in the 22 completed borings. SCS proposed that the remaining borings be advanced utilizing air rotary methods. Samples were obtained utilizing a strainer or metal catcher to collect cuttings continuously from each five-foot interval. Drilling rates were maintained at such a speed to ensure that cuttings could be logged as drilling progressed and changes in drilling were noted to adequately log the lithology of the borehole. Once anticipated groundwater elevations were encountered, the drilling speed was further reduced to allow for observance of groundwater. The May 6, 2021 letter along with the ODEQ approval letter are included in **APPENDIX A** of this report.

As per OAC 252:515-7-5, once approval was granted for the drilling plan, a Notice of Intent to Drill was prepared and submitted to ODEQ prior to initiating drilling activities. All subsurface drilling activities were conducted in accordance with the approved Drilling Work Plan and were supervised by a qualified groundwater scientist.

2.0 REGIONAL CHARACTERIZATION

In accordance with OAC 252:515-7-38, this section discusses the regional climate, soils, hydrology, geology, hydrogeology, and water quality of the area surrounding the AEL. The information contained in these sections was compiled from published literature, previous studies conducted at the site, and the borings advanced during the current investigation.

2.1 REGIONAL SOILS

According to the Soil Survey of Osage County, Oklahoma published by the U.S. Soil Conservation Service (USDA, 1979), Supplement to the Soil Survey of Osage County, Oklahoma published by the U.S Soil Conservation Service (USDA, 2008), and the review of information provided by the Web Soil Survey website (March 1, 2022), the soils in the vicinity of the Landfill can be classified as eight distinct soil units:

1. Niotaze-Bigheart Rock outcrop (15 to 20% slopes) - (approximately 35.2%)
2. Dougherty loamy fine sand (3 to 8% slopes) - (approximately 27.7%)
3. Bigheart-Niotaze Rock outcrop (1 to 8% slopes) - (approximately 25.4%)
4. Agra-Ashport, frequently flooded complex (0 to 12% slopes) – (approximately 5.1%)
5. Norge silt loam (3 to 5% slopes) – (approximately 3.1%)
6. Eufaula loamy fine sand (3 to 15 % slopes) – (approximately 2.2%)
7. Verdigris silt loam (0 to 1 % slopes) - (approximately 1.0%)
8. Norge, Agra, and Prue soils (3 to 8%) – (approximately 0.3%)

FIGURE 2.1.1 displays the locations of the soil units from the USDA 1979 Soil Survey, the USDA 2008 Supplement to the Soil Survey and the Web Soil Survey website (March 1, 2022) in relation to the Landfill property boundary. The soils were mapped prior to landfill activities within the expansion area. Note the majority of soils on the landfill property consist of the Niotaze-Bigheart rock outcrop, Dougherty loamy fine sand, and Bigheart-Niotaze Rock outcrop. The soil information described below is from the Soil Survey of Osage County, Oklahoma USDA (1979) and Web Soil Survey Site (March 1, 2022).

The Niotaze-Bigheart Rock outcrop consists of moderately deep, somewhat poorly drained, slowly permeable soils that form from loamy colluvium derived from sandstone over clayey residuum weathered from shale of Pennsylvanian age. These steep soils are hillslopes on hills and uplands that are found on the back slopes and side slopes of hills. The surface layer is comprised of very stony sandy loam to 10 inches. The subsoil silty clay to a depth of 43 inches. The underlying material is bedrock.

The Dougherty loamy fine sand (3% to 8% slopes) consists of soils that are deep and are well-drained. These gently sloping soils are found on crests and side slopes of uplands. The Dougherty fine sand is formed from sandy eolian deposits derived from sedimentary rock over sandy and loamy alluvium. The surface layer is a dark brown loamy fine sand to a depth of 22 inches thick. The sub soil is yellowish-red sandy clay loam to a depth of 50 inches. The underlying material is yellowish-red loamy fine sand to a depth of 72 inches.

The Bigheart-Niotaze Rock outcrop consists of shallow, well-drained, moderately slow permeable soils that form from residuum weathered from sandstone. These steep soils are hillslopes on the shoulder of hills and uplands that are found on the side slope and noes slope. The surface layer is comprised of fine sandy loam to 15 inches. The underlying material is bedrock.

2.2 REGIONAL GEOLOGY

The proposed Site is located within the Osage Plains, a section of the Central Lowland province, which in turn is part of the larger Interior Plains physiographic province. Three sub-regions make up the Osage Plains, the Flint Hills, the Blackland Prairies, and the Cross Timbers. The sub-region that stretches across central Oklahoma is known as the Cross Timbers region. The woodland and savanna portions of the Cross Timbers are mainly Post Oak and Blackjack Oak on coarse, sandy soils, while the prairie portions are chiefly tallgrass on finer, dry soils.

A regional geologic map is provided in FIGURE 2.2 and FIGURE 2.3 and is the site geologic map. The Landfill is located within several Pennsylvanian-age shale, sandstone and limestone formations known as the Wann Formation, Iola Formation and Chanute Formation, in descending order of elevation in the site's vicinity. The Wann formation consists of shale and fine-to-medium-grained sandstone with many thin layers of fossiliferous limestone. Total thickness varies from 50 to 500 feet. The Iola Formation contains three members; from youngest to oldest, they are the Avant Limestone, Muncie Creek Shale, and Paola Limestone. The total thickness of the formation varies from 7 to 70 feet, depending on the thickness of the middle clastic unit within the Avant Limestone. The Avant Limestone consists of an upper and lower limestone, separated by an intervening interbedded sandstone and shale interval. The Muncie Creek Shale is a well-laminated to fissile phosphatic clayshale approximately 25 ft thick. The Paola Limestone is usually a single bed of skeletal wackestone to packstone; oolids and glauconite may occur locally (averages <1 ft thickness). The Chanute Formation is mostly a grayish orange to pale yellowish brown, very silty clayshale to mudshale. Laminated to blocky bedded and weakly calcareous, silt content and loss of bedding in shale increases toward the top of the Chanute. Locally, an 8' to 10' thick, indurated, laminated to thin-bedded, fine to very fine-grained sandstone that may correlate to the Cottage Grove Sandstone occurs near the top of the formation. The Thayer Coal also occurs in the formation but was not observed in the field area. The total thickness of the formation is approximately 130 ft.

Beneath the previously mentioned formations, the Dewey Formation is exposed to the east of the existing permit boundary. The Dewey Formation consists of two, thin, slightly sandy limestone beds with an intervening shale and sandstone interval. The total thickness of the formation is approximately 40 ft.

2.2.1 Seismicity

Based on the USGS U.S. Seismic Hazard Map, Peak Horizontal Acceleration with 2% Probability of Exceedance in 50 Years (2018), the location of the Site is depicted as exhibiting a maximum horizontal acceleration (or effective peak ground acceleration) in the rock between 0.6 and 1 percent of gravity with a 98 percent probability of not exceeding the horizontal acceleration within a 50-year reoccurrence. This acceleration factor may be utilized during seismic analysis of soil performance to liquefaction and during the design of structural elements to resist earthquake forces.

2.3 REGIONAL HYDROLOGY AND WATER QUALITY

According to the Hydrologic Atlas (HA-7) Reconnaissance of the Water Resources of the Enid Quadrangle, the facility is located in an area with minor aquifers comprised of shale, minor sandstone, thin alluvium and terrace deposits, and less productive areas of other aquifers. The Hydrologic Atlas also noted that wells within these areas yield 0 to 25 gallons per minute. See FIGURE 2.4 *Hydrologic Atlas Reconnaissance of the Water Resources of the Tulsa Quadrangle.*

According to the Oklahoma Water Resources Board, the nearest aquifer is the Arkansas River Alluvial Aquifer (**FIGURE 2.4**). The area covered by the aquifer is located southeast of the existing and proposed permit boundaries and extends around the river in an area of 860 square miles in northeast Oklahoma. The large outcrop area combined with an average precipitation of 39.78 inches per year is conducive to high infiltration rates. The average saturated sand thickness of the aquifer is 250 feet, and it is estimated to contain 31,600,000-acre-feet of water having less than 1,000 ppm total dissolved solids.

Oklahoma Geological Survey's quadrangle map of the area (**FIGURE 2.3**) shows the estimated extent of Terrace Sands that are possibly present on the southern portion of the proposed expansion area. The map legend notes that extensive terrace deposits occur along the north bank of the Arkansas River, consisting mainly of unconsolidated fine- to very fine-grained quartz sand, silt, and wind-blown loess; little to no gravel-sized material observed. Thickness varies from 0 to as much as 100 feet.

FIGURE 2.5 presents a portion of the Map of Aquifers and Recharge Areas of Oklahoma (Map GM-44, Aquifers and Recharge Areas). This map indicates there may be a portion of the proposed expansion that overlaps the area identified as terrace deposits on the map. However, as discussed in the Work Plan, previous boring logs from the Phase IV area east of the 203-acre expansion indicate sandstones and shales underlay the expansion site, which are consolidated formations and not terrace deposits. Borings performed for this investigation, only identified a few areas where unconsolidated materials will be beneath the planned expansion excavation and the materials were identified primarily as silty clay or sandy clay. Materials composed of primarily silt or primarily sand, indicative of terrace deposits, were not identified below the planned expansion excavation. However, a few borings south of the planned waste boundary encountered material comprised primarily of sand and/or silt indicative of terrace deposits.

FIGURE 2.6 shows monitoring wells and groundwater wells that are located in the vicinity of the Landfill Property.

3.0 BORING PROGRAM

From November 2020 to August 2021, a characterization of the subsurface and groundwater conditions in the area of the proposed 203-acre expansion was conducted. The fieldwork was conducted in accordance with OAC 252:515-7-4 and the ODEQ-approved Drilling Work Plan prepared by SCS dated November 19, 2020 (see **APPENDIX A**). A total of forty-two (42) borings were drilled and piezometers were installed in thirteen (13) of these borings. The boreholes ranged in depth from approximately 40 feet below ground surface (bgs) to a maximum depth of approximately 200 feet bgs. Further discussion of the lithology encountered in these borings and groundwater elevations measured over time can be found in **SECTIONS 3.1** and **4.2** respectively. Construction details for each boring drilled can be found in **TABLE 3.1** and boring logs in **APPENDIX B**. The location of each boring is included in **FIGURE 3.1.**

The drilling contractor for drilling activities was Mohawk Drilling, Inc. of Tulsa, Oklahoma. A track-mounted Dedrick-50 and Atlas T3W drill rigs were utilized to advance the borings. Twenty-two of the soil borings (P-1, B-2, B-3, P-4, B-5, P-6, B-7, P-9, B-10, B-11, P-12, B-14, P-15, P-19, P-23, P-27, P-30, B-34, B-35, P-37, P-39, and P-42) were advanced utilizing 8.25 OD hollow stem augers with continuous sampling unless auger refusal was reached. When hollow stem auger refusal occurred, these borings were drilled utilizing wash rotary drilling techniques to the specified depth below ground surface. During wash rotary drilling of the twenty-two borings samples were obtained at five-foot intervals from the continuous core barrel.

For the remaining twenty borings (B-8, B-13, B-16, B-17, B-18, B-20, B-21, B-22, B-24, B-25, B-26, B-28, B-29, B-31, B-32, B-33, B-36, B-38, B-40 and B-41) the soil borings were advanced utilizing air rotary methods to the specified depth below ground surface. During air rotary drilling a 6-inch OD air hammer was utilized and cutting samples were obtained every 5 feet. A SCS Field Geologist logged each boring and a detailed field boring log for each soil boring is presented in **APPENDIX B**.

Currently, all piezometers drilled as part of this subsurface investigation are active. Borings that were not converted to piezometers were decommissioned by filling the annulus from the total depth to ground surface with bentonite/Portland grout or similar in accordance with OAC 252:515-7-71 (a).

3.1 BORING LOGS

In accordance with OAC 252:515-7-32 and 33, boring and lithologic logs were completed for the borehole for its entire depth. However, the lithologic description for P-15 was misplaced during field activities. No lithologic description exists for this piezometer. Each available log includes the following information:

- Pertinent information, such as the depth at which water was encountered
- Depth of water at the time of drilling and again 24 hours later
- Geotechnical information about drilling, such as penetration rates, hydraulic conductivity test intervals and results, and drill bit changes
- Identification of soil and rock layers encountered during drilling describing color, texture, thickness, degree of compaction or consolidation and amount of moisture present in each layer

In accordance with OAC 252:515-35, soil samples were collected continuously utilizing a 5-foot soil core barrel within the hollow stem auger. Once auger refusal was reached and drilling with wash rotary methods began, samples were collected at five-foot intervals from the continuous core barrel. As approved by ODEQ, during air rotary drilling, samples were obtained using a strainer or metal catcher to collect continuous cuttings from each five-foot interval. Samples were placed in plastic Ziploc baggies to preserve the sample. Samples will be stored until final action has been taken by the ODEQ.

The site geology and hydrogeologic conditions were defined by the forty-two borings drilled within the proposed expansion area and two existing monitoring wells (MW-36 and MW-38). The soil boring/lithologic logs are presented in **APPENDIX B** of this report. In addition, two cross-sections were prepared to provide a visual presentation of the lithology beneath the proposed 203-acre expansion area. The cross-section location map is **FIGURE 3.2**. The two cross-sections are **FIGURES 3.3 and 3.4**.

As the boring logs and cross-sections present, the lithology beneath the site is consistent with the Wann, Iola, and Chanute formations and with the geology as discussed in **SECTION 2.2** of this report. Shale, sandstone and limestone form the topographic high ridge line that runs along the northwestern portion of the expansion area. Limestone and shale consistent with the Iola formation are observed in lithology beneath the Wann formation. Shales consistent with the Chanute formation are observed at lower elevations below the Iola limestone and are more predominant in the south and southeastern portions of the expansion area. The site geology consists of shale, sandstone, and limestone.

The unconsolidated material on-site consists mainly of clay, silty clay, sandy clay, sandy silt, silty sand, and sand. The coarser materials (silt and sand) were more predominant along the southern border of the expansion area, outside of the planned waste footprint. The thickness of the unconsolidated material ranges from approximately 0 ft to 56 ft across the site with the greatest thickness observed in P-4, located along the southern boundary of the proposed expansion area, outside of the planned waste footprint.

The expansion area consists of a topographic high that runs northeast to southwest across the area with a change in elevation of approximately 200 feet. The topographic high dominates the north and northwestern portions of the expansion area. The majority of the stormwater on the site flows to the southwest or south away from the area. Only the northwestern portion of the expansion areas stormwater runoff is to the northwest.

The expansion area's location is at a topographic high, with relatively steep slopes underlain by low permeability bedrock which results in limited recharge potential and marginal aquifer development.

3.2 DOWNHOLE GEOPHYSICAL LOGS

Downhole geophysical logs were obtained as per OAC 252:515-7-34 which states that for waste disposal areas of 20 acres or less, at least three boreholes shall be logged by geophysical tools. In addition, one additional borehole shall be logged for each additional 20 acres of waste disposal. Gamma-ray/neutron logs from total depth to the surface were logged within the casing of 13 of the boreholes during this investigation. Geophysical Logs are included in **APPENDIX C** of this report.

In accordance with OAC 252:515-7-32(a) and OAC 252:515-7-34(a), borehole geophysical logging was performed within boreholes that were converted to piezometers. Logging was performed on 13

of the onsite borings. The geophysical logs were performed by Century Geophysical Corporation of Tulsa, Oklahoma and include natural gamma, resistivity, and conductivity.

The natural gamma log is the recording of a scintillation counter or detector to the natural gamma radiation emitted by naturally occurring formations, or materials placed in the well bore annulus. Higher gamma readings occur in the presence of clay and shale. The neutron log uses a 1.0 Ci, Americium Beryllium neutron emitting radioactive source to measure the relative porosity of the formation. In cased hole applications, raw counts are recorded and scaled proportionally with increasing counts to the right, which are indications of sands or limestone. Decreasing counts to the left of the scale show higher water content or more clay or shale-type formations. The borehole geophysical logs are included in **APPENDIX C.**

3.3 SOILS TESTS

In order to characterize the proposed expansion area in terms of geotechnical properties, samples were collected from boreholes drilled during this investigation. A total of 5 samples were collected from 5 boreholes. These 5 samples were taken at various depths and locations at the site and submitted to Golder Associates USA, Inc. for geotechnical analysis. The purpose of these analyses was to gain information on the geotechnical properties of the samples and to properly characterize each individual soil type found on site.

The appropriate geotechnical lab tests outlined below were conducted for characterization purposes, and compliance with OAC252:515-7-36(3):

- Soil classification according to the specifications of ASTM D2487
- Particle-size analysis of soil according to the specifications of ASTM D422
- Sieve analysis for the following screen sizes: #4, #10, #40, #200
- Percent fines (#200 sieve) according to the specifications of ASTM D1140
- Atterberg limits according to the specifications of ASTM D4318
- Moisture content according to the specifications of either the oven drying method of ASTM D2216 or the microwave drying method of ASTM D4643
- Moisture-density relationship according to the specifications of the standard proctor test of ASTM D698 or the modified proctor test of ASTM D1557
- Hydraulic conductivity according to the specifications of ASTM D5084

APPENDIX D contains all geotechnical laboratory test results associated with the current proposed permit modification. The following sections summarize the results of the geotechnical testing conducted during this investigation.

3.3.1 Sieve Analysis

Particle size analyses were conducted on the samples collected during this investigation for the purpose of analyzing grain size distribution and classification associated with soils native to the proposed expansion area.

In the sieve analysis, a series of sieves (screens) differing in slot size are stacked with the larger sizes over the smaller ones. The soil sample being tested is dried, clumps are broken, and the sample is passed through the series of sieves by shaking. Larger particles are caught on the upper sieves, and the smaller particles filter through to be caught on one of the smaller underlying sieves. The weight of material retained on each sieve is conventionally presented as a grain or particle size distribution in the tables presented in the results.

Sieve analysis was conducted in 5 samples from the onsite soils. The percent of particles passing the #200 sieve within the clays ranged from 8.3% in the sand from B-8 to 88.5% in the clay from B-23. Sieve Analysis is presented in **TABLE 3.2** and **APPENDIX D**

3.3.2 Atterberg Limits/Moisture Content

In the remolded state, the consistency of clay soil varies in proportion to the water content. At higher water content, the soil-water mixture possesses the properties of a liquid. At lesser water contents a soil-water mixture possesses properties that resemble a plastic. At still lesser water contents, soil-water mixtures approach a solid or semi-solid state. The water content indicating the division between the liquid and plastic state has been designated as the Liquid Limit. The division between the plastic and semi-solid state is referred to as the Plastic Limit. The numerical difference between the Liquid Limit and the Plastic Limit is identified as the Plasticity Index. These values are often referred to as Atterberg Limits. The Atterberg Limits test is used to obtain basic index information on soils and is used to estimate strength, settlement, and workability characteristics. It is the primary form of classification for cohesive soil properties for soils commonly used in the construction of landfill liner systems. As presented in **TABLE 3.2,** 3 samples were collected and analyzed for Atterberg Limits during this investigation.

In general, on-site clays determined to have plasticity indices greater than 10 can be considered for use in the construction of any clay liner system. The Plasticity Indices within the onsite clays ranged from 13 to 33 percent. Liquid Limits ranged from 27 percent to 54 percent and the plastic limits ranged from 14 to 21 percent within the onsite clays. The Atterberg Limits results are presented in **APPENDIX D**.

3.3.3 Standard Proctor Density Summary/Moisture Density Relationships

Standard Proctor density tests were performed on a sample taken during the investigation in order to better classify the geotechnical properties of the soils on-site. Representative soils obtained within the study area were analyzed to determine the suitability for the construction of the clay liner system. The samples were obtained and analyzed by Golder Associates USA, Inc. to determine the moisture-density relationship as defined in ASTM D698. Based on Standard Proctor analyses taken from the samples, it is anticipated that the optimum moisture content range from approximately 11.9% to 18.3% with a maximum dry density range of approximately 104.5 to 119.3 pounds per cubic foot (pcf). Standard proctor results are presented in **APPENDIX D** and **TABLE 3.2**.

3.3.4 Hydraulic Conductivity Summary

Soil samples were obtained from B-8, B-16, B-23, and B-40 for the purpose of characterizing the permeability characteristics of area soils. The results of these samples are presented in **APPENDIX D**. **TABLE 3.2** summarizes the results of remolded hydraulic conductivity analyses for local soils. All tests were completed on remolded specimens in accordance with ASTM D-5084. Three samples were obtained from the onsite Clays and one sample was obtained from the onsite sand. The values

obtained from the clay units tested were $3.0X10^{-6}$, $3.4X10^{-8}$ cm/sec and $3.4X10^{-8}$ cm/sec with an average result of $1.02X10^{-6}$ cm/sec. The value obtained from the sand unit tested was $2.61X10^{-2}$ cm/sec.

3.3.5 Soil Classification Summary

The Unified Soil Classification System (USCS) is commonly used in engineering and construction applications. Soil Classifications are on the basis of coarse and fine-grained soils and are categorized based on laboratory tests including the grain size distribution analyses and Atterberg Limits. In general, the following soil classifications were identified within and near the expansion area.

CH	Clay
CL	Silty Clay
ML	Silt and Sand
SP-SM	Sand

The samples collected for geotechnical analyses were from bulk samples. The Soil Classifications can be seen in **APPENDIX D** of this report.

3.3.6 Standard Penetration Test Summary

Standard Penetration Tests (SPT) were conducted on overburden soils in the borings drilled within the proposed expansion area. The boring logs completed by SCS, located in **APPENDIX D**, note the "field" blow counts associated with the SPT analyses in the Comments portion of the logs.

3.3.7 Suitability for Landfill Uses

There are liner quality soils located on the site that meet the requirements of OAC 252:515-11-33. A discussion of this material is presented in the Permit Application.

4.0 GROUNDWATER STUDY

4.1 PIEZOMETERS INSTALLED

As per OAC regulation 252:515-7-52&53, the piezometers were installed in the uppermost saturated zone at locations approved by ODEQ in order that the data collected would be representative of the expansion area. The lateral expansion area is 203 acres, therefore a minimum of fifteen (15) piezometers were required by OAC 252:515-7-53(a)&(b). During this investigation, thirteen (13) piezometers were installed and water levels were obtained on a monthly basis at the thirteen (13) piezometers, two (2) existing onsite monitoring wells, and continuously via In-situ water level troll at PZ-6. The piezometer construction consisted of a 2-inch diameter Schedule 40 PVC solid riser and ten feet of 0.010" slotted screen. The sand filter pack extends to a minimum of two feet above the screened interval. A minimum 2-foot bentonite pellet seal was placed immediately above the filter pack. After the placement of the entire bentonite seal, the pellets were allowed to hydrate prior to the placement of a cement/bentonite grout mixture from the top of the bentonite seal to approximately two feet below grade level. The backfill material was mixed in accordance with the ratio requirements set forth in OAC 785:35-7-2(b)(6)(C).

The depth of sand or bentonite was measured with a cloth tape as the material was added to the borehole to ensure that bridging did not occur within any portion of the borehole. All piezometers were surveyed after completion. The piezometer installation diagrams are included in **APPENDIX B**. The monthly groundwater elevations measured in the piezometers are included in **TABLE 4.1**.

4.1.1 Piezometer Development

Once the piezometers were installed, each piezometer was developed utilizing a Waterra Hydrolift-2 inertial pump. Well-development is necessary in order to remove silt and sediment in the bottom of the piezometer along with the fines from the sand pack and well screen that accumulated during drilling. Each piezometer was considered developed once a minimum of 5 well volumes was removed. Newly installed piezometers were developed at a minimum of 24 hours after the installation of grout.

4.2 GROUNDWATER ELEVATIONS

Based on the results of these borings/piezometers it appears that onsite groundwater is confined and is observed within the onsite shales and limestone.

During the current investigation, piezometers were installed within thirteen (13) of the boreholes to allow the gathering of additional information relative to the groundwater flow in the expansion area (P-1, P-4, P-6, P-9, P-12, P-15, P-19, P-23, P-27, P-30, P-37, P-39, and P-42). Attributes for each of these piezometers are listed in **TABLE 3.1**. The well construction diagrams are presented in **APPENDIX B**. At each of the piezometers, groundwater depths were noted when they were encountered during drilling. Water levels were also obtained 24 hours after completion. Stabilized groundwater elevations in the piezometers ranged from 699.95 fmsl in P-6 located in the southern portion of the proposed expansion area to 787.30 fmsl in P-27 located along the north-western property boundary of the proposed expansion area.

A previous investigation performed for the Phase IV Hydro Investigation conducted by Aquaterra Environmental Solutions (now owned by SCS) in July 2011 identified two distinct and separate water-bearing zones. The uppermost zone was characterized as a thin, laterally discontinuous unit with extremely low permeability and yield potential. The deeper unit was characterized as the major

water-bearing unit and consists of a confined aquifer that yields from a deeper limestone unit. Some borings located within the topographic high along the northern extent of the proposed expansion area exhibited similar hydraulic characteristics that were observed during the Phase IV Hydro Investigation.

4.2.1 Monthly Measurements

In accordance with OAC 252:515-7-54, a groundwater elevation survey was conducted to determine the relationship between the highest water table and the lowest waste placement elevations. Groundwater measurements were taken monthly at piezometers P-1, P-4, P-6, P-9, P-12, P-15, P-19, P-23, P-27, P-30, P-37, P-39, P-42, and existing monitoring wells MW-36 and MW-38 from July 2021 to August 2022. Groundwater measurements were recorded on approximately the same date each month. See **Table 4.1** and **FIGURES 4.1** through **4.5** for the recorded monthly groundwater data.

4.2.2 Highest Groundwater Elevations and Groundwater Flow Direction

During this investigation, the highest groundwater elevation was measured in piezometer P-27 (786.02 fmsl). P-27 is located on the northwestern portion of the proposed expansion area. The lowest groundwater elevation recorded occurred in piezometer PZ-15 (693.45 fmsl), located along the south-central portion of the expansion area. A potentiometric surface map, **FIGURE 4.6,** was constructed utilizing the highest recorded elevation during the investigation. This potentiometric surface was utilized to show the separation between the highest groundwater elevation and the deepest excavation of the landfill bottom. The deepest placement of waste would therefore be 5 feet above this elevation which would be the top of the liner. The potentiometric surface, proposed excavation, and proposed compacted clay liner are provided in cross-sections in **FIGURES 3.3 and 3.4**.

A second potentiometric surface map utilizing the water levels taken at all of the piezometers in August 2022 was produced to show the groundwater flow across the site. The August 2022 potentiometric surface is depicted in **FIGURE 4.7**. As depicted in the figure, groundwater generally flows from north to south across the expansion area.

4.2.3 Continuous Measurements

In accordance with OAC 252:515-7-54(b) and the approved Work Plan, an In-situ water level troll was installed in PZ-6 and allowed to monitor water levels for a 12-month period beginning in July 2021 through July 2022. All groundwater elevations were measured in accordance with the specifications outlined in ASTM D4750. A Hydrograph depicting the data from the continuous water level monitoring system is included in **FIGURE 4.8**. As depicted in the figure, over the course of a year, the water level showed approximately 2.3-foot variation between the highest recorded water level and the lowest recorded water level.

4.2.4 Area Rainfall

The climate for Osage County, Oklahoma is humid and temperate and is characterized by warm summers and cold, dry winters. Average temperatures range between 48°F to 72°F. The coolest month for Osage County is typically January with a mean temperature of 39°F. The warmest month is July with a mean temperature of 83°F. Mean annual precipitation is approximately 39.78 inches, with approximately 202 days in the growing season. Wet months are usually May and June. The

driest months are January and February. On average, about 34 percent of the annual precipitation is in spring, 29 percent in summer, 24 percent in fall, and 13 percent in winter.

As per OAC 252:515-7-55, daily and monthly precipitation data was obtained from the climatological station closest to the proposed 203-acre expansion area for the months of April 2021 through May 2022 along with the preceding 12 months. **Table 4.2** shows the precipitation for Tulsa. During the period from April 2021 through August 2022, May 2022 had the highest rainfall (9.06 inches) and August 2021 had the least rainfall (0.66 inches). No significant increases or decreases were recorded in the water level data from those months at any of the piezometers.

Oklahoma has an average rainfall of 38.75 inches which is 0.4 inches of rain less than the national average of 39.17. Tulsa has had an average rainfall of 43.16 inches over the last 9 years, which is 3.99 inches greater than the average nationwide, and 4.41 inches greater than the average in Oklahoma.

4.3 AQUIFER TESTING

During July and August 2022, slug tests were performed in the thirteen (13) piezometers (P-1, P-4, P-6, P-9, P-12, P-15, P-19, P-23 P-27, P-30, P-37, P-39, and P-42) located within the proposed expansion area. A falling head test and a raising head test were performed in each of these piezometers/monitoring wells. The falling head test was performed by lowering a slug into the well and measuring the initial rise in water level followed by the gradual fall in water level to pre-slug conditions. The rising head tests were performed by removing the slug and measuring the initial fall in water level followed by the gradual rise in water level to pre-slug conditions. The slug test data were analyzed using the Bouwer and Rice method for confined aquifers. Data analysis was performed using the computer program AQTESOLV and analysis graphs are included in **APPENDIX E**.

As presented in **TABLE 4.3**, the hydraulic conductivity (K values) ranged between $1.2660X10^{-4}$ cm/sec (0.359 ft/day) and $2.097X10^{-7}$ cm/sec ($5.946X10^{-4}$ ft/day). The hydraulic conductivity geometric mean for all piezometers was calculated as $1.183X10^{-5}$ cm/sec or $3.351X10^{-2}$ ft/day.

5.0 CONCLUSIONS

- The soils in the vicinity of the American Environmental Landfill can be classified as eight distinct soil units:

  1. Niotaze-Bigheart Rock outcrop (15 to 20% slopes) - (approximately 35.2%)
  2. Dougherty loamy fine sand (3 to 8% slopes) - (approximately 27.7%)
  3. Bigheart-Niotaze Rock outcrop (1 to 8% slopes) - (approximately 25.4%)
  4. Agra-Ashport, frequently flooded complex (0 to 12% slopes) – (approximately 5.1%)
  5. Norge silt loam (3 to 5% slopes) – (approximately 3.1%)
  6. Eufaula loamy fine sand (3 to 15 % slopes) – (approximately 2.2%)
  7. Verdigris silt loam (0 to 1 % slopes) - (approximately 1.0%)
  8. Norge, Agra, and Prue soils (3 to 8%) – (approximately 0.3%)

- The American Environmental Landfill is located within Pennsylvanian-age shale, sandstone, and limestone formations known as the Wann, Iola, and Chanute formations.

- According to the Hydrologic Atlas (HA-7) Reconnaissance of the Water Resources of the Enid Quadrangle, the facility is located in areas with minor aquifers and are comprised of shale, minor sandstone, thin alluvium and terrace deposits, and less productive areas of other aquifers. The Hydrologic Atlas also noted that wells within these areas yield 0 to 25 gallons per minute.

- From November 2020 through August 2021, a characterization of the subsurface and groundwater conditions in the area of the proposed 203-acre expansion was conducted. A total of forty-two (42) borings were drilled and piezometers were installed in thirteen (13) of these borings. The boreholes ranged in depth from approximately 40 feet below ground surface (bgs) to a maximum depth of approximately 200 feet bgs.

- The site geology and hydrogeologic conditions were defined by the 42 borings drilled within the proposed expansion area and two existing monitoring wells (MW-36 and MW-38). As the boring logs and cross-section present, the lithology beneath the site is consistent with the Wann, Iola, and Chanute formations. Shale, sandstone and limestone form the topographic high ridge line that runs along the northwestern portion of the expansion area. Limestone and shale consistent with the Iola formation are observed in lithology beneath the Wann formation. Shales consistent with the Chanute formation are observed at lower elevations below the Iola limestone and are more predominant in the south and southeastern portions of the expansion area. The site geology consists of shale, sandstone, and limestone ranging in color from orange to brown along with clay, silty clay, sandy clay, silty sand, and sand.

- Borehole geophysical logging was performed within thirteen (13) of the 42 boreholes. The results of these logs indicated that the majority of the boreholes do not show a clearly defined change in neutron counts which makes it difficult to determine the change to a saturated zone.

- The highest groundwater elevation was measured in piezometer P-27 (786.02 fmsl). P-27 is located on the northwestern portion of the proposed expansion area. The lowest groundwater elevation recorded occurred in piezometer PZ-15 (693.45 fmsl), located along the south-central portion of the expansion area.

- Groundwater measurements were taken monthly at piezometers P-1, P-4, P-6, P-9, P-12, P-15, P-19, P-23, P-27, P-30, P-37, P-39, P-42, and existing monitoring wells MW-36 and MW-38 from July 2021 to August 2022.

- A Hydrograph depicting the data from the continuous water level monitoring system is included in **FIGURE 4.8**. As depicted in the figure, over the course of a year, the water level showed approximately 2.3-foot variation between the highest recorded water level and the lowest recorded water level.

- During the period from April 2021 through August 2022, May 2022 had the highest rainfall (9.06 inches) and August 2021 had the least rainfall (0.66 inches). No significant increases or decreases were recorded in the water level data from those months at any of the piezometers.

- Hydraulic conductivity (K values) ranged between $1.2660X10^{-4}$ cm/sec (0.359 ft/day) and $2.097X10^{-7}$ cm/sec ($5.946X10^{-4}$ ft/day). The hydraulic conductivity geometric mean for all piezometers was calculated as $1.183X10^{-5}$ cm/sec or $3.351X10^{-2}$ ft/day

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Tables and Figures

Table 2.1 - Stratigraphic Column

Formation Thickness	Approx. Depth	Age	Formation	Members	Description
66 to 400 Feet	0 to 80	Pennsylvanian	WANN FORMATION		Shale and fine to medium grained sandstone with many thin layers of fossiliferous limestone
7 to 66 Feet	80 to 140		LOLA FORMATION	Avant Limestone	Upper and lower limestone, separated by an interveining interbedded sandtone and shale interval
				Muncie Creek Shale	Well-laminated to fissile, fphosphatic clayshale
				Paola Limestone	Single bed of skeletal wackestone to packstone
52 to 75 Feet	140 to 210		CHANUTE FORMATION		grayish orange to pale yellowish brown, laminated to blocky bedded, weakly calcareous, very silty clayshale to mudshale
7 to 49 Feet	210 to 220		DEWEY FORMATION		Consist of two, thin, slightly sany limestone beds with an intervening shale and sandstone interval
427 Feet	220 to 640		NELLE BLY FORMATION		Clayshale and mudsstone, interbedded with some prominent sandstone,

TABLE 3.1
Boring Construction Details

Well	Northing	Easting	GS Elev. (fmsl)	Stick-up (ft)	TOC Elev. (fmsl)	Total Drilled Depth (bgs)	Bottom of Boring Elev. (fmsl)	PZ Installed Depth (bgs)	Screened Interval (fmsl)	Groundwater Observed during Drilling (bgs)	Observed GW Elev. (fmsl)	GW Stabilized (bgs)	Date Stabilized WL Obtained	GW Stabilized Elev. (fmsl)
P-1	427676.72	2497783.12	741.91	2.62	744.53	70	671.91	53.81	698.10-688.10	46	695.91	31.91	7/19/2021	710.00
B-2	427659.90	2498000.10	746.30	NA	NA	76	670.30	NA	NA	52	694.30	Bridged	NA	NA
B-3	427661.20	2498500.00	764.30	NA	NA	94	670.30	NA	NA	71	693.30	Bridged	NA	NA
P-4	427663.23	2499001.01	757.67	3.06	760.73	87	670.67	73.44	694.23-684.23	64	693.67	48.65	7/19/2021	709.02
B-5	427663.50	2499499.90	731.00	NA	NA	62	669.00	NA	NA	43	688.00	Bridged	NA	NA
P-6	4276672.52	2500001.93	719.31	1.7	721.01	48	671.31	38.74	690.57-680.57	26	693.31	19.36	7/15/2021	699.95
B-7	427999.90	2497777.50	751.30	NA	NA	74	677.30	NA	NA	57	694.30	Bridged	NA	NA
B-8	428039.40	2498006.00	767.70	NA	NA	100	667.70	NA	NA	68	699.70	20.81	7/6/2021	746.89
P-9	427999.72	2498499.68	779.44	2.44	781.88	102	677.44	95.88	693.56-683.56	86	693.44	54.52	7/20/2021	724.92
B-10	427989.90	2498999.90	756.20	NA	NA	75	681.20	NA	NA	61	695.20	Bridged	NA	NA
B-11	428000.00	2499500.00	730.70	NA	NA	62	668.70	NA	NA	28	702.70	Bridged	NA	NA
P-12	428505.84	2497779.78	786.85	2.31	789.16	108.28	678.57	108.28	688.57-678.57	98	688.85	46.08	8/2/2021	740.77
B-13	428501.60	2498001.20	811.90	NA	NA	128	683.90	NA	NA	NA	NA	40.52	7/6/2021	771.38
B-14	428500.10	2498499.90	813.40	NA	NA	129	684.40	NA	NA	124	689.40	Bridged	NA	NA
P-15	428502.65	2499002.47	773.90	2.65	776.55	86.33	687.57	86.33	697.57-687.57	80	693.90	70.75	7/15/2021	703.15
B-16	428499.90	2499500.00	744.40	NA	NA	55	689.40	NA	NA	24	720.40	29.62	7/6/2021	714.78
B-17	428993.40	2497772.30	800.30	NA	NA	112	688.30	NA	NA	NA	NA	78.55	7/6/2021	721.75
B-18	428999.90	2498000.00	811.00	NA	NA	118	693.00	NA	NA	NA	NA	28.07	7/6/2021	782.93
P-19	428999.55	2499000.79	789.48	2.39	791.87	98	691.48	93.10	706.38-696.38	83	706.48	56.8	7/15/2021	732.68
B-20	429004.20	2499511.00	747.80	NA	NA	56	691.80	NA	NA	28	719.80	Bridged	NA	NA
B-21	429023.50	2499940.20	738.90	NA	NA	40	698.90	NA	NA	15	723.90	15.83	7/7/2021	723.07
B-22	429522.70	2497826.80	800.70	NA	NA	108	692.70	NA	NA	57	743.70	37.39	7/6/2021	763.31
P-23	429503.21	2498001.03	814.98	2.79	817.77	116	698.98	96.11	728.87-718.87	97	717.98	83.18	7/20/2021	731.80
B-24	429472.20	2499025.50	789.10	NA	NA	105	684.10	NA	NA	NA	NA	24.59	7/6/2021	764.51
B-25	429497.30	2499479.50	791.00	NA	NA	96	695.00	NA	NA	78	713.00	56.76	7/6/2021	734.24
B-26	429479.10	2499994.30	758.70	NA	NA	59	699.70	NA	NA	55	703.70	36.35	7/7/2021	722.35
P-27	429990.14	2498047.85	806.54	2.83	809.37	98	708.54	93.46	723.08-713.08	83	723.54	19.24	7/20/2021	787.30
B-28	429987.60	2498544.70	889.80	NA	NA	200	689.80	NA	NA	87	802.80	65.19	7/6/2021	824.61
B-29	430018.00	2498958.20	875.80	NA	NA	170	705.80	NA	NA	108	767.80	79.65	7/6/2021	796.15
P-30	430001.00	2499500.27	821.46	2.67	824.13	115	706.46	112.63	718.83-708.83	103	718.46	89.79	8/2/2021	731.67
B-31	430493.80	2498553.90	833.00	NA	NA	120	713.00	NA	NA	76	757.00	31.09	7/6/2021	801.91
B-32	430487.50	2499018.30	897.70	NA	NA	200	697.70	NA	NA	119	778.70	Bridged	NA	NA
B-33	430514.40	2499502.60	855.30	NA	NA	142	713.30	NA	NA	82	773.30	Bridged	NA	NA
B-34	430500.00	2500000.00	815.80	NA	NA	108	707.80	NA	NA	87	728.80	Bridged	NA	NA
B-35	430565.50	2500495.00	808.00	NA	NA	123	685.00	NA	NA	NA	NA	Bridged	NA	NA
B-36	430925.80	2498752.40	830.80	NA	NA	109	721.80	NA	NA	82	748.80	66.61	7/6/2021	764.19
P-37	430933.72	2499000.47	846.20	2.81	849.01	124	722.20	106.25	749.95-739.95	NA	NA	85.14	8/2/2021	761.06
B-38	430940.30	2499484.90	903.80	NA	NA	200	703.80	NA	NA	138	765.80	64.21	7/6/2021	839.59
P-39	430955.82	2500000.48	821.98	2.62	824.52	99	722.98	90.19	741.79-731.79	78	743.98	54.37	7/6/2021	770.15
B-40	430966.70	2500500.20	799.40	NA	NA	78	721.40	NA	NA	NA	NA	Bridged	NA	NA
B-41	430984.70	2501000.10	873.60	NA	NA	145	728.60	NA	NA	NA	NA	Bridged	NA	NA
P-42	431004.77	2501496.87	841.74	2.62	844.46	118	723.74	100.40	751.34-741.34	94	747.74	92.96	7/20/2021	748.78
MW-36*	427948.70	2500404.97	729.10	2.00	731.1	57.5	671.60	57.50	681.60-671.60	NO	NO	NA*	NA*	NA*
MW-38*	428689.42	2500077.29	727.40	2.10	729.5	50	677.40	45.00	682.40-672.40	23	704.40	NA*	NA*	NA*

*Monitoring well installed prior to this investigation

TABLE 3.2
Geotechnical Sample Summary

Boring	Depth	Soil Classification	Soil Description	Moisture Content (%)	% Passing # 200 Sieve	Liquid Limit (%)	Plasitic Limit (%)	Plasticity Index (%)	Optimum Moisture (%)	Max Dry Density (pcf)	Hydraulic Conductivity (cm/sec)
B-2		ML	Silt and Sand, fine to course sand; yellowish red	DNR	56.8	DNR	DNR	DNR	DNR	DNR	DNR
B-8		SP-SM	Sand, fine to medium, some fines; reddish brown	DNR	8.3	DNR	DNR	DNR	DNR	DNR	2.61E-02
B-16		CL	Silty Clay and Sand, fine to coarse, some fine to coarse gravel; yellowish brown	13	59.4	27	14	13	11.9	119.3	3.00E-06
B-23		CH	Clay, some fine to coarse sand, trace fine gravel; pale yellow	18.7	88.5	54	21	33	18.3	104.5	3.40E-08
B-40		CL	Sandy Silty Clay, trace fine gravel; brown	16.8	86.9	44	14	30	16.4	111.8	3.40E-08

DNR = Did Not Run on this Sample
CNBD = Could Not Be Determined

Table 4.1
Monthly Groundwater Elevation Summary

		July 2021		August 2021		September 2021		October 2021		November 2021		December 2021	
Well	Top of Casing Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)
MW-36	731.10	34.54	696.56	35.13	695.97	34.61	696.49	33.32	697.78	33.07	698.03	33.24	697.86
MW-38	729.50	10.47	719.03	11.02	718.48	11.86	717.64	12.44	717.06	12.21	717.29	11.76	717.74
P-1	744.53	33.76	710.77	34.19	710.34	34.60	709.93	34.50	710.03	34.42	710.11	33.97	710.56
P-4	760.73	48.75	711.98	48.57	712.16	48.75	711.98	48.54	712.19	48.43	712.30	48.28	712.45
P-6	721.01	19.44	701.57	20.36	700.65	20.69	700.32	20.11	700.90	19.86	701.15	19.56	701.45
P-9	781.88	56.53	725.35	56.34	725.54	56.50	725.38	56.43	725.45	56.40	725.48	56.41	725.47
P-12	789.16	45.61	743.55	104.76	684.40	102.94	686.22	101.05	688.11	98.99	690.17	96.29	692.87
P-15	776.55	86.49	690.06	85.55	691.00	85.22	691.33	84.93	691.62	84.70	691.85	84.50	692.05
P-19	791.87	79.82	712.05	66.28	725.59	66.22	725.65	65.92	725.95	65.97	725.90	65.87	726.00
P-23	817.77	95.53	722.24	94.43	723.34	93.83	723.94	93.17	724.60	91.59	726.18	92.12	725.65
P-27	809.37	79.91	729.46	34.71	774.66	32.18	777.19	31.00	778.37	30.51	778.86	30.22	779.15
P-30	824.13	89.53	734.60	90.21	733.92	90.52	733.61	90.69	733.44	90.85	733.28	90.78	733.35
P-37	849.01	84.79	764.22	85.63	763.38	85.97	763.04	86.11	762.90	88.95	760.06	86.16	762.85
P-39	825.52	55.37	770.15	54.71	770.81	54.41	771.11	55.06	770.46	54.58	770.94	53.43	772.09
P-42	844.46	93.06	751.40	95.60	748.86	96.42	748.04	96.67	747.79	96.69	747.77	96.47	747.99

Highest Recorded GW Elevation (12 Month Period)

ft below TOC - feet below top of casing

ft MSL - feet above mean sea level

Monthy Measurements were typically obtained near the end of the month. Due to weather the February reading was not obtained, however two readings were obtained in March, both on the 5th and 31st.

Table 4.1
Monthly Groundwater Elevation Summary

Well	Top of Casing Elevation (ft msl)	January 2022		March 5, 2022		March 31, 2022		April 2022		May 2022		June 2022		Aug-22	
		Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)
MW-36	731.10	31.96	699.14	31.95	699.15	32.00	699.10	32.04	699.06	32.05	699.05	31.94	699.16	31.97	699.13
MW-38	729.50	11.49	718.01	11.35	718.15	11.32	718.18	11.47	718.03	11.20	718.30	10.48	719.02	11.58	717.92
P-1	744.53	34.22	710.31	34.10	710.43	34.17	710.36	34.30	710.23	34.30	710.23	33.85	710.68	34.65	709.88
P-4	760.73	48.71	712.02	48.78	711.95	49.16	711.57	49.10	711.63	48.43	712.30	49.61	711.12	50.12	710.61
P-6	721.01	19.80	701.21	19.57	701.44	19.45	701.56	19.37	701.64	19.02	701.99	18.60	702.41	19.33	701.68
P-9	781.88	56.48	725.40	56.64	725.24	56.65	725.23	56.67	725.21	56.71	725.17	56.72	725.16	56.85	725.03
P-12	789.16	94.85	694.31	92.95	696.21	90.63	698.53	89.05	700.11	86.56	702.60	83.00	706.16	79.80	709.36
P-15	776.55	84.32	692.23	84.00	692.55	83.89	692.66	83.75	692.80	83.60	692.95	83.34	693.21	83.10	693.45
P-19	791.87	65.98	725.89	65.77	726.10	65.77	726.10	65.70	726.17	65.58	726.29	65.48	726.39	65.92	725.95
P-23	817.77	89.95	727.82	87.90	729.87	87.06	730.71	86.40	731.37	85.32	732.45	84.08	733.69	82.17	735.60
P-27	809.37	29.67	779.70	28.65	780.72	27.40	781.97	26.25	783.12	24.68	784.69	23.35	786.02	26.59	782.78
P-30	824.13	91.04	733.09	90.95	733.18	91.05	733.08	90.95	733.18	90.98	733.15	90.81	733.32	91.03	733.10
P-37	849.01	86.28	762.73	86.20	762.81	86.38	762.63	86.31	762.70	86.10	762.91	85.28	763.73	85.86	763.15
P-39	825.52	55.93	769.59	55.51	770.01	55.16	770.36	55.66	769.86	56.05	769.47	55.24	770.28	56.19	769.33
P-42	844.46	96.43	748.03	96.30	748.16	96.34	748.12	96.29	748.17	96.22	748.24	96.18	748.28	96.77	747.69

Highest Recorded GW Elevation (12 Month Period)

ft below TOC - feet below top of casing

ft MSL - feet above mean sea level

Monthy Measurements were typically obtained near the end of the month. Due to weather the February reading was not obtained, however two readings were obtained in March, both on the 5th and 31st.

TABLE 4.2
Precipitation of Tulsa, OK

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1981 - 2010 Normal	1.68	1.61	3.4	3.81	5.82	4.92	3.29	2.97	4.45	3.75	2.83	2.34	40.87
Mesonet Average	2.06	1.6	3.46	4.34	7.17	3.78	4.36	3.83	2.51	4.44	2.86	2.75	43.16
1994	*0.68*	*2.21*	*3.35*	*6.57*	*2.81*	*2.73*	*11.39*	*4.1*	*3.6*	*3.76*	*7.1*	*1.21*	*49.51*
1995	*0.93*	*0.57*	*1.83*	*5.92*	*10.73*	*9.84*	*2.55*	*1.44*	*4.81*	*1.05*	*0.25*	*1.77*	*41.69*
1996	*0.47*	*0.16*	*2.07*	*1.4*	*2.14*	*3.96*	*4.15*	*1.33*	*5.07*	*5.6*	*7.21*	*0.1*	*33.66*
1997	*0.25*	*3.41*	*1.63*	*4.09*	*1.66*	*5.77*	*5.63*	*7.86*	*3.06*	*1.99*	*1.62*	*4.3*	*41.27*
1998	*3.48*	*0.3*	*7.34*	*4.54*	*2.46*	*3.37*	*4.31*	*1.67*	*5.13*	*9.04*	*3.26*	*1.57*	*46.47*
1999	*3.01*	*1.26*	*3.55*	*7.2*	*9.55*	*5.21*	*0.4*	*0.42*	*9.69*	*1.75*	*1.32*	*5.11*	*48.47*
2000	*0.89*	*1.33*	*3.76*	*2.71*	*7.01*	*6.25*	*6.58*	*0.01*	*1.1*	*6.32*	*3.51*	*1.62*	*41.09*
2001	*2.09*	*2.62*	*0.77*	*1.19*	*6.32*	*3.04*	*0.51*	*2.26*	*1.95*	*2.81*	*3.33*	*2.25*	*29.14*
2002	*2.67*	*0.9*	*2.39*	*3.71*	*5.21*	*2.9*	*2.18*	*3.55*	*1.24*	*3.33*	*0.48*	*2.75*	*31.31*
2003	*0.14*	*1.76*	*3.25*	*2.17*	*5.25*	*5.96*	*0.89*	*8.78*	*4.95*	*3.96*	*1.73*	*2.46*	*41.3*
2004	*2.36*	*1.2*	*6.16*	*5.97*	*3.07*	*6.41*	*8.63*	*1.62*	*0.82*	*8.51*	*3.92*	*0.85*	*49.52*
2005	*3.69*	*1.93*	*1.21*	*2.81*	*1.61*	*3.94*	*1.62*	*5.91*	*3.09*	*1.58*	*0.31*	*0.52*	*28.22*
2006	*0.72*	*0.35*	*2.8*	*5.83*	*3.04*	*5.85*	*4.41*	*4.06*	*2.01*	*1.31*	*3.58*	*4.27*	*38.23*
2007	*2.27*	*1.23*	*3.07*	*2.25*	*10.03*	*9.17*	*6.1*	*0.69*	*10.82*	*3.04*	*0.54*	*3.88*	*53.09*
2008	*0.88*	*2.01*	*4.73*	*9.33*	*9.6*	*9.43*	*4.64*	*4.59*	*4.4*	*2.75*	*1.96*	*1.77*	*56.09*
2009	*0.68*	*2.28*	*5.02*	*4.34*	*6.8*	*3.51*	*2.84*	*3.76*	*8.29*	*6.14*	*0.58*	*1.88*	*46.12*
2010	*2.36*	*2.03*	*3.25*	*2.08*	*5.23*	*7.07*	*4.67*	*1.19*	*2.85*	*1.23*	*1.96*	*0.55*	*34.47*
2011	*0.57*	*2.57*	*1*	*5.41*	*3.58*	*1.47*	*0.36*	*5.76*	*2.58*	*1.87*	*5.37*	*1.45*	*31.99*
2012	*0.61*	*1.61*	*6.24*	*3.62*	*1.18*	*4.29*	*1.38*	*3.32*	*1.78*	*2.75*	*1.11*	*0.85*	*28.74*
2013	*1.54*	*3.18*	*1.1*	*3.35*	*4.71*	*1.69*	*4.33*	*3.69*	*2.5*	*3.72*	*1.91*	*1.55*	*33.09*
2014	0.13	0.27	2.64	1.73	3.03	4.77	4.34	0.77	2.08	3.85	2.18	1.77	27.56
2015	0.82	1.02	4.21	3.9	15.53	5.83	6.87	6.31	2.53	1.53	7.93	8.35	64.83
2016	0.36	0.73	2.47	5.92	3.79	0.93	2.79	2.09	1.82	2.3	1.9	0.53	25.63
2017	4.02	1.26	1.8	10.43	8.24	2.37	2.48	4.79	1.74	7.13	0.56	1.58	46.4
2018	0.29	4.76	3.4	1.7	2.02	2.74	2.74	5.65	3.21	3.38	1.75	4.5	36.14
2019	3.83	1.48	4.3	4.71	13.68	9.74	4.65	5.08	3.47	6.17	4.93	1.39	63.43
2020	5.31	1.45	5.91	4.6	3.92	0.24	6.47	5.42	3.72	6.44	2.18	3.71	49.37
2021	3.1	0.65	3.68	3.71	5.29	7.44	4.58	0.66	1.49	5.4	1.45	1.34	38.79
2022	0.68	2.74	2.75	2.32	9.06	4.56	2.68	1.11	2.25	2.01			

Italicized: National Weather Service. Otherwise, data from Mesonet

Source: National Weather Service (weather.gov/tsa/climo_tulyearrain)

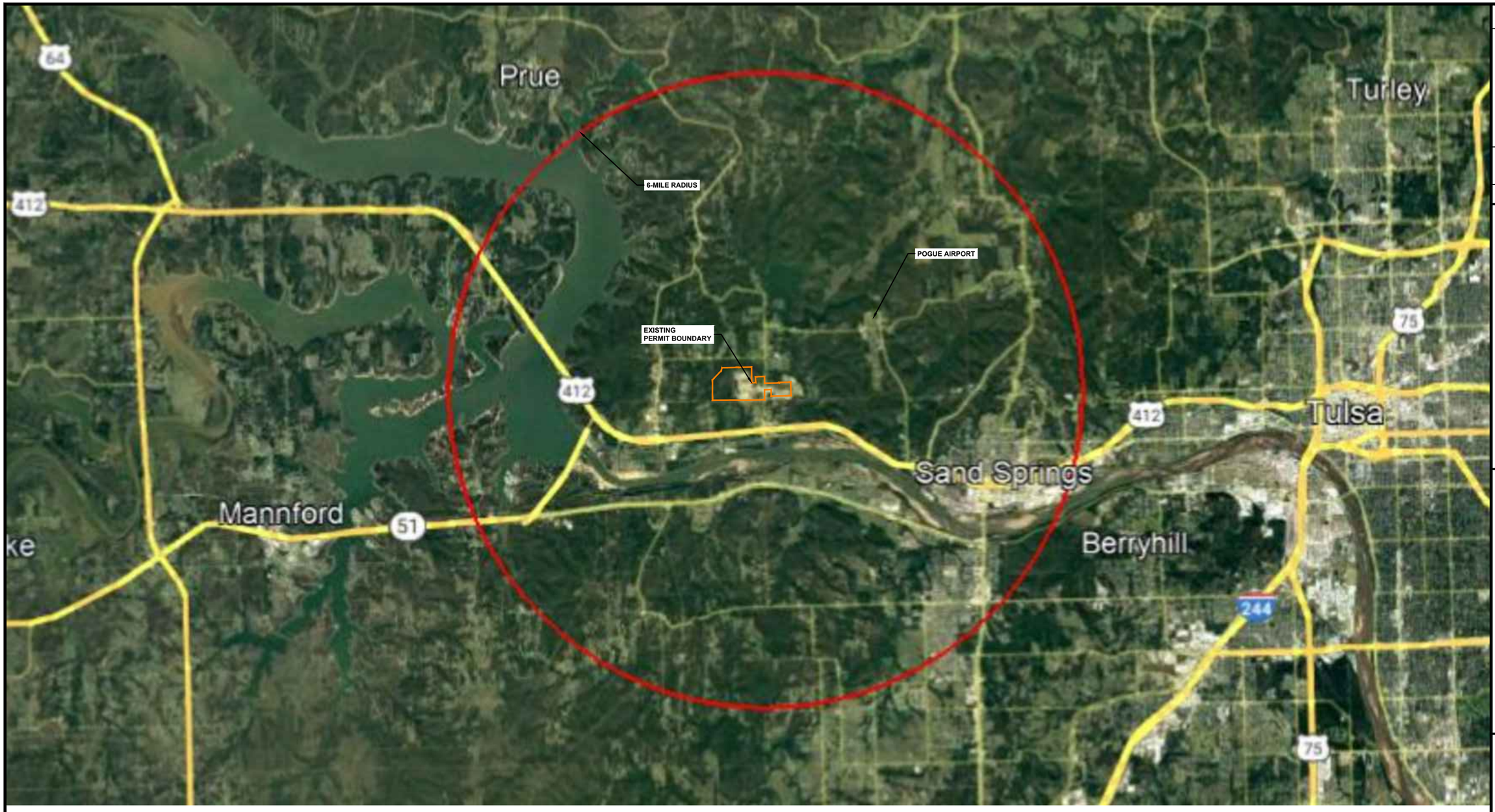
mesonet.org/index.php/weather/monthly_rainfall_table

Station Information:

County	Tulsa
Commissioned	6/25/2013
Lat	36.19666
Lon	-95.93883

TABLE 4.3
Aquifer Test Results

WELL		K VALUE (ft/day)	K VALUE (cm/sec)	GEOMETRIC MEAN K VALUE (ft/day)	GEOMETRIC MEAN K VALUE (cm/sec)
P-1	In	7.930E-01	2.798E-04	6.981E-01	2.463E-04
	Out	6.146E-01	2.168E-04		
P-4	In	3.342E-01	1.179E-04	2.162E-01	7.628E-05
	Out	1.399E-01	4.935E-05		
P-6	In	7.443E-01	2.626E-04	8.340E-01	2.942E-04
	Out	9.345E-01	3.297E-04		
P-9	In	6.758E-02	2.384E-05	3.076E-02	1.085E-05
	Out	1.400E-02	4.939E-06		
P-12	In	1.502E-04	5.299E-08	3.654E-04	1.289E-07
	Out	8.887E-04	3.135E-07		
P-15	In	1.941E-02	6.847E-06	9.956E-04	3.512E-07
	Out	5.107E-05	1.802E-08		
P-19	In	5.533E-02	1.952E-05	1.363E-02	4.807E-06
	Out	3.356E-03	1.184E-06		
P-23	In	7.415E-04	2.616E-07	4.983E-04	1.758E-07
	Out	3.348E-04	1.181E-07		
P-27	In	9.013E-04	3.221E-07	9.005E-04	3.197E-07
	Out	8.997E-04	3.174E-07		
P-30	In	2.802E-01	9.885E-05	2.099E-01	7.404E-05
	Out	1.572E-01	5.546E-05		
P-37	In	5.687E-01	2.006E-04	4.287E-01	1.512E-04
	Out	3.231E-01	1.140E-04		
P-39	In	2.646E-01	9.335E-05	1.997E-01	7.045E-05
	Out	1.507E-01	5.316E-05		
P-42	In	4.061E-01	1.433E-04	4.342E-01	1.532E-04
	Out	4.643E-01	1.638E-04		
Geometric Mean K Value				**3.351E-02**	**1.183E-05**



LEGEND:

- PERMIT BOUNDARY
- 6-MILE RADIUS

NOTES:

1. SOURCE OF THE APPROXIMATE 6 MILE RADIUS FROM SITE IS FROM GOOGLE EARTH PRO

5000 0 5000 10000
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
SITE LOCATION MAP

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH: (913) 681-0030 FAX: (913) 681-0012

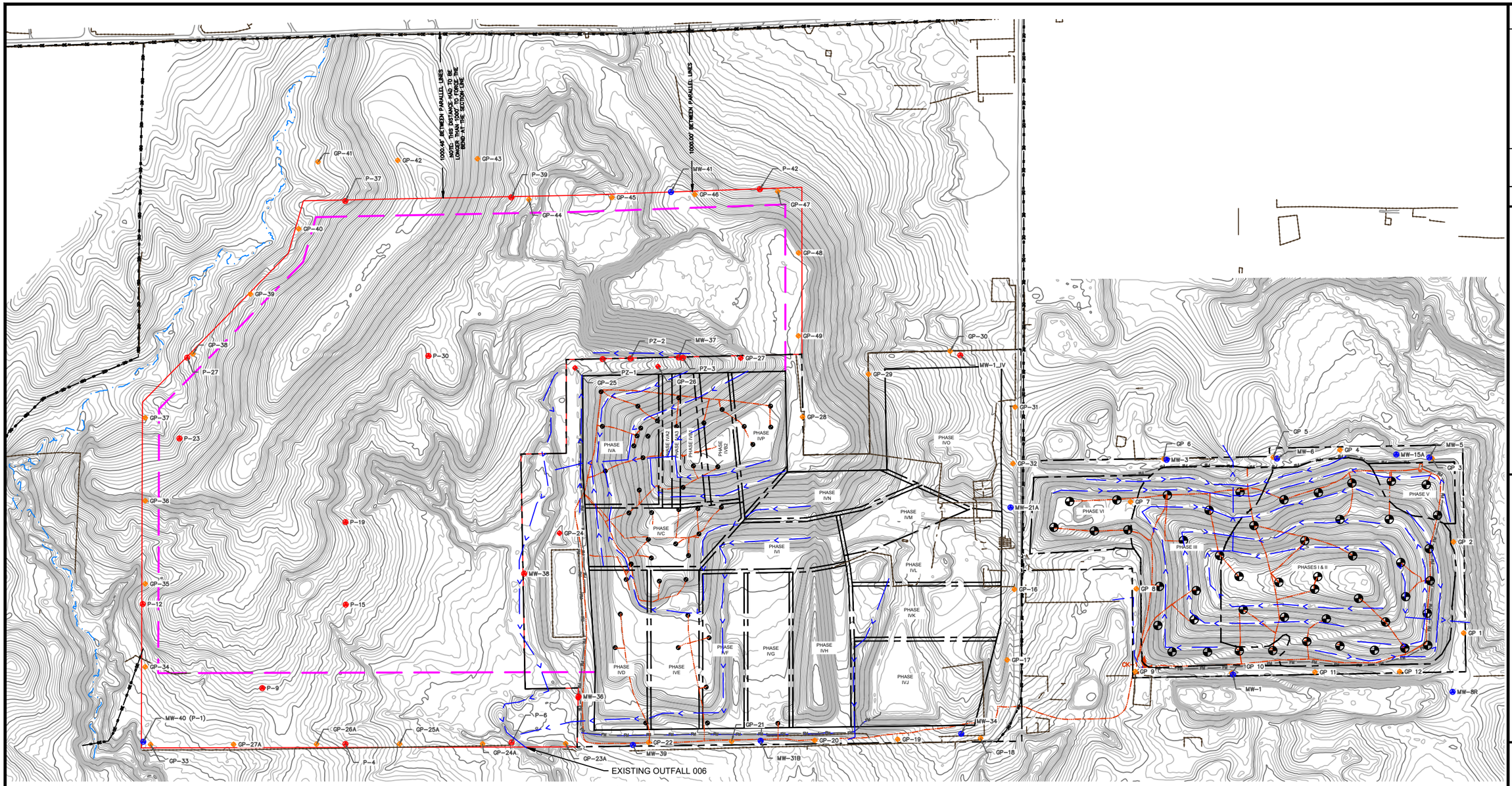
PROJ. NO. 27220345.00
DSN. BY: TWL
DSN. BY: TWL
CHK. BY: WJM
Q/A REW BY: WJM
PROJ. MGR WJM

CADD FILE:
SITE LOCATION MAP.DWG

DATE:
6/22/23

DRAWING NO.
1.1

K:\AEL\Projects\2020\27220345.00 - Lateral Expansion Permitting\Task 3 - Groundwater Study and Report\CAD\Site Location Map.dwg Jun 22, 2023 - 2:59pm Layout Name: Site Location Map By: 4810twl



LEGEND:

- EXISTING 2' MINOR CONTOUR
- EXISTING 10' MAJOR CONTOUR (1570)
- EXISTING FENCE
- EXISTING OVERHEAD ELECTRIC (OE)
- EXISTING UNPAVED ROAD
- EXISTING PAVED ROAD
- EXISTING BODY OF WATER
- SOLID WASTE PHASE BOUNDARY
- SOLID WASTE PERMIT BOUNDARY
- EXISTING STREAM
- MONITORING WELL
- GAS PROBE
- EXTRACTION WELL
- MONITORING WELL ABANDOMENT
- GAS PROBE ABANDONMENT
- LANDFILL GAS COLLECTION SYSTEM PIPING
- ELECTRICAL CONDUIT
- LEACHATE FORCEMAIN (FM)
- PROPOSED EXPANSION AREA PERMIT BOUNDARY
- PROPOSED LIMITS OF WASTE
- SURFACE DRAINAGE

NOTE:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.
2. PROPOSED GAS PROBES AND MONITORING WELLS ARE DEPICTED WITHIN THE EXPANSION AREA

300 0 300 600
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
SITE LAYOUT MAP

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
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PROJ. NO.	DWN. BY:	Q/A RVW BY:
27220345.00	TWL	WJM
DSN. BY:	CHK. BY:	PROJ. MGR
TWL	CF	WJM

CADD FILE:
SITE LAYOUT MAP.DWG

DATE:
6/22/23

DRAWING NO.
1.2

C:\Users\4810twl\AppData\Local\Temp\AcPublish_2708\Site Layout Map.dwg Dec 06, 2023 - 10:32am Layout Name: Site Layout By: 4810twl

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21
NBRF
BNRD
39
42
18
20
67

valid at this scale.

200 0 200 400
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
SOILS LOCATION MAP
OSAGE COUNTY

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
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PROJ. NO. 27220345.00
DSN. BY: TWL
CHK. BY: WJM
DSN. BY: TWL
Q/A REVW BY: WJM
PROJ. MGR WJM

CADD FILE:
SITE GEOLOGICAL MAP.DWG

DATE:
6/22/23

DRAWING NO.
2.1.1

K:\AEL\Projects\2020\27220345.00 - Lateral Expansion Permitting\Task 3 - Groundwater Study and Report\CAD\Site Geological Map.dwg Jun 22, 2023 - 3:25pm Layout Name: Site Soils Map By: 4810twl

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Osage County, Oklahoma
Survey Area Data: Version 19, Aug 27, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 5, 2020—Aug 4, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
18	Agra-Ashport, frequently flooded complex, 0 to 12 percent slopes	10.8	5.1%
20	Dougherty loamy fine sand, 3 to 8 percent slopes	58.2	27.7%
21	Eufaula loamy fine sand, 3 to 15 percent slopes	4.7	2.2%
39	Norge silt loam, 3 to 5 percent slopes	6.6	3.1%
42	Norge, Agra, and Prue soils, 3 to 8 percent slopes, gullied	0.7	0.3%
67	Verdigris silt loam, 0 to 1 percent slopes, frequently flooded	2.1	1.0%
BNRD	Bigheart-Niotaze-Rock outcrop complex, 1 to 8 percent slopes	53.3	25.4%
NBRF	Niotaze-Bigheart-Rock outcrop complex, 15 to 25 percent slopes, extremely stony	74.0	35.2%
Totals for Area of Interest		**210.3**	**100.0%**

REV. | DATE | DESCRIPTION | CK. BY

SHEET TITLE: SOILS LOCATION MAP LEGEND

PROJECT TITLE: HYDROGEOLOGIC REPORT

CLIENT: AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
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PROJ. NO. 27220345.00
DSN. BY: TWL
DWN. BY: TWL
CHK. BY: WJM
QA/A RVW BY: WJM
PROJ. MGR: WJM

CADD FILE: SITE GEOLOGICAL MAP.DWG

DATE: 6/22/23

DRAWING NO. 2.1.2

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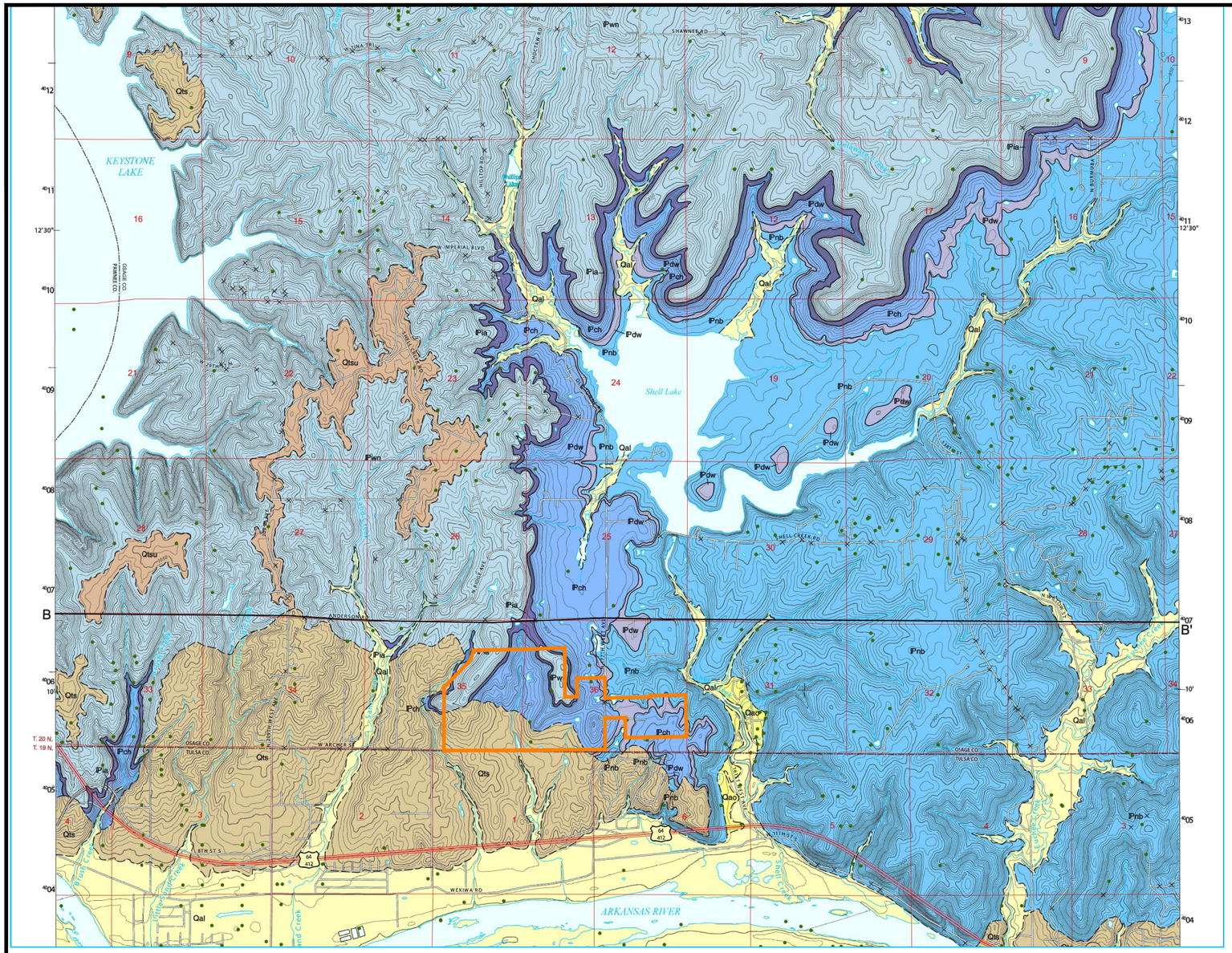
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Shell Lake
ARKANSAS RIVER
W IMPERIAL BLVD
W ARCHER ST
W 11TH ST S
E 8TH ST S
WEKIWA RD
ANDERSON RD
SHELL CREEK RD
WELL CREEK RD
HILTON RD
N 129TH W AVE
N 145TH W AVE
N 161ST W AVE
N 193RD W AVE
N 209TH W AVE
N 225TH W AVE
N 241ST W AVE
N 257TH W AVE
N 273RD W AVE
N 289TH W AVE
N 305TH W AVE
N 321ST W AVE
N 337TH W AVE
N 353RD W AVE
N 369TH W AVE
N 385TH W AVE
N 401ST W AVE
N 417TH W AVE
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N 1969TH W AVE
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N 2097TH W AVE
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N 2129TH W AVE
N 2145TH W AVE
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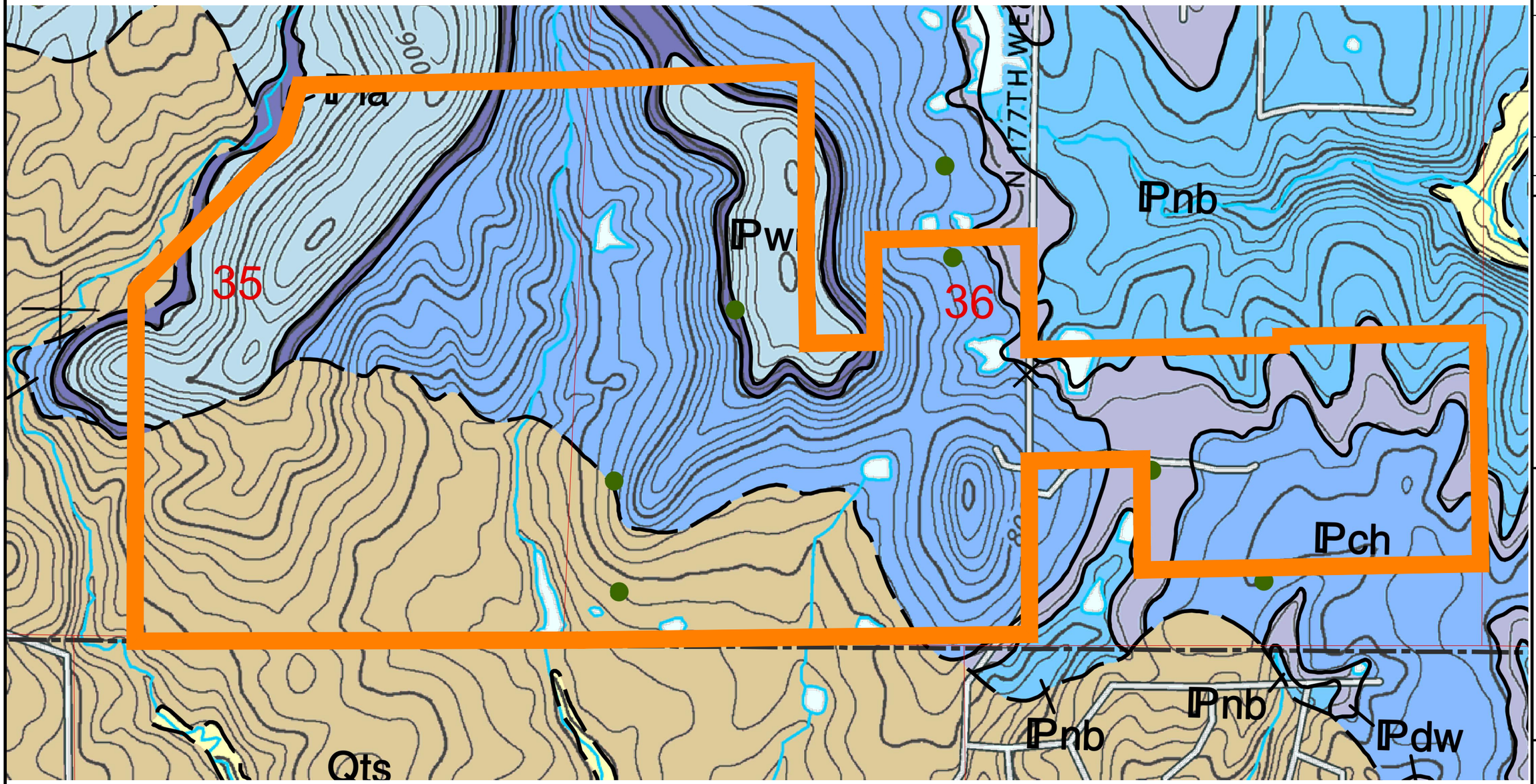

LEGEND:

- PERMIT BOUNDARY
- UNIT CONTACT
- COVERED FAULT
- DOWNTHROWN FAULT
- OUTCROP
- PETROLEUM WELL
- DRILL HOLE

NOTES:

1. UNIT CONTACT IS DASHED WERE APPROXIMATE.
2. OUTCROPS ARE GEOLOGIC OBSERVATIONS.
3. PETROLEUM WELLS INCLUDE OIL, GAS, OIL AND GAS, DRY SERVICE, JUNKED AND ABANDONED, AND UNKNOWN WELLS. MODIFIED FROM THE NATURAL RESOURCES INFORMATION SYSTEM DATABASE.
4. MAP MODIFIED FROM OKLAHOMA GEOLOGIC SURVEY QUADRANGLE OGQ-80 GEOLOGIC MAP OF THE WEKIWA 7.5' QUADRANGLE IN OSAGE, PAWNEE, AND TULSA COUNTIES, OKLAHOMA. CREDITED TO THOMAS M. STANLEY AND DATED 2010.
5. SEE FIGURE 2.2 FOR GEOLOGIC SURVEY LEGEND.

300 0 300 600
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
SITE GEOLOGICAL MAP

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH: (913) 681-0030 FAX: (913) 681-0012

PROJ. NO. 27220345.00
DSN. BY: TWL
CHK. BY: WJM
DSR. BY: TWL
Q/A REW BY: WJM
PROJ. MGR: WJM

CADD FILE:
SITE GEOLOGICAL MAP.DWG

DATE:
6/22/23

DRAWING NO.
2.3

K:\AEL\Projects\2020\27220345.00 - Lateral Expansion Permitting\Task 3 - Groundwater Study and Report\CAD\Site Geological Map.dwg Jun 22, 2023 - 3:26pm Layout Name: Site Geologic Map By: 4810twl

Alluvial aquifer

Fine to coarse sand and gravel in alluvium. This area also includes the terrace deposits at Enid and some terrace deposits along the major streams. Saturated sand and gravel 1.5 to 60 feet (0.5 to 18 m) thick.

Cedar Hills aquifer

Fine-grained sandstone. Yields water for irrigation in an area a few miles west of the Enid quadrangle.

Ada aquifer

Fine-grained sandstone. Yields are highest in Creek County where the sandstone layers are thicker and more numerous.

Vamoosa aquifer

Fine- to coarse-grained sandstone. Yields are highest in Creek County where some of the sandstone layers are coarse grained.

Ada and Vamoosa aquifers combined

In this area, wells 700 to 750 feet (210 to 230 m) deep obtain water from both aquifers.

Minor aquifers

Includes shale, minor sandstone, thin alluvium and terrace deposits, and less productive areas of other aquifers.

POTENTIAL WELL YIELD, IN GALLONS PER MINUTE
(Levino van Sicoen)

Note: Locally, an individual well in any area shown on the map might yield more or less water than indicated on the map.

- 300 to 600 (19 to 38)
- 150 to 300 (9.5 to 19)
- 50 to 150 (3.2 to 9.5)
- 25 to 50 (1.6 to 3.2)
- 0 to 25 (0 to 1.6)

Boundary for principal aquifer; dashed where approximately located.

32 / 15 / 15
Well

Upper number is depth of well below land surface, in feet; lower number is water level below land surface, in feet; + indicates well yield the yield of the well, in gallons per minute; -indicates well yield less than 1 gallon per minute; ? indicates well yield not known; T = trace amount shown; U = unknown. Where only two numbers are shown, they are well depth and depth to water; where only one number is shown it is well depth.

4 / 17 / 10
Well field

Upper number is number of wells in field; second number is average depth, in feet; third number is average water level below land surface, in feet; fourth number is average yield per well, in gallons per minute; U = unknown.

PERMIT BOUNDARY

2000 0 2000 4000
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
HYDROLOGIC ATLAS MAP

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
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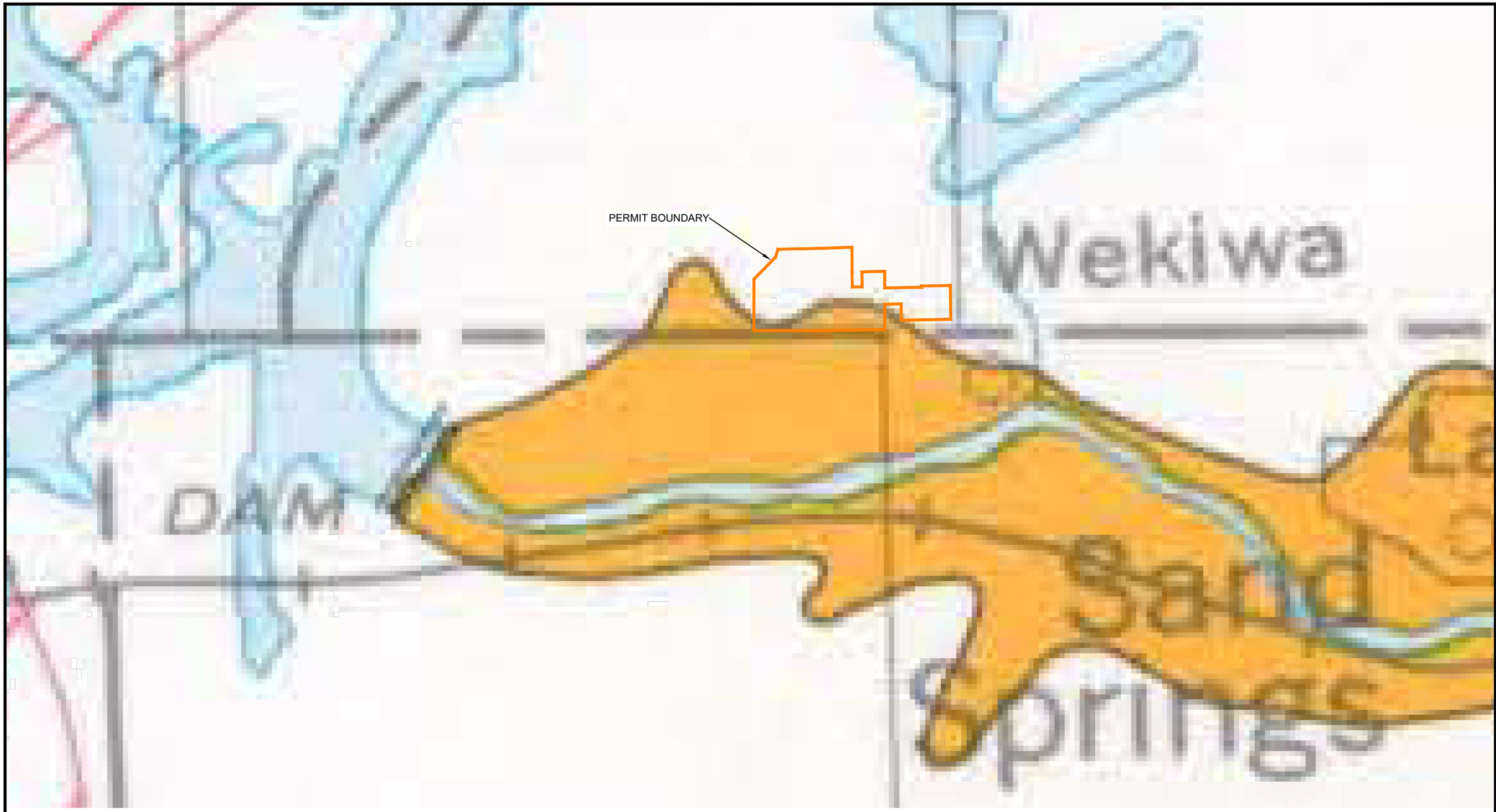
PROJ. NO.	DWN. BY:	Q/A RVW BY:
27220345.00	TWL	W.J.M
DSN. BY: TWL	CHK. BY: W.J.M	PROJ. MGR W.J.M

CADD FILE:
HYDROLOGIC ATLAS MAP.DWG

DATE:
6/23/23

DRAWING NO.
2.4

C:\Users\4810twl\AppData\Local\Temp\AcPublish_6268\Hydrologic Atlas Map.dwg Jun 23, 2023 - 7:26am Layout Name: Site Location Map By: 4810twl



LEGEND:

PERMIT BOUNDARY

NOTES:

1. GROUNDWATER RECHARGE AREA ARE DERIVED FROM THE MAP OF AQUIFERS AND RECHARGE AREAS IN OKLAHOMA BY KENNETH S. JOHNSON.

2000 0 2000 4000

SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
GROUNDWATER RECHARGE MAP

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

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PROJ. NO. 27220345.00
DSN. BY: TWL
CHK. BY: WJM
DSR. BY: TWL
Q/A REW BY: WJM
PROJ. MGR WJM

CADD FILE:
GROUNDWATER RESOURCE MAP.DWG

DATE:
6/23/23

DRAWING NO.
2.5

C:\Users\4810twl\AppData\Local\Temp\AcPublish_6268\Groundwater Resource Map.dwg Jun 23, 2023 - 7:51am Layout Name: Groundwater Recharge Map By: 4810twl

Peninsula Dr N
Appalachia Bay Recreation Area
New Prue Rd
Shell Lake
3-MILE BUFFER
N 177th West Ave
Shell Creek Rd
1-MILE BUFFER
PERMIT BOUNDARY
William Pogue Municipal Airport
97
N McKinley Ave
New Prue Rd
Keystone Expy
Willow St
N Highway 97
Canyons at Blackjack Ridge
Sand Springs Expy
Wekiwa
Brush Creek Recreation Area
W Wekiwa Rd
Arkansas River
N Adams Rd
Keystone State Park
Sand Springs
42nd Rainbow Infantry Div Mem Hwy
Lotsee
W Highway 51
51
Case Community Park
Keystone Lake
Shirk
S 265

LEGEND:

- PERMIT BOUNDARY
- MONITORING WELL
- GROUNDWATER WELL
- 1-MILE RADIUS
- 3-MILE RADIUS

NOTES:

1. PUBLIC AND PRIVATE WATER WELLS ARE DERIVED FROM THE OKLAHOMA WATER RESOURCE BOARD.

2000 0 2000 4000
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
GROUNDWATER RESOURCE MAP

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

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8575 West 110th Street, Suite 100
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PROJ. NO.	DWN. BY:	CHK. BY:	QA/A RW BY:
27220345.00	TWL	WJM	WJM
DSN. BY:			PROJ. MGR
TWL			WJM

CADD FILE:
GROUNDWATER RESOURCE MAP.DWG

DATE:
6/23/23

DRAWING NO.
2.6

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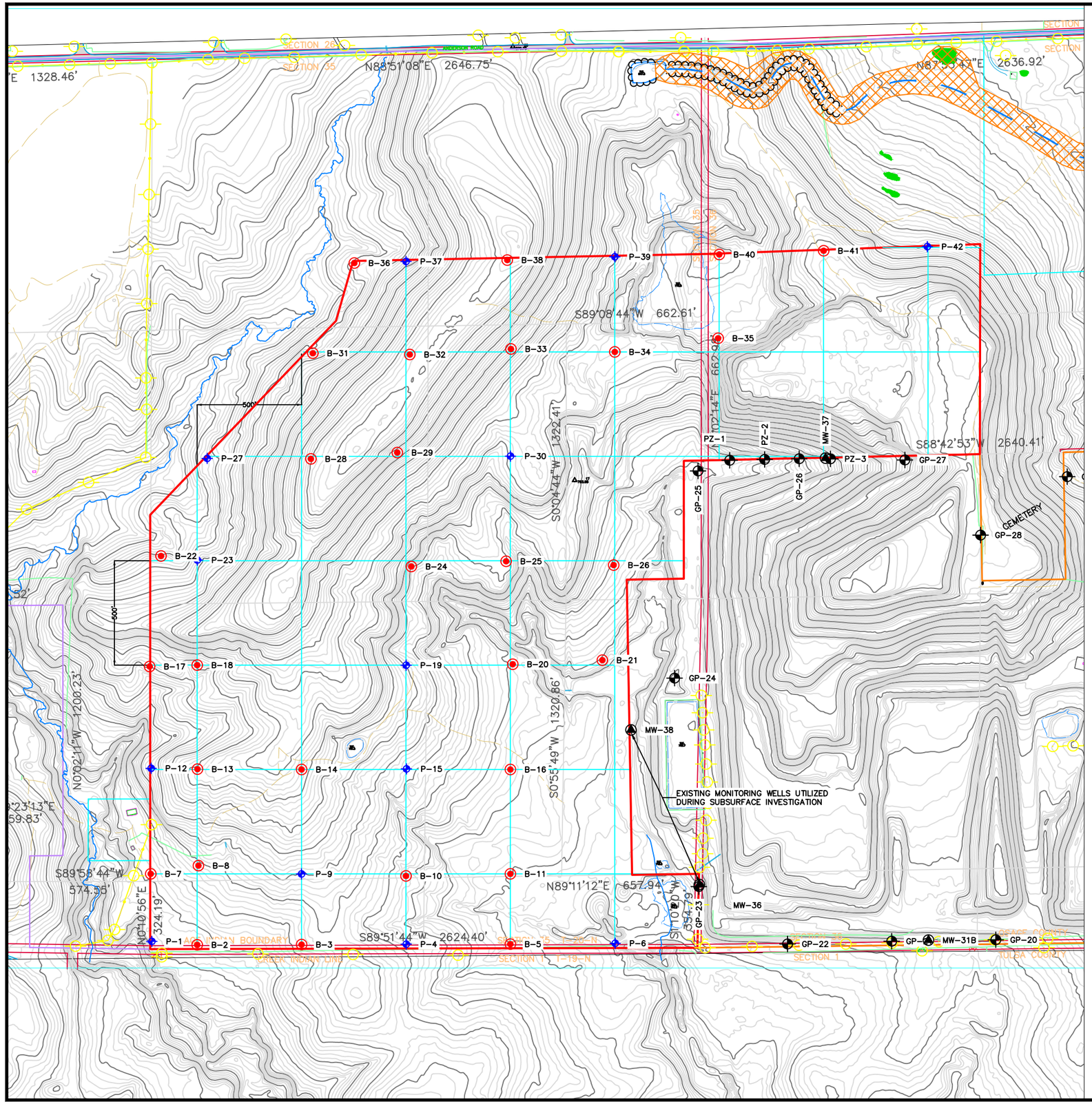


LEGEND

- MINOR CONTOUR
- MAJOR CONTOUR
- WATER/STREAM
- FENCELINE
- BUILDING
- EXISTING PERMIT BOUNDARY
- PROPOSED PERMIT BOUNDARY
- PROPERTY BOUNDARY
- PROPERTY EASEMENTS
- TRAIL
- EXISTING CULVERT
- GRID SPACING
- OVERHEAD UTILITY LINES
- WETLAND
- EXISTING MITIGATION AREA
- EXISTING PIEZOMETER LOCATION
- BORING LOCATION
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER/GAS PROBE

NOTES:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.

N

500 0 500 1000

SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: **BORING LOCATION MAP**

PROJECT TITLE: **HYDROGEOLOGIC REPORT**

CLIENT: **AMERICAN ENVIRONMENTAL LANDFILL, INC.**
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH: (913) 681-0030 FAX: (913) 681-0012

PROJ. NO.	DWN. BY:	Q/A RVW BY:
27220345.00	TWL	W.J.M
DSN. BY:	CHK. BY:	PROJ. MGR:
TWL	W.J.M	W.J.M

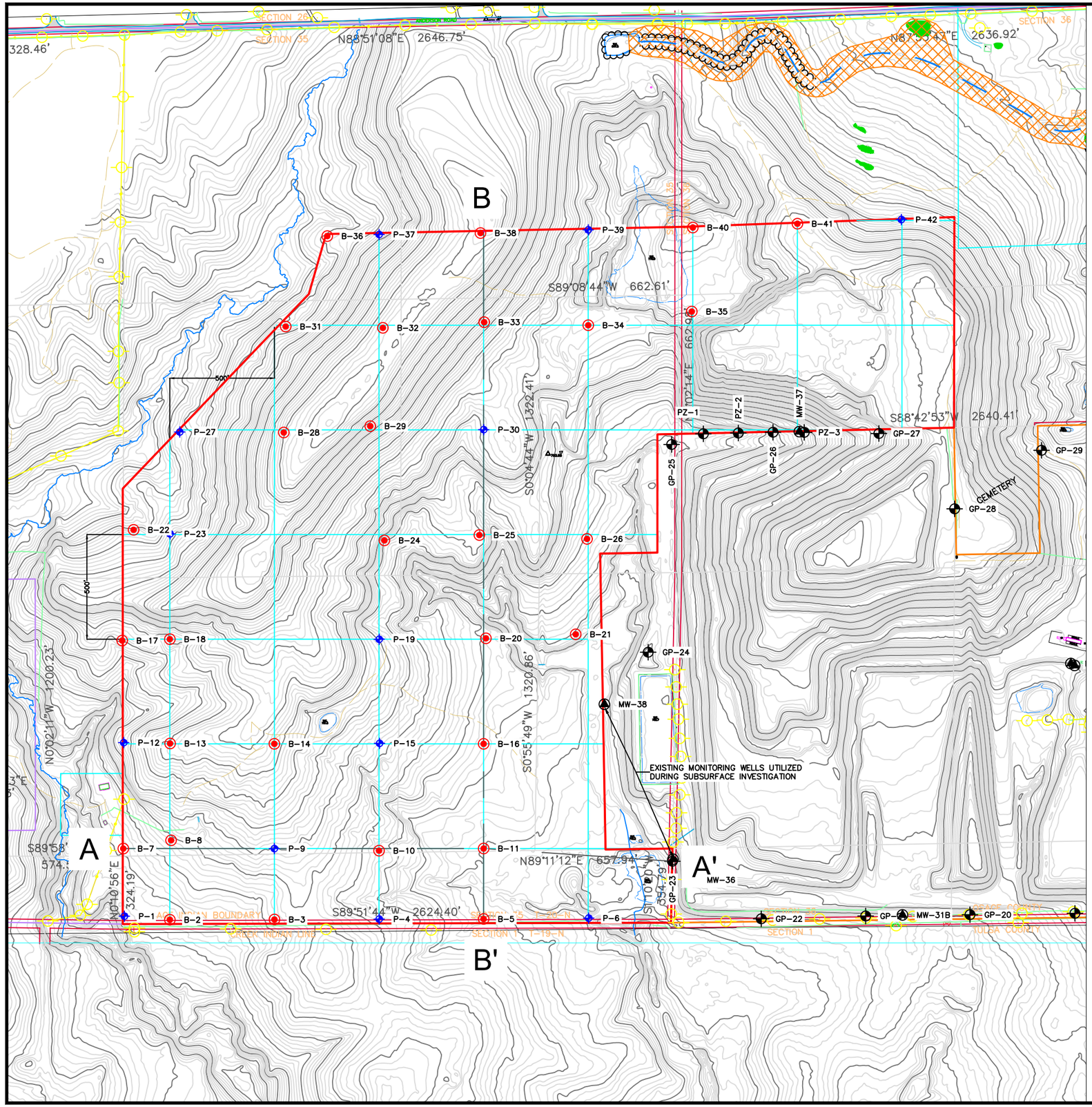
CADD FILE: BORING LOCATION MAP.DWG

DATE: 6/23/23

SCALE: 1"=500'

DRAWING NO.

3.1



LEGEND

- MINOR CONTOUR
- MAJOR CONTOUR
- WATER/STREAM
- FENCELINE
- BUILDING
- EXISTING PERMIT BOUNDARY
- PROPOSED PERMIT BOUNDARY
- PROPERTY BOUNDARY
- PROPERTY EASEMENTS
- TRAIL
- EXISTING CULVERT
- GRID SPACING
- OVERHEAD UTILITY LINES
- WETLAND
- EXISTING MITIGATION AREA
- EXISTING PIEZOMETER LOCATION
- BORING LOCATION
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER/GAS PROBE
- CROSS SECTION LOCATION

NOTES:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.

N

500 0 500 1000

SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: CROSS SECTIONS LOCATION MAP

PROJECT TITLE: HYDROGEOLOGIC REPORT

CLIENT: AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

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PROJ. NO. 27220345.00
DSN. BY: TWL
DWN. BY: TWL
CHK. BY: WJM
QA/QC BY: WJM
PROJ. MGR: WJM

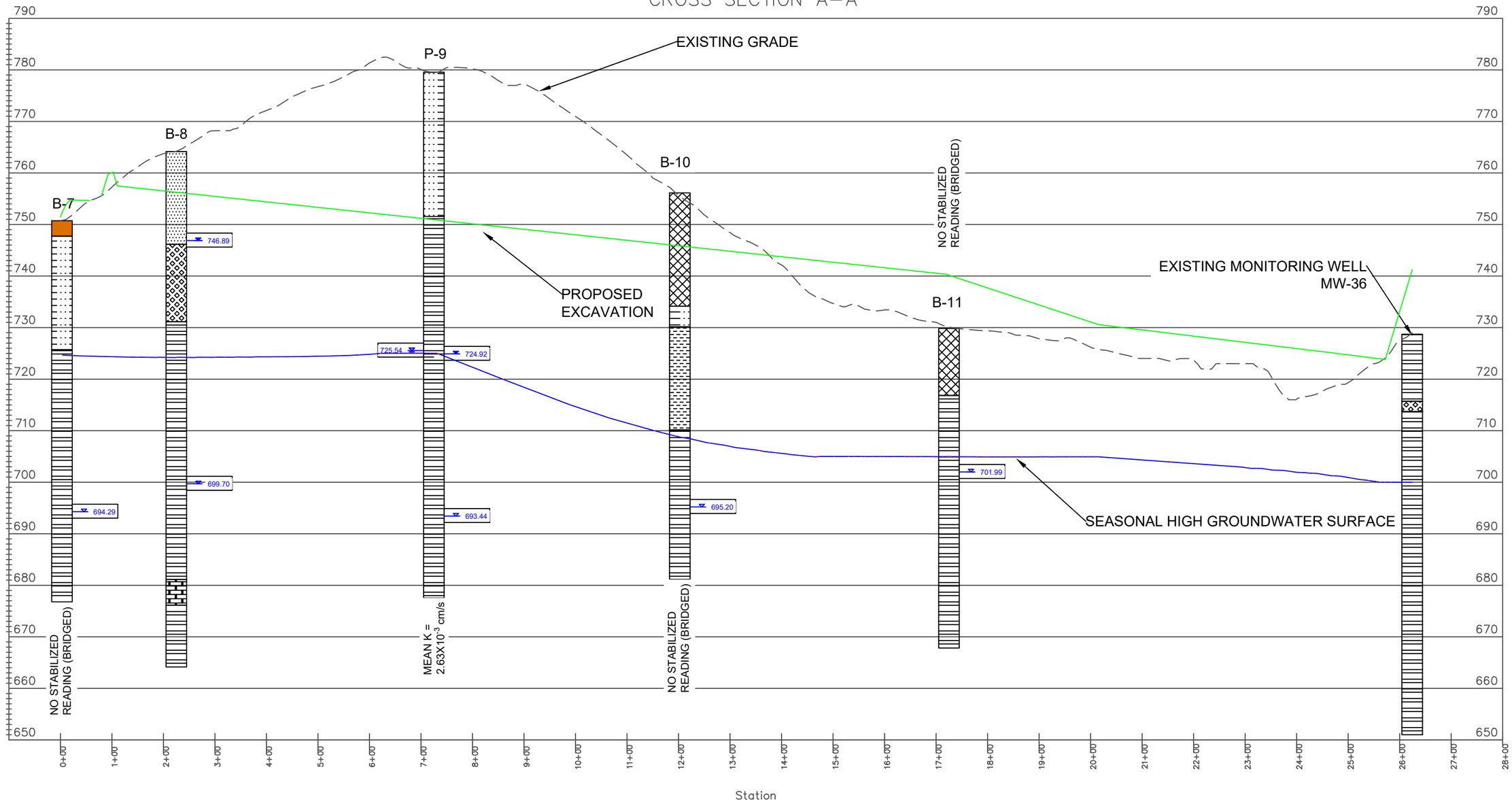
CADD FILE: BORING LOCATION MAP.DWG

DATE: 6/23/23

SCALE: 1"=500'

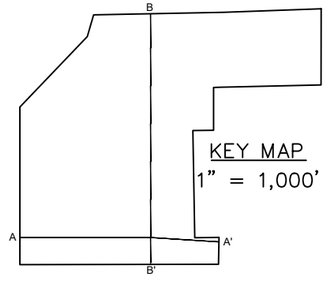
DRAWING NO. 3.2

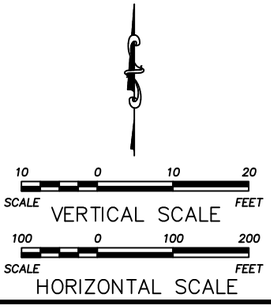
CROSS SECTION A–A'



LEGEND:

- EXISTING GRADE
- PROPOSED EXCAVATION
- SEASONAL HIGH GROUNDWATER SURFACE
- TOP SOIL
- SAND
- SILTY SAND
- SANDY SILT
- CLAY
- SILTY CLAY
- SANDY CLAY
- SHALE
- SANDSTONE
- LIMESTONE
- 723.34 SEASONAL HIGH GROUNDWATER LEVEL IN PIEZOMETER
- 723.34 OBSERVED GROUNDWATER ELEVATION
- 723.34 STABILIZED GROUNDWATER ELEVATION





REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: **CROSS SECTION A-A'**

PROJECT TITLE: **HYDROGEOLOGIC REPORT**

CLIENT: **AMERICAN ENVIRONMENTAL LANDFILL, INC**
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH: (913) 681-0030 FAX: (913) 681-0012

PROJ. NO. 27220345.00 | DSN. BY: TWL | Q/A REW BY: W.J.M | CHK. BY: W.J.M | PROJ. MGR: W.J.M | DSR. BY: TWL

CADD FILE: CROSS SECTIONS.DWG

DATE: 6/23/23

DRAWING NO. **3.3**

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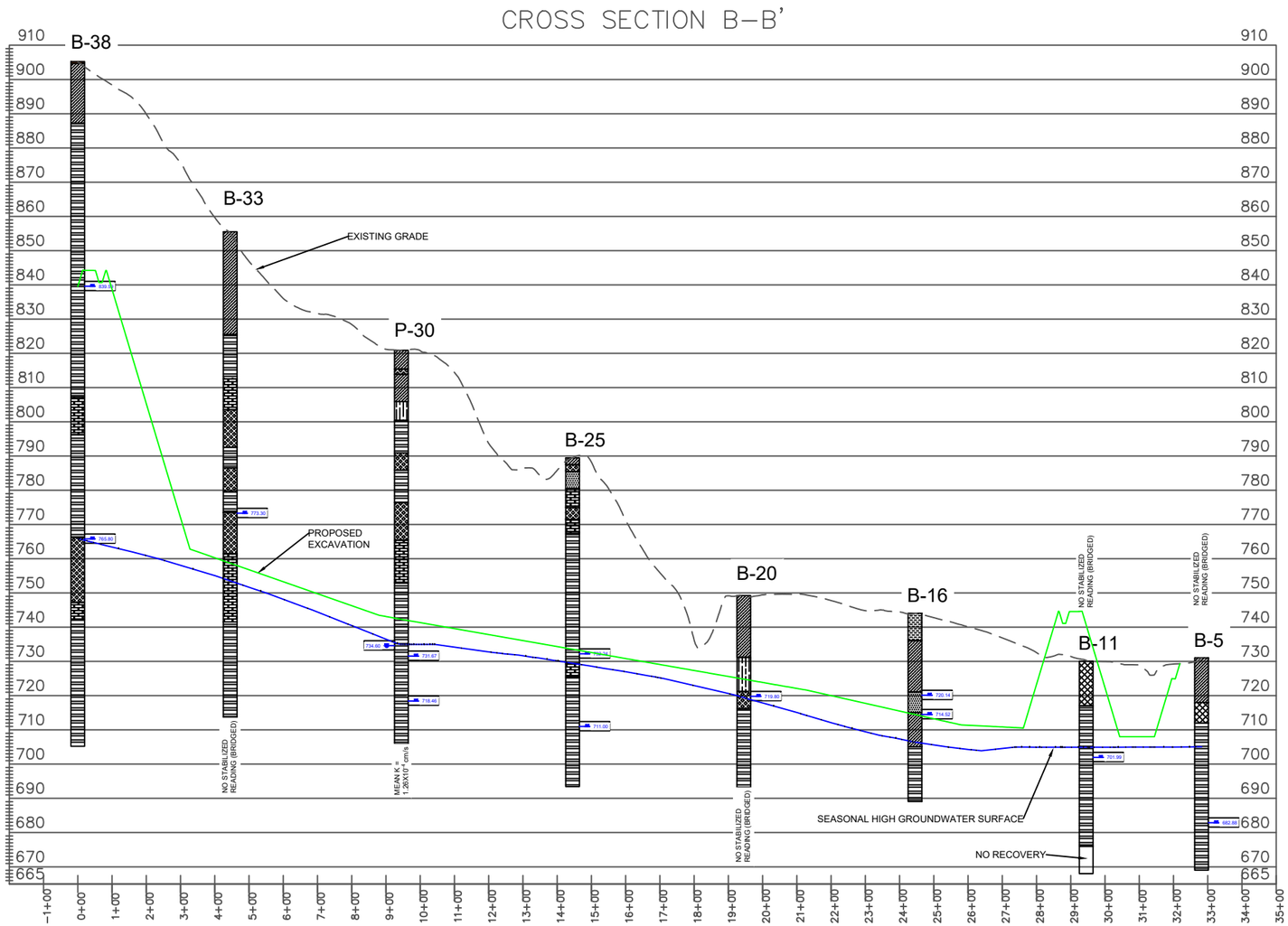
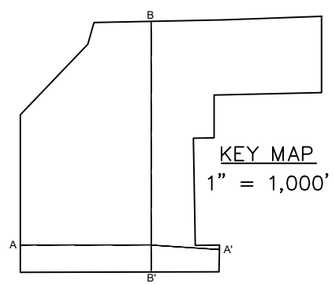
CROSS SECTION B–B'



LEGEND:

- EXISTING GRADE
- PROPOSED EXCAVATION
- SEASONAL HIGH GROUNDWATER SURFACE
- TOP SOIL
- SAND
- SILTY SAND
- SANDY SILT
- CLAY
- SILTY CLAY
- SANDY CLAY
- SHALE
- SANDSTONE
- LIMESTONE
- 723.34 SEASONAL HIGH GROUNDWATER LEVEL IN PIEZOMETER
- 723.34 OBSERVED GROUNDWATER ELEVATION
- 723.34 STABILIZED GROUNDWATER ELEVATION



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VERTICAL SCALE

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SCALE FEET
HORIZONTAL SCALE

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
CROSS SECTION B-B'

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
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PROJ. NO.	DSN. BY:	DWN. BY:	CHK. BY:	QA/A RVW BY:	PROJ. MGR
27220345.00	TWL	TWL	WJM	WJM	WJM

CADD FILE:
CROSS SECTIONS.DWG

DATE:
6/23/23

DRAWING NO.
3.4

Figure 4.1 Hydrograph
(MW-36, MW-38, P-1, P-4)

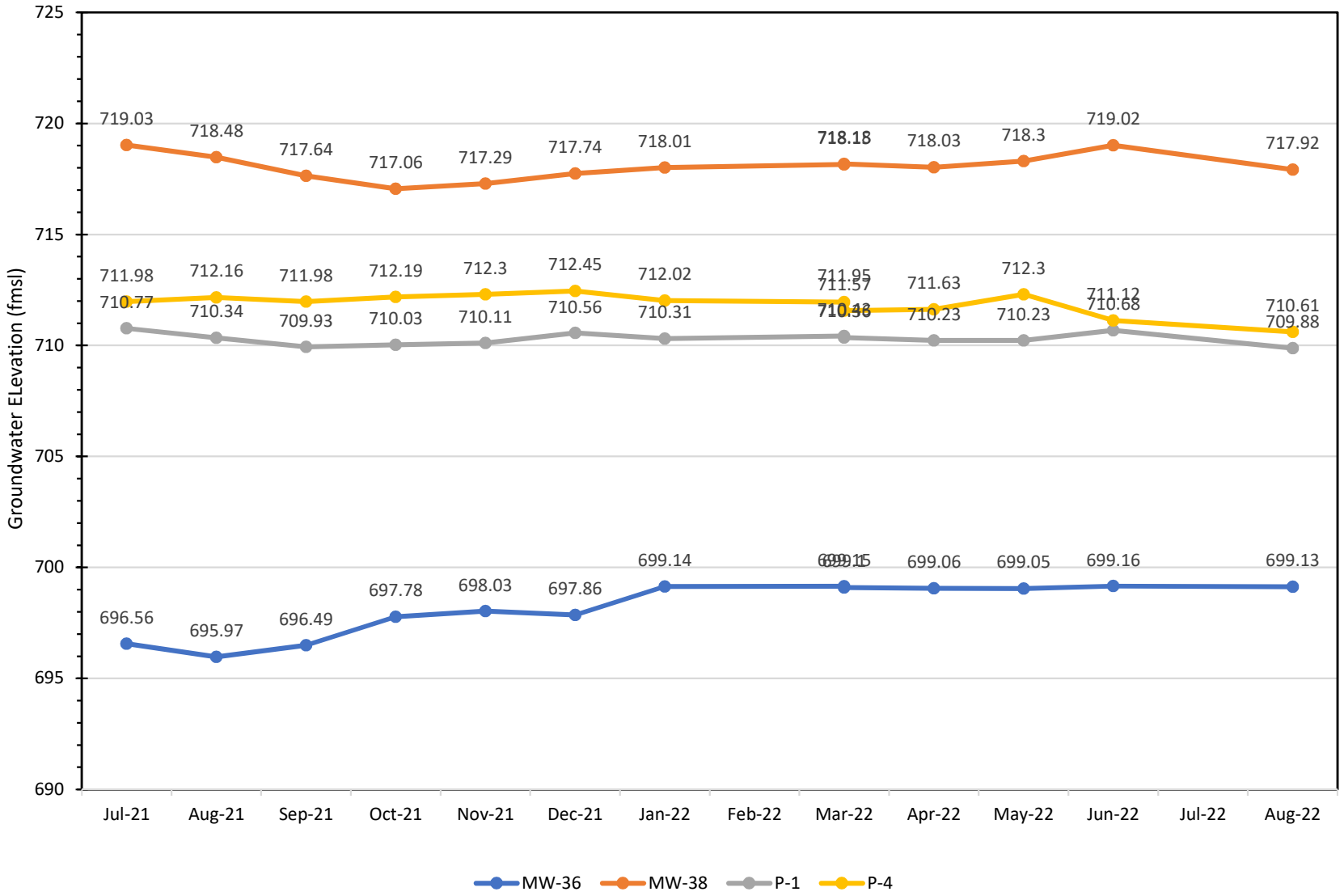


Figure 4.2 Hydrograph
(P-6, P-9, P-12, P-15)

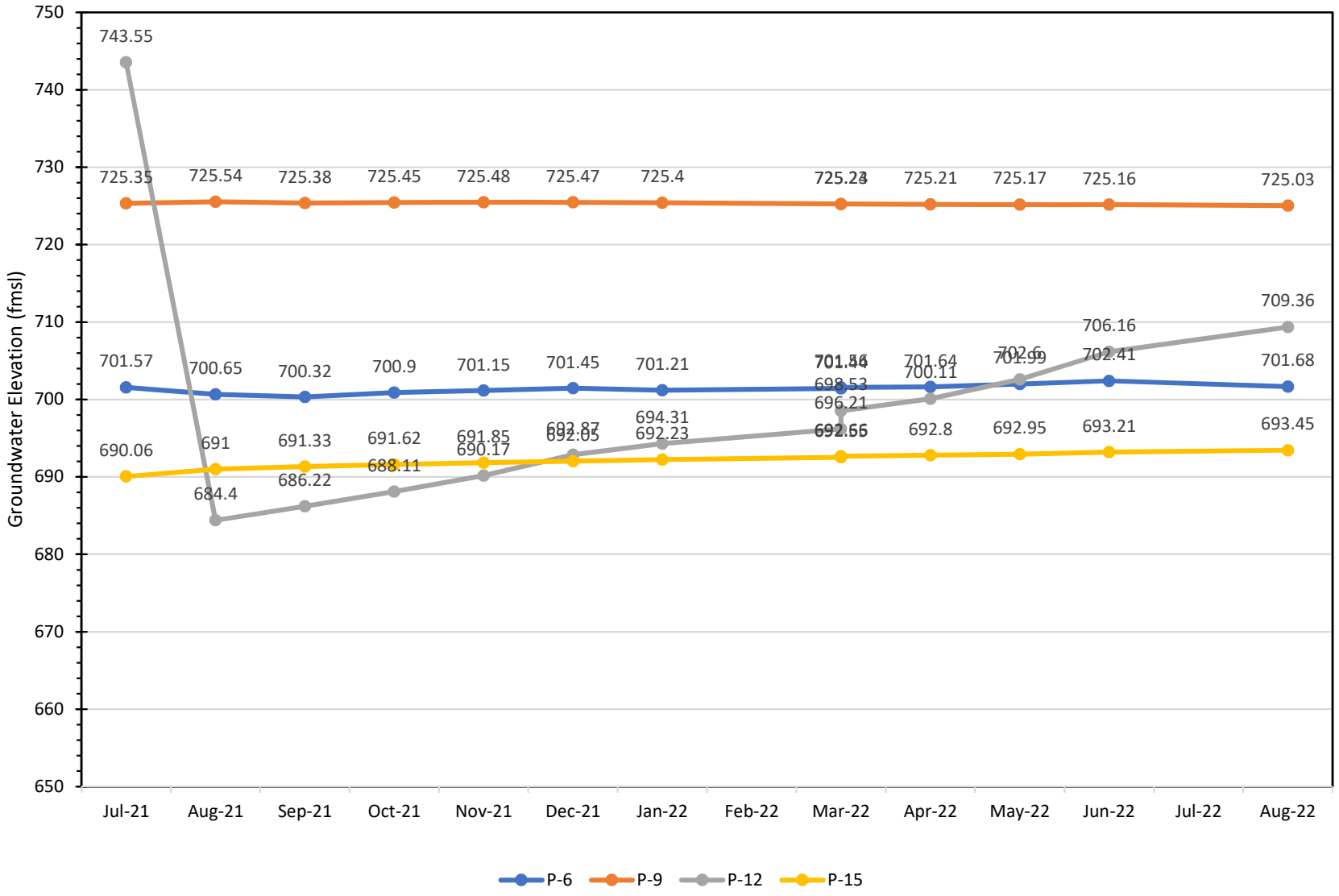


Figure 4.3 Hydrograph
(P-19, P-23, P-27, P-30)

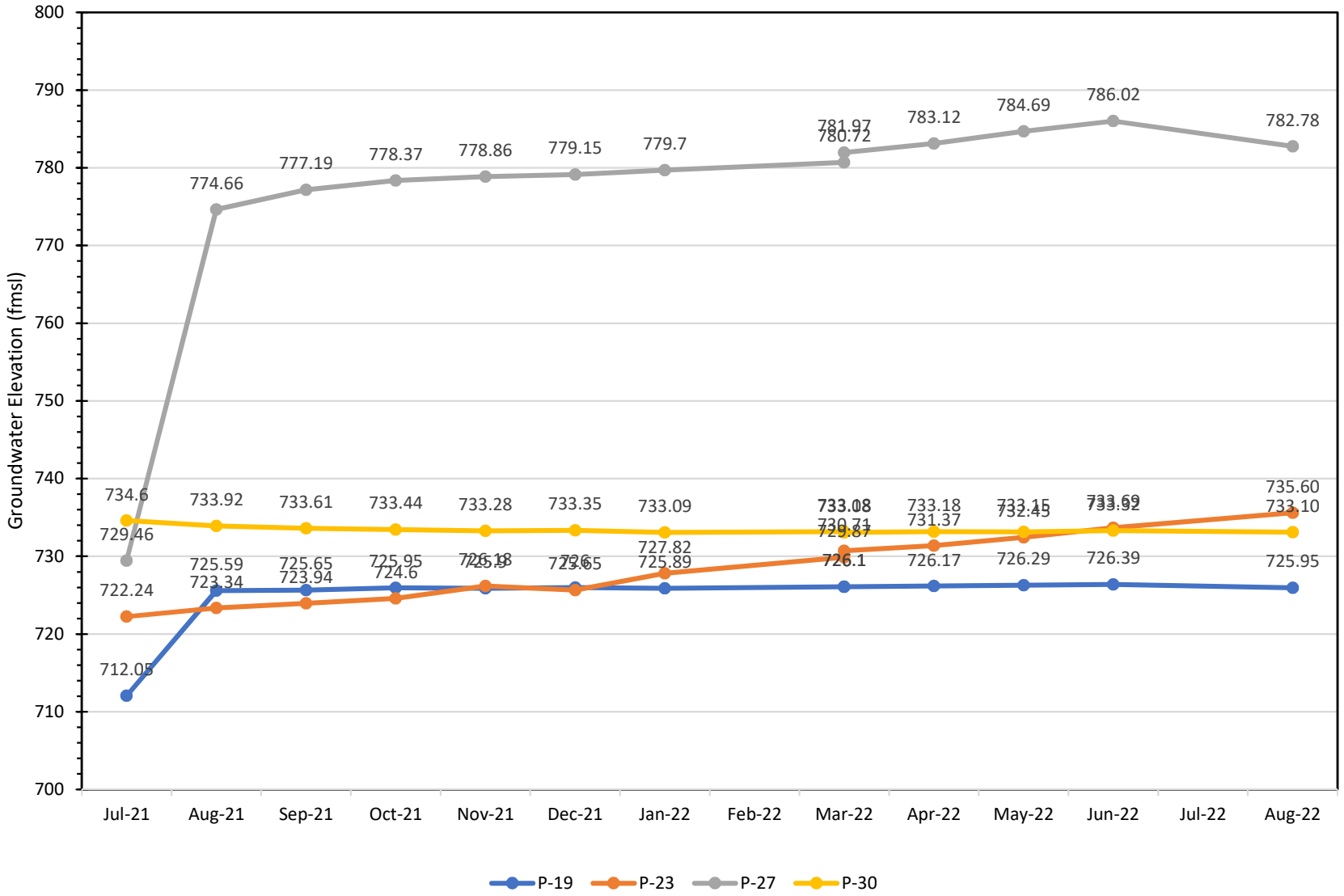


Figure 4.4 Hydrograph
(P-37, P-39, P-42)

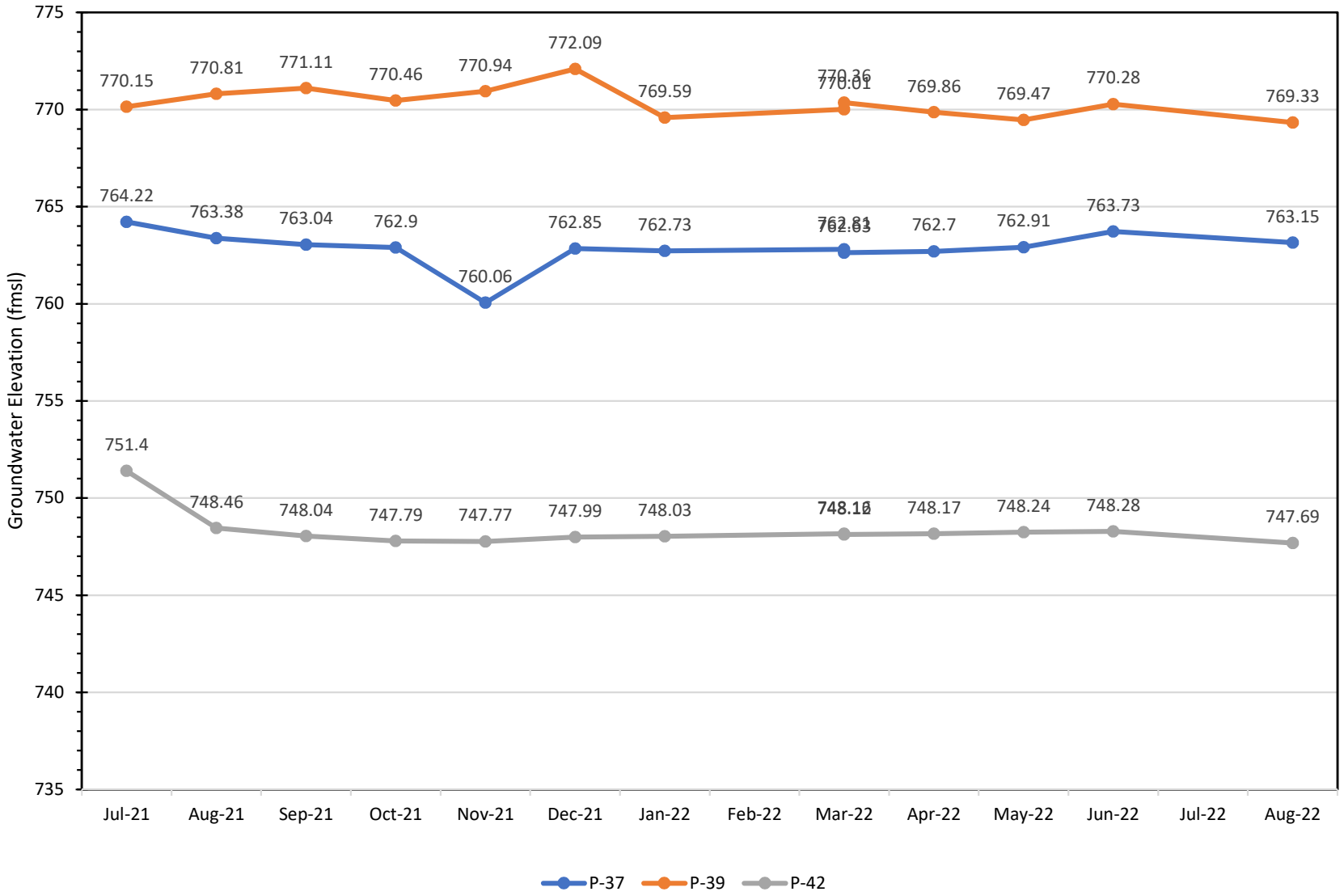
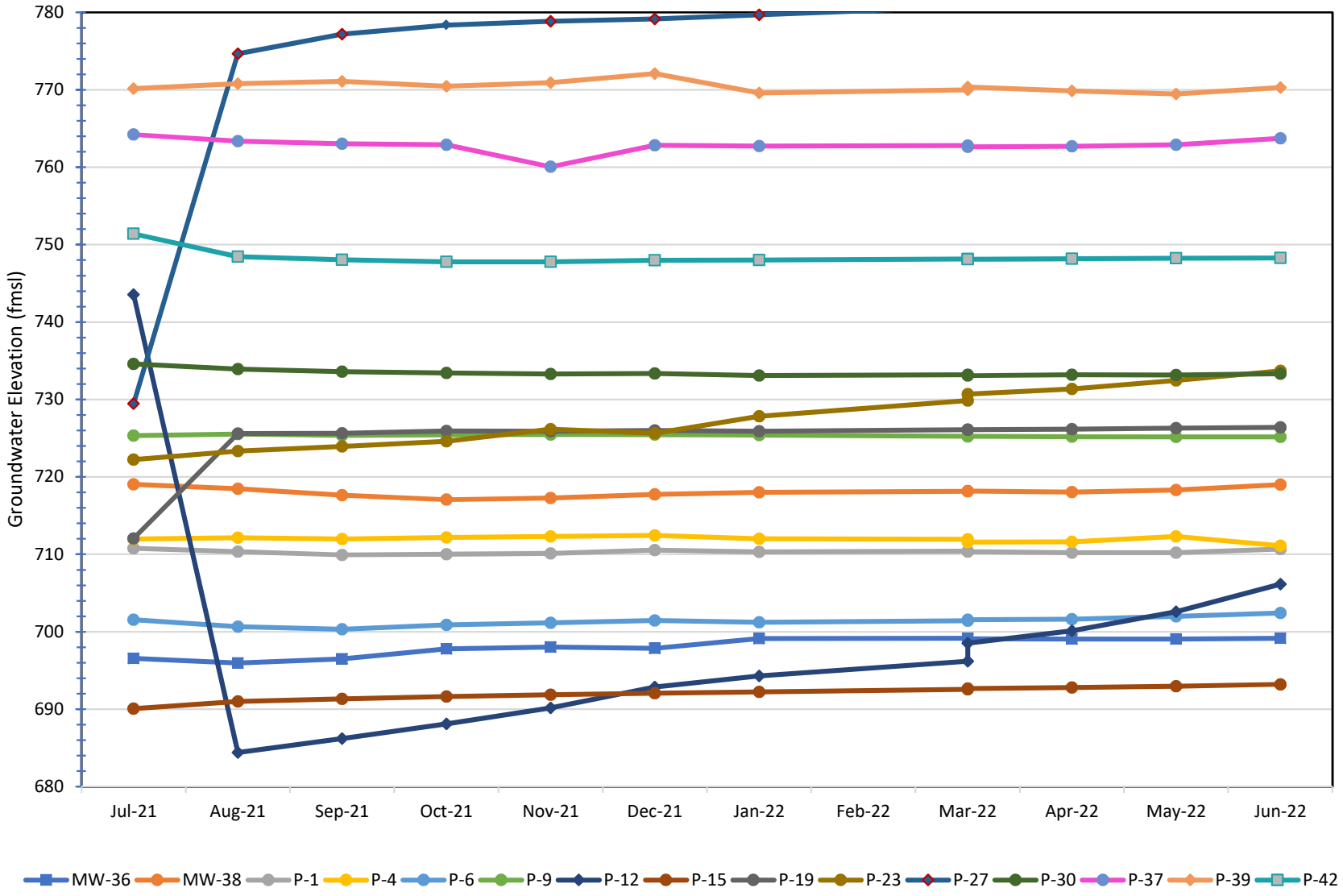


Figure 4.5 Hydrograph
(All monitoring points)



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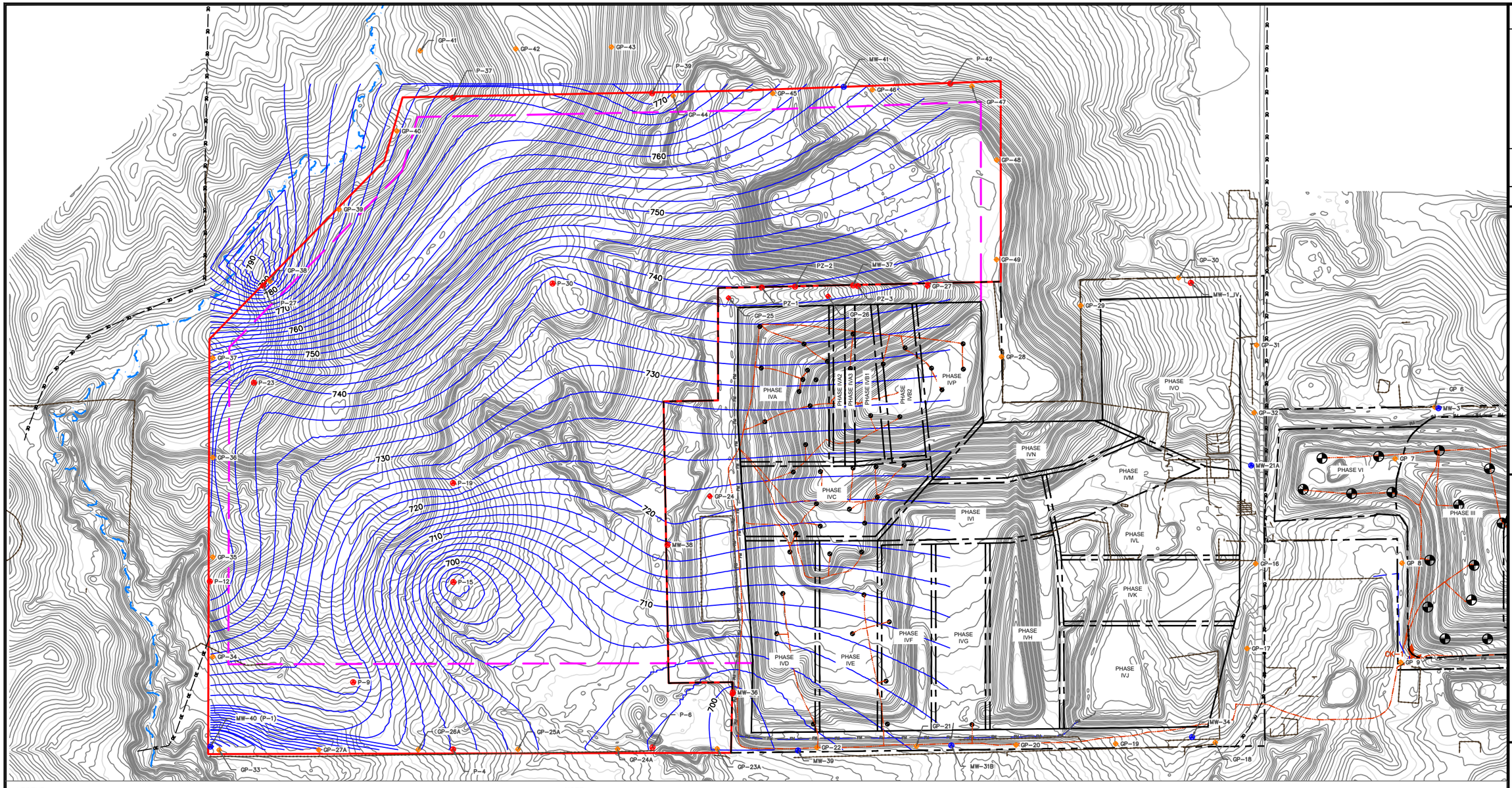


LEGEND:

- EXISTING 2' MINOR CONTOUR
- EXISTING 10' MAJOR CONTOUR (1570)
- EXISTING FENCE
- EXISTING OVERHEAD ELECTRIC (OE)
- EXISTING UNPAVED ROAD
- EXISTING PAVED ROAD
- EXISTING BODY OF WATER
- SOLID WASTE PHASE BOUNDARY
- SOLID WASTE PERMIT BOUNDARY
- EXISTING STREAM
- MONITORING WELL
- GAS PROBE
- EXTRACTION WELL
- MONITORING WELL ABANDOMENT
- GAS PROBE ABANDONMENT
- LANDFILL GAS COLLECTION SYSTEM PIPING
- ELECTRICAL CONDUIT
- LEACHATE FORCEMAIN (FM)
- PROPOSED EXPANSION AREA PERMIT BOUNDARY
- PROPOSED LIMITS OF WASTE
- SEASONAL HIGH GW SURFACE (AUGUST 2021 - JULY 2022)

NOTE:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.
2. PROPOSED GAS PROBES AND MONITORING WELLS ARE DEPICTED WITHIN THE EXPANSION AREA

250 0 250 500
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
SEASONAL HIGH WATER LEVEL

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

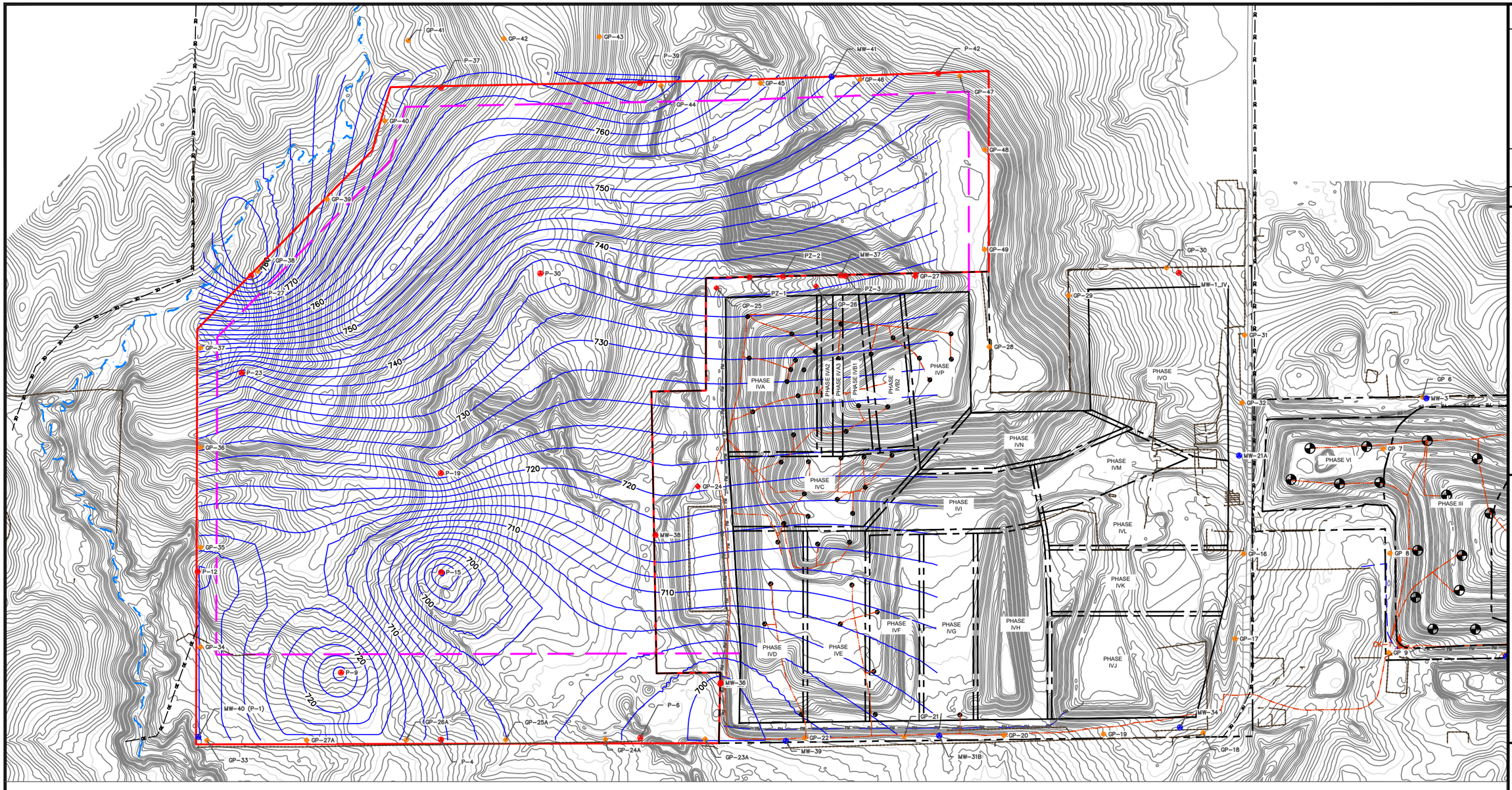
SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH: (913) 681-0030 FAX: (913) 681-0012

PROJ. NO.	DSN. BY:	DWN. BY:	CHK. BY:	Q/A REW BY:	PROJ. MGR.
27220345.00	TWL	TWL	W.JM	W.JM	W.JM

CADD FILE:
PIEZOMETRIC SURFACE MAP.DWG

DATE:
12/6/23

DRAWING NO.
4.6



LEGEND:

- EXISTING 2' MINOR CONTOUR
- 1570 EXISTING 10' MAJOR CONTOUR
- EXISTING FENCE
- OE OE EXISTING OVERHEAD ELECTRIC
- EXISTING UNPAVED ROAD
- EXISTING PAVED ROAD
- EXISTING BODY OF WATER
- SOLID WASTE PHASE BOUNDARY
- SOLID WASTE PERMIT BOUNDARY
- EXISTING STREAM
- MONITORING WELL
- GAS PROBE
- EXTRACTION WELL
- MONITORING WELL ABANDOMENT
- GAS PROBE ABANDONMENT
- LANDFILL GAS COLLECTION SYSTEM PIPING
- ELECTRICAL CONDUIT
- FM FM LEACHATE FORCEMAIN
- PROPOSED EXPANSION AREA PERMIT BOUNDARY
- PROPOSED LIMITS OF WASTE
- AUGUST 2022 GW SURFACE

NOTE:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.
2. PROPOSED GAS PROBES AND MONITORING WELLS ARE DEPICTED WITHIN THE EXPANSION AREA

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SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
AUGUST 2022 - WATER LEVEL

PROJECT TITLE
HYDROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

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8575 West 110th Street, Suite 100
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PROJ. NO.	DWN. BY:	Q/A RVW BY:
27220345.00	TWL	W.JM
DSN. BY:	CHK. BY:	PROJ. MGR
TWL	W.JM	W.JM

CADD FILE:
PIEZOMETRIC SURFACE MAP.DWG

DATE:
12/6/23

DRAWING NO.
4.7

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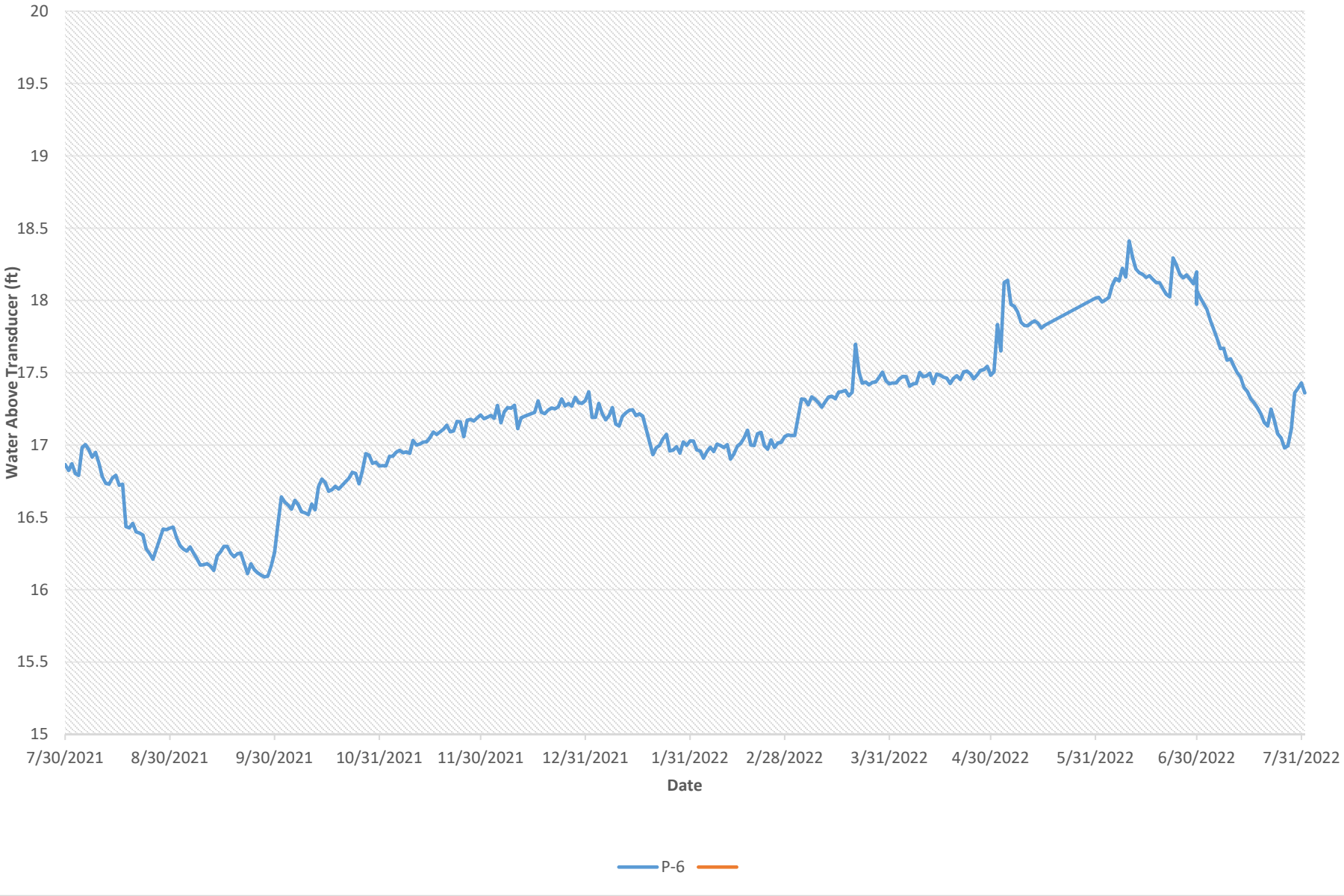
FIGURE 4.8 Continuous WLs P-6



(NOT TO SCALE)

SURFACE SEAL: CONCRETE OR CEMENT GROUT PLACED ABOVE THE ANNULAR SEAL FROM A DEPTH OF 2–FT TO GROUND SURFACE.

ANNULAR SEAL: BENTONITE CHIPS, CEMENT/BENTONITE GROUT, OR BENTONITE GROUT (SEE NOTE 1) PLACED FROM FILTER PACK SEAL TO WITHIN 2–FT OF GROUND SURFACE

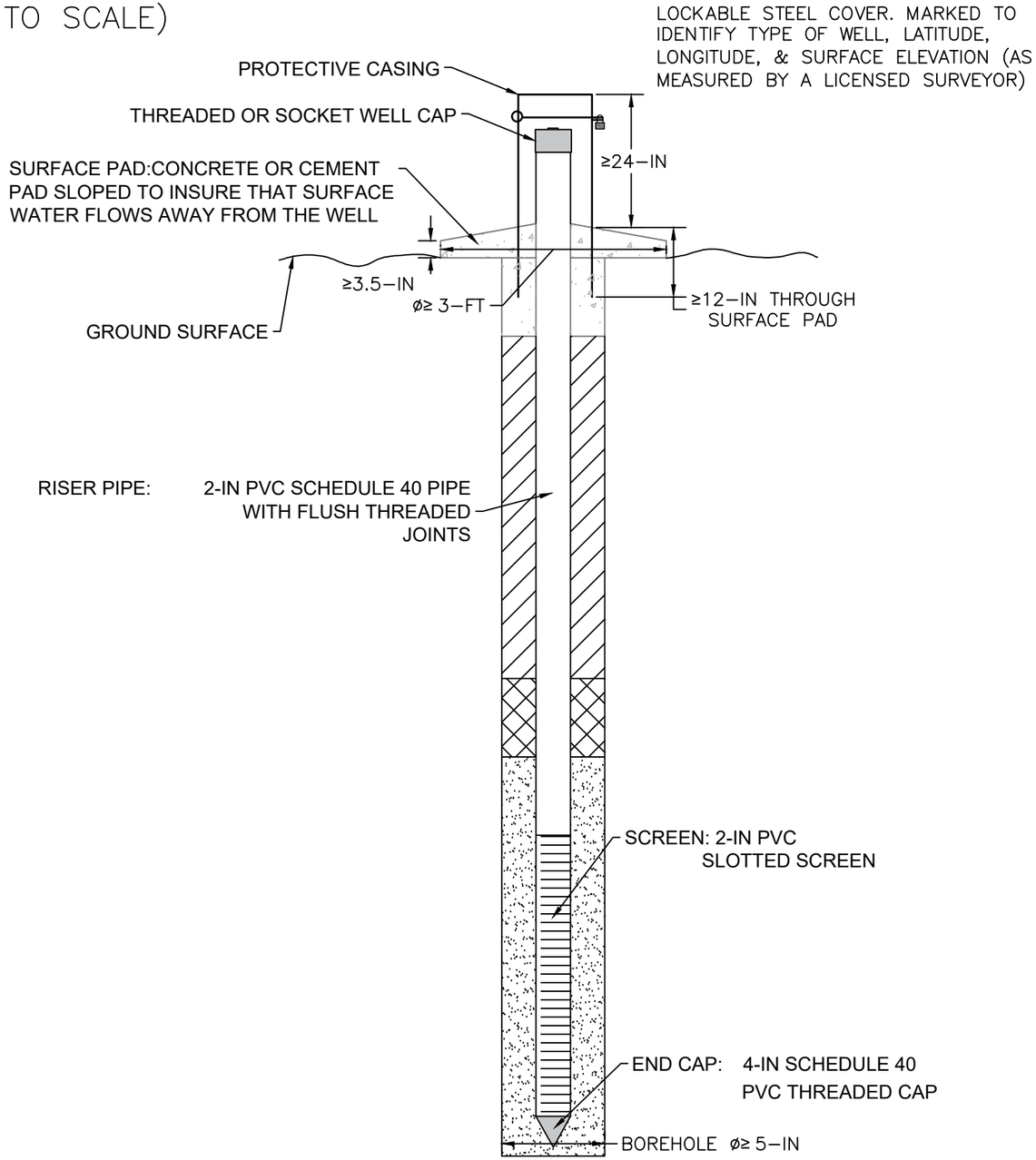
FILTER PACK SEAL: AT LEAST 2–FT OF HYDRATED BENTONITE (0.25"–0.75" IN SIZE) PLACED ABOVE FILTER PACK.

FILTER PACK: SILICA SAND; PLACED FROM BOTTOM OF BOREHOLE TO 2–FT ABOVE THE TOP OF SCREEN.

NOTES:

1. ANNULAR SEAL: CEMENT GROUT MIX RATIO OF 94–LBS CEMENT TO A MAXIMUM OF 6–GAL WATER IS USED, AND MIXED TO THE CONSISTENCY RECOMMENDED BY THE CEMENT MANUFACTURER. MAXIMUM OF TWENTY PERCENT (20%) BENTONITE BY DRY WEIGHT MAY BE ADDED TO THE CEMENT GROUT TO FORM THE CEMENT/BENTONITE GROUT MIXTURE. THE BENTONITE IS PREHYDRATED TO THE MANUFACTURER'S RECOMMENDED CONSISTENCY. THE BENTONITE GROUT HAS AT LEAST TWENTY PERCENT (20%) BENTONITE BY DRY WEIGHT, AND IS MIXED ACCORDING TO THE MANUFACTURER'S RECOMMENDED CONSISTENCY.

2. WHEN THE PLACEMENT OF GROUT WILL EXCEED 20–FT, THE GROUT IS PLACED THROUGH A TREMIE PIPE AND FILLED OR PUMPED FROM THE BOTTOM UPWARD.



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SHEET TITLE
TYPICAL MONITORING WELL CONSTRUCTION

PROJECT TITLE
HDYROGEOLOGIC REPORT

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
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PROJ. NO.	DSN. BY:	Q/A RVW BY:
27220345.00	TWL	WJM
DSN. BY:	CHK. BY:	PROJ. MGR.
TWL	WJM	WJM

CADD FILE:
TYPICAL MONITORING WELL CONSTRUCTION.DWG

DATE:
12/5/23

DRAWING NO.
5.1

Appendix A

Drilling Plan and Approvals

November 19, 2020
File No. 27219106.00

Ms. Cindy Hailes
Oklahoma Department of Environmental Quality
Division of Land Protection
707 N. Robinson
P.O. Box 1677
Oklahoma City, OK 73101-1677

Subject: NOD Response – Drilling Plan
American Environmental Landfill
Permit No. 3557021

Dear Ms. Hailes:

On behalf of our client, American Environmental landfill, Inc., SCS Engineers is submitting this response to the Notice of Deficiency dated November 17, 2020 from the Oklahoma Department of Environmental Quality (ODEQ) associated with the American Environmental Landfill Drilling Plan for the proposed 203-acrea horizontal expansion. SCS Engineers has addressed the deficiencies noted in the Notice of Deficiency and those responses are shown below.

1. *Please include the OAC 252:515 Appendix D calculations, used to determine the number of required borings; and*

Response: Section 1.2 has been revised while incorporating Table 1 used to determine the number of required borings.

2. *Please designate which borings meet the requirements of OAC 252:515-7-4(b)(4)(B). OAC 252:515-7-4(b)(4)(B) requires at least three borings drilled 200 feet deep or a minimum of 10 feet drilled into the uppermost saturated zone, whichever is less, in accordance with OAC 252:515 Appendix D. Table 2 boring B-38 is the deepest boring listed at 184 feet below ground surface.*

Response: Section 3.2.1 and Table 3 (Figure 1) have been revised. Borings B-28, B-32, and B-38 will be drilled two hundred feet deep or a minimum of ten feet into the uppermost saturated zone, whichever is less.

We trust that the attached documents include all necessary information sufficient for your approval. If you have any questions or comments, or need additional information, please do not hesitate to contact the undersigned. Thank you very much for your time and effort in this matter.

Sincerely,

Wade J. Miller
Project Director

Sarah Rafalowski, PE
Senior Project Professional

cc: Mr. Todd Green – American Environmental Landfill

Drilling Plan for 203-Acre Expansion of American Environmental Landfill Permit # 3557021

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063
918-245-7786

SCS ENGINEERS

27219016.00 | November 19, 2020

1817 Commons Circle, Suite 1
Yukon, Oklahoma 73099
405.265.3960

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Tables

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Drilling Plan (Plan) is to provide guidance and rationale for activities being conducted in association with the subsurface investigation for the proposed 203-acre horizontal expansion of the American Environmental Landfill near Sand Springs, which is owned and operated by American Environmental Landfill, Inc. (AEL). This Plan has been developed and prepared in accordance with the Oklahoma Department of Environmental Quality (ODEQ) Oklahoma Administrative Code (OAC) 252:515.

1.2 SCOPE AND OBJECTIVES

The Plan will involve obtaining geologic and hydrogeologic data to aid in the design and construction of the proposed landfill expansion. The work will entail drilling, piezometer installation, aquifer testing, sampling, and analysis of the conditions and materials present at the proposed landfill expansion site. Per OAC 252:515-7-4(b)(3)(C) for areas larger than five acres, additional borings shall be placed in accordance with **Table 1** below.

Table 1. Borings In Drilling Plan
Proposed Expansion - AEL Landfill
Sand Springs, Osage County, Oklahoma

Size of Site	Total Number of Borings Required	Number of Borings Drilled at Least Ten Feet Into the Uppermost Saturated Zone
5 acres or less	4	3
> 5-10	5	3
> 10-15	6	3
> 15-20	7	3
> 20-25	8	4
> 25-30	9	4
> 30-35	10	4
> 35-40	11	4
> 40-45	12	5
> 45-50	13	5
> 50-55	14	5
> 55-60	15	5
> 60-65	16	6
> 65-70	17	6
> 70-75	18	6
> 75-80	19	6
> 80-85	20	7
> 85-90	21	7
> 90-95	22	7

> 95-100	23	7
> 100-105	24	8
> 105-110	25	8
> 110-115	26	8
> 115-120	27	8
> 120-125	28	9
> 125-130	29	9
> 130-135	30	9
> 135-140	31	9
> 140-145	32	10
> 145-150	33	10
> 150-155	34	10
> 155-160	35	10
> 160-165	36	11
> 165-170	37	11
> 170-175	38	11
> 175-180	39	11
> 180-185	40	12
> 185-190	41	12
> 190-195	42	12
> 195-200	43	12
> 200-205	44	13

Based upon **Table 1**, 44 borings are required for the proposed 203-acre horizontal expansion. As allowed by OAC 252:151-7-4(b)(3)(D), 2 existing wells located within 200 feet of the proposed boundary are proposed to replace required borings as discussed in Section 2.7. Data collected from routine monitoring and past expansion investigations was utilized in determining placement of 44 borings (42 to be drilled within proposed expansion and utilizing 2 existing wells within the Phase IV permit boundary), which will be drilled to determine the subsurface conditions beneath the site. Potential borings and piezometers locations are presented in **Figure 1**. Aquifer testing will be performed to evaluate the hydraulic properties of the materials that underlie the site. Groundwater levels and precipitation measurements will be collected to determine seasonal potentiometric surface variations and the effect of surficial recharge on the uppermost continuous aquifer beneath the site.

2.0 BACKGROUND INFORMATION

2.1 PHYSICAL SETTING

The proposed landfill expansion site (Site) consists of approximately 203 acres on the north and west sides of the existing permit boundary, located approximately 3 miles northwest of Sand Spring in Osage County, Oklahoma. The expansion is located in portions of Section 35 and Section 36, Township 20 North, Range 10 East of the Indian Meridian (Wekiwa USGS Topographic Quadrangle). Refer to **Figure 2** for the site location map.

Site specific maps have been generated and/or appended in accordance with OAC 252:515-7-4(b)(2) for the following:

- Figure 1 - Contour Map & Proposed Boring Locations
- Figure 2 - Site Location Map
- Figure 3 - Flood Plain Map
- Figure 4 - Map of Alluvium & Terrace Deposits
- Figure 5 - USGS Topography 7.5 Minute Quadrangle
- Figure 6 - Typical Monitoring Well Construction
- Appendix C - Seismic Hazard Map

2.2 CLIMATE

The climate for Osage County, Oklahoma is humid and temperate, and is characterized by warm summers and cold, dry winters. Average temperatures range between 48 °F and 72 °F. Mean annual precipitation is approximately 39.78 inches, with approximately 202 days in the growing season (OCS).

2.3 PHYSIOGRAPHY

The proposed Site is located within the Osage Plains, a section of the Central Lowland province, which in turn is part of the larger Interior Plains physiographic province. Three subregions make up the Osage Plains; the subregion that stretches across central Oklahoma is known as the Cross Timbers region. The woodland and savanna portions of the Cross Timbers are mainly post oak and blackjack oak on coarse, sandy soils, while the prairie portions are chiefly tallgrass on finer, dry soils.

Surface elevations at the Site range from approximately 720 to 900 feet above mean sea level. The vegetative cover is predominantly mature oak/hickory woodlands with a native grass understory on steep sloping hills. Two drainage ways transect the subject site from north to the south for approximately 1 mile before joining the Arkansas River. **Figure 3** shows the flood plains and river from the Flood Insurance Rate Maps (FIRM) for the area surrounding the existing and expansion sites.

2.4 SOILS

Soils on the Site are primarily comprised of the Niotaze-Bigheart-Rock outcrop complex (approximately 37%), Dougherty loamy fine sand (approximately 28%), Bigheart-Niotaze-Rock outcrop complex (approximately 27%), Agra-Ashport complex (approximately 4%), 3 to 5% slopes Norge silt loam (approximately 3%) and Eufaula loamy fine sand (approximately <2%).

2.5 GEOLOGY AND HYDROGEOLOGY

According to the Oklahoma Geological Survey, the local geology consists of several Pennsylvanian-age shale, sandstone and limestone formations known as the Wann Formation, Iola Formation and Chanute Formation. The Wann Formation occurs at the highest elevations in the Site's vicinity and consists of shale and fine-to medium-grained sandstone with many thin layers of fossiliferous limestone. Total thickness varies from 50 to 500 feet.

Next highest is the Iola Formation consisting of three members, which are, in descending order: 1) Avant Limestone; 2) Muncie Creek Shale; and 3) Paola Limestone. Total thickness of the formation varies from 7, to as much as 70 feet, depending on the thickness of the middle clastic unit within the Avant Limestone. The Avant Limestone consists of an upper and lower limestone, separated by and an intervening interbedded sandstone and shale interval; the Muncie Creek Shale is a well-laminated to fissile, phosphatic clayshale (approximately 25 ft thickness); and the Paola Limestone is usually a single bed of skeletal wackestone to packstone; oolids and glauconite may occur locally (averages <1 ft thickenss).

The Chanute Formation is mostly a grayish orange to pale yellowish brown, laminated to blocky bedded, weakly calcareous, very silty clayshale to mudshale; ; silt content and loss of bedding in shale increases toward top of formation. Locally, an 8' to 10' thick, indurated, laminated to thin-bedded, fine to very fine-grained sandstone that may correlate to the Cottage Grove Sandstone, occurs near the top of the formation. The Thayer Coal also occurs in the formation, but was not observed in the field area. Total thickness of the formation about 130 ft.

Beneath the previously mentioned formations and exposed to the east of the existing permit boundary, is the Dewey Formation. The Dewey Formation consists of two, thin, slightly sandy limestone beds with an intervening shale and sandstone interval. Total thickness of the formation about 40 ft.

According to the Oklahoma Water Resources Board, the nearest aquifer is the Arkansas River Alluvial Aquifer. The area covered by the aquifer is located southeast of the existing and proposed permit boundaries, and extends around the river in an area of 860 mi^2 in northeast Oklahoma. The large outcrop area combined with precipitation of up to 50 inches per year is conducive to high infiltration rates. The average saturated sand thickness of the aquifer is 250 feet, and it is estimated to contain 31,600,000 acre-feet of water having less than 1,000 ppm total dissolved solids.

2.5.1 Alluvium and Terrace Deposits and Recharge Areas

Oklahoma Geological Survey's quadrangle map of the area indicates that Terrace Sands are possibly present on the southern portion of the proposed expansion area. The map legend notes that extensive terrace deposits occur along the north bank of the Arkansas river, consisting mainly of unconsolidated fine- to very fine-grained quartz sand, silt, and wind-blown loess; little to no gravel-sized material observed. Thickness varies from 0 to as much as 100 feet.

As shown in **Figure 4**, there may be a portion of the proposed expansion that overlaps with a terrace deposit area depicted on the map. However, previous boring logs from the Phase IV area near the 203-acre expansion indicate sandstones and shales underlay the expansion site, which are consolidated formations and not terrace deposits. Once soil testing is completed (as outlined in later sections), it will be possible to further investigate the location and extent of any alluvium and terrace deposits on the property.

2.5.2 Coordination with USACE

As part of the 203-Acre Expansion, AEL has been working with the U.S. Army Corps of Engineers (USACE) to obtain an Individual Permit under Section 404 of the Clean Water Act (CWA) to place fill material into an unnamed tributary of Arkansas River. The Joint Public Notice sent by USACE and ODEQ for the permit application is attached in **Appendix D**. The unnamed tributary of Arkansas River is included in **Figure 1**, and the proposed drilling locations offset the stream by at least 90 feet. The offset is sufficient to ensure the stream is not impacted by the activities described in this plan.

2.6 SEISMICITY

Based on the USGS U.S. Seismic Hazard Map, *Peak Horizontal Acceleration with 2% Probability of Exceedance in 50 Years* (2018), the location of the Site is depicted as exhibiting a maximum horizontal acceleration of between 0.6 and 1 percent of gravity with a 98 percent probability of not exceeding the horizontal acceleration within a 50-year reoccurrence. This acceleration factor may be utilized during seismic analysis of soil performance to liquefaction and during design of structural elements to resist earthquake forces.

Based on the USGS report, *One-year seismic hazard forecast for the Central and Eastern United States from induced and natural earthquakes* (2018), the Site had a 2-5% chance of potentially minor damage in 2018. **Appendix C** includes the USGS Map Caption that gives context to the increased short-term seismic hazard in Oklahoma.

2.7 EXISTING WELLS TO BE UTILIZED DURING SUBSURFACE INVESTIGATION

As allowed by OAC 252:151-7-4(b)(3)(D), 2 existing wells located within 200 feet of the proposed boundary are proposed to replace required borings. Groundwater elevations, surveyed location and waste depth are presented for the existing wells in **Table 2**. The locations of the existing borings are included in **Figure 1** and boring logs are included in **Appendix B.**

Table 2. Existing Wells

Well ID	Northing	Easting	Elevation at TOC (ft MSL)	Lowest Depth to Groundwater[1] (ft below TOC)	Date Gauged	Water Level Elevation (ft MSL)	Deepest Proposed Placement of Waste (ft MSL)	Total Depth Elevation (ft MSL)	Well Depth below Proposed Waste Depth (ft)	Screen Length (ft)
MW-36	427948.70	2500404.97	731.1	32.1	6/20/2013	699.0	704.0	671.6	32.4	10
MW-38	428689.42	2500077.29	729.5	11.6	12/17/2015	717.9	722.9	682.4	40.5	10

Abbreviations: TOC=Top of Casing; ft MSL=feet above mean sea level

[1] Lowest depth to groundwater was determined by reviewing semi-annual gauge readings taken over the following period: March 2013 to June 2020.

3.0 TECHNICAL APPROACH

3.1 PLAN STRATEGY

This Plan will utilize a strategy that will allow for flexibility in approach while meeting the regulatory criteria for the proposed landfill expansion. This will allow the detail of information collected to be increased or decreased in order to accommodate specific situations encountered during the work.

3.2 SUBSURFACE INVESTIGATION

3.2.1 Soil and Bedrock

Data collected from routine monitoring and past expansion investigations was utilized in determining placement of 44 borings (42 to be drilled within proposed expansion and utilizing 2 existing wells within the Phase IV permit boundary), which will be drilled to aid in the characterization of the hydrogeologic and soil conditions underlying the proposed expansion site. **Table 3** located alongside **Figure 1** lists the 42 borings with approximate locations and depths. However, if complex hydrogeology exists, such as groundwater divides, shallow saturated zones, or hydraulic barriers, additional borings may be required. Data collected from routine monitoring and existing wells will also be used to aid in the characterization at the Site. These locations will be advanced using a combination of one or more of the following dry drilling methods:

- Hollow stem auger
- Air rotary
- Cable tool
- Sonic

Per OAC 252:515-7-4(b)(4)(A): all borings will be drilled a minimum of thirty feet below the deepest proposed placement of waste, the elevation of which shall be reported in relation to mean sea level; and at least thirteen borings will be drilled a minimum of ten feet into the uppermost saturated zone.

Per OAC 252:515-7-4(b)(4)(B): at least three borings shall be drilled two hundred feet deep or a minimum of ten feet into the uppermost saturated zone, whichever is less. Borings B-28, B-32, and B-38 will be drilled two hundred feet deep or a minimum of ten feet into the uppermost saturated zone, whichever is less.

Geophysical logging will be completed on the thirteen boreholes converted to piezometers. The geophysical logs will be obtained using gamma ray/neutron logs or an alternative method approved by ODEQ from the total depth to the surface, in either open hole or behind casing.

Soil/rock samples will be collected at a rate of 1 sample per 5 feet of soil/rock drilled and at soil and rock changes from the surface to the total depth drilled. The samples will be stored until directed by AEL to dispose of them. Specific details concerning subsurface investigative methodologies and procedures are provided in **Section 4.0** of this Plan.

3.2.2 Groundwater

Borings will be advanced into the uppermost water-bearing geologic unit beneath the Site while thirteen borings will be completed as piezometers. The proposed piezometers include P-1, P-4, P-6,

P-9, P-12. P-15, P-19, P-23, P-27, P-30, P-37, P-39 and P-42 and will be logged with geophysical methods. See **Figure 1** for approximate locations and surface elevations.

The water-bearing unit will need to yield sufficient quantities of groundwater for regular sampling events. Aquifer testing and/or field hydraulic conductivity (slug) tests will be performed on selected piezometers.

Details describing the specific procedures for installation and completion of the piezometers and performance of field testing are presented in **Section 4.0**.

3.3 SAMPLING AND GROUNDWATER ELEVATIONS

3.3.1 Soil Sampling

To aid in the characterization and determination of the site as a suitable location for a horizontal landfill expansion, soil samples will be collected for testing (see **Appendix A**). The samples will be shipped to a geotechnical laboratory and tested under the direction of a licensed professional engineer. The following tests will be conducted on each type of soil sampled:

- Soil classification according to the specifications of ASTM D2487
- Particle-size analysis of soil according to the specifications of ASTM D422
- Sieve analysis for the following screen sizes: #4, #10, #40, #200
- Percent fines (#200 sieve) according to the specifications of ASTM D1140
- Atterberg limits according to the specifications of ASTM D4318
- Moisture content according to the specifications of either the oven drying method of ASTM D2216 or the microwave drying method of ASTM D4643
- Moisture-density relationship according to the specifications of the standard proctor test of ASTM D698 or the modified proctor test of ASTM D1557
- Hydraulic conductivity according to the specifications of ASTM D5084

3.3.2 Groundwater Elevations

In accordance with OAC 252:515-7-54(a), groundwater elevations will be collected monthly for one year, to aid in establishment of groundwater flow direction and aquifer geometry underlying the proposed horizontal expansion. SCS will install a continuous water level monitoring system in one piezometer, and will monitor the water levels in all other piezometers once each month for 12 consecutive months on approximately the same date each month. If significant changes in the water level in the continuous monitor are identified following heavy rainfall events, ODEQ may require additional measurements in other piezometers to further define the level of highest groundwater elevation. In the event that trends in the data indicate that groundwater characteristics are similar to previously collected data, a shortened piezometric measurement period may be requested.

SCS will obtain daily and monthly precipitation data from the climatological station closest to the expansion area, for the months in which the on-site measurements were taken and for the preceding 12 months. CLIMOCS will be used to obtain the 30-year mean precipitation from the climatological station. The precipitation data will be used to interpret any fluctuations in the piezometric surface throughout the site characterization period.

3.4 QUALITY ASSURANCE/QUALITY CONTROL

The quality assurance (QA) objective for analytical data is to collect environmental monitoring data of known and acceptable quality. To meet this objective, the following quality control (QC) parameters and measures for meeting each parameter is listed below:

- Precision and Accuracy (obtain reproducible results within accuracy imposed by the intended use of data)
  - Use of ASTM or approved procedures for field and laboratory measurements
  - Calibration of instruments in accordance with approved protocol or manufacturer recommendations
- Representativeness (accurately represents the actual site conditions)
  - Assessed after initial data validation and reduction, so further analysis will be based only on validated data.
- Completeness (provide sufficient valid data to meet the goals of the investigation)
  - Assessed by comparing the number of the valid sample results to the number of samples collected.
- Comparability
  - Establish that the data developed during the investigation are comparable with applicable criteria and with data available from other scientific studies in the area.

3.5 REPORTING

Per OAC 252:515-7-38, AEL will complete a regional hydrogeologic study of the proposed Site and the results included with the Tier III permit modification application. AEL will collect the following information to be included:

- The formation underlying the deepest formation penetrated by the boreholes and/or piezometers;
- All formations exposed in the outcrop on or within 1/4 mile of the proposed permitted boundary;
- A geologic column and structural information of all rock formations occurring from surface to a depth of 500 feet;
- A regional surface geological map;
- Illustrations of the regional stratigraphic column and geologic or hydrogeologic cross sections;
- A description of regional groundwater quality; and
- References indicating the sources of information.

4.0 PROCEDURES

This chapter presents the details regarding specific types of field investigation procedures. These procedures include drilling, piezometer installation, aquifer testing, sample collection, and decontamination. In addition, health and safety measures, methods for managing investigation-derived waste, and sample-handling/chain of custody procedures are provided.

4.1 HEALTH AND SAFETY

Drilling and sampling personnel will conduct operations in accordance with promulgated Occupational Safety and Health Administration (OSHA) regulations. Upon arrival at the site work location, field personnel will record the time, location, and weather conditions in the field logbook. Field personnel will be suited in Modified Level D personal protective equipment (PPE), which consists of:

- Steel-toed boots
- Hard hat
- High-visibility vest or shirt
- Safety glasses, splash goggles, or face shield
- Hearing protection

4.2 DRILLING AND SAMPLING

4.2.1 Overview

Drilling and sampling procedures can be conducted by using a number of different methods. The variability of geologic and topographic conditions, in addition to the engineering or protocol requirements will dictate the type of equipment and methodologies to be employed on any specific project.

4.2.1.1 Auger Drilling

Auger drilling utilizes a spiral tool form to convey dug material to the surface. An auger is essentially a conveyor which has a drill head, or cutting bit, or combination head and bit at its bottom end to cut the formation, which is then conveyed upward. There are four basic types of auger in use: bucket auger, digger auger, solid-stem continuous flight auger, and hollow-stem continuous flight auger. Auger drilling does not normally require the use of drilling fluids.

4.2.1.2 Rotary Drilling

Rotary drilling is a drilling method in which drill pipe with an attached bit is continuously rotated against the face of the borehole while drilling fluid (i.e., drilling mud or air), is pumped through the pipe and bit to flush the cuttings to the surface. In air rotary drilling, air is compressed and circulated down through the drill rods and up the open hole. The rotary drill bit is attached to the lower end of the drill pipe, and as the bit cuts into the formation, cuttings are immediately removed from the bottom of the borehole and transported to the surface by the air that is circulating down through the drill pipe and up through the annular space. When there is no water entering the borehole from the formation, penetration and removal of cuttings may be enhanced by adding small quantities of water.

4.2.1.3 Sonic Drilling

Sonic drilling advances a borehole using resonant high frequency vibrations to fluidize the formation at the drill bit. Vibrations created in the sonic head at the top of the drill string move rapidly up and down the drill string with intense vibration at the drill bit. Resonant frequencies of around 150 Hertz, which are audible and thus "sonic," can be controlled to suit the type of formation. Rotation can be added when drilling in harder geologic formations. The primary benefits of this technology are that very rapid drilling rates are possible, combined with reduced volumes of derived waste.

4.2.2 Procedures

4.2.2.1 Logging Criteria

For specifics on logging criteria, refer to **Section 6.1.**

4.2.2.2 Soil Sampling

Geotechnical samples will be collected continuously on 5-foot intervals to total depth within the overburden using split spoon samplers, continuous split barrel samplers, and/or thin walled sampling tubes (Shelby Tubes). Soil samples will be collected for chemical or geotechnical analysis using the following procedure:

1. For split spoon or continuous split barrel samplers, remove the sub and shoe and split open the two halves of the sampler. Samples collected using Shelby Tubes will be capped and extruded at the testing laboratory.

2. Visually examine and log the remaining geologic material.

3. Geotechnical samples will be collected as described in **Appendix A**.

4. Transfer the soil into the appropriate sample containers.

4.2.2.3 Borehole Abandonment

A temporary borehole not converted into a monitoring well or piezometer will be plugged in accordance with OAC 785:35-11.

4.3 PIEZOMETER INSTALLATION

4.3.1 Overview

4.3.1.1 Drilling Methods

Installation methods will include the use of hollow stem auger, air rotary or sonic drilling techniques with minimal introduction of drilling fluid into the borehole. All groundwater piezometers will be installed to yield representative water level and groundwater quality data.

4.3.1.2 Piezometer Materials

Piezometers installed for long term monitoring will be two inches or larger in diameter and constructed of PVC. All joints will be flush-threaded without the use of cementing compounds. Piezometer and monitor well completion will be in accordance with OAC 785:35-7-2. **Figure 6** details how the piezometers are constructed.

4.3.2 Procedures

4.3.2.1 Equipment

Other equipment needed for sampling, drilling and installation of piezometers includes the following:

- One-quart resealable plastic bags
- Munsell Soil and Rock Color Charts
- Boring logs and data forms
- Field file
- Indelible marking pen
- Garbage bags
- Hand lens
- Caution tape
- Lath and flagging
- Utility knife
- Stainless steel sampling knife and/or spoon
- Keyed-alike locks
- Fiberglass tape
- Electronic water level indicator
- Sampling containers
- Applicable decontamination equipment (refer to **Section 5.0**)
- Applicable safety equipment (refer to **Section 4.1**)

4.3.2.2 Installation

Borehole Diameter

The nominal borehole diameter for piezometer installation will be determined as per subsurface conditions and potential use. The borehole will provide sufficient diameter to permit approximately three inches of annular space between the borehole wall on all sides of the well (centered riser and screen).

Screen and Casing Placement

Well screens and well casings will be clean and free of foreign matter prior to use. Pre-washing will not be necessary if the materials have been packaged by the manufacturer and the packaging is intact up to the time of installation. Well casing will bear the manufacturer's markings that identify the material as that specified. Washed screens and casings will be stored in clean plastic sheeting or the manufacturer's packaging until insertion into the borehole.

Screen bottoms will be securely fitted with a threaded cap or plug of the same composition as the screen. No solvents or glues will be used for attachment.

Filter Pack Placement

The annular space between the screen and borehole will be filled with a filter pack, and aggregates used for the filter pack will consist of uncontaminated quartz sand, silica or other material that will not affect the groundwater quality. The filter pack will be selected to prevent or minimize infiltration of the formation fines. The filter pack will extend two feet above the top of the screen, and will be placed in the well annulus in such a manner that bridging of the filter pack material will not occur.

Bentonite Seal

A minimum of two feet of bentonite pellets, chips or granules between 0.25 and 0.75 inches in size will be placed immediately above the filter pack in the annular space between the well casing and borehole and properly hydrated.

Cement/Bentonite Grout Placement

Above the bentonite seal, a cement/bentonite grout mixture or other suitable backfill material will be placed from the top of the bentonite seal to approximately two feet below grade level. The backfill material will be mixed in accordance with the ratio requirements set forth in OAC 785:35-7-2(b)(6)(C).

When the placement of grout will exceed 20 feet, the grout will be placed using a tremie pipe and filled or pumped from the bottom upward.

Surface Seal

A concrete or cement grout surface seal will be placed around the casing immediately above the annular seal, from a depth of two feet to land surface.

Protective Cover and Concrete Pad

When the grout has cured to the proper depth below ground surface (bgs), a 3-foot diameter concrete pad with a minimum thickness of 3.5 inches will be placed around the piezometers. The surface pad will be sloped in a manner to ensure that all surface water flows away from the piezometer.

All protective casings will be free of extraneous openings, and devoid of any asphaltic, bituminous, encrusting, and/or coating except the paint or primer applied by the manufacturer.

A steel surface casing will be set a minimum of 12 inches through the cement or concrete surface pad and will extend a minimum of 24 inches above the pad or ground. The top of the protective casing will be fitted with a locking cap and will be marked to clearly identify the well as a piezometer or site assessment observation well.

Surveying

Upon completion of the drilling activities and installation of piezometers, the locations and casing elevations of each piezometer will be surveyed in accordance with criteria described in **Section 7.0**.

4.4 PIEZOMETER WELL DEVELOPMENT

4.4.1 Overview

The purpose of well development is to remove fines (clay, silt, fine sand, rock flour) and drilling fluid residue from the filter pack and the natural formation in the vicinity of the screened interval in the monitoring well. Additionally, well development results in the settlement and stabilization of the material adjacent to the well screen.

4.4.1.1 Methods

Following well completion, well development will be performed to remove fluids used during drilling and to remove fines from the natural formation. This will provide a particulate-free discharge for sampling. When possible, development will be done by reversing flow direction or surging the well. If possible, no fluids other than natural formation water will be added during development. There are a number of different methods to develop a monitoring well. Bailing, air lifting, pumping, and pumping and surging are all adequate methods for well development. The appropriate method that is actually utilized for a particular well is highly dependent upon hydrogeologic conditions, volume of groundwater produced by the formation, and the drilling method used for the installation.

4.4.2 Procedures

4.4.2.1 Equipment

The equipment to be used for piezometer well development consists of:

- Stainless steel submersible pump with backflow check valve and Teflon® tubing capable of pumping from the depth of the wells
- Disposable bailers
- Polypropylene rope
- Mechanical surge block
- Electronic water level indicator, water level popper, or Teflon ® -coated woven tape
- Field file
- Specific conductivity meter
- pH meter and calibration buffer solutions
- Thermometer
- Sample containers and preservatives
- Calculator
- Generator
- Bladder pump capable of pumping 150 mL per minute or less
- Applicable decontamination equipment (refer to Section 5.0)
- Applicable safety equipment (refer to Section 4.1)

4.4.2.2 Methodologies

Newly installed piezometers will be developed no sooner than 24 hours after the installation of grout. Wells can be developed by bailing, air lifting, pumping, and/or surging and pumping. If surging and pumping is used, a surge block will be used to force the groundwater in and out of the filter pack and

surrounding native material. Water will be removed using a submersible pump or bailer. Water will be removed from the entire water column in the well by periodically raising and lowering the pump. Surging and pumping will be repeated in cycles until the well development parameters are met.

4.5 FIELD MEASUREMENTS

4.5.1 Water Level Measurements

An electronic water level meter will be used to gauge the piezometers. The following procedure will be used to measure to measure the water levels:

1. Decontaminate the cable and probe. Wipe the cable with paper towels as the cable is rewound onto the reel.

2. Turn on the water level indicator and press the instrument test button to check the batteries.

3. Lower the probe into the borehole or well by pulling the cable from the hand-held reel until the indicator light illuminates or the audible signal sounds.

4. Move the cable up and down to determine the upper groundwater surface. Note the exact length of the cable extended from the probe fluid sensor to the reference point at the top of the well casing. Record the measurement to the nearest 0.01 foot, the boring or well designation, and the date the measurement was taken.

5. Measure the total depth by gently lowering the probe or weighted tape to the bottom of the boring or well until the cable becomes slack. Reel in the slack cable and note the length of the cable extended from the tip of the probe to the reference point. Add the length of the distance between the end of the probe and the fluid sensor to the total depth measurement. Record the depth to the nearest 0.01 foot in the field logbook.

6. Decontaminate the probe prior to gauging the next boring or well.

4.6 IN-SITU HYDRAULIC CONDUCTIVITY TESTING

4.6.1 Overview

Determination of the in-situ hydraulic conductivity of a formation is an aspect in the characterization of a site. The usage of slug tests can provide data that will aid in understanding the dynamics of the geology and hydrogeology of the site.

4.6.2 Procedures

4.6.2.1 Slug Test

Slug tests will be used to determine the hydraulic conductivity of distinct water bearing geologic horizons under in-situ conditions. Slug tests will be conducted on selected piezometers.

Water will not be added to any of the piezometers. All equipment to be used in piezometers will be decontaminated prior to the slug test to avoid cross-contamination. Slug tests will be conducted only on piezometers at which development has been completed. If a test is conducted on a well recently purged for water sampling, the measured water level must be within 0.1 foot of the static water level prior to testing.

The slug test may be conducted using an electronic data-logger and pressure transducer or by manually measuring well recovery. All data collected with the data-logger will be stored electronically. The information will be directly transferred to a computer and analyzed. A computer printout of the data will be kept in the project files for documentation. Manual readings will be recorded in the field logbook.

Slug testing will be performed in accordance with ASTM D 4044-96 Standard Test Method (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers. Data analysis will be performed using the computer program AQTESOLV. The data analysis will be performed using the Hvorslev (1951) or the Bouwer and Rice (1976) method.

5.0 SAMPLE NUMBERING SYSTEM

A numbering system will be used to identify each boring and well. The purpose of this numbering system is to provide a tracking system for data retrieval. The sample identification allocated for the investigation will be used on drilling logs, sample labels, chain of custody records, and all other applicable documentation used during the sampling activities. An SCS site representative will maintain a listing of sample identification numbers in the field logbook.

5.1 SAMPLE IDENTIFICATION

All samples will be identified with a unique sample number. The sample will be comprised of the sampling point, sample designator, and depth interval, as appropriate.

The sampling point indicates the location of sampling; e.g., B-1, where "B" indicates a boring and "1" is the first boring. The sample designator will be comprised of a matrix abbreviation followed by a consecutive sample number. The matrix abbreviations are as follows:

SS	-	Soil
CT	-	Rock / Soil Cuttings
RC	-	Rock Core
GW	-	Groundwater

Subsurface soil and rock samples will be further identified according to location and depth. Samples collected from each boring will be consecutively numbered by depth. The actual sample depth will be recorded in the field logbook and on the chain of custody record.

In summary, the sample numbering system will consist of the sampling point, sample designator, and depth interval (if necessary). The following are examples of the sample numbering systems:

Sampling Point	Sample Designator	Depth Interval
B-1	SS1	0-4 ft
B-1	SS2	8-10 ft
B-1	GW1	10 ft

If piezometers are installed in a boring, the identifier "B" will be converted to "P" for piezometer.

6.0 DOCUMENTATION, SAMPLE CUSTODY, PACKAGING AND SHIPPING

Each sample, field measurement, and field activity will be documented to facilitate timely, correct, and complete analyses, and support actions concerning the site. The documentation system should provide a means to identify, track, and monitor sampling activities.

6.1 LOGGING CRITERIA

The logging of borings is one of the fundamental activities in a subsurface investigation. The main elements of the logging process are accurately locating the boring horizontally and vertically, elevations, accurately measuring the depths of observations relative to the surface, and consistently describing soils, consolidated materials, and groundwater occurrence.

6.1.1 General Requirements

The following are the general requirements for logging consolidated and unconsolidated geologic materials.

1. For each borehole, a geologic log will be prepared in the field by a qualified groundwater scientist. The logs will be hand-printed utilizing an appropriate scale. Logs will be of such quality that revisions will not be necessary prior to inclusion within a report. Logs will be prepared on forms specified by the client or on the SCS Drilling Log.

2. The drilling logs will be filled out as completely as possible, where appropriate information is available. At entry points on the form that are not applicable, write "N/A" (e.g., "N/A" is written in the bedrock footage section if bedrock is not encountered in the borehole).

3. Stratigraphic or lithologic changes will be identified under the description of material column as a solid horizontal line which corresponds to a measured borehole depth where the changes occur. Gradational changes in stratigraphy and lithology or changes identified from cuttings or methods other than direct observation will be represented as a horizontal dashed line at appropriate depth based upon the best judgment of the logger.

4. Borehole measurements (i.e., run depths and water levels) will be recorded to the nearest 0.1 foot.

5. The logs will show total depth of penetration and sampling. The bottom of the borehole will be represented as a double line from margin to margin with notation of "T.D. = __ ft. bgs" written below the double lines.

6. Any evidence of contamination will be noted in "Remarks," including color, odor, etc.

7. The depth to groundwater will be recorded in the header box labeled "Depth Groundwater Encountered." After drilling is completed and the water level has stabilized, a second water depth measurement will be recorded in the box labeled "Depth to Water and Elapsed time after Drilling Completed."

8. The length of core or soil sample (recovery) will be measured with a tape measure to the nearest 0.1 foot and recorded in the "Recovery" column.

9. The size and type of sampler or coring bit and barrel will be recorded on the form in the header. Logs will show borehole and sample diameters and depths at which sampling method or equipment changes.

10. Logs will show the drilling fluid used, including, as appropriate: source of makeup water; drilling fluid additives by brand and product name; mixture proportions; and type of filter for compressed air.

11. The amount of water used during drilling will be noted and recorded on the form. Any water gains or losses estimated rates and depths will be noted in the "Remarks" column.

12. The depth and type of temporary casing used will be noted in the "Remarks" column.

13. Depth intervals of borehole instability that are encountered during drilling will be recorded on the drilling log. In addition, difficulties during drilling (e.g., drilling speed, rates or downhole torque) and special sampling problems will be noted, along with problem resolution.

14. Samples retained for lithologic or chemical analyses will be noted in the "Sample No." column.

15. Any changes or corrections to the drilling log descriptions will be lined through and initialed with corrected notation adjacent to it.

6.1.1.1 Logging Soils (Unconsolidated Materials)

1. Unconsolidated materials will be visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM D2488. The visual field classification will provide principal and minor soil constituents along with approximate proportions.

2. The moisture content will be described in relative terms (e.g., dry, damp, moist, wet) and noted in the description. In addition, relative plasticity and consistency (cohesive soils), relative gradation and density (cohesionless soils), grain size, angularity, depositional environment, and structure will be recorded in the description column.

3. Bedding characteristics and evidence of bioturbation, root holes, or fractures will be recorded.

6.1.1.2 Logging Rock (Consolidated Materials)

1. Bedrock will be described based on visual observations, in accordance with standard geologic nomenclature.

2. This nomenclature includes, but is not limited to: formation name (if known); relative hardness; density; texture; grain size; weathering; bedding; fractures, joints, and cavities; and other descriptive features, such as fossils.

3. The moisture content will be described in relative terms (e.g., dry, damp, moist, wet) and noted in description.

6.2 PHOTOGRAPHS

Photographs taken to document sampling point locations should include two or more reference points to facilitate relocating the sample location at a later date. The following information should be noted in the field logbook:

- Date & Time
- General direction faced and description of subject
- Sequential number of the photograph

A photograph location sketch may also be drawn in the field book.

7.0 SURVEYING

Following the completion of field activities, a surveyor will determine the positions of all unsurveyed sample locations, including subsurface sampling locations with piezometers and other discrete sampling points.

All sample locations will be surveyed utilizing the State Plane Coordinate System, and the ground surface elevation of the sampling locations will be relative to mean sea level (MSL). For all piezometers, the top of the riser pipe (top of casing) will be used as a reference point and surveyed relative to MSL.

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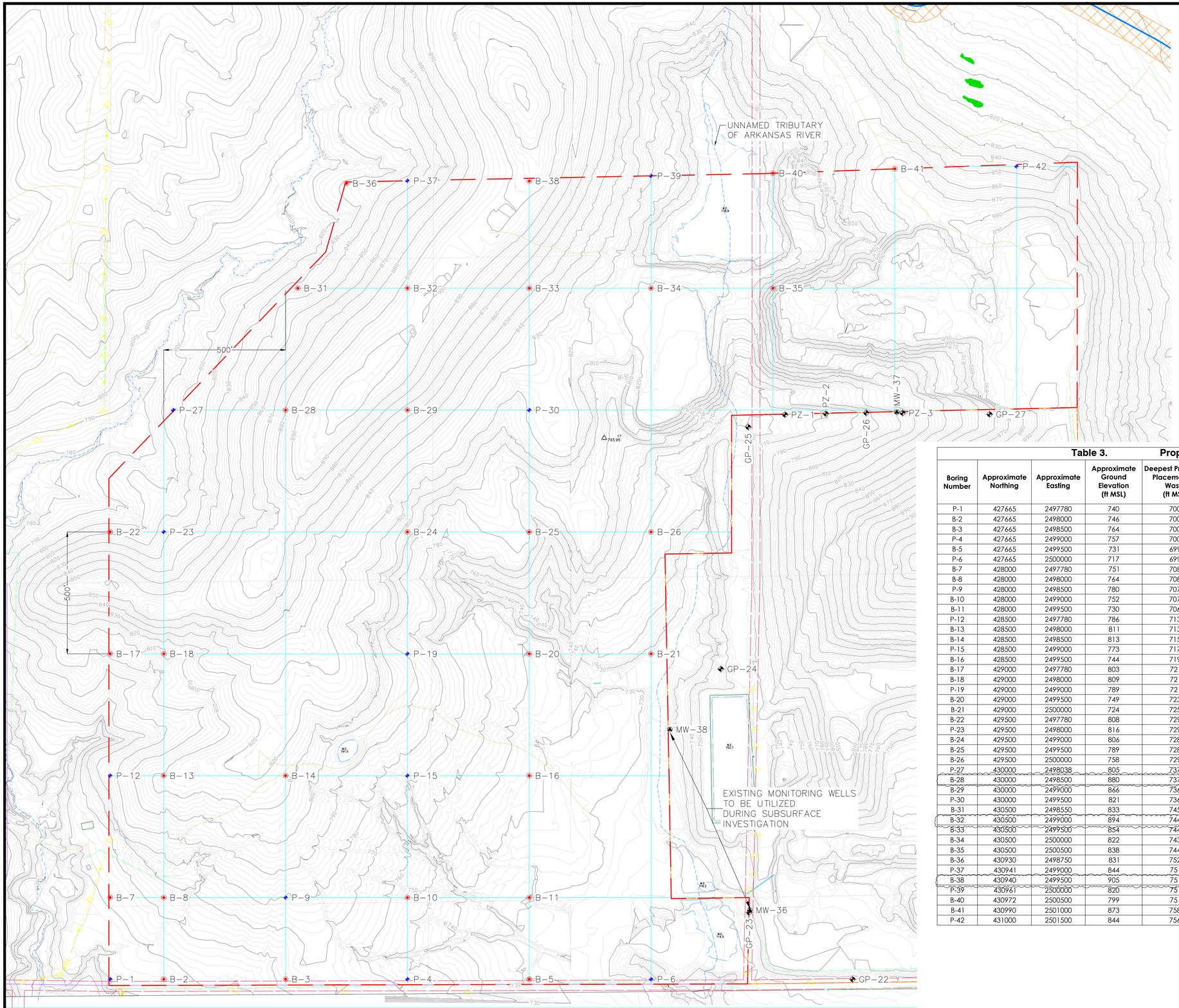
Figures/Tables



LEGEND

- MINOR CONTOUR
- MAJOR CONTOUR
- WATER/STREAM
- FENCELINE
- BUILDING
- EXISTING PERMIT BOUNDARY
- PROPOSED PERMIT BOUNDARY
- PROPERTY BOUNDARY
- PROPERTY EASEMENTS
- TRAIL
- EXISTING CULVERT
- GRID SPACING
- OVERHEAD UTILITY LINES
- WETLAND
- PROPOSED MITIGATION–PROJECT AREA
- PROPOSED PIEZOMETER LOCATION
- PROPOSED BORING LOCATION
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER/GAS PROBE

NOTES:

1. *CALCULATED BY SUBTRACTING 30' FROM THE PROPOSED PLACEMENT OF WASTE ELEVATION.
2. MSL = ABOVE MEAN SEA LEVEL; BGS = BELOW GROUND SURFACE

Table 3. Proposed Borings

Boring Number	Approximate Northing	Approximate Easting	Approximate Ground Elevation (ft MSL)	Deepest Proposed Placement of Waste (ft MSL)	Proposed Total Depth Elevation* (ft MSL)	Proposed Drilling Depth (ft BGS)	Proposed Screen Elevation (ft MSL)	Proposed Screen Length (ft)
P-1	427665	2497780	740	700	670	70	690-700	10
B-2	427665	2498000	746	700	670	76		
B-3	427665	2498500	764	700	670	94		
P-4	427665	2499000	757	700	670	87	690-700	10
B-5	427665	2499500	731	699	669	62		
P-6	427665	2500000	717	699	669	48	689-699	10
B-7	428000	2497780	751	708	678	74		
B-8	428000	2498000	764	708	678	86		
P-9	428000	2498500	780	707	677	102	697-707	10
B-10	428000	2499000	752	707	677	75		
B-11	428000	2499500	730	706	676	54		
P-12	428500	2497780	786	713	683	103	703-713	10
B-13	428500	2498000	811	713	683	128		
B-14	428500	2498500	813	715	685	129		
P-15	428500	2499000	773	717	687	86	707-717	10
B-16	428500	2499500	744	719	689	55		
B-17	429000	2497780	803	721	691	112		
B-18	429000	2498000	809	721	691	118		
P-19	429000	2499000	789	721	691	98	711-721	10
B-20	429000	2499500	749	723	693	56		
B-21	429000	2500000	724	725	695	29		
B-22	429500	2497780	808	729	699	108		
P-23	429500	2498000	816	729	699	117	719-729	10
B-24	429500	2499000	806	728	698	108		
B-25	429500	2499500	789	728	698	92		
B-26	429500	2500000	758	729	699	59		
P-27	430000	2498038	805	737	707	98	727-737	10
B-28	430000	2498500	880	737	680	200		
B-29	430000	2499000	866	736	706	160		
P-30	430000	2499500	821	736	706	115	726-736	10
B-31	430500	2498550	833	745	715	119		
B-32	430500	2499000	894	744	694	200		
B-33	430500	2499500	854	744	714	140		
B-34	430500	2500000	822	743	713	108		
B-35	430500	2500500	838	744	714	124		
B-36	430930	2498750	831	752	722	109		
P-37	430941	2499000	844	751	721	122	741-751	10
B-38	430940	2499500	905	751	705	200		
P-39	430961	2500000	820	751	721	99	741-751	10
B-40	430972	2500500	799	751	721	78		
B-41	430990	2501000	873	758	728	145		
P-42	431000	2501500	844	756	726	118	746-756	10

1

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200 0 200 400
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY
1	11/19/20	TABLE 3 UPDATED TO INCLUDE 200 FT DEEP WELLS.	SAR

SHEET TITLE
CONTOUR MAP & PROPOSED BORING LOCATIONS

PROJECT TITLE
DRILLING PLAN FOR 203-ACRE EXPANSION

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AEL LANDFILL
SAND SPRINGS, OKLAHOMA
OSAGE COUNTY

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
1817 COMMONS CIRCLE, SUITE 1
YUKON, OKLAHOMA 73099
PH.(405) 265-3960

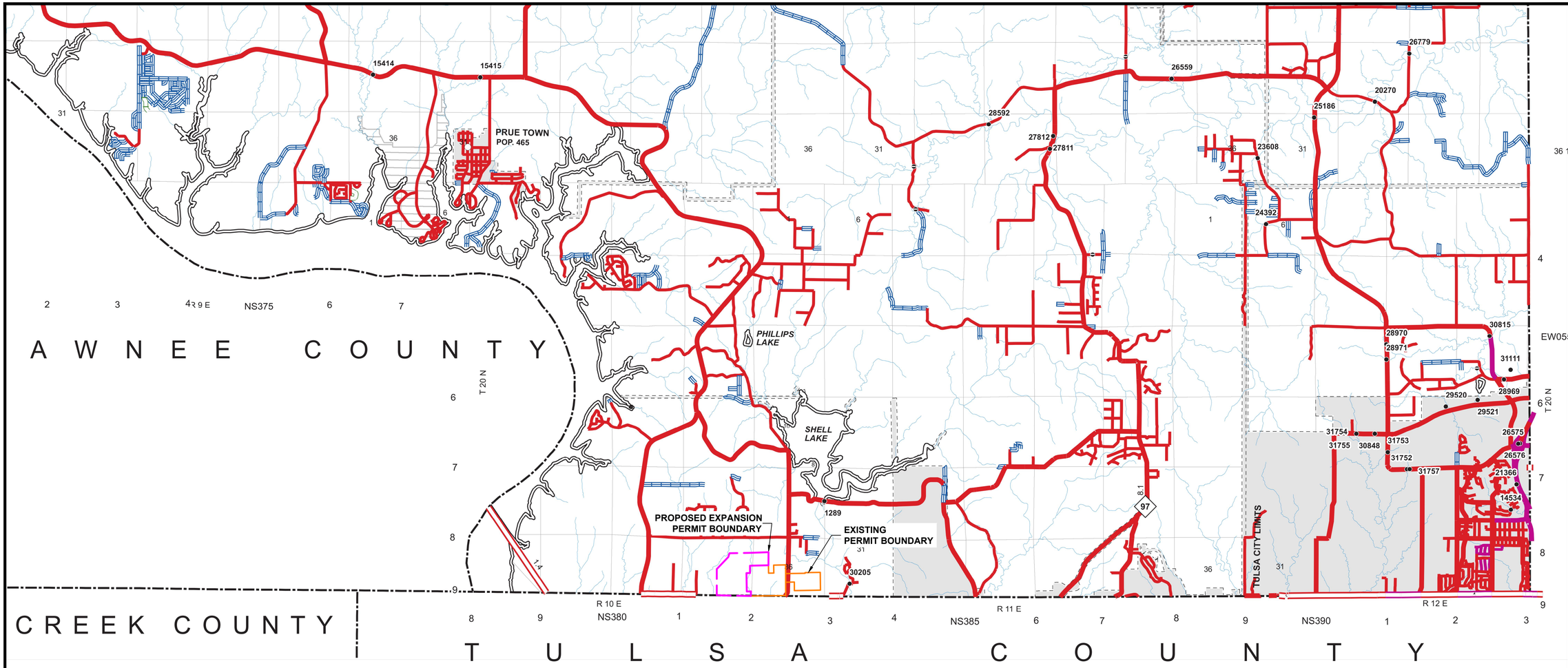
PROJ. NO. 27219016.00 | DWN. BY: SAR | Q/A RVW BY: WJM
DSN. BY: SAR | CHK. BY: WJM | PROJ. MGR: WJM

CADD FILE: CONTOUR MAP.DWG

DATE: 11/19/20

SCALE: AS SHOWN

FIGURE **1**



Legend

- Interstate Highway
- US Highway
- State Highway
- Bridge
- Low Water Crossing
- Town Center
- Mesas
- Mountains & Peaks
- Lake or Reservoir
- River or Stream

Divided, 4 or more lanes

- Asphalt
- Concrete

Road Surface Type

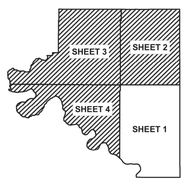
- Asphalt
- Concrete
- Gravel
- Grade & Drain
- Unimproved

EXISTING PERMIT BOUNDARY

- Railroad
- Section Line
- Corporate Limits
- County Line
- Wildlife Refuge
- Wildlife Management Area
- State Park
- US Military Installation
- State Line

PROPOSED EXPANSION PERMIT BOUNDARY

ALL DATA CURRENT AS OF DATE LISTED BELOW
October 2, 2019



OSAGE COUNTY
GENERAL HIGHWAY MAP

OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
STRATEGIC ASSET AND PERFORMANCE
MANAGEMENT DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

N

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SCALE FEET

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID; OKLAHOMA PLANE COORDINATE SYSTEM NORTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 2010 U.S. CENSUS
CO. POP. 47,472

CK. BY

REV.	DATE	DESCRIPTION

SHEET TITLE: SITE LOCATION MAP

PROJECT TITLE: **DRILLING PLAN FOR 203-ACRE EXPANSION**

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AEL LANDFILL
SAND SPRINGS, OKLAHOMA
OSAGE COUNTY

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
1817 COMMONS CIRCLE, SUITE 1
YUKON, OKLAHOMA 73099
PH. (405) 265-3960

PROJ. NO.	DWN. BY:	Q/A RVW BY:	PROJ. MGR:
27219016.00	SAR	W.J.M	W.J.M
DSN. BY: SAR	CHK. BY: W.J.M		

CADD FILE: SITE LOCATION MAP.DWG

DATE: 6/19/20

SCALE: AS SHOWN

FIGURE **2**

LEGEND

- EXISTING PERMIT BOUNDARY
- PROPOSED EXPANSION PERMIT
- 1-MILE FROM PROPOSED EXPANSION PERMIT BOUNDARY

NOTE:
FLOOD INSURANCE RATE MAPS OBTAINED FROM FEMA WEBSITE. MAP NUMBERS 40113C1215K & 40113C1216K, OSAGE COUNTY, OKLAHOMA, EFFECTIVE APRIL 2008. MAP NUMBERS 40143C0190K, 40143C0191K & 40143C0193K, TULSA COUNTY, OKLAHOMA, EFFECTIVE AUGUST 2009.

N

1000 0 1000 2000
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: FLOOD PLAIN MAP

PROJECT TITLE: **DRILLING PLAN FOR 203-ACRE EXPANSION**

CLIENT: **AMERICAN ENVIRONMENTAL LANDFILL, INC.**
AEL LANDFILL
SAND SPRINGS, OKLAHOMA
OSAGE COUNTY

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
1817 COMMONS CIRCLE, SUITE 1
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PH. (405) 265-3960

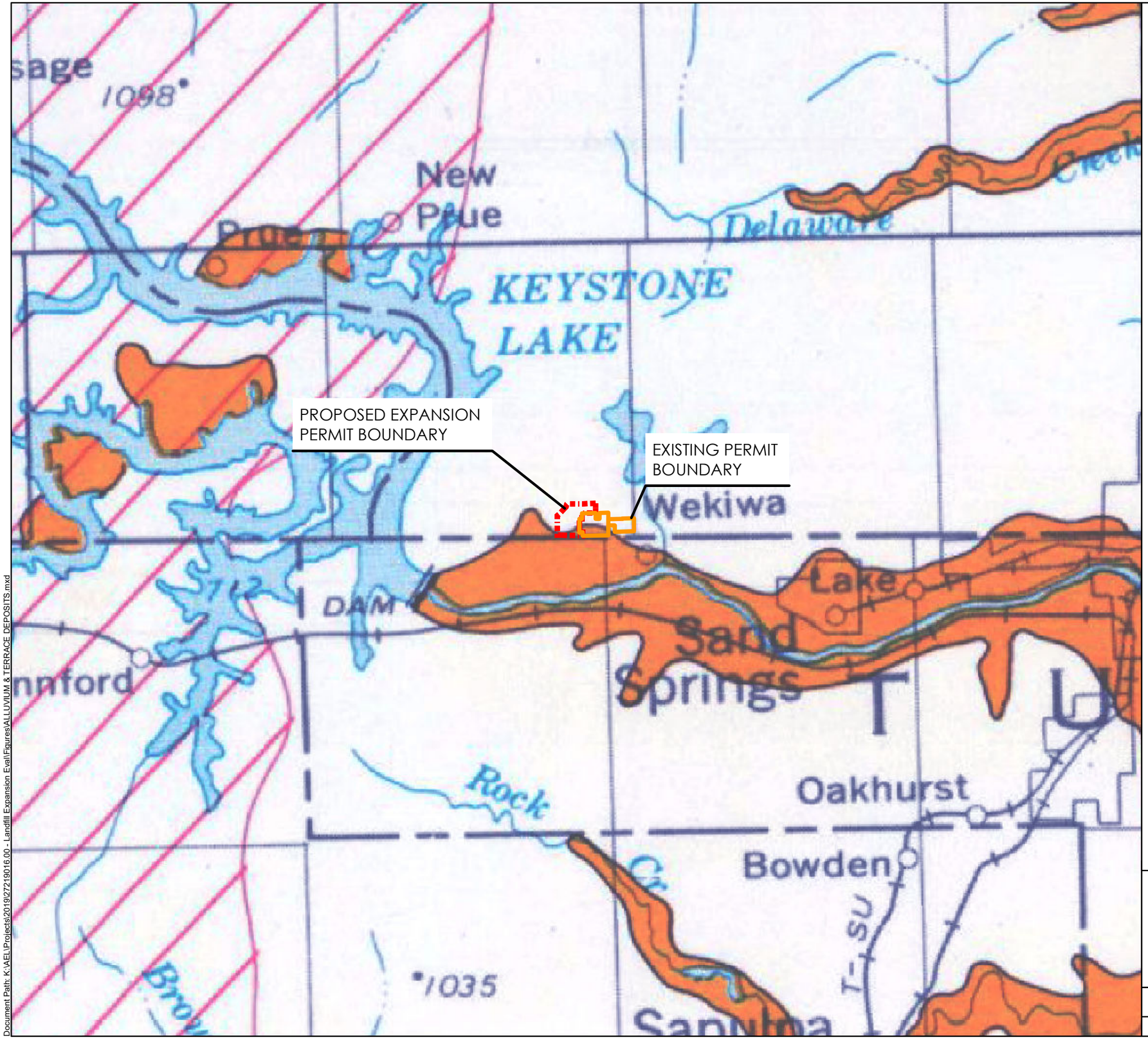
PROJ. NO.	DWN. BY:	Q/A RVW BY:
27219016.00	SAR	W.J.M
DSN. BY:	CHK. BY:	PROJ. MGR:
SAR	W.J.M	W.J.M

CADD FILE: FLOOD_PLAIN_MAP_2.DWG

DATE: 5/28/20

SCALE: AS SHOWN

FIGURE **3**



Legend

Existing Permit Boundary

Proposed Expanded Permit Boundary

Alluvium and Terrace Deposits and Their Recharge Areas (Quaternary in age). Unconsolidated deposits of sand, silt, clay, and gravel that occur along or adjacent to modern and ancient streams. Thickness generally ranges from 10 to 50 ft (locally as much as 100 ft). Wells generally yield 10 to 500 gpm of water (locally several thousand gpm), and most water is of good quality (less than 1,000 mg/L dissolved solids). Recharge areas are essentially the same as distribution of the alluvium and terrace deposits.

Bedrock Aquifers and Their Recharge Areas (Cambrian through Tertiary in age). Rock units and sediments that generally are favorable or moderately favorable for development of groundwater resources. Thickness of aquifers generally ranges from 100 ft to several thousand ft. Depths to fresh water range from a few feet to more than 1,000 ft, with most wells 100-400 ft deep. Wells drilled into these aquifers generally yield 25–300 gpm, although wells in some aquifers yield up to 600–2,500 gpm. Water in most aquifers is of good to fair quality (300–1,500 mg/L dissolved solids). Pattern on map also includes known and potential recharge areas for bedrock aquifers.

MAP OF AQUIFERS AND RECHARGE AREAS IN OKLAHOMA

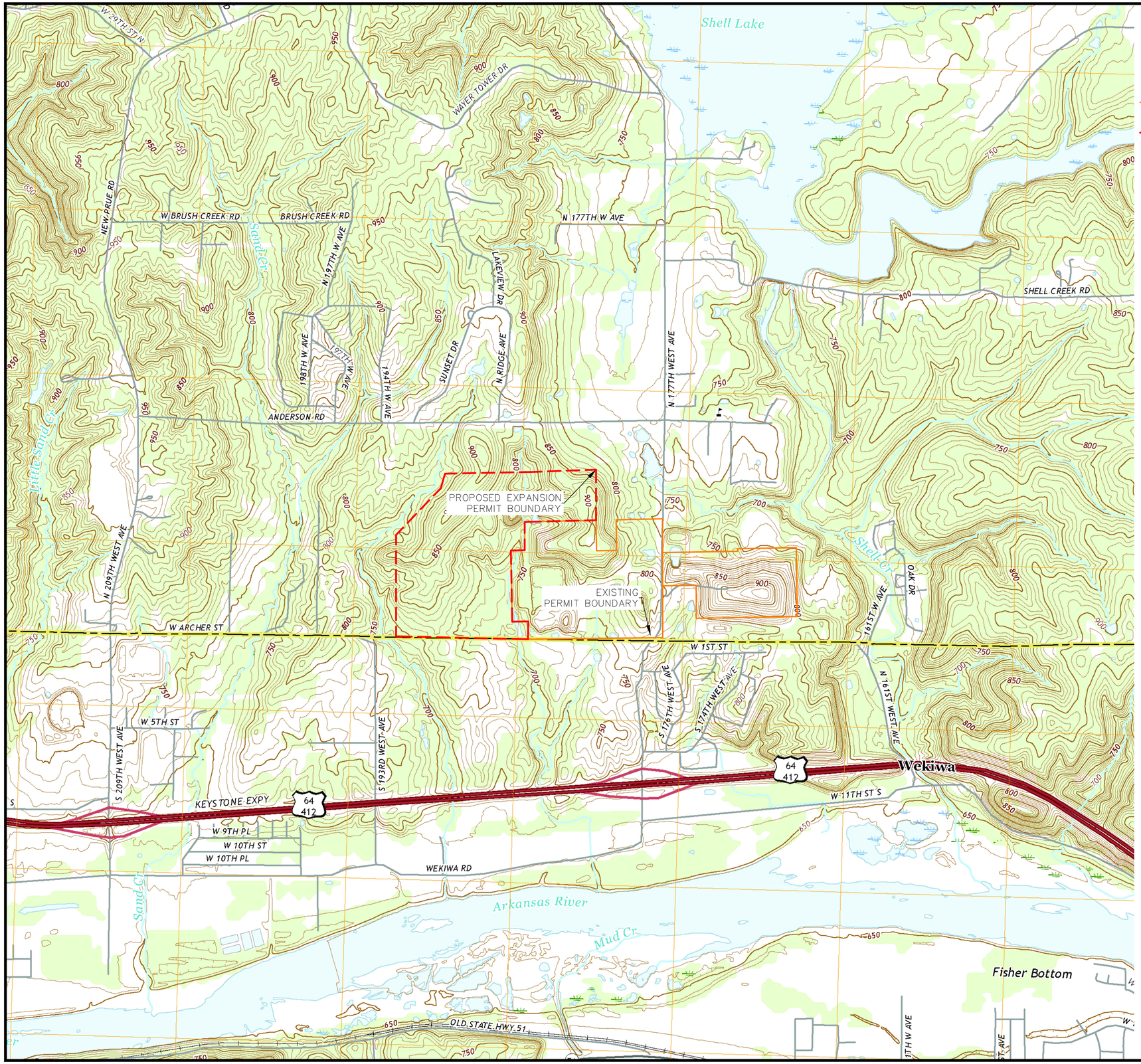
Compiled by
Kenneth S. Johnson
Oklahoma Geological Survey
1991

FIGURE 4
AMERICAN ENVIRONMENTAL LANDFILL
MAP OF ALLUVIUM & TERRACE DEPOSITS
OSAGE COUNTY, OKLAHOMA

SCS ENGINEERS
Yukon, OK | June 2020

0 1 2 Miles N

Document Path: K:\AEL\Projects\20192721901600 - Landfill Expansion Eval\Figures\ALLUVIUM & TERRACE DEPOSITS.mxd



LEGEND

EXISTING PERMIT BOUNDARY

PROPOSED EXPANSION PERMIT

NOTE:
MAP AND CONTOURS SHOWN ARE FROM THE USGS 7.5' SERIES WEKIWA QUADRANGLE IN OSAGE AND TULSA COUNTIES, OKLAHOMA DATED 2018.

1000 0 1000 2000
SCALE FEET

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REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
USGS TOPOGRAPHY 7.5 MINUTE QUADRANGLE

PROJECT TITLE
DRILLING PLAN FOR 203-ACRE EXPANSION

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AEL LANDFILL
SAND SPRINGS, OKLAHOMA
OSAGE COUNTY

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
1817 COMMONS CIRCLE, SUITE 1
YUKON, OKLAHOMA 73099
PH. (405) 265-3960

PROJ. NO. 27219016.00
DSN. BY: SAR
DWN. BY: SAR
CHK. BY: WJM
Q/A RVW BY: WJM
PROJ. MGR: WJM

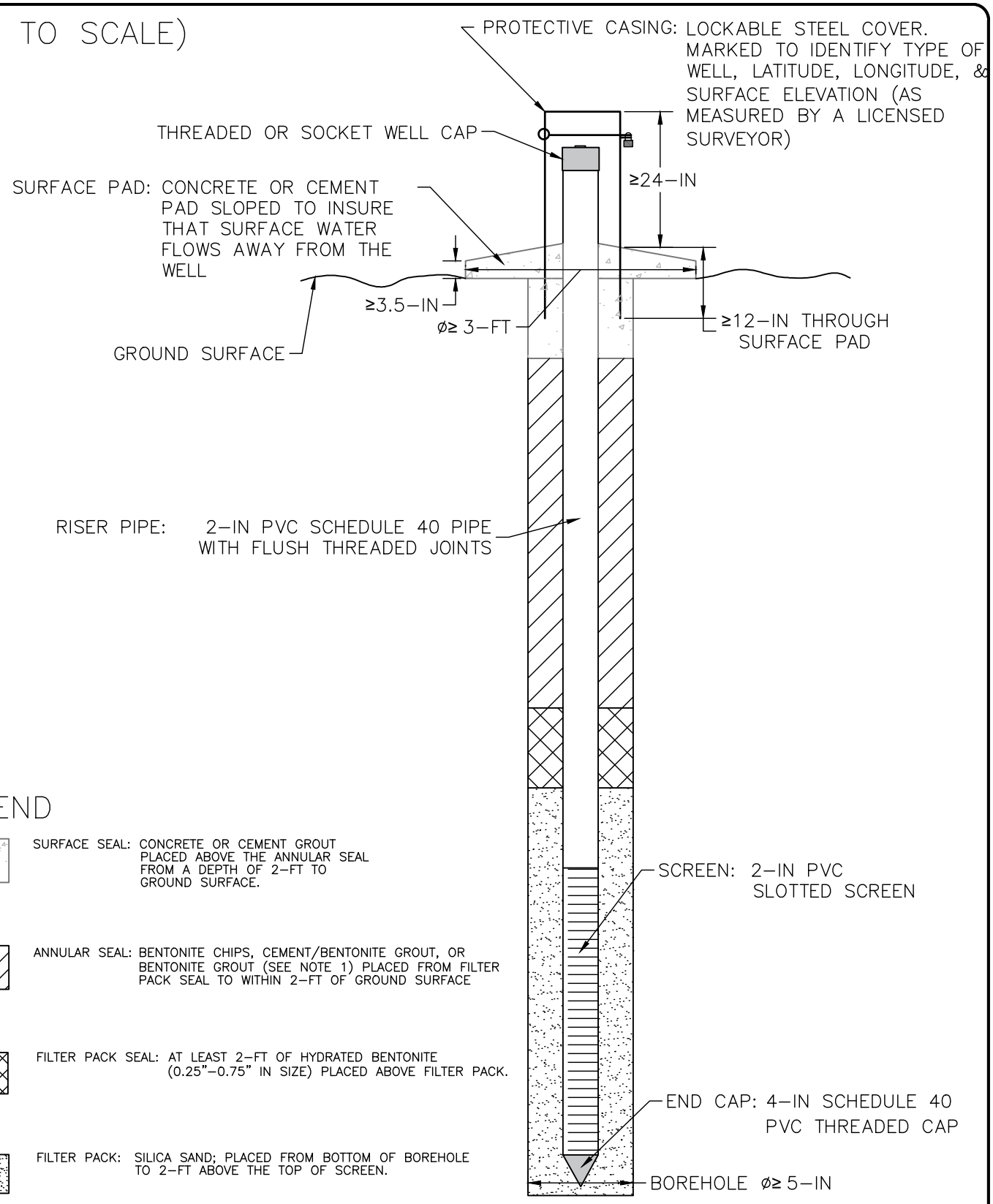
CADD FILE:
SITE LOCATION MAP.DWG

DATE:
8/4/20

SCALE:
AS SHOWN

FIGURE
5

(NOT TO SCALE)



LEGEND

SURFACE SEAL: CONCRETE OR CEMENT GROUT PLACED ABOVE THE ANNULAR SEAL FROM A DEPTH OF 2–FT TO GROUND SURFACE.

ANNULAR SEAL: BENTONITE CHIPS, CEMENT/BENTONITE GROUT, OR BENTONITE GROUT (SEE NOTE 1) PLACED FROM FILTER PACK SEAL TO WITHIN 2–FT OF GROUND SURFACE

FILTER PACK SEAL: AT LEAST 2–FT OF HYDRATED BENTONITE (0.25"–0.75" IN SIZE) PLACED ABOVE FILTER PACK.

FILTER PACK: SILICA SAND; PLACED FROM BOTTOM OF BOREHOLE TO 2–FT ABOVE THE TOP OF SCREEN.

NOTES:

1. ANNULAR SEAL: CEMENT GROUT MIX RATIO OF 94–LBS CEMENT TO A MAXIMUM OF 6–GAL WATER IS USED, AND MIXED TO THE CONSISTENCY RECOMMENDED BY THE CEMENT MANUFACTURER. MAXIMUM OF TWENTY PERCENT (20%) BENTONITE BY DRY WEIGHT MAY BE ADDED TO THE CEMENT GROUT TO FORM THE CEMENT/BENTONITE GROUT MIXTURE. THE BENTONITE IS PREHYDRATED TO THE MANUFACTURER'S RECOMMENDED CONSISTENCY. THE BENTONITE GROUT HAS AT LEAST TWENTY PERCENT (20%) BENTONITE BY DRY WEIGHT, AND IS MIXED ACCORDING TO THE MANUFACTURER'S RECOMMENDED CONSISTENCY.
2. WHEN THE PLACEMENT OF GROUT WILL EXCEED 20–FT, THE GROUT IS PLACED THROUGH A TREMIE PIPE AND FILLED OR PUMPED FROM THE BOTTOM UPWARD.

SCS ENGINEERS

STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS, INC.
1817 COMMONS CIRCLE, SUITE #1
YUKON, OKLAHOMA 73099
PH.(405) 265-3960

TYPICAL MONITORING WELL CONSTRUCTION

AMERICAN ENVIRONMENTAL LANDFILL, INC.

207 NORTH 177TH WEST AVENUE, SAND SPRINGS, OKLAHOMA 74063

CHK. BY: WJM	DWN. BY: SAR	DSN. BY: SAR	PROJ. NO. 27219016.00
PROJ. MGR: WJM	DATE: 6/22/20	CADD FILE: TYPICAL MONITORING WELL CONSTRUCTION.DWG	DRAWING NO. 6

Appendix A

Soil Sampling for Geotechnical Analyses

SOIL SAMPLING FOR GEOTECHNICAL ANALYSES

Soil samples collected from the borings or excavations may be retained for selected physical analyses that can be performed on disturbed soil samples. Representative samples for grain size analyses (ASTM International (ASTM) D-6913) can be obtained from the interval in which the screen for the monitoring well will be placed (if well is screened in unconsolidated materials).

Disturbed soil samples collected for physical/geotechnical analysis will be placed in sealable plastic bags if moisture content analysis (ASTM D-2216) is requested. Remaining sample material will be placed in sealable plastic bags or buckets and labeled with the date, boring number, and depth of sample for Atterberg limits (ASTM D-4318) or grain size analysis.

In the event that undisturbed soil samples are collected, a thin-walled sample of "Shelby Tube" will be used to obtain these samples (ASTM D-1587). These samples can be taken in cohesive or granular material for laboratory classification and limited testing purposes. The sampling procedures when using a drilling rig are as follows:

1. Advance the borehole to the required depth, taking care not to disturb material to be sampled.

2. Examine the thin-walled tube to determine that it is free of rust, dents or scratches. The cutting edge should be beveled and drawn-in slightly less than the outside diameter of the tube.

3. Attach the thin-walled sampler to the head assembly and drill rods.

4. Lower the sampler assembly to the required depth and press the sampler 2 feet into the soil.

5. To insure good recovery, leave the assembly in the borehole for 10 to 15 minutes, to allow buildup of skin friction within the thin-wall sampler. Then rotate entire assembly 1 or 2 revolutions to shear off sample from soil below withdraw assembly from the borehole and disassemble.

6. Remove any disturbed material from the tube ends and measure the recovery.

7. Seal, mark, and store the tube in an upright position during storage and shipment to testing laboratory.

Appendix B

Boring Logs for Existing Wells

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-24** SHEET NUMBER 1 of 3

CLIENT:	American Environmental Landfill
PROJECT NAME:	Gas Probe Installation Oversight
PROJECT NUMBER:	5386.1
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	See Location Map
AES PROJECT NO:	5386.1
AES GEOLOGIST:	Emily Dunn
START DATE:	04/26/12 FINISH DATE: 04/26/12
START TIME:	9:30 FINISH TIME: 14:00

DRILLING CONTRACTOR:	Mohwak Drilling Inc.
DRILLER:	Jeremy B.
DRILLING RIG:	Failing F-10
DRILLING METHOD:	HSA's / Air Rotary
SAMPLING METHOD:	Continuous Sampler / Cuttings
BORING DIAMETER:	4" inch
WELL DIAMETER:	1-inch
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	745.20

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	1	IN
WELL TOTAL DEPTH:	48	FT BGS
SCREEN LENGTH:	40	FT
RISER LENGTH:	8	FT
TOP OF SCREEN:	8	FT BGS
BOTTOM OF SCREEN:	48	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	6	FT BGS
TOP OF SEAL:	0	FT BGS
TYPE OF SEAL:	Bentonite Chips 3/8"	
TYPE OF FILTER PACK:	Pea Gravel	

DRILLING TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES AND WELL CONSTRUCTION
HSA	0-5	1.0	1 2 3 4 5			Fill from work done for access to GP location	
HSA	5-10	5.0	6 7 8 9 10	CL		SILT Clayey, dark reddish brown, 5 YR 5/4, moist, medium hard	
HSA	10-15	4.8	11 12 13 14 15	SM		SILTY with sand, light red 2.5 YR 7/6, hard, dry	difficult drilling
HSA	15-20	2.0	16 17 18 19 20			medium hard increasing sand content	

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-24** SHEET NUMBER 2 of 3

GEOLOGIST: Emily Dunn
CLIENT: American Environmental Landfill
DATE: 04/26/12
PROJECT NAME: Gas Probe Installation Oversight
PROJECT NUMBER: 5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
HSA	20-25	4.5	20	SM		SILT with sand, light red 2.5 YR 7/6, hard, dry	
HSA	25-30	5.0	25			moist at 27-37'	
HSA	30-35	4.0	30	CL		SILT clayey, dark reddish brown 5 YR 5/4, moist to wet, medium soft	
HSA	35-40	4.0	35			wet to saturated 37-41'	
HSA	40-45	2.5	40	SH		SHALE, gray 5 YR 5/1, wet dry at 41'	degree of saturation varied in borehole, auger brought up wetter cuttings at lower depths

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-24**

GEOLOGIST:	Emily Dunn
CLIENT:	American Environmental Landfill
DATE:	04/26/12
PROJECT NAME:	Gas Probe Installation Oversight
PROJECT NUMBER:	5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
HSA	45-50	1.0	46–70	SH		SHALE, gray 5 YR 5/1, dry Boring Termianted at 48 feet bgs	bottom of sampler shoe was dry

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
Environmental Solutions, Inc.
1817 Commons Circle, Suite 1, Yukon, OK 73099

LOG OF BORING NO.: **GP-25** SHEET NUMBER 1 of 2

CLIENT:	American Environmental Landfill
PROJECT NAME:	Monitoring Well Installation Oversight
PROJECT NUMBER:	5386.10
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	
AES PROJECT NO:	05386.10
AES GEOLOGIST:	C. Joyce
START DATE:	12/18/12 FINISH DATE: 12/19/12
START TIME:	FINISH TIME:

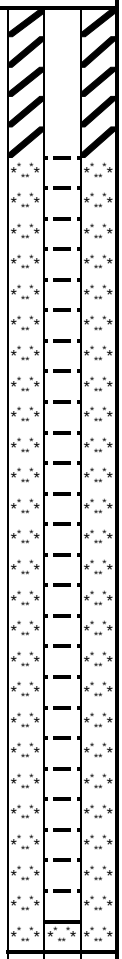
DRILLING CONTRACTOR:	Mohawk Drilling, Inc.
DRILLER:	Jeremy B.
DRILLING RIG:	GEFCO Strata Star 25
DRILLING METHOD:	Air Rotary
SAMPLING METHOD:	Continuous/ Grab
BORING DIAMETER:	4"
WELL DIAMETER:	1"
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	754.30

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	1	IN
WELL TOTAL DEPTH:	30.24	FT BGS
SCREEN LENGTH:	25	FT
RISER LENGTH:	7.5	FT
TOP OF SCREEN:	5.24	FT BGS
BOTTOM OF SCREEN:	30.24	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	5	FT BGS
TOP OF SEAL:	2	FT BGS
TYPE OF SEAL:	3/8" BENTONITE CHIPS	
TYPE OF FILTER PACK:	12/20 MESH SILICA	

SAMPLE TYPE	SAMPLE DEPTH	PID (PPM)	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS
RB	0-5		N/A	2			0.0 FILL, weathered silty shale, pale yellowish brown 10YR6/2,light olive gray, 5YR52, dry
RB	5-10		N/A	6			
RB	10-15		N/A	12			
RB	15-20		N/A	16			
RB	20-25		N/A	22			Fine clayey snad, light brown, 5YR56, Dry
RB	25-30		N/A	26			
RB	30-35		N/A	32			Sandy clay, moderate brown, 5YR34, moist 30.24 End of boring (12/19/12)
	35-40			36			

NOTES AND WELL CONSTRUCTION



LEGEND:
SS - Split Spoon
CS - 4' Macro-Core Sampler
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-27** SHEET NUMBER 1 of 8

CLIENT:	American Environmental Landfill
PROJECT NAME:	Gas Probe Installation Oversight
PROJECT NUMBER:	5386.1
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	See Location Map
AES PROJECT NO:	5386.1
AES GEOLOGIST:	Emily Dunn
START DATE:	05/31/12 FINISH DATE: 06/01/12
START TIME:	8:00 FINISH TIME: 10:00

DRILLING CONTRACTOR:	Mohwak Drilling Inc.
DRILLER:	Jeremy B.
DRILLING RIG:	Failing F-10
DRILLING METHOD:	HSA's / Air Rotary
SAMPLING METHOD:	Continuous Sampler / Cuttings
BORING DIAMETER:	4" inch
WELL DIAMETER:	1-inch
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	889.20

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	1	IN
WELL TOTAL DEPTH:	188	FT BGS
SCREEN LENGTH:	180	FT
RISER LENGTH:	8	FT
TOP OF SCREEN:	8	FT BGS
BOTTOM OF SCREEN:	188	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	6	FT BGS
TOP OF SEAL:	0	FT BGS
TYPE OF SEAL:	Bentonite Chips 3/8"	
TYPE OF FILTER PACK:	Pea Gravel	

DRILLING TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES AND WELL CONSTRUCTION
Air Rotary	0-5	NA	0	SC		SILT clayey with Sand, dark reddish brown 2.5 YR 3/3, medium hard	
	840		5				became very hard at 5'
Air Rotary	5-10	NA	6			dry, becoming sandier	
	905		10	SH		SHALE, light gray 7.5 YR 7/1, dry	
Air Rotary	10-15	NA	15				
Air Rotary	15-20	NA	20				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-27**

GEOLOGIST:	Emily Dunn
CLIENT:	American Environmental Landfill
DATE:	5/31/2012 and 6/1/2012
PROJECT NAME:	Gas Probe Installation Oversight
PROJECT NUMBER:	5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	20-25	NA	21–25	SH		SHALE, light gray 7.5 YR 7/1, dry	
Air Rotary	25-30	NA	26–30				
Air Rotary	30-35	NA	31–35				
Air Rotary	35-40	NA	36–40				
Air Rotary	40-45	NA	41–45				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-27**

GEOLOGIST:	Emily Dunn
CLIENT:	American Environmental Landfill
DATE:	5/31/2012 and 6/1/2012
PROJECT NAME:	Gas Probe Installation Oversight
PROJECT NUMBER:	5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	45-50	NA	46	SH		SHALE, light gray 7.5 YR 7/1, dry	
			47				
			48				
			49				
	1000		50				
Air Rotary	50-55	NA	51	LS		LIMESTONE, white 10 YR 8/1, dry	
			52				
			53				
			54	SS		SANDSTONE, red 2.5 Y 6/5, dry	
			55				
Air Rotary	55-60	NA	56				
			57				
			58				
			59				
	1018		60				
Air Rotary	60-65	NA	61	SH		SHALE, light gray 7.5 YR 7/1, dry	
			62				
			63				
			64				
			65				
Air Rotary	65-70	NA	66				
			67				
			68				
			69				
			70				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-27**

CLIENT:	American Environmental Landfill
PROJECT NAME:	Gas Probe Installation Oversight
GEOLOGIST:	Emily Dunn
DATE:	5/31/2012 and 6/1/2012
PROJECT NUMBER:	5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	70-75 1040	NA	70 71 72 73 74 75	SH		SHALE, light gray 7.5 YR 7/1, dry	
Air Rotary	75-80	NA	75 76 77 78 79 80				
Air Rotary	80-85 1110	NA	80 81 82 83 84 85				
Air Rotary	85-90 1115	NA	85 86 87 88 89 90				
Air Rotary	90-95 1120	NA	90 91 92 93 94 95				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-27** SHEET NUMBER 5 of 8

CLIENT:	American Environmental Landfill
PROJECT NAME:	Gas Probe Installation Oversight
GEOLOGIST:	Emily Dunn
DATE:	5/31/2012 and 6/1/2012
PROJECT NUMBER:	5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	95-100	NA	96–100	SH		SHALE, light gray 7.5 YR 7/1, dry	
Air Rotary	100-105	NA	101–105				
Air Rotary	105-110	NA	106–110				
Air Rotary	110-115	NA	111–115				
Air Rotary	115-120	NA	116–120				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-27** SHEET NUMBER 6 of 8

GEOLOGIST:	Emily Dunn
CLIENT:	American Environmental Landfill
DATE:	5/31/2012 and 6/1/2012
PROJECT NAME:	Gas Probe Installation Oversight
PROJECT NUMBER:	5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	120 - 125	NA	120	SH		SHALE, light gray 7.5 YR 7/1, dry	
Air Rotary	125 - 130	NA	125				
Air Rotary	130 - 135	NA	130				
Air Rotary	135 - 140	NA	135				
Air Rotary	140 -145	NA	140				
			145				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-27** SHEET NUMBER 7 of 8

GEOLOGIST:	Emily Dunn
CLIENT:	American Environmental Landfill
DATE:	5/31/2012 and 6/1/2012
PROJECT NAME:	Gas Probe Installation Oversight
PROJECT NUMBER:	5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	145 -150	NA	145	SH		SHALE, light gray 7.5 YR 7/1, dry	
Air Rotary	150 - 155	NA	150				
Air Rotary	155 - 160	NA	155				
Air Rotary	160 - 165	NA	160				
Air Rotary	165 - 170	NA	165				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1817 Commons Circle, Suite 100 Yukon, OK 73099

LOG OF BORING NO.: **GP-27**

GEOLOGIST:	Emily Dunn
CLIENT:	American Environmental Landfill
DATE:	5/31/2012 and 6/1/2012
PROJECT NAME:	Gas Probe Installation Oversight
PROJECT NUMBER:	5386.1

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	170 - 175	NA	170	SH		SHALE, light gray 7.5 YR 7/1, dry	
Air Rotary	175 - 180	NA	175				
Air Rotary	180 - 185	NA	180				
Air Rotary	185 - 190	NA	185			Boring Terminated at 188 feet bgs	
			190				
			195				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
Environmental Solutions, Inc.
1817 Commons Circle, Suite 1, Yukon, OK 73099

LOG OF BORING NO.: **PZ-1** SHEET NUMBER 1 of 1

CLIENT:	American Environmental Landfill
PROJECT NAME:	Monitoring Well Installation Oversight
PROJECT NUMBER:	5386.10
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	on stake
AES PROJECT NO:	05386.10
AES GEOLOGIST:	C. Joyce
START DATE:	01/02/13 FINISH DATE: 01/02/13
START TIME:	8:18 FINISH TIME:

DRILLING CONTRACTOR:	Mohawk Drilling, Inc.
DRILLER:	Jeremy B.
DRILLING RIG:	GEFCO Strata Star 25
DRILLING METHOD:	Air Rotary
SAMPLING METHOD:	Continuous/ Grab
BORING DIAMETER:	6-inch
WELL DIAMETER:	2-inch
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	762.30

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	2	IN
WELL TOTAL DEPTH:	40.5	FT BGS
SCREEN LENGTH:	35.5	FT
RISER LENGTH:	7.5	FT
TOP OF SCREEN:	5	FT BGS
BOTTOM OF SCREEN:	40.5	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	5	FT BGS
TOP OF SEAL:	2	FT BGS
TYPE OF SEAL:	3/8" Bentonite Chips	
TYPE OF FILTER PACK:	12/20 Mesh silica sand	

SAMPLE TYPE	SAMPLE DEPTH		RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES AND WELL CONSTRUCTION
RB	0-5		N/A	2			FILL, sandy lean CLAY with weathered shale frag pale yellowish brown 10YR6/2 to light olive gray 5 5/2, dry.	
				4			weathered clayey shale, moderate brown 5YR4/4 slightly moist.	
RB	5-10		N/A	6				
				8			fine clayey SAND, light brown 5YR5/6, moist	
RB	10-15		N/A	10				
				12				
				14				
RB	15-20		N/A	16				
				18				
				20				
RB	20-25		N/A	22				
				24			fine weathered sandstone, light brown 5YR5/6, dr	
RB	25-29		N/A	26				
				28				
				30				
RB	30-35		N/A	32				
				34				
RB	35-40.5		N/A	36				
				38				
				40			End of Boring 40.5 feet below ground surface	

LEGEND:
SS - Split Spoon
CS - 4' Macro-Core Sampler
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA
Environmental Solutions, Inc.
1817 Commons Circle, Suite 1, Yukon, OK 73099

LOG OF BORING NO.: **PZ-3** SHEET NUMBER 1 of 2

CLIENT:	American Environmental Landfill
PROJECT NAME:	Monitoring Well Installation Oversight
PROJECT NUMBER:	5386.10
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	ON STAKE
AES PROJECT NO:	05386.10
AES GEOLOGIST:	C. Joyce
START DATE:	01/04/13 FINISH DATE: 01/04/13
START TIME:	15:00 FINISH TIME: 9:05

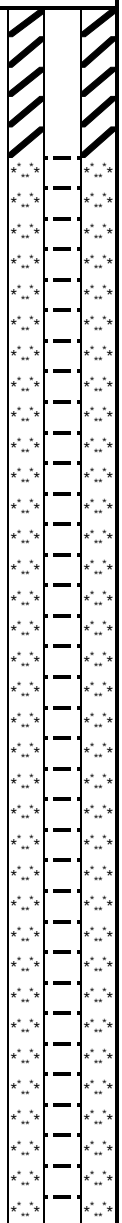
DRILLING CONTRACTOR:	Mohawk Drilling, Inc.
DRILLER:	Jeremy B.
DRILLING RIG:	GEFCO Strata Star 25
DRILLING METHOD:	Air Rotary
SAMPLING METHOD:	Continuous/ Grab
BORING DIAMETER:	6"
WELL DIAMETER:	2"
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	803.10

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	2	IN
WELL TOTAL DEPTH:	77.7	FT BGS
SCREEN LENGTH:	72.7	FT
RISER LENGTH:	7.5	FT
TOP OF SCREEN:	5	FT BGS
BOTTOM OF SCREEN:	77.7	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	5	FT BGS
TOP OF SEAL:	2	FT BGS
TYPE OF SEAL:	3/8" BENTONITE CHIPS	
TYPE OF FILTER PACK:	12/20 MESH SILICA	

SAMPLE TYPE	SAMPLE DEPTH	PID (PPM)	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS
RB	0-5		N/A	2			0.0 FILL, weathered silty shale, pale yellowish brown 10YR6/2, dry
RB	5-10		N/A	6			
RB	10-15		N/A	12			13.0 fine SANDSTONE, light brown 5YR5/6, dry
RB	15-20		N/A	16			15.0 clayey SHALE, light olive gray 5Y5/2, moist
RB	20-25		N/A	22			23.0 weathered silty SHALE, moderate yellowish brown10YR5/4, dry
RB	25-30		N/A	26			25.0 silty SHALE, medium gray N5, dry
RB	30-35		N/A	32			
RB	35-40		N/A	36			

NOTES AND WELL CONSTRUCTION



LEGEND:
SS - Split Spoon
CS - 4' Macro-Core Sampler
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA
Environmental Solutions, Inc.
1817 Commons Circle, Suite 1, Yukon, OK 73099

LOG OF BORING NO.: **PZ-3** SHEET NUMBER 2 of 2

GEOLOGIST: C. Joyce
CLIENT: American Environmental Landfill
DATE: 01/04/13
PROJECT NAME: Monitoring Well Installation Oversight
PROJECT NUMBER: 5386.1

SAMPLER TYPE	SAMPLE DEPTH	PID (PPM)	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
RB	40-45		N/A	42			silty SHALE, medium gray N5, dry	
RB	45-50		N/A	46				
RB	50-55		N/A	52				
RB	55-60		N/A	56				
RB	60-65		N/A	62				
RB	65-70		N/A	66				
RB	70-75		N/A	72				
RB	75-77.7		N/A	76			77.7 End of boring (12/17/12)	
				82				
				86				
				90				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sampler
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA
Environmental Solutions, Inc.
1817 Commons Circle, Suite 1, Yukon, OK 73099

LOG OF BORING NO.: **MW-36** SHEET NUMBER 1 of 2

CLIENT:	American Environmental Landfill
PROJECT NAME:	Monitoring Well Installation Oversight
PROJECT NUMBER:	5386.10
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	offset ~15' south
AES PROJECT NO:	05386.10
AES GEOLOGIST:	C. Joyce
START DATE:	12/12/12 FINISH DATE: 12/13/12
START TIME:	9:42 FINISH TIME: 16:30

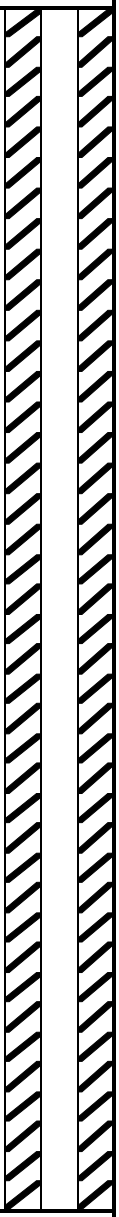
DRILLING CONTRACTOR:	Mohawk Drilling, Inc.
DRILLER:	Jeremy B.
DRILLING RIG:	Brainerd Kilman-61/ GEFCO Strata Star-25
DRILLING METHOD:	4.25" H.S.A./ 6" Air Rotary
SAMPLING METHOD:	Continuous/ Grab
BORING DIAMETER:	8.25"
WELL DIAMETER:	2"
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	729.10

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	2	IN
WELL TOTAL DEPTH:	57.5	FT BGS
SCREEN LENGTH:	10	FT
RISER LENGTH:	50	FT
TOP OF SCREEN:	47.5	FT BGS
BOTTOM OF SCREEN:	57.5	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	45	FT BGS
TOP OF SEAL:	2	FT BGS
TYPE OF SEAL:	3/8" bentonite chips	
TYPE OF FILTER PACK:	12/20 mesh silica	

SAMPLE TYPE	SAMPLE DEPTH	PID (PPM)	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS
G	0-5		N/A	2			0.0 silty SAND, light brown 5YR5/6, dry 0.5 sandy lean CLAY, light brown 5YR5/6, dry
G	5-10		N/A	6			7.0 weathered fine SANDSTONE, light brown 5YR5/6, dry
G	10-15		N/A	12			13.0 weathered fine SANDSTONE, light brown 5YR5/6, slightly moist
G	15-20		N/A	16			16.0 silty shale, light brown 5YR5/6, moist grades to moderate brown 5YR4/4 20.0 clayey SHALE, light olive gray 5Y5/2, slightly moist
G	20-25		N/A	22			22.0 LIMESTONE, yellowish gray 5Y7/2 22.1 clayey SHALE, light olive gray 5Y5/2, slightly moist
G	25-30		N/A	26			
G	30-35		N/A	32			35.0 silty SHALE, medium dark gray N4, dry
G	35-40		N/A	36			

NOTES AND WELL CONSTRUCTION



LEGEND:
SS - Split Spoon
CS - 4' Macro-Core Sampler
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

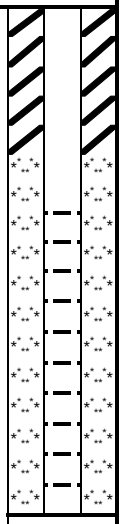
THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA
Environmental Solutions, Inc.
1817 Commons Circle, Suite 1, Yukon, OK 73099

LOG OF BORING NO.: **MW-36** SHEET NUMBER 2 of 2

GEOLOGIST: C. Joyce
CLIENT: American Environmental Landfill
DATE: 12/13/12
PROJECT NAME: Monitoring Well Installation Oversight
PROJECT NUMBER: 5386.1

SAMPLER TYPE	SAMPLE DEPTH	PID (PPM)	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
G	40-45		N/A	42			silty SHALE, medium dark gray N4, dry	
G	45-50		N/A	46			47.0 LIMESTONE, medium gray N5	
				48			47.3 silty SHALE, medium dark gray N4, dry	
G	50-55		N/A	50				
				52			53.0 LIMESTONE, thin shaley layers, medium gray N5	
G	55-57.5		N/A	54				
				56				
				58			57.5 End of boring	
				60				
				62				
				64				
				66				
				68				
				70				
				72				
				74				
				76				
				78				
				80				
				82				
				84				
				86				
				88				
				90				



LEGEND:
SS - Split Spoon
CS - 5 foot CME Sampler
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA
Environmental Solutions, Inc.
1817 Commons Circle, Suite 1, Yukon, OK 73099

LOG OF BORING NO.: **MW-38** SHEET NUMBER 1 of 2

CLIENT:	American Environmental Landfill
PROJECT NAME:	Monitoring Well Installation Oversight
PROJECT NUMBER:	5386.10
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	offset 4' south and 6' east due to steep slope
AES PROJECT NO:	05386.10
AES GEOLOGIST:	C. Joyce
START DATE:	12/14/12 FINISH DATE: 12/15/12
START TIME:	9:45 FINISH TIME: 10:40

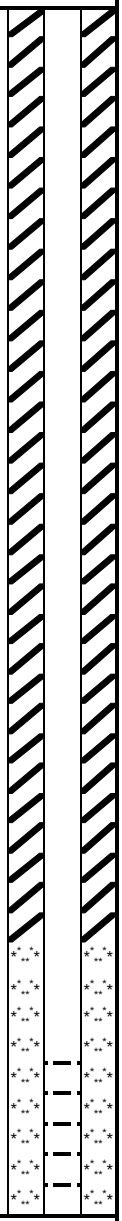
DRILLING CONTRACTOR:	Mohawk Drilling, Inc.
DRILLER:	Jeremy B.
DRILLING RIG:	GEFCO Strata Star-25
DRILLING METHOD:	4.25" H.S.A.
SAMPLING METHOD:	Continuous/ Grab
BORING DIAMETER:	8.25"
WELL DIAMETER:	2"
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	727.40

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	2	IN
WELL TOTAL DEPTH:	45	FT BGS
SCREEN LENGTH:	10	FT
RISER LENGTH:	37.5	FT
TOP OF SCREEN:	35	FT BGS
BOTTOM OF SCREEN:	45	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	33	FT BGS
TOP OF SEAL:	31	FT BGS
TYPE OF SEAL:	3/8" BENTONITE CHIPS	
TYPE OF FILTER PACK:	12/20 MESH SILICA	

SAMPLE TYPE	SAMPLE DEPTH	PID (PPM)	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS
RB	0-5		N/A	2			0.0 clayey silty SAND, moderate brown 5YR4/4, dry, loose 3.0 sandy lean CLAY, light brown 5YR5/6, moist, medium plasticity
RB	5-10		N/A	6			
RB	10-15		N/A	10			9.0 weathered silty SHALE, dark yellowish brown 5YR4/2, dry
RB	15-20		N/A	14			14.0 weathered silty SHALE, dark yellowish brown 5YR4/2, moist
RB	20-25		N/A	18			
RB	25-30		N/A	22			23.0 fine sandy lean CLAY, moderate yellowish brown 10YR5/4, wet 25.0 lean CLAY, dark yellowish brown 10YR4/2, moist
RB	30-35		N/A	26			28.0 LIMESTONE, medium gray N5 28.5 silty SHALE, medium gray N5, dry
RB	35-40		N/A	30			
				34			35.0 LIMESTONE, light gray N7, fossiliferous-brachiopods 35.2 silty SHALE, medium gray N5, dry
				38			
				40			

NOTES AND WELL CONSTRUCTION



LEGEND:
SS - Split Spoon
CS - 4' Macro-Core Sampler
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA
Environmental Solutions, Inc.
1817 Commons Circle, Suite 1, Yukon, OK 73099

LOG OF BORING NO.: **MW-38** SHEET NUMBER 2 of 2

GEOLOGIST: C. Joyce
CLIENT: American Environmental Landfill
DATE: 12/15/12
PROJECT NAME: Monitoring Well Installation Oversight
PROJECT NUMBER: 5386.1

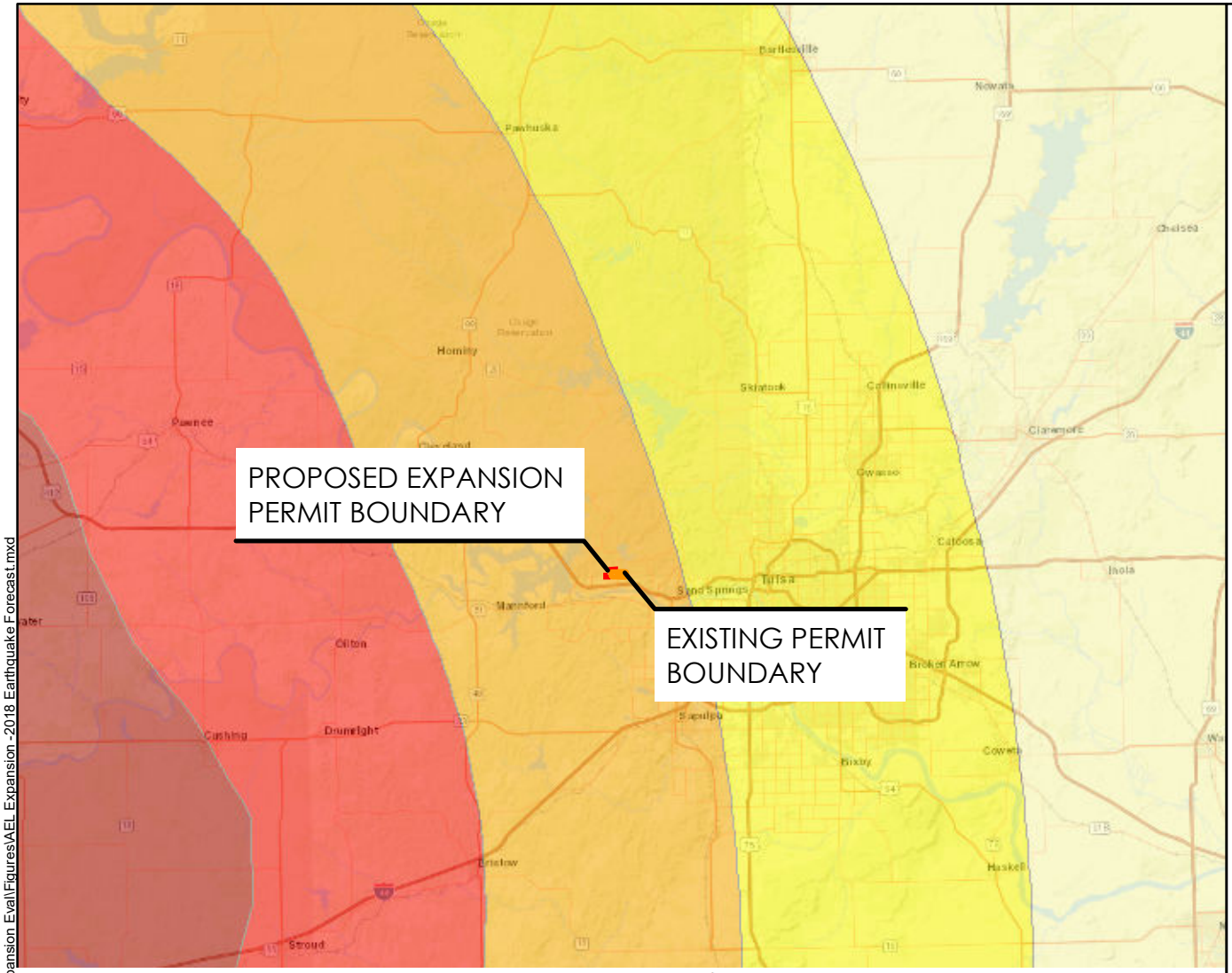
SAMPLER TYPE	SAMPLE DEPTH	PID (PPM)	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
RB	40-45		N/A	42			silty SHALE, medium gray N5, dry	
				44				
RB	45-50		N/A	46				
				48				
				50			50.0 End of boring-Hole Sloughed Off to 45' bgs	
				52				
				54				
				56				
				58				
				60				
				62				
				64				
				66				
				68				
				70				
				72				
				74				
				76				
				78				
				80				
				82				
				84				
				86				
				88				
				90				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sampler
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Appendix C

USGS Seismic Hazards



Chance of potentially minor-damage* ground shaking in 2018

<1%	1% – 2%	2% – 5%	5% – 10%	10% – 14%

* equivalent to Modified Mercalli Intensity VI, which is defined as: "Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight."

USGS Map Caption -

The USGS has produced the 2018 one-year probabilistic seismic hazard forecast for the central and eastern United States from induced and natural earthquakes. For consistency, the updated 2018 forecast is developed using the same probabilistic seismicity-based methodology as applied in the two previous forecasts.

Rates of earthquakes across the U.S. M ≥ 3.0 grew rapidly between 2008 and 2015 but have steadily declined over the past three years, especially in areas of Oklahoma and southern Kansas where fluid injection has decreased. The seismicity pattern in 2017 was complex with earthquakes more spatially dispersed than in previous years. Some areas of west-central Oklahoma experienced increased activity rates where industrial activity increased. Earthquake rates in Oklahoma (429 earthquakes of M ≥ 3 and 4 M ≥ 4), Raton Basin (Colorado/New Mexico border, 6 earthquakes M ≥ 3), and the New Madrid seismic zone (11 earthquakes M ≥ 3) continue to be higher than historical levels. Almost all of these earthquakes occurred within the highest hazard regions of the 2017 forecast.

Even though rates declined over the past three years, the short-term hazard for damaging ground shaking across much of Oklahoma remains at high levels due to continuing high rates of smaller earthquakes that are still hundreds of times higher than at any time in the State's history. These short-term hazard levels are similar to active regions in California. During 2017, M ≥ 3 earthquakes also occurred in or near Ohio, West Virginia, Missouri, Kentucky, Tennessee, Arkansas, Illinois, Oklahoma, Kansas, Colorado, New Mexico, Utah, and Wyoming.

Legend

- Existing Permit Boundary
- Proposed Expanded Permit Boundary

FIGURE 6
DRILLING PLAN - AEL LANDFILL EXPANSION
2018 ONE-YEAR SEISMIC HAZARD FORECAST
OSAGE COUNTY, OKLAHOMA

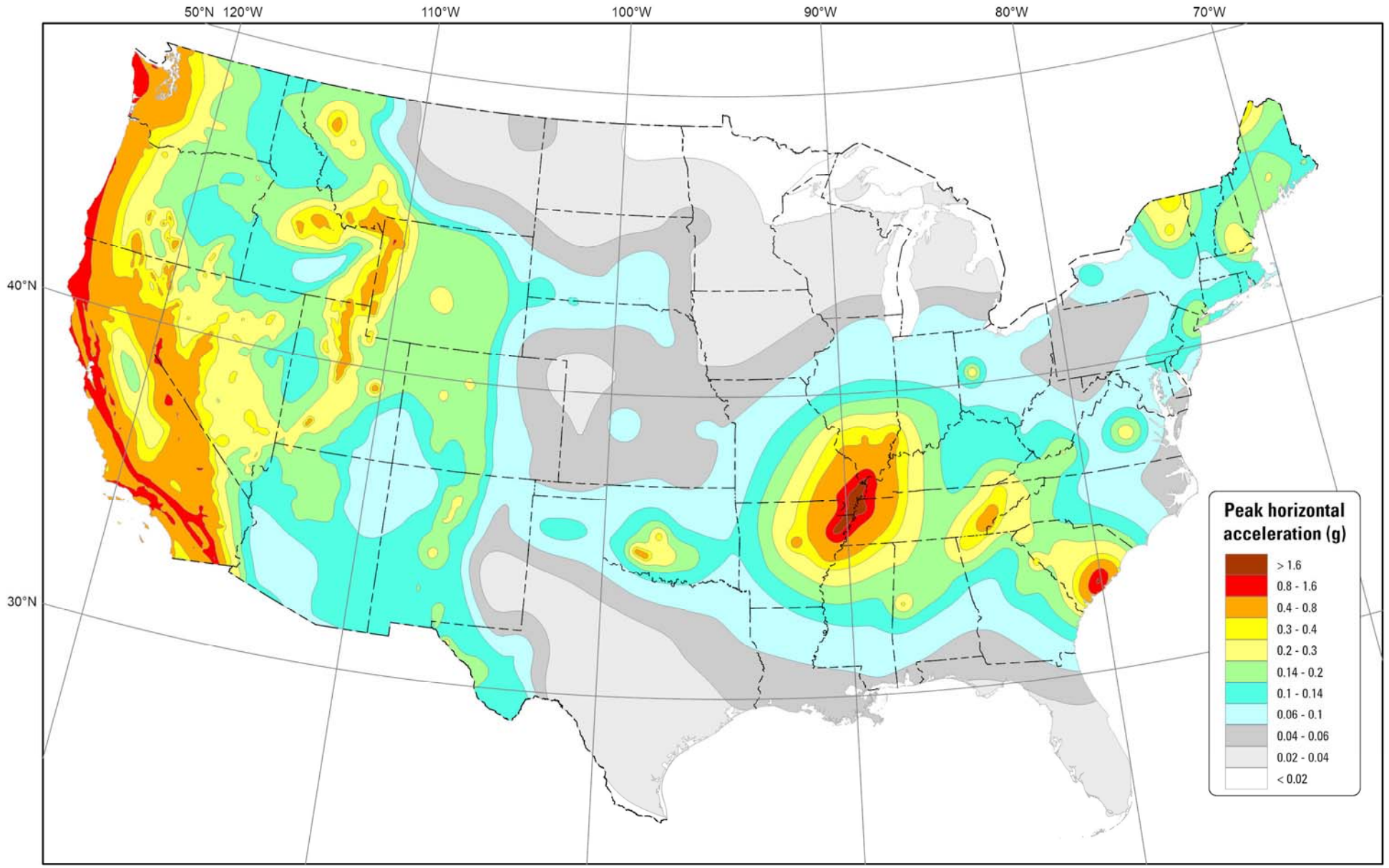
SCS ENGINEERS

Yukon, OK	May 2020

0 5 10 Miles

N

Document Path: K:\AEL\Projects\2019\27219016.00 - Landfill Expansion Eval\Figures\AEL Expansion -2018 Earthquake Forecast.mxd



2018 National Seismic Hazard Model for the conterminous United States

Peak horizontal acceleration
with a 2% probability of exceedance in 50 years
NEHRP site class B/C (V_{s30} = 760 m/s)

Appendix D

Location Restrictions

Public Notice

U.S. Army Corps of Engineers
Tulsa District

Reply To:

U.S. Army Corps of Engineers
ATTN: Regulatory Office
2488 East 81St Street
Tulsa, Oklahoma 74137-4290

SWT-2017-339
Public Notice No.

November 18, 2019
Public Notice Date

December 17, 2019
Expiration Date

PURPOSE

The purpose of this public notice is to inform you of a proposal for work in which you might be interested and to solicit your comments and information to better enable us to make a reasonable decision on factors affecting the public interest.

SECTION 10

The U.S. Army Corps of Engineers is directed by Congress through Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) to regulate all work or structures in or affecting the course, condition, or capacity of navigable waters of the United States. The intent of this law is to protect the navigable capacity of waters important to interstate commerce.

SECTION 404

The U.S. Army Corps of Engineers is directed by Congress through Section 404 of the Clean Water Act (33 U.S.C. 1344) to regulate the discharges of dredged and fill material into all waters of the United States. These waters include lakes, rivers, streams, mudflats, sandflats, sloughs, wet meadows, natural ponds, and wetlands adjacent to other waters. The intent of the law is to protect these waters from the indiscriminate discharge of material capable of causing pollution and to restore and maintain their chemical, physical, and biological integrity.

NOTICE TO PUBLISHERS

This public notice has been provided as a public service and may be reprinted at your discretion. However, any cost incurred as a result of reprinting or further distribution shall not be a basis for claim against the Government.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
2488 EAST 81ST STREET
TULSA, OKLAHOMA 74137-4290

Application No. SWT-2017-339

JOINT PUBLIC NOTICE
U.S. ARMY CORPS OF ENGINEERS
AND
OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY (ODEQ)
(30-DAY COMMENT PERIOD)

Interested parties are hereby notified that the District Engineer (DE) has received an application for a Department of the Army (DA) permit and water quality certification pursuant to Sections 404 and 401 of the Clean Water Act (CWA). The ODEQ hereby incorporates this public notice and procedure as its own public notice and procedure by reference thereto.

Applicant: Mr. Todd Green
American Environmental Landfill (AEL)
207 North 117th West Avenue
Sands Springs, OK 74063

Agent: Mr. Wade Miller
SCS Engineers
1817 Commons Circle, Suite 1
Yukon, OK 73099

Location: The proposed project is in the North ½ of Section 35 and West ½ of Section 36, Township 20 North, Range 10 East, in Sand Springs, Osage County, Oklahoma. The project site can be found on the Wekiwa Oklahoma 7.5 Minute USGS Quadrangle map at North Latitude 36.165971 and West Longitude 96.199087.

Project Description: The application is for an after-the-fact (ATF) permit for placement of fill material into an unnamed tributary of Arkansas River and also includes the placement of fill material for the proposed lateral AEL expansion of the existing, active solid waste landfill.

Purpose: The overall purpose of this work is for an expansion of the primary destination of solid waste for the Tulsa Region. The proposed landfill expansion would allow AEL to continue to receive and manage solid waste for approximately next 120 years. The proposal would construct interlocking impervious cell liners, which will expand the storage capacity of the landfill. The project is not a water dependent activity and there are no special aquatic sites located within the project site.

Summary Table of Impacts:

Original Proposal					
Number or Location	Impact Activity	Type of Water	Type of Fill Material	Quantity of Material (CY) below OHWM	Footprint (AC and/or LF)
Unnamed Tributary of the Arkansas River Stream 1 North	Placement of Fill Material	Stream	Earthen Material/Grey shale	79	1,283 LF 0.095 AC
Unnamed Tributary of the Arkansas River (ATF) Stream 1 Central	Placement of Fill Material	Stream	Earthen Material/Grey Shale	145	1,300 LF 0.135 AC
Unnamed Tributary of the Arkansas River Stream 1 Southern	Placement of Fill Material	Stream	Earthen Material/Grey Shale	172	1,934 LF 0.272 AC
cubic yards (cy), ordinary high water mark (OHWM), acre (ac), linear feet (lf)					

Description of Work: The applicant's proposal would eliminate this reach of the stream channel by the placement of fill material using 396 CY of compacted clay and HDPE Geomembrane for approximately 4,517 LF (0.502 AC) of the unnamed tributary of the Arkansas River. Also, the applicant proposes to construct a composite liner for a solid waste landfill. The fill material may consist of grey shale and earthen material. The work would be performed using conventional earth moving equipment.

Avoidance and Minimization Information: The applicant provided the following statement with regard to how avoidance and minimization of impacts to aquatic resources was incorporated into the project plan:

This applicant did not provide a statement to avoidance and minimization of impacts to aquatic resources.

Mitigation: Furthermore, the applicant proposes the following as compensatory mitigation for the existing impact and additional unavoidable impacts to aquatic resources expected from the proposed project:

The mitigation stream (unnamed tributary of Shell Creek) would be shorter than the impacted stream channel (2,920 LF [0.67 AC]). The proposed mitigation channel would begin at a spillway located at the southeast corner of a farm pond and traverse east to a second pond. The constructed channel would be sinuous in nature, including rocks and boulders in and along the channel to re-establish desired condition that simulate the reference stream channel and establish the riparian area. An additional 1.85 AC of existing wetlands/ponds/streams channel will be included as preservation.

This mitigation plan is the applicant's proposal. The Corps has made no determination at this time with regard to the adequacy of the proposed mitigation relative to the federal mitigation rules and guidance, including Tulsa District's Mitigation and Monitoring Guidelines Compensatory Mitigation for unavoidable impacts may be required to ensure that this activity requiring a Section 404 permit, if issued complies with the Section 404 (b)(1) Guidelines. The Corps bears the final decision on the need for and extent of mitigation required if the project proposed herein is authorized.

Government Authorizations obtained or received: The Corps has not reviewed any copies of other required permits.

Project Setting: This project is located within the Oklahoma Ecoregion of Cross Timber Transition, which is part of the Northern Cross Timbers geomorphic province. The Transition is characterized by a series of woodland and prairies. The project is in the floodplain of the Arkansas River.

Existing Condition: The parcel of land is comprised woodlands, savanna, and tallgrass prairies in the uplands. The intermittent stream channel is jurisdictional waters of the United States. The primary use for the land historically was for woodlands.

Cultural Resources: The DE is responsible to ensure compliance with the National Historic Preservation Act of 1966 (NHPA) (Public Law 89-665), as amended, and other cultural resources laws and Executive Orders. A preliminary review of the state's records has been completed for the presence of sites included in, or eligible for, inclusion in the National Register of Historic Places, as well as the Oklahoma Landmark Inventory Database. There are no known historic properties, as defined by the NHPA, in or within the vicinity of the proposed permit area.

Threatened and Endangered Species: The following federally listed species are known to occur in the vicinity or are listed for the county in which the proposed action is located: least tern (*Sterna antillarum),* piping plover (*Charadrius melodus),* red knot *(Calidris canutus rufa),* whooping crane *(Grus americana)* and American burying beetle *(Nicrophorus americanus*). A copy of this notice is being furnished to the U.S. Fish and Wildlife Service and appropriate state agencies.

We are currently assessing the potential effects of the proposed action on these species and will comply with the Endangered Species Act with regard to any effect of our decision on this permit application.

Evaluation Factors: The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts of the proposed activity and its intended use on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects thereof: conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownerships, and, in general, the needs and welfare of the people. A permit will be denied if the discharge does not comply with the Environmental Protection Agency's 404(b)(1) Guidelines. Subject to the 404(b)(1) Guidelines and any other applicable guidelines or criteria, a permit will be granted unless the DE determines that it would be contrary to the public interest.

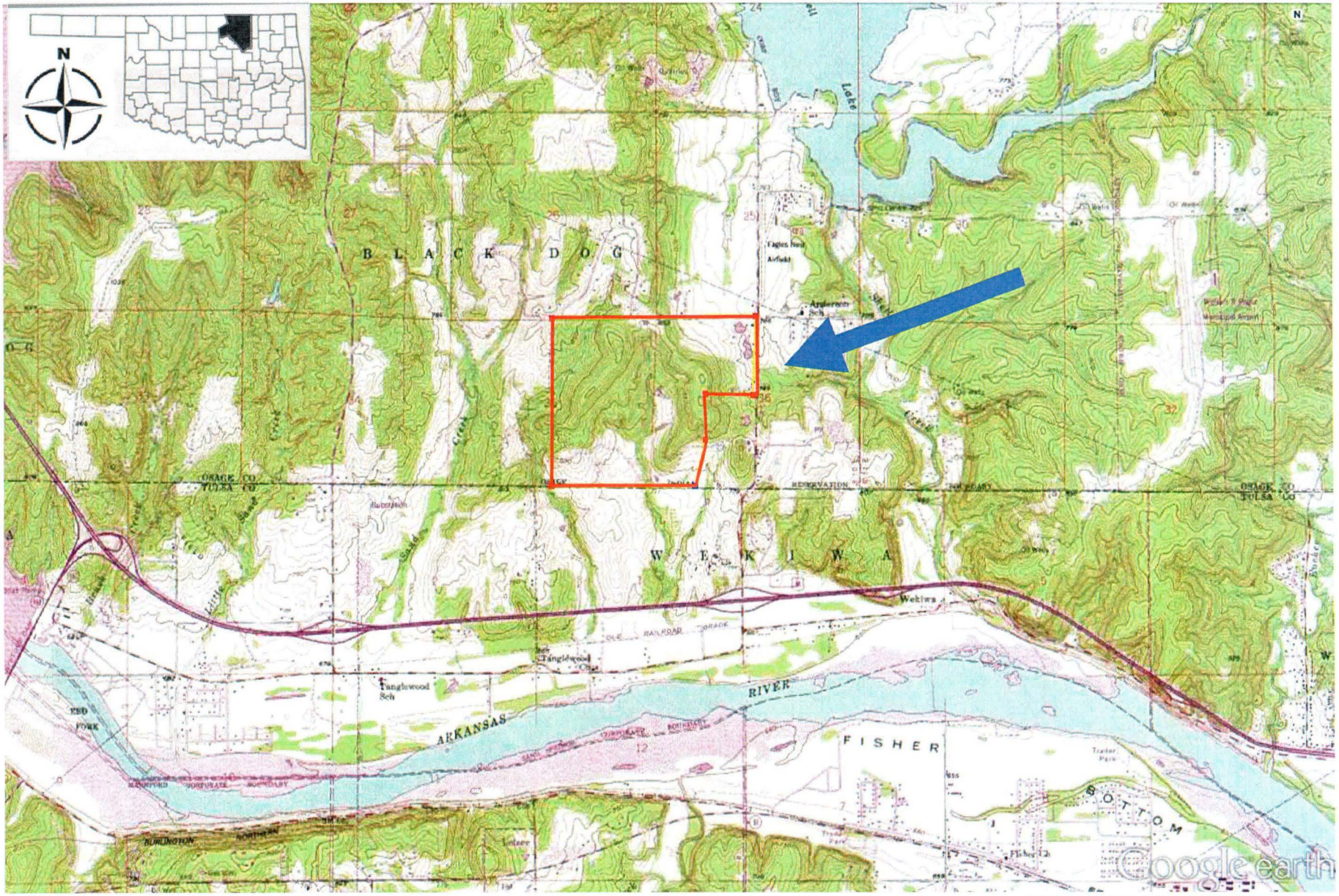
Plans and Data: Plans showing the location of the proposed activity and other data are enclosed with this notice (Enclosure 1 of 8). If additional information is desired, it may be obtained from Mr. Marcus Ware, Tulsa District Corps of Engineers, ATTN: Regulatory Office, 2488 East 81st Street, Tulsa, OK 74137; or telephone 918-669-7400.

Comments: In order to consider and evaluate the impacts of this proposed activity the Corps is soliciting comments from the public, federal, state, and local agencies and officials, floodplain administrators, state historic preservation officers, Indian tribes, and other interested parties. Comments concerning the issuance of this permit should be received by the DE no later than the expiration date of this public notice. You may submit comments to mailing address Tulsa District Corps of Engineers, ATTN: Regulatory Office, 2488 East 81st Street, Tulsa, OK 74137; or email CESWT-RO@usace.army.mil, please include the public notice number SWT-2017-339 in the subject line of the message.

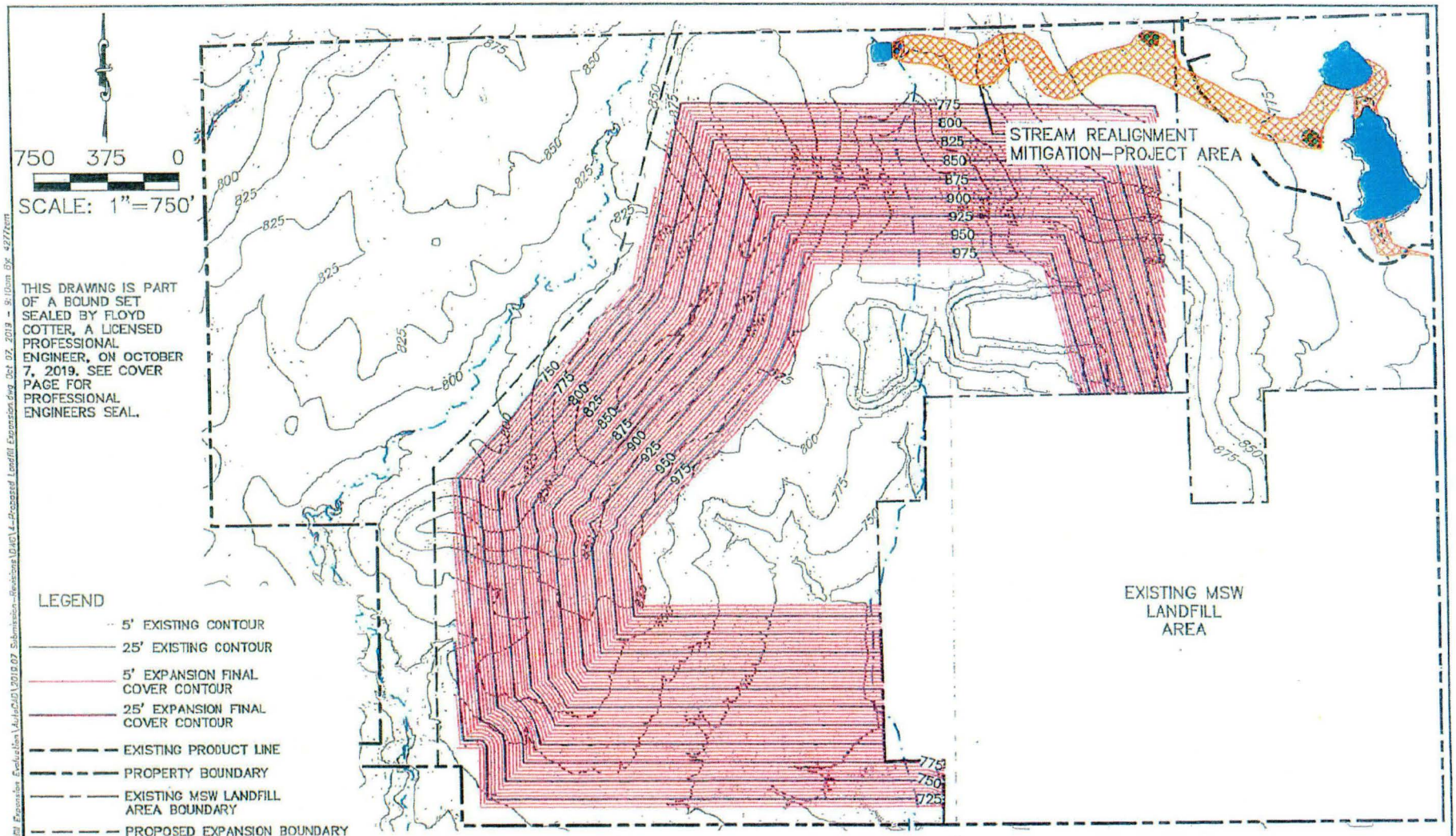
Comments concerning water quality impacts will be forwarded to ODEQ for consideration in issuing a Section 401 Water Quality Certification for the proposed project. Work may **not** commence until decisions have been made on both Sections 401 and 404.

Andrew R. Commer
Chief, Regulatory Office

Enclosures



SWT-2017-339
AEL Landfill Proposed Lateral Expansion
Unnamed Tributary of the Arkansas River
Osage County, Oklahoma
Enclosure 1 of 8



NOTES:

1. EXISTING TOPOGRAPHY, PROPERTY BOUNDARY AND ROADWAYS FROM SURVEY PROVIDED BY PROFESSIONAL SURVEYING, INC. OF TULSA, OKLAHOMA, DATED MARCH 7, 2018.
2. EXISTING PRODUCT LINE FROM SURVEY PROVIDED BY PROFESSIONAL SURVEYING, INC. OF TULSA, OKLAHOMA, DATED
3. EXISTING STREAMS, WETLANDS, AND PONDS LOCATED USING NATIONAL WETLANDS INVENTORY MAP AND SITE VISITS PERFORMED BY SCS ENGINEERS.
4. FINAL COVER CONTOURS SHOWN ARE FOR CONCEPTUAL PURPOSES ONLY.

SCS ENGINEERS
8575 WEST 110TH ST. SUITE 100
OVERLAND PARK, KS 66210
PH. (913) 681-0030 FAX. (913) 681-0012

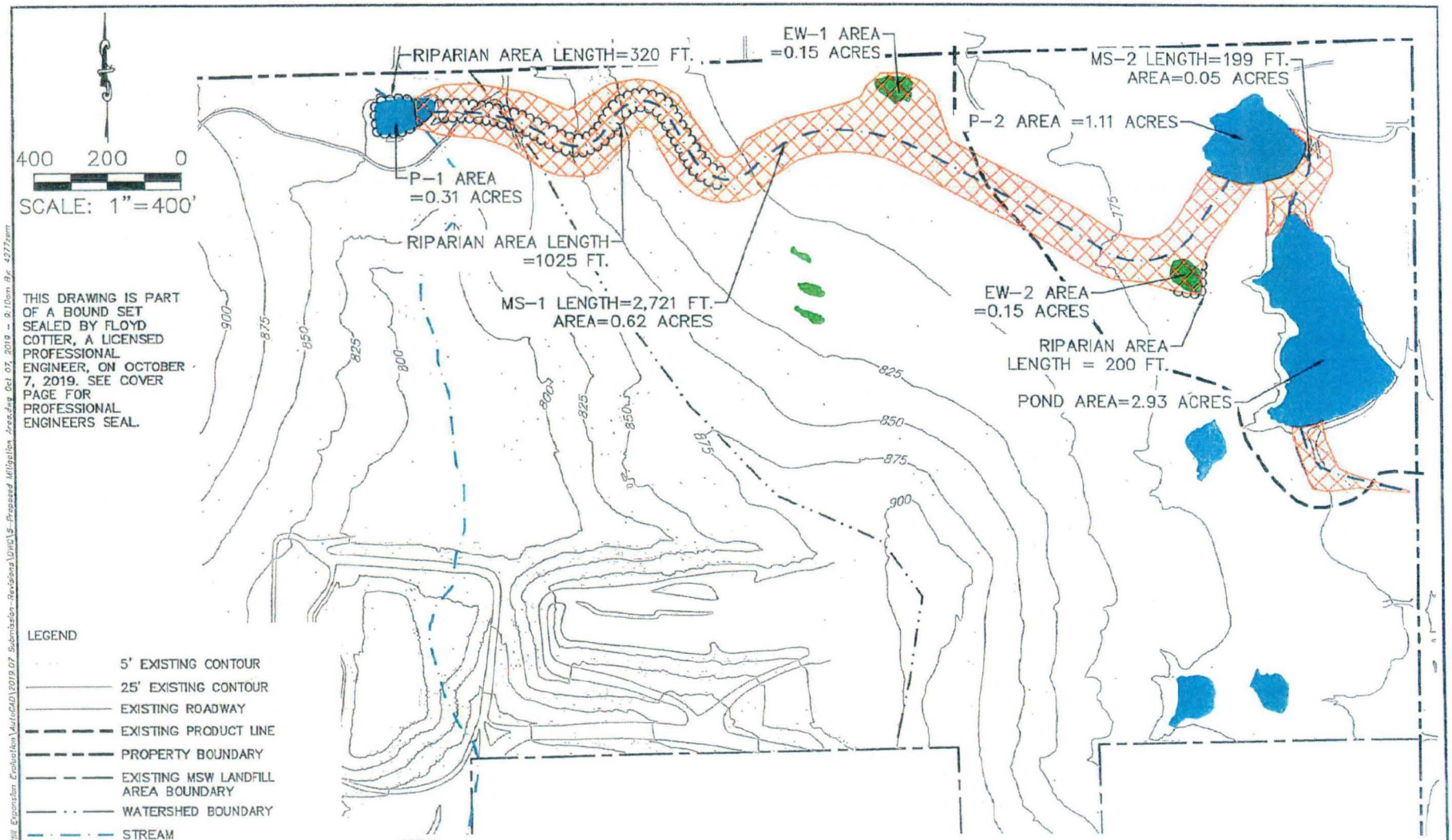
PROJ. NO.	DSN. BY	Q/A REVW. BY
27219016.00	ZEM	VW
DSN. BY	CHK. BY	PROJ. MGR.
ZEM	MPP	WM

SWT-2017-339
AEL Landfill Proposed Lateral Expansion
Unnamed Tributary of the Arkansas River
Osage County, Oklahoma
Enclosure 2 of 8

SHEET TITLE: **PROPOSED LANDFILL EXPANSION**

PROJECT TITLE: **PROPOSED EXPANSION AND STREAM MITIGATION DESIGN**

DATE: 10/7/19
SCALE: SCALE
DRAWING NO. 4 of 13



SCS ENGINEERS
8575 WEST 110TH ST. SUITE 100
OVERLAND PARK, KS 66210
PH. (913) 681-0030 FAX. (913) 681-0012

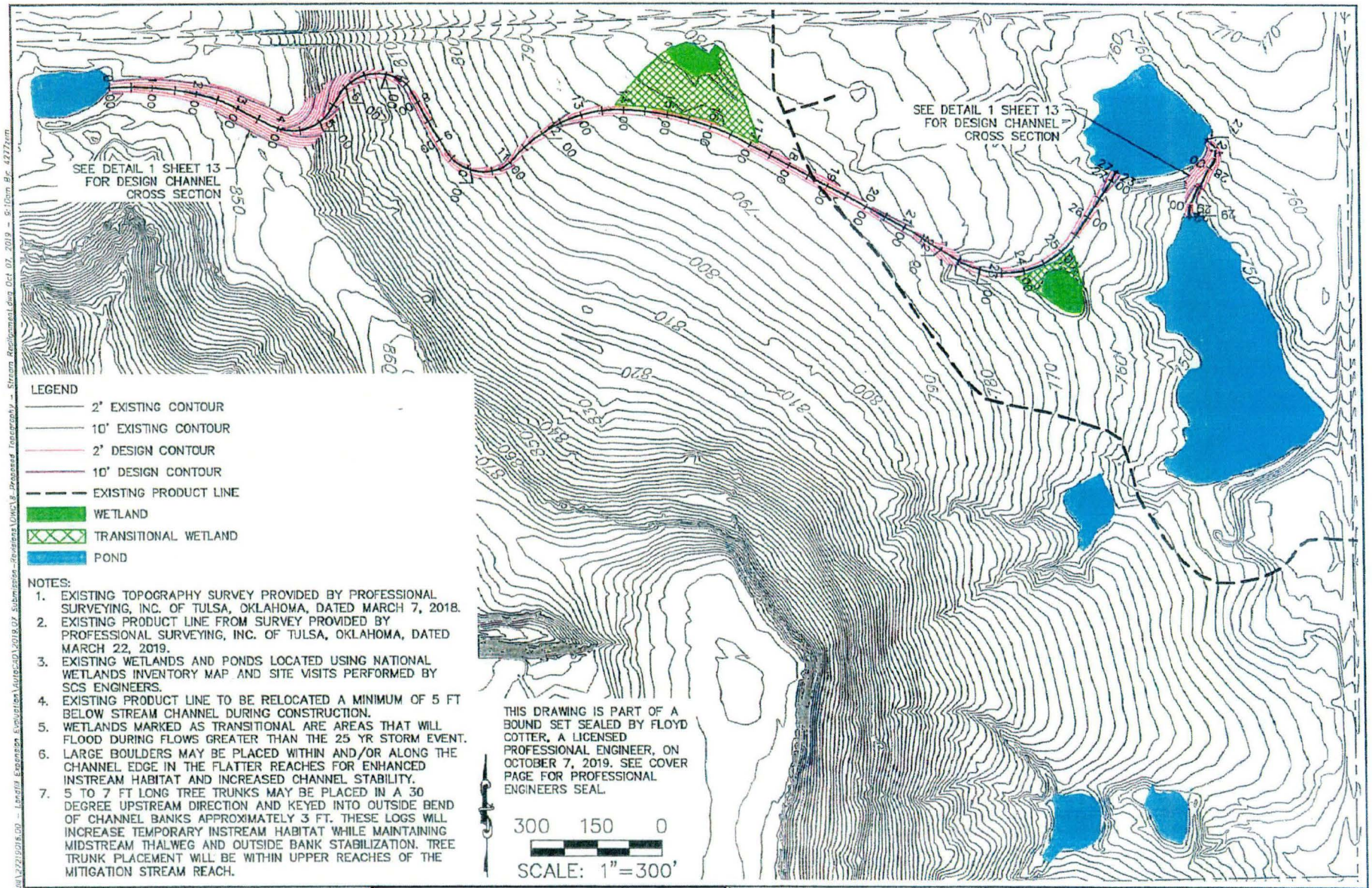
PROJ. NO.	DSN. BY:	Q/A REVW. BY:
27219016.00	ZEM	VW
DSN. BY:	CHC. BY:	PROJ. MGR:
ZEM	MPP	WM

SWT-2017-339
AEL Landfill Proposed Lateral Expansion
Unnamed Tributary of the Arkansas River
Osage County, Oklahoma
Enclosure 3 of 8

SHEET TITLE:
PROPOSED MITIGATION AREA

PROJECT TITLE:
PROPOSED EXPANSION AND STREAM MITIGATION DESIGN

DATE: 10/7/19
SCALE: AS SHOWN
DRAWING NO. 5 of 13



SCS ENGINEERS
8575 WEST 110TH ST. SUITE 100
OVERLAND PARK, KS 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO.	DWN. BY	Q/A RVW. BY
27219016.00	ZEM	VW
DSN. BY	CHK. BY	PROJ. MGR.
ZEM	MPP	WM

SWT-2017-339
AEL Landfill Proposed Lateral Expansion
Unnamed Tributary of the Arkansas River
Osage County, Oklahoma
Enclosure 4 of 8

SHEET TITLE:
PROPOSED REALIGNMENT (OVERVIEW)

PROJECT TITLE:
PROPOSED EXPANSION AND STREAM MITIGATION DESIGN

DATE: 10/7/19
SCALE: SCALE
DRAWING NO. 8 of 13

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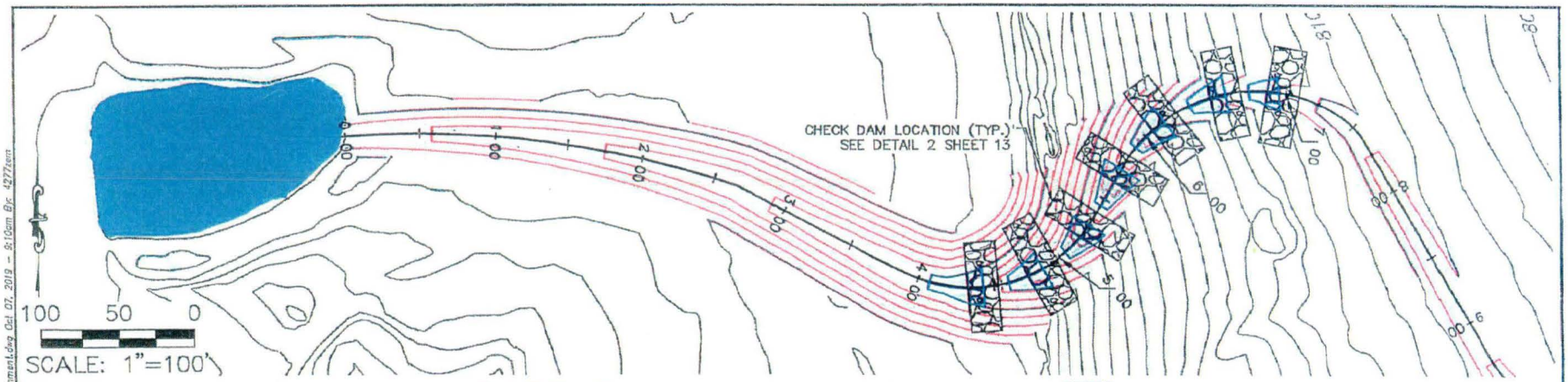

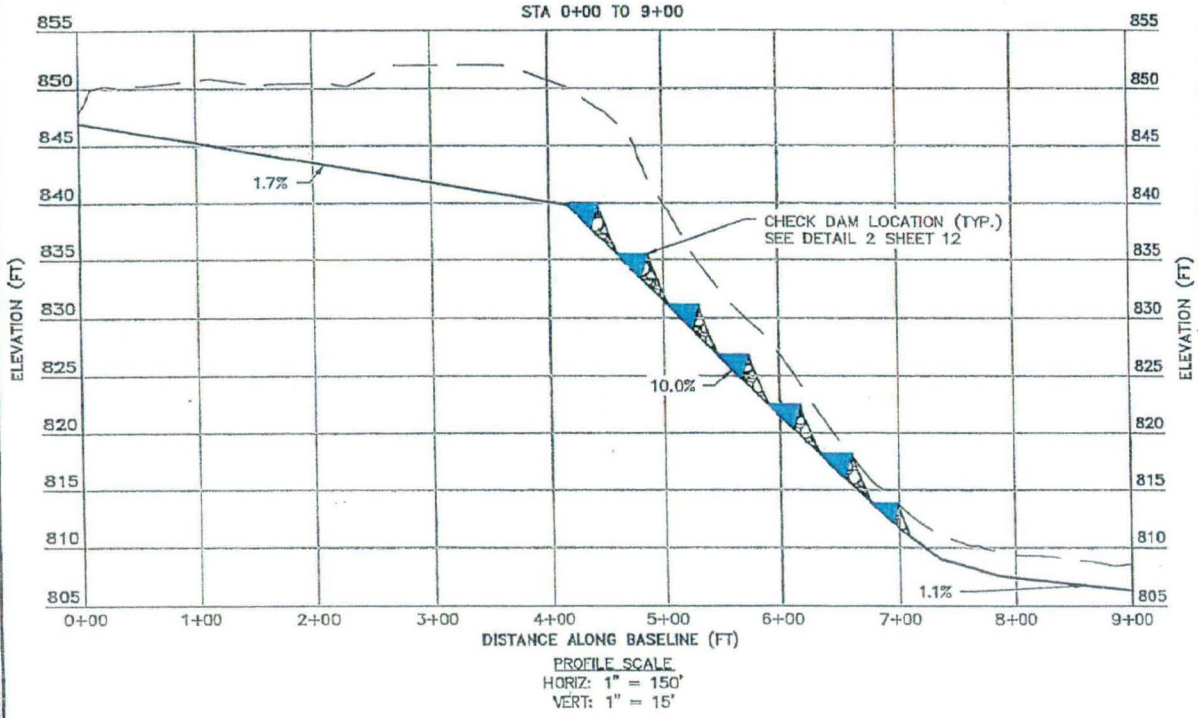

PROFILE SCALE
HORIZ: 1" = 150'
VERT: 1" = 15'

LEGEND
- 2' EXISTING CONTOUR
- 10' EXISTING CONTOUR
- 2' DESIGN CONTOUR
- 10' DESIGN CONTOUR
- EXISTING PROFILE
- DESIGN PROFILE
- POND
- CHECK DAM

NOTES:
1. EXISTING TOPOGRAPHY SURVEY PROVIDED BY PROFESSIONAL SURVEYING, INC. OF TULSA, OKLAHOMA, DATED MARCH 7, 2018.
2. EXISTING PRODUCT LINE FROM SURVEY PROVIDED BY PROFESSIONAL SURVEYING, INC. OF TULSA, OKLAHOMA, DATED MARCH 22, 2019.
3. EXISTING WETLANDS AND PONDS LOCATED USING NATIONAL WETLANDS INVENTORY MAP AND SITE VISITS PERFORMED BY SCS ENGINEERS.
4. EXISTING PRODUCT LINE TO BE RELOCATED A MINIMUM OF 5 FT BELOW STREAM CHANNEL DURING CONSTRUCTION.
5. WETLANDS MARKED AS TRANSITIONAL ARE AREAS THAT WILL FLOOD DURING FLOWS GREATER THAN THE 25 YR STORM EVENT.
6. LARGE BOULDERS MAY BE PLACED WITHIN AND/OR ALONG THE CHANNEL EDGE IN THE FLATTER REACHES FOR ENHANCED INSTREAM HABITAT AND INCREASED CHANNEL STABILITY.
7. 5 TO 7 FT LONG TREE TRUNKS MAY BE PLACED IN A 30 DEGREE UPSTREAM DIRECTION AND KEYED INTO OUTSIDE BEND OF CHANNEL BANKS APPROXIMATELY 3 FT. THESE LOGS WILL INCREASE TEMPORARY INSTREAM HABITAT WHILE MAINTAINING MIDSTREAM THALWEG AND OUTSIDE BANK STABILIZATION. TREE TRUNK PLACEMENT WILL BE WITHIN UPPER REACHES OF THE MITIGATION STREAM REACH.

THIS DRAWING IS PART OF A BOUND SET SEALED BY FLOYD COTTER, A LICENSED PROFESSIONAL ENGINEER, ON OCTOBER 7, 2019. SEE COVER PAGE FOR PROFESSIONAL ENGINEERS SEAL.

SCS ENGINEERS
8575 WEST 110TH ST. SUITE 100
OVERLAND PARK, KS 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO.	DES. BY	Q/A REVIEW BY
27219016.00	ZEM	VW
DSN. BY	CHK. BY	PROJ. MGR.
ZEM	MPP	WM

SWT-2017-339
AEL Landfill Proposed Lateral Expansion
Unnamed Tributary of the Arkansas River
Osage County, Oklahoma
Enclosure 5 of 8

SHEET TITLE:
PROPOSED REALIGNMENT (0 TO 9+00)

PROJECT TITLE:
PROPOSED EXPANSION AND STREAM MITIGATION DESIGN

DATE: 10/7/19
SCALE: SCALE
DRAWING NO. 9 of 13

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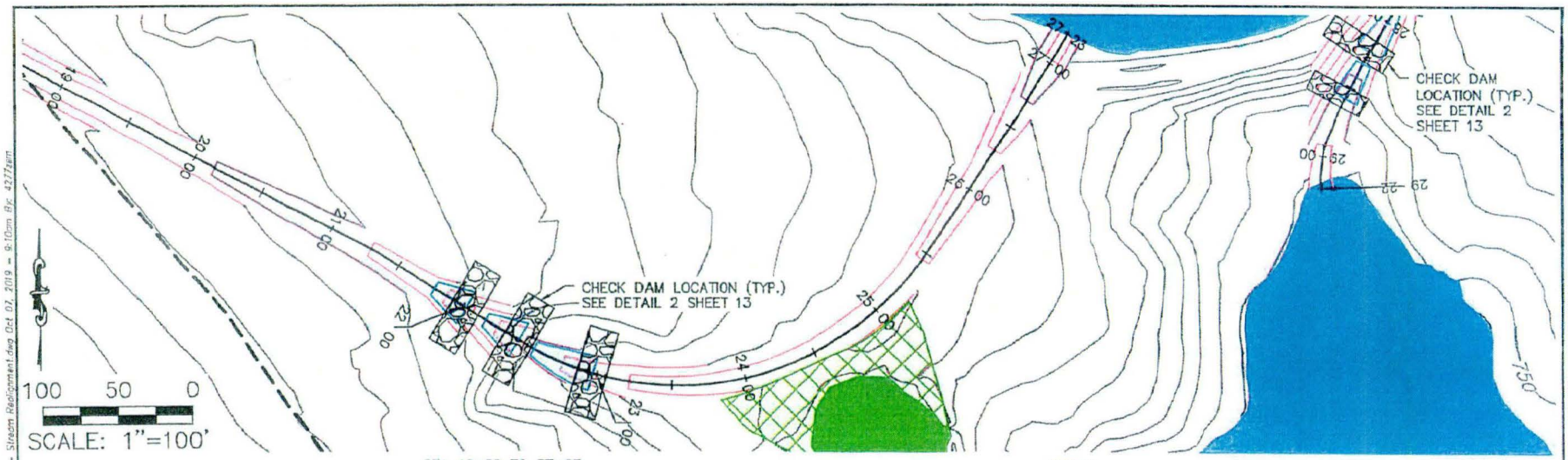

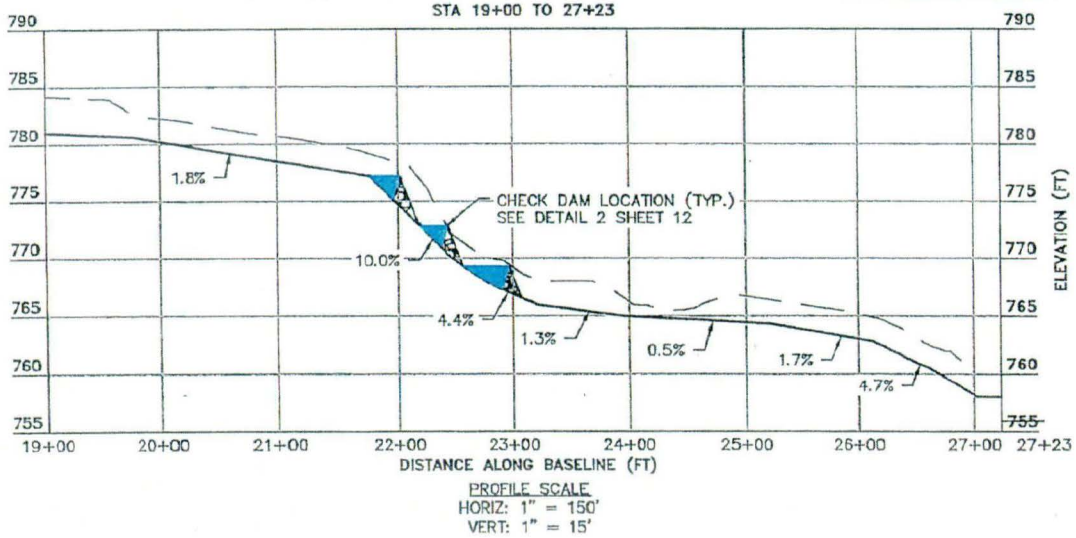

PROFILE SCALE
HORIZ: 1" = 150'
VERT: 1" = 15'

LEGEND

- 2' EXISTING CONTOUR
- 10' EXISTING CONTOUR
- 2' DESIGN CONTOUR
- 10' DESIGN CONTOUR
- EXISTING PROFILE
- DESIGN PROFILE
- EXISTING PRODUCT LINE
- WETLAND
- TRANSITIONAL WETLAND
- POND
- CHECK DAM

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5. WETLANDS MARKED AS TRANSITIONAL ARE AREAS THAT WILL FLOOD DURING FLOWS GREATER THAN THE 25 YR STORM EVENT.
6. LARGE BOULDERS MAY BE PLACED WITHIN AND/OR ALONG THE CHANNEL EDGE IN THE FLATTER REACHES FOR ENHANCED INSTREAM HABITAT AND INCREASED CHANNEL STABILITY.
7. 5 TO 7 FT LONG TREE TRUNKS MAY BE PLACED IN A 30 DEGREE UPSTREAM DIRECTION AND KEYED INTO OUTSIDE BEND OF CHANNEL BANKS APPROXIMATELY 3 FT. THESE LOGS WILL INCREASE TEMPORARY INSTREAM HABITAT WHILE MAINTAINING MIDSTREAM THALWEG AND OUTSIDE BANK STABILIZATION. TREE TRUNK PLACEMENT WILL BE WITHIN UPPER REACHES OF THE MITIGATION STREAM REACH.

THIS DRAWING IS PART OF A BOUND SET SEALED BY FLOYD COTTER, A LICENSED PROFESSIONAL ENGINEER, ON OCTOBER 7, 2019. SEE COVER PAGE FOR PROFESSIONAL ENGINEERS SEAL.

SCS ENGINEERS
8575 WEST 110TH ST. SUITE 100
OVERLAND PARK, KS 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO.	DES. BY:	Q/A REVR. BY:
27219016.00	ZEM	VW
DSN. BY:	CHK. BY:	PROJ. MGR:
ZEM	MPP	WM

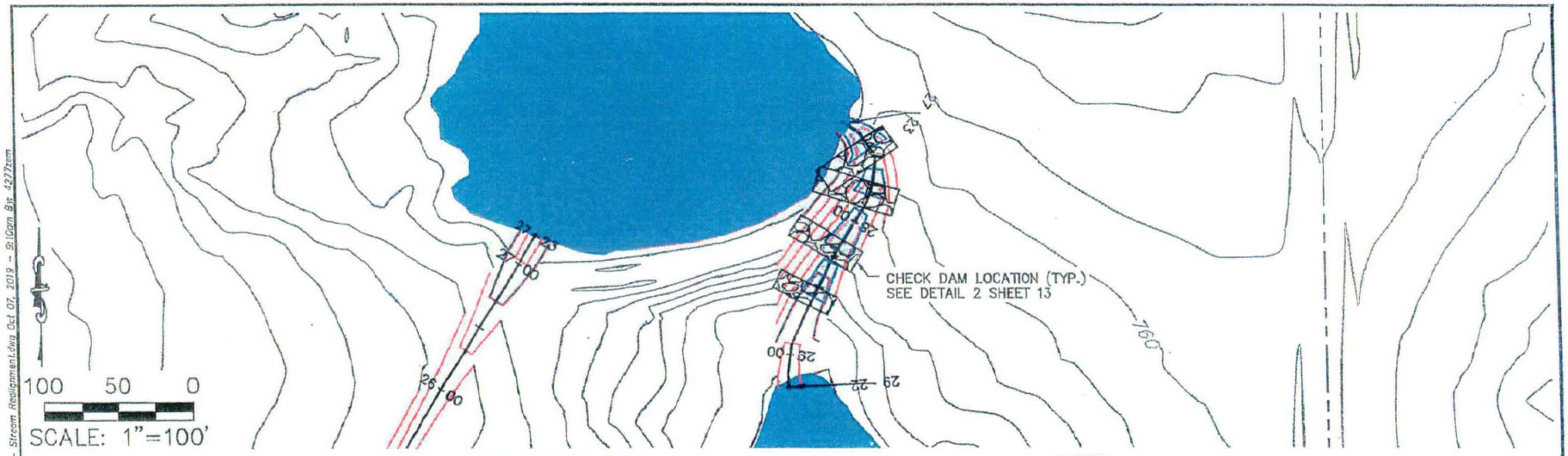
SWT-2017-339
AEL Landfill Proposed Lateral Expansion
Unnamed Tributary of the Arkansas River
Osage County, Oklahoma
Enclosure 6 of 8

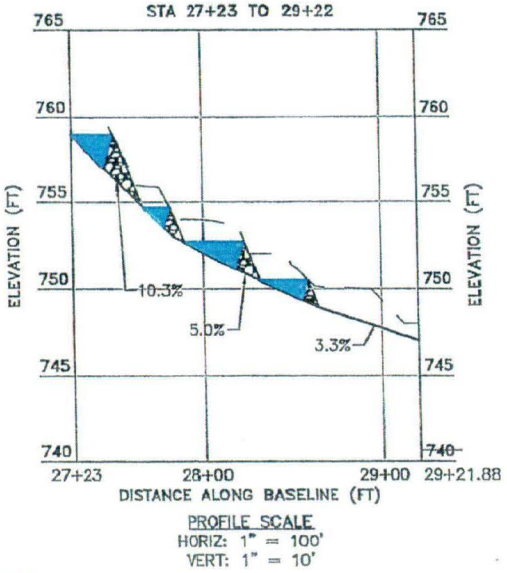
SHEET TITLE:
PROPOSED REALIGNMENT (19+00 TO 27+23)

PROJECT TITLE:
PROPOSED EXPANSION AND STREAM MITIGATION DESIGN

DATE: 10/7/19
SCALE: SCALE
DRAWING NO. 11 of 13

K:\American Environmental Landfill\27219016.00 - Landfill Expansion Evaluation\Mxd\CAD\2019.07 Submission-Revisions\DWG\8-Proposed Topography - Stream Realignment.dwg Oct 07, 2019 - 9:10am Rjc 43.7item





PROFILE SCALE
HORIZ: 1" = 100'
VERT: 1" = 10'

LEGEND

- 2' EXISTING CONTOUR
- 10' EXISTING CONTOUR
- 2' DESIGN CONTOUR
- 10' DESIGN CONTOUR
- EXISTING PROFILE
- DESIGN PROFILE
- EXISTING PRODUCT LINE
- WETLAND
- TRANSITIONAL WETLAND
- POND
- CHECK DAM

NOTES:

1. EXISTING TOPOGRAPHY SURVEY PROVIDED BY PROFESSIONAL SURVEYING, INC. OF TULSA, OKLAHOMA, DATED MARCH 7, 2018.
2. EXISTING PRODUCT LINE FROM SURVEY PROVIDED BY PROFESSIONAL SURVEYING, INC. OF TULSA, OKLAHOMA, DATED MARCH 22, 2019.
3. EXISTING WETLANDS AND PONDS LOCATED USING NATIONAL WETLANDS INVENTORY MAP AND SITE VISITS PERFORMED BY SCS ENGINEERS.
4. EXISTING PRODUCT LINE TO BE RELOCATED A MINIMUM OF 5 FT BELOW STREAM CHANNEL DURING CONSTRUCTION.
5. WETLANDS MARKED AS TRANSITIONAL ARE AREAS THAT WILL FLOOD DURING FLOWS GREATER THAN THE 25 YR STORM EVENT.
6. LARGE BOULDERS MAY BE PLACED WITHIN AND/OR ALONG THE CHANNEL EDGE IN THE FLATTER REACHES FOR ENHANCED INSTREAM HABITAT AND INCREASED CHANNEL STABILITY.
7. 5 TO 7 FT LONG TREE TRUNKS MAY BE PLACED IN A 30 DEGREE UPSTREAM DIRECTION AND KEYED INTO OUTSIDE BEND OF CHANNEL BANKS APPROXIMATELY 3 FT. THESE LOGS WILL INCREASE TEMPORARY INSTREAM HABITAT WHILE MAINTAINING MIDSTREAM THALWEG AND OUTSIDE BANK STABILIZATION. TREE TRUNK PLACEMENT WILL BE WITHIN UPPER REACHES OF THE MITIGATION STREAM REACH.

THIS DRAWING IS PART OF A BOUND SET SEALED BY FLOYD COTTER, A LICENSED PROFESSIONAL ENGINEER, ON OCTOBER 7, 2019. SEE COVER PAGE FOR PROFESSIONAL ENGINEERS SEAL.

SCS ENGINEERS
8575 WEST 110TH ST. SUITE 100
OVERLAND PARK, KS 66210
PH. (913) 681-0030 FAX. (913) 681-0012

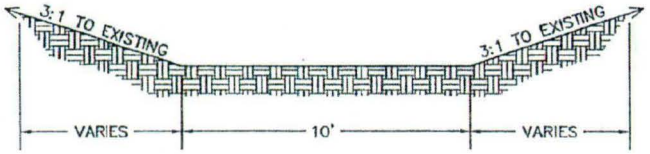
PROJ. NO.	DSN. BY:	Q/A REVS. BY:
27219016.00	ZEM	VW
DSN. BY:	CHK. BY:	PROJ. MGR:
ZEM	MPP	WM

SWT-2017-339
AEL Landfill Proposed Lateral Expansion
Unnamed Tributary of the Arkansas River
Osage County, Oklahoma
Enclosure 7 of 8

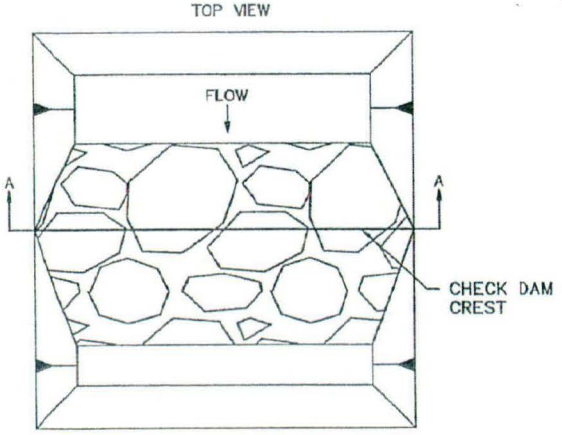
SHEET TITLE:
PROPOSED REALIGNMENT (27+23 TO 29+22)

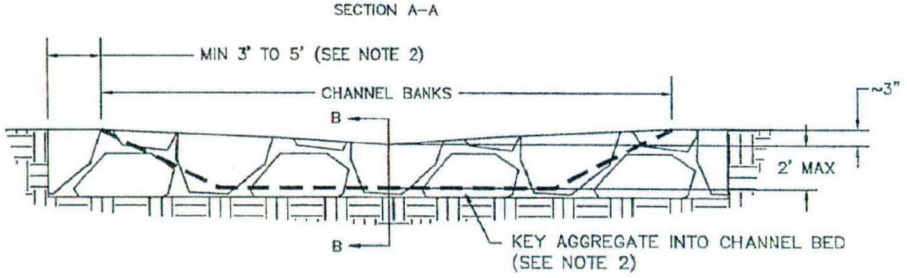
PROJECT TITLE:
PROPOSED EXPANSION AND STREAM MITIGATION DESIGN

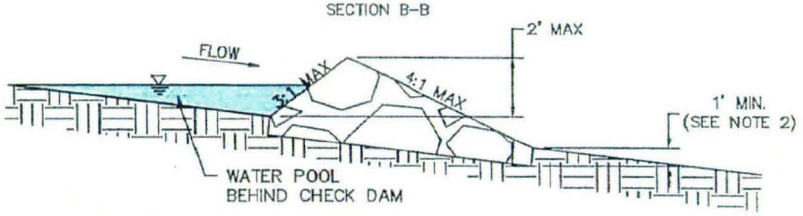
DATE: 10/7/19
SCALE: SCALE
DRAWING NO. 12 of 13

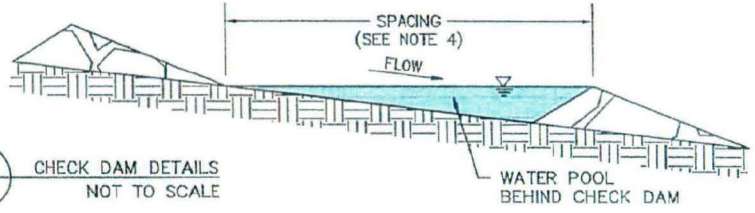


1 DESIGN CHANNEL CROSS SECTION
NOT TO SCALE









2 CHECK DAM DETAILS
NOT TO SCALE

NOTES:
1. CHECK DAMS SHALL BE CONSTRUCTED OF NATIVE AGGREGATE HAVING A D_{50} EQUAL TO OR GREATER THAN 9 INCHES.
2. AGGREGATE FOR CHECK DAMS SHALL BE KEYED INTO CHANNEL BANKS A MINIMUM OF 3 FEET ON STRAIGHT SECTIONS AND INSIDE CURVES, A MINIMUM OF 5 FEET ON OUTSIDE CURVES, AND A MINIMUM OF 1 FOOT INTO THE CHANNEL BED TO REDUCE LIKELIHOOD OF BYPASS FLOW AND EXCESSIVE SCOUR.
3. CHECK DAMS SHALL BE CONSTRUCTED WITH THE LOWEST POINT LOCATED AT THE CHANNEL CENTERLINE TO DIRECT FLOW INTO THE CENTER OF THE CHANNEL.
4. CHECK DAMS SHALL BE SPACED SUCH THAT THE CREST OF THE DOWNSTREAM DAM IS APPROXIMATELY LEVEL WITH THE LOWEST ELEVATION OF THE UPSTREAM DAM.

THIS DRAWING IS PART OF A BOUND SET SEALED BY FLOYD COTTER, A LICENSED PROFESSIONAL ENGINEER, ON OCTOBER 7, 2019. SEE COVER PAGE FOR PROFESSIONAL ENGINEERS SEAL.

SCS ENGINEERS
8575 WEST 110TH ST. SUITE 100
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PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO.	DWN. BY:	QA/QC REVIEW BY:
27219016.00	ZEM	VW
DSN. BY:	CHK. BY:	PROJ. MGR:
ZEM	MPP	WM

SWT-2017-339
AEL Landfill Proposed Lateral Expansion
Unnamed Tributary of the Arkansas River
Osage County, Oklahoma
Enclosure 8 of 8

SHEET TITLE: **DETAILS**

PROJECT TITLE: **PROPOSED EXPANSION AND STREAM MITIGATION DESIGN**

DATE: 10/7/19
SCALE: SCALE
DRAWING NO. 13 of 13

MARY ANN PRITCHARD
DIRECTOR

J. KEVIN STITT
GOVERNOR

STATE OF OKLAHOMA
DEPARTMENT OF MINES

July 8, 2020

Ms. Sarah Rafalowski
Senior Project Professional
SCS Engineers
1817 Commons Circle, Suite 1
Yukon, OK 73099

Re: American Environmental Landfill
Proposed Landfill Expansion
Portions of S/2 NE/4 & SE/4 Section 35, T20N, R10E
SW/4 NW/4 Section 36, T20N, 10E
Osage County, Oklahoma

Dear Ms. Rafalowski:

The Oklahoma Department of Mines (ODM) received your request for information concerning the subject proposed expansion of the American Environmental Landfill project in Osage County, Oklahoma on June 5, 2020. As required by Oklahoma Department of Environmental Quality (ODEQ) Oklahoma Administrative Code 252:515-5-52(d) a determination is necessary for the proposed expansion. The ODEQ regulation states the following: No new waste management or disposal areas of a land disposal facility shall be located over a subsurface mining area or any other unstable area. After researching our current and historical data file, ODM did not find any coal, non-coal permits or any other surface reclamation efforts on record that might affect your project

If you have further questions or need clarification please contact me at (405) 522-9851.

Sincerely,

Mike Lewis
ODM Geologist, Technical Services

Cc: Rhonda Dossett, Coal Program Director, Stacy Woody, Coal Permit Officer-ODM

2915 N. CLASSEN, SUITE 213, OKLAHOMA CITY, OKLAHOMA 73106 TEL:405/427-3859 FAX: 405/427-9646

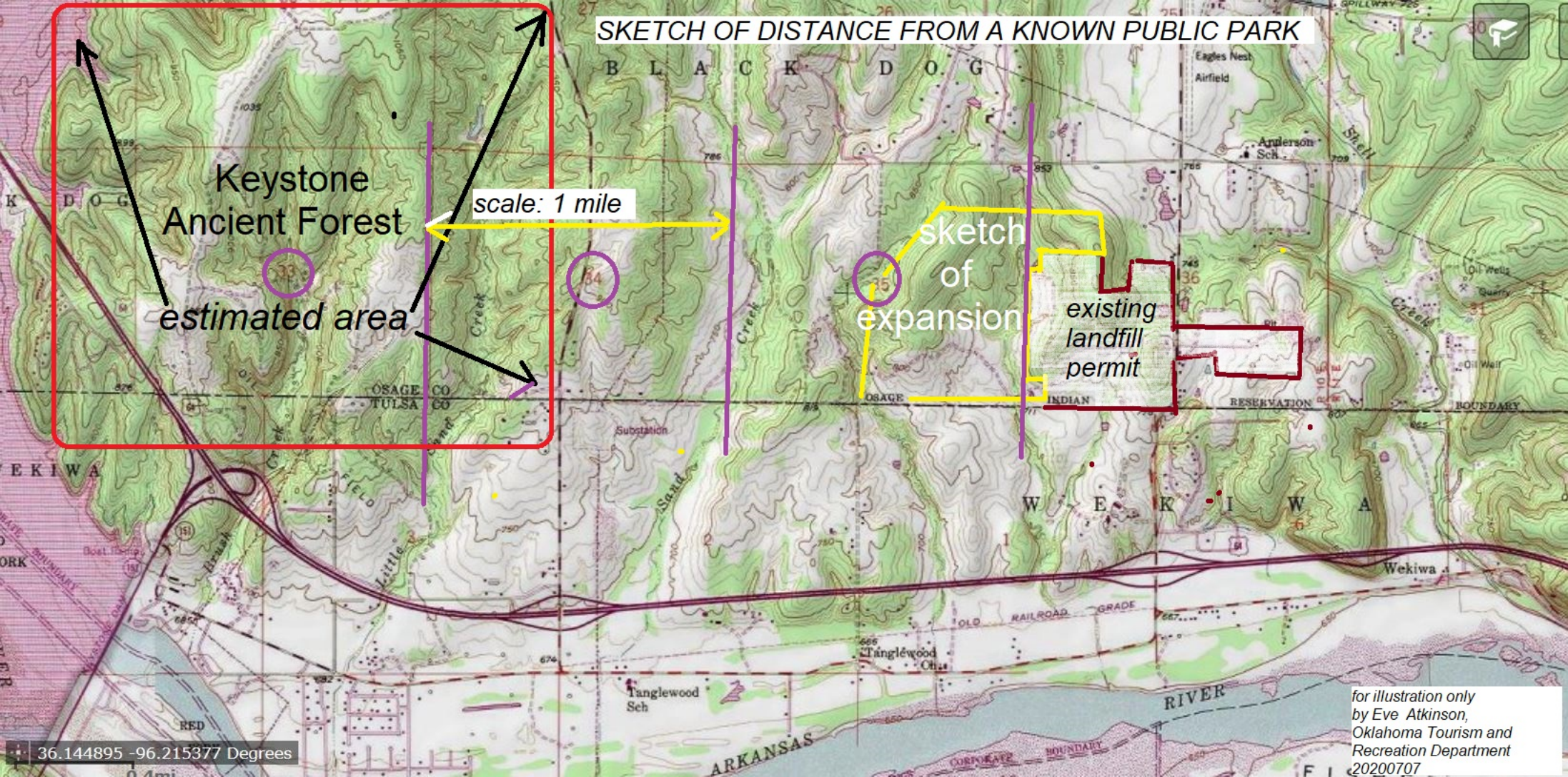
From: Eve Atkinson <Eve.Atkinson@travelok.com>
Sent: Tuesday, July 7, 2020 12:20 PM
To: wmiller@scsengineering.com
Cc: Susan Henry <Susan.Henry@travelok.com>
Subject: Osage County, Sand Springs proposed Landfill expansion, SCS Engineering

Although your proposal is further than ½ mile from a known public park or area with outdoor recreation resources, I am sending a sketch I made to show the distance from The Keystone Ancient Forest, as it does not appear on a USGS map or Google. The last known manager is the City of Sand Springs.

Your project proposal will have no significant adverse impact on any federally funded park or recreation area or state park, regarding the LWCF Act 54 U.S.C. 200305(f)(3) no land may be permanently used for private or non-outdoor recreation purposes (defined by the program).

Thank you for the opportunity to review your proposal.

Eve Atkinson
Planner II
Oklahoma Department of Tourism and Recreation
900 N. Stiles
Oklahoma City, OK 73104
405.522.9516.
Eve.Atkinson@travelok.com *****use this e-mail for rapid communication


SKETCH OF DISTANCE FROM A KNOWN PUBLIC PARK
Keystone
Ancient Forest
estimated area
scale: 1 mile
sketch
of
expansion
existing
landfill
permit
for illustration only
by Eve Atkinson,
Oklahoma Tourism and
Recreation Department
20200707
36.144895 -96.215377 Degrees

Oklahoma Archeological Survey
THE UNIVERSITY OF OKLAHOMA

June 12, 2020

SCS Engineers
Attn: Wade Miller
Project Director
1817 Commons Circle, Ste. 1
Yukon, OK 73099

Re: OAS FY20-2378 SCS Engineers Proposes American Environmental Landfill, Inc (AEL)
Proposed Landfill Expansion: 207 North 177th West Ave, Sand Springs.
Legal Description: Portions of Section 35 & 36, T20N, R10E, Osage County, Oklahoma.

Dear Mr. Miller:

The Community Assistance Program staff of the Oklahoma Archeological Survey has reviewed the above referenced project in order to identify areas that may potentially contain prehistoric or historic archeological materials (historic properties). The location of your project has been crosschecked with the state site files containing approximately 26,000 archaeological sites, which are currently recorded for the state of Oklahoma. No Sites are listed as occurring within your project area, and based on the topographic and hydrologic setting, no archaeological materials are likely to be encountered. Thus, an archaeological field inspection is not considered necessary. Please contact this office at (405) 325-7211 if buried archaeological materials such as chipped stone tools, pottery, bone, historic crockery, glass, metal items or building materials are exposed during construction activities.

This environmental review and evaluation is done in cooperation with the State Historic Preservation Office, Oklahoma Historical Society. The responsible federal agency or their official delegate must also have a letter from that office to document consultation pursuant to Section 106 of the National Historic Preservation Act.

In addition to our review comments, under 36CFR Part 800.3 you are reminded of your responsibility to consult with the appropriate Native American tribe/groups to identify any concerns they may have pertaining to this undertaking and potential impacts to properties of traditional and/or ceremonial value.

Sincerely,

Debra K. Green, Ph.D.
Assistant State Archaeologist

Kary L. Stackelbeck, Ph.D.
State Archaeologist

: ksw
cc: SHPO

From: Horton, Russ
To: Weaver, Vaughn
Subject: Re: Follow up on AEL
Date: Tuesday, April 14, 2020 10:09:01 PM
Attachments: image001.jpg

Vaughn:

Having heard nothing back from my staff, we have no comments / concerns RE this project.

Thank you,

Russ Horton
Assistant Chief of Wildlife Division
Oklahoma Department of Wildlife Conservation
1801 North Lincoln Blvd
Oklahoma City OK 73105
(405) 521-2730 (Office)
(405) 202-5901 (Cell)
russ.horton@odwc.ok.gov

On Tue, Apr 14, 2020 at 10:26 AM Weaver, Vaughn <VWeaver@scsengineers.com> wrote:

> Mr. Horton,
>
> We sent a report to ODWC for review on February 10, 2020. I am checking to see if there are any concerns with the proposed project? I can't find a response from ODWC on this project and am just following up.
>
> Vaughn Weaver
>
> Senior Project Biologist
>
> 11120 E. 26th Street North
>
> Suite 1100
>
> Wichita, Kansas 67226

Office: 316-315-4501

Fax: 316-315-4505

Mobile: 316-207-7130

From: Echo-Hawk, Patricia
To: Weaver, Vaughn
Subject: Re: AEL TES Summary report
Date: Monday, February 10, 2020 9:55:48 AM
Attachments: image001.jpg

========== This message originated outside of SCS Engineers ==========

Greetings Vaughn,

I've reviewed the TES report you recently sent, the survey methods, and the negative results for the presence of T&E species.

The Service concurs with the determination of "not likely to adversely affect" for American burying beetle and Northern long-eared bat. As there is no habitat for the rattlesnake master borer moth, a "no affect" determination is more accurate in this instance.

Thank you for consulting with the Service.

Best Regards,

Patricia D. Echo-Hawk
Fish and Wildlife Biologist
Region 2 Dive Officer

U.S. Fish and Wildlife
Oklahoma Ecological Services Field Office
9014 E. 21st Street
Tulsa, OK, 74129
phone # 918-382-4505
fax # 918-581-7467

Patricia_echo-hawk@fws.gov

Anyone can find the dirt in someone. Be the one that finds the gold.
Only when the last tree has died, the last river poisoned and the last fish caught, will we realize we can't eat money.
-Cree Proverb

From: Weaver, Vaughn <VWeaver@scsengineers.com>
Sent: Wednesday, February 5, 2020 4:59 PM
To: Echo-Hawk, Patricia
Subject: [EXTERNAL] AEL TES Summary report

Patricia,

I talked with you last week about submitting a TES report for the AEL proposed expansion. After we talked, I learned that there was not a report completed a report was completed.

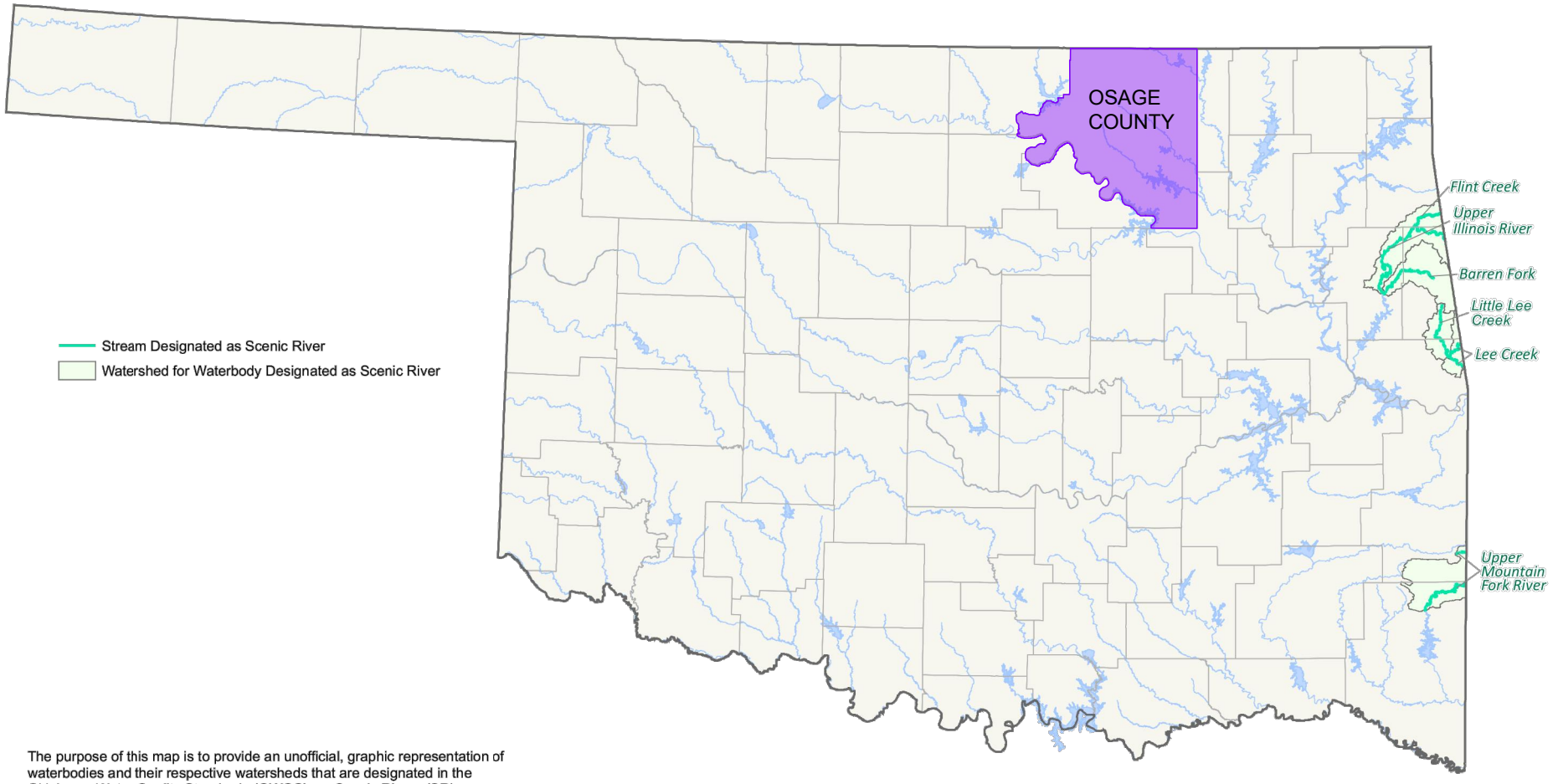
Now that the report is done, how would you like to receive it. Traditional mail/hard copy with an electronic CD or an electronic copy be sufficient.

Sorry for the delay in getting this report to you.

Vaughn Weaver
Senior Project Professional
[SCS_Engineers_short_bar-small]
11120 E. 26th Street North
Suite 1100
Wichita, Kansas 67226
Office: 316-315-4501
Fax: 316-315-4505
Mobile: 316-207-7130

Oklahoma Water Quality Standards

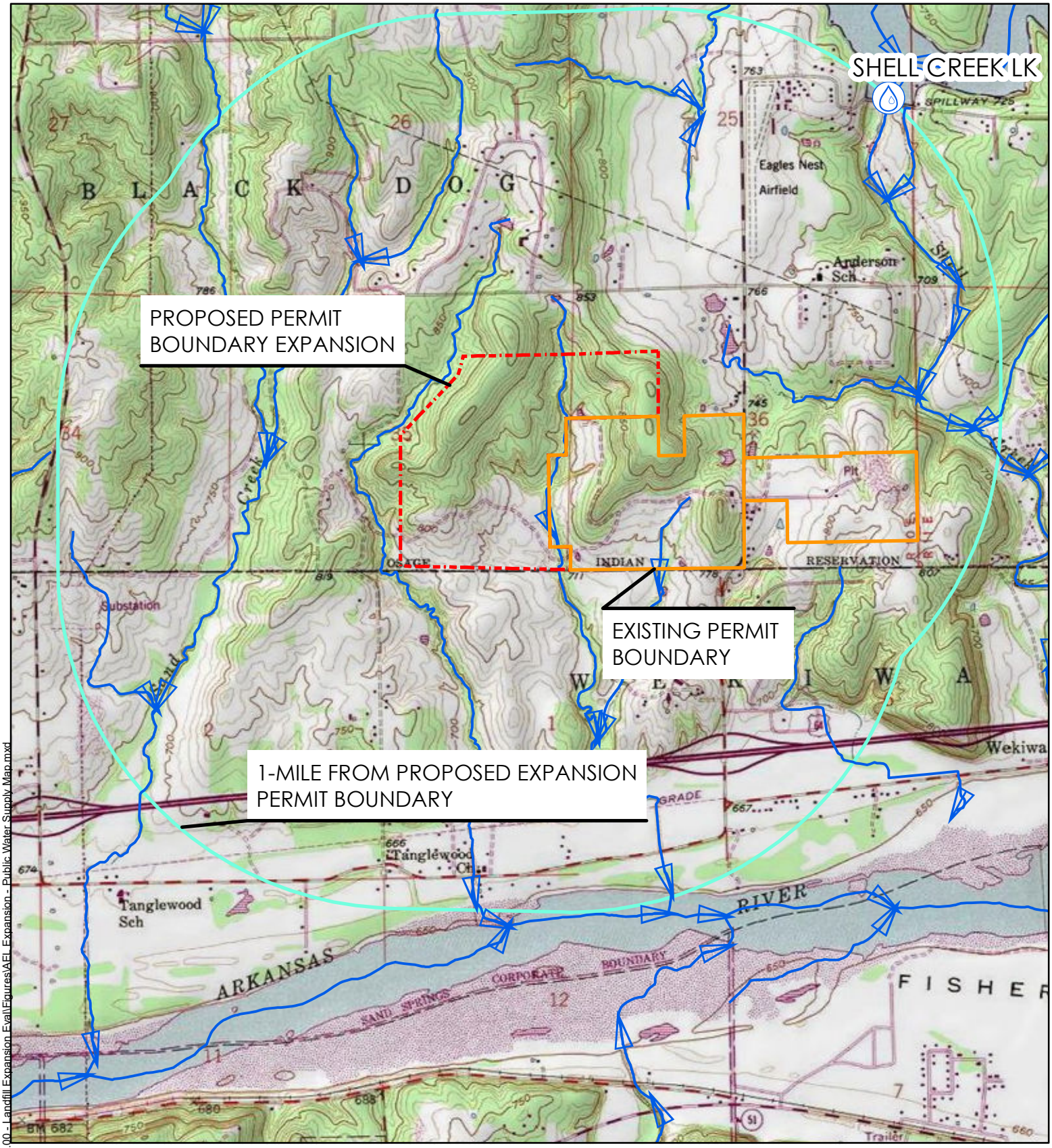
Scenic Rivers (SR)



The purpose of this map is to provide an unofficial, graphic representation of waterbodies and their respective watersheds that are designated in the Oklahoma Water Quality Standards (OWQS), as Scenic Rivers (SR). The official version of the OWQS is published by the Oklahoma Secretary of State in the Oklahoma Administrative Code at Title 785, Chapter 45 (http://www.sos.ok.gov). A complete but unofficial version of the OWQS is available through the OWRB homepage (http://www.owrb.ok.gov).
7/1/2011

State of Oklahoma
OWRB
Water Resources Board
the water agency

EDITED BY SCS ENGINEERS TO HIGHLIGHT COUNTY OF SITE



Layer Information from OWRB Open Data website. For flowlines, OWRB credits USGS and the National Hydrography Dataset (NHD). Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

Legend

- Public Water Supply Surface Water Intake
- Public Water Supply Well
- Existing Permit Boundary
- Proposed Expanded Permit Boundary
- NHDFlowline
- 1-Mile from Proposed Expansion Permit Boundary

FIGURE 7
AMERICAN ENVIRONMENTAL LANDFILL EXPANSION
PUBLIC WATER SUPPLY LOCATIONS
OSAGE COUNTY, OKLAHOMA

SCS ENGINEERS

Yukon, OK | May 2020

0 1,000 2,000 Feet

N

Document Path: K:\AEL\Projects\2019\27219016.00 - Landfill Expansion Eval\Figures\AEL Expansion - Public Water Supply Map.mxd

SCOTT A. THOMPSON
Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

KEVIN STITT
Governor

November 24, 2020

Mr. Kenneth F. Burkett, President
American Environmental Landfill, Inc.
1420 West 35th Street, Suite B
Tulsa, Oklahoma 74107

Re: Drilling Plan for 203 Acre Expansion and Notice of Intent to Drill
American Environmental Landfill
Osage County
Solid Waste Permit No: 3557021

Dear Mr. Burkett:

The Oklahoma Department of Environmental Quality (DEQ) issued a Notice of Deficiency on November 17, 2020 for the "Drilling Plan for 203 Acre Expansion". On November 19, 2020, by email, DEQ received the "AEL Drilling Plan Revision (Plan)." The Plan was submitted on behalf of American Environmental Landfill (AEL) by SCS Engineers.

DEQ found two (2) deficiencies in the original drilling plan: (1) the Oklahoma Administrative Code (OAC) 252:515 Appendix D boring calculations; and (2) no 200 feet deep borings meeting the requirements of OAC 252:515-7-4(b)(4)(B). The Plan fulfilled both deficiencies and is approved as submitted.

AEL submitted the Notice of Intent to Drill (Notice), by email, on November 19, 2020 for compliance with OAC 252:515-7-5(a). AEL plans to commence drilling on November 30, 2020. DEQ approves the Notice as submitted.

On November 23, 2020, by email, DEQ approved both the Plan and the Notice. This letter is written confirmation of that email. Should you have any questions or require additional information, please contact Ms. Cindy Hailes of my staff at (405) 702-5114 or cindy.hailes@deq.ok.gov.

Sincerely,

Hillary Young, P. E.
Chief Engineer
Land Protection Division

HY/ckh

cc: Todd Green, Vice President of Landfill Operations, American Environmental Landfill
Sarah Rafalowski, P.E., SCS Engineers

May 6, 2021
File No. 27219106.00

Ms. Cindy Hailes. *e-copy only*
Oklahoma Department of Environmental Quality
Land Protection Division
P.O Box 1677
Oklahoma City, OK 73101-1677

Subject: **Request for Alternative Sampling Method – Drilling Plan (November 2020)**
American Environmental Landfill
ODEQ Permit #3557021

Dear Ms. Hailes:

Stearns, Conrad, and Schmidt, Consulting Engineers, Inc. (dba SCS Engineers) on behalf of American Environmental Landfill, Inc. (AEL) is submitting this letter to request an alternative sampling method for collecting soil and/or rock samples at five foot intervals during drilling for the AEL Landfill near Sand Springs Oklahoma.

Currently at the site, 22 of the 42 borings have been advanced and collection of soil and/or rock samples have been obtained utilizing methodologies approved in the OAC 252:515-7-35 and in the DEQ approved work plan dated November 2020. All of the proposed borings that are to be converted to piezometers are included in the 22 completed borings.

Onsite borings are currently being sampled utilizing split spoon samplers until Standard Penetration Tests (SPT) result in a density of 50 hammer blows for 2 inches or less. Once this density is encountered, rock coring is conducted and samples are obtained within five foot intervals or at lithology changes.

Coring weathered or highly friable shales as observed within the AEL expansion area has proved to be difficult and time consuming with weekly drilling totals of 200 to 250 feet per week. SCS is proposing that the remaining borings be advanced utilizing air rotary methods. Samples will be obtained utilizing a strainer or metal catcher to collect cuttings continuously from each 5 foot interval. Drilling rates will be maintained at such a speed (approximately 2-3 ft/minute) to ensure that cuttings can be logged as drilling progresses and changes in drilling can be noted to adequately log the lithology of the borehole. Once anticipated groundwater elevations are encountered, the drilling speed will be further reduced (approximately 1 ft/minute) to allow for observance of groundwater.

If you have any questions or comments regarding this document, please do not hesitate to contact Robert Fowler at (501) 812-4551 or rfowler@scsengineers.com or Wade Miller at 405-246-1574 or wmiller@scsengineers.com.

Sincerely,

Robert Fowler, P.G.
Project Professional
SCS Engineers

Wade J. Miller
Project Director
SCS Engineers

cc: Mr. Todd Green – American Environmental Landfill

SCOTT A. THOMPSON
Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

KEVIN STITT
Governor

May 13, 2021

Mr. Kenneth F. Burkett, President
American Environmental Landfill, Inc.
1420 West 35th Street, Suite B
Tulsa, Oklahoma 74107

Re: Sampling Method Change Request
Subsurface Investigation
American Environmental Landfill
Osage County
Solid Waste Permit No: 3557021

Dear Mr. Burkett:

The Oklahoma Department of Environmental Quality (DEQ) received, by email, on May 6, 2021 a request to employ an alternative sampling method for collecting soil and/or rock samples at five (5) foot intervals for the subsurface investigation at American Environmental Landfill (AEL). The request was submitted on behalf of AEL by SCS Engineers.

DEQ approved the subsurface drilling plan for the 203-acre lateral expansion on November 24, 2020. Appendix A, Soil Sampling for Geotechnical Analyses of the plan approved borings to be sampled utilizing split spoon samplers. The air rotary method of drilling the boreholes was included in the subsurface drilling plan in Section 4.2.1.2.

In accordance with Oklahoma Administrative Code (OAC) 252:515-7-35(c)(4), DEQ approved by email dated May 6, 2021, the use of an alternative method of sampling due to difficulties encountered while drilling in weathered shale at the site. Twenty-two (22) borings that will be converted to piezometers have already been installed utilizing the previously approved methods of split spoon sampling or coring. For the remaining 20 borings, AEL proposes to utilize a strainer or metal catcher to collect cuttings continuously from each 5-foot interval during air rotary drilling. Air rotary drilling rates will be maintained at such a speed (approximately 2-3 ft/minute) to ensure that cuttings can be logged as drilling progresses and changes in drilling can be noted to adequately log the lithology of the borehole. Once anticipated groundwater elevations are encountered, the drilling speed will be further reduced (approximately 1 ft/minute) to allow for observance of groundwater.

DEQ requested AEL to document all pertinent information in the borehole logs, lithologic sample logs, and the geophysical logs as required by OAC 252:515-7-31. DEQ also required AEL to include in the subsurface investigation report which boreholes were sampled/drilled by which

method. DEQ agreed to send a written confirmation of the May 6, 2021 email approval. This letter is the written confirmation.

Should you have any questions, please contact Ms. Cindy Hailes of my staff at (405) 702-5114 or cindy.hailes@deq.ok.gov.

Sincerely,

Hillary Young, P. E.
Chief Engineer
Land Protection Division

HY/ckh

cc: Robert Fowler, P.G., Project Professional, SCS Engineers, 11219 Richardson Drive, N. Little Rock Arkansas 72113
Wade J. Miller, Project Director, SCS Engineers
Todd Green, General Manager, American Environmental Landfill

Appendix B

Boring Logs and Construction Diagrams

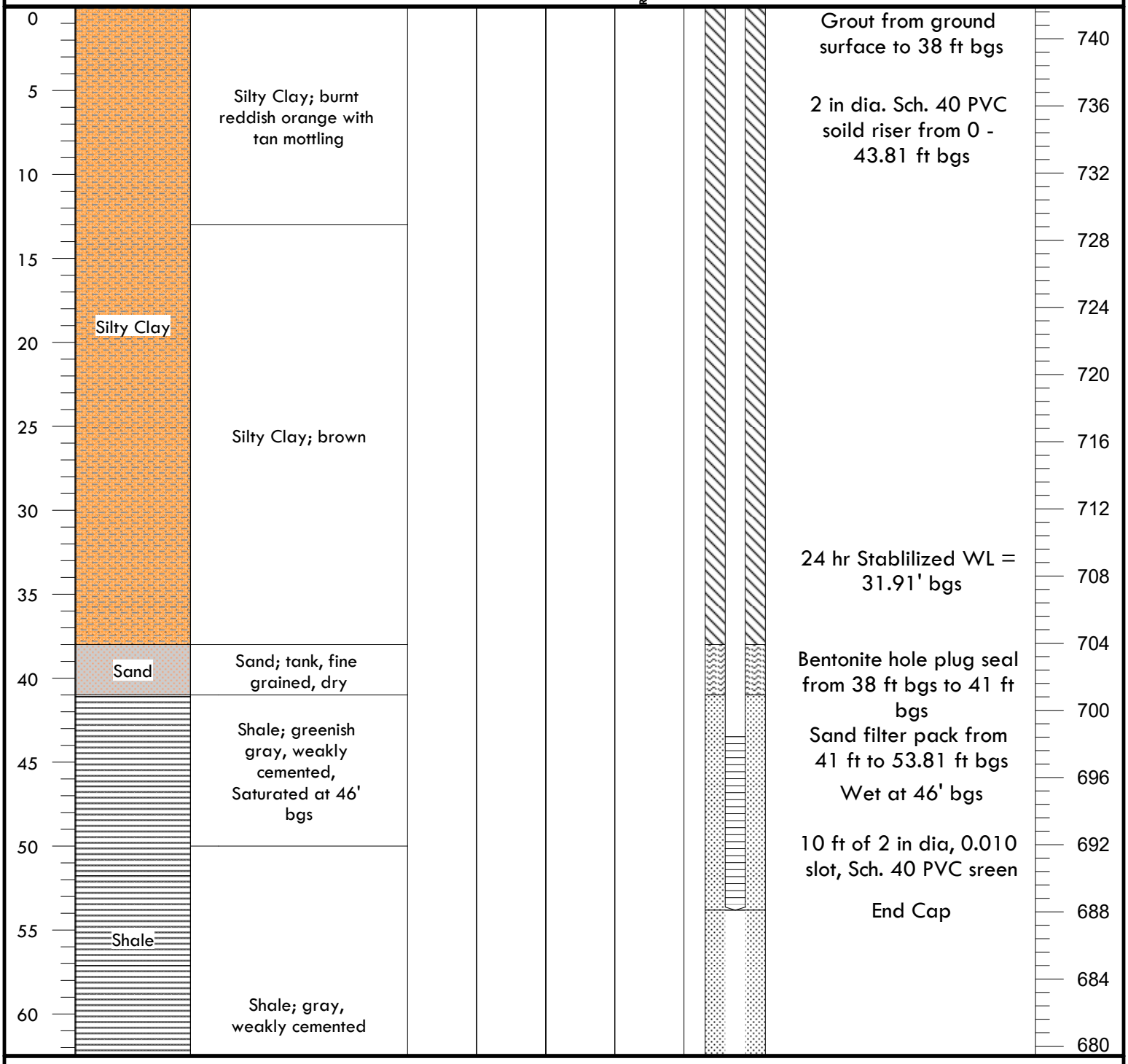
SCS ENGINEERS

LOG OF BORING NO.: **P-1**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 741.91 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 744.53 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 70 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2497783.12 NORTHING: 427676.72
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 31.91 fbgs
START DATE: 12/16/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 710 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/19/2021



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-1**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Timothy Swyden	SURFACE ELEVATION: 741.91 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 744.53 ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 70 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2497783.12
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 427676.72
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 31.91 fbgs
START DATE: 12/16/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 710 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/19/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65									676
70								TD Drilled 70' bgs	672

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-2**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 746.3 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 76 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498000.1 NORTHING: 427659.9
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 52 fbgs
START DATE: 12/4/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 694.3 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Sandy Silt	Sandy Silt; brown							744
5			SPT	5	4,3,5				740
10	Silty Clay	Silty Clay; burnt reddish orange with tan mottling	SPT	10	5,6,5				736
15			SPT	15	7,9,11				732
20			SPT	20	9,14,17				728
25	Clay	Clay; burnt reddish orange	SPT	25	9,20,28				724
30			SPT	30	9,16,19				720
35		Clay; brown	SPT	35	9,13,16				716
40			SPT	40	10,17,20				712
45			SPT	45	3,6,11				708
50									704
55								Wet at 52' bgs	700
60	Shale	Shale; gray, weakly cemented,							696
									692
									688
									684

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-2**

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 746.3 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 76 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498000.1 NORTHING: 427659.9
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 52 fbgs
START DATE: 12/4/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 694.3 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65		Saturated at 52' bgs							680
70									676
75								TD Drilled 76' bgs	672

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-3**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 764.3 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 94 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498500 NORTHING: 427661.2
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 71 fbgs
START DATE: 12/1/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 693.3 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Sandy Silt	Sandy Silt; burnt reddish orange with tan mottling	SPT	0	1,2,2				760
5			SPT	5	,,6,8				755
10			SPT	10	5,7,9				750
15	Silty Clay	Silty Clay; burnt reddish orange with tan mottling	SPT	15	5,7,8				745
20			SPT	20	7,7,8				740
25			SPT	25	7,8,12				735
30	Siltstone	Siltstone; tan, weakly cemented, silt sized grains	SPT	30	9,21,20				730
35			SPT	35	50/0.5"				725
40	Silty Clay	Silty Clay; brown, small clasts of siltstone and one inch diameter pebbles	SPT	40	12,20,35				720
45			SPT	45	50,1.5"				715
50	Sandy Silt	Sandy Silt; brown							710
55		Sandy Silt; brown, small clasts of gray shale							705
60									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS	LOG OF BORING NO.: **B-3**	SHEET NUMBER: 2 of 2
11219 Richardson Drive North Little Rock, AR	DRILLER: Timothy Swyden	SURFACE ELEVATION: 764.3 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 94 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2498500
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 427661.2
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 71 fbgs
START DATE: 12/1/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 693.3 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65									700
70								Wet at 71' bgs	695
75	Shale	Shale; gray, weakly cemented, Saturated at 71' bgs							690
80									685
85									680
90								TD Drilled 94' bgs	675

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-4**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 757.67 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 760.73 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 87 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499001.01 NORTHING: 427663.23
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 48.65 fbgs
START DATE: 12/13/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 709.02 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/19/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Topsoil	Topsoil; dark brown to brown with some roots	SPT	0	1,4,4			Grout from ground surface to 58 ft bgs	756
5	Silty Clay	Silty Clay; burnt reddish orange with tan mottling	SPT	5	5,5,5			2 in dia. Sch. 40 PVC soild riser from 0 - 63.44 ft bgs	752
10			SPT	10	4,5,0				748
15		Silty Sand; brown	SPT	15	4,6,9				744
20			SPT	20	5,9,9				740
25	Silty Sand	Silty Sand; reddish brown	SPT	25	6,9,4				736
30			SPT	30	6,7,10				732
35			SPT	35	7,9,9				728
40			SPT	40	4,5,7			Bentonite hole plug seal from 58 ft bgs to 61 ft bgs	724
45			SPT	45	3,4,5				720
50								24 hr Stablilized WL = 48.65' bgs	716
55									712
60									708
									704
									700
									696

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-4**

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 757.67 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 760.73 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 87 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499001.01 NORTHING: 427663.23
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 48.65 fbgs
START DATE: 12/13/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 709.02 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/19/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65	Shale	Shale; gray, weakly cemented, Saturated at 64' bgs						Sand filter pack from 61 ft to 73.44 ft bgs Wet at 64' bgs 10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen End Cap	692
70									688
75									684
80									680
85								TD Drilled 87' bgs	676
									672

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

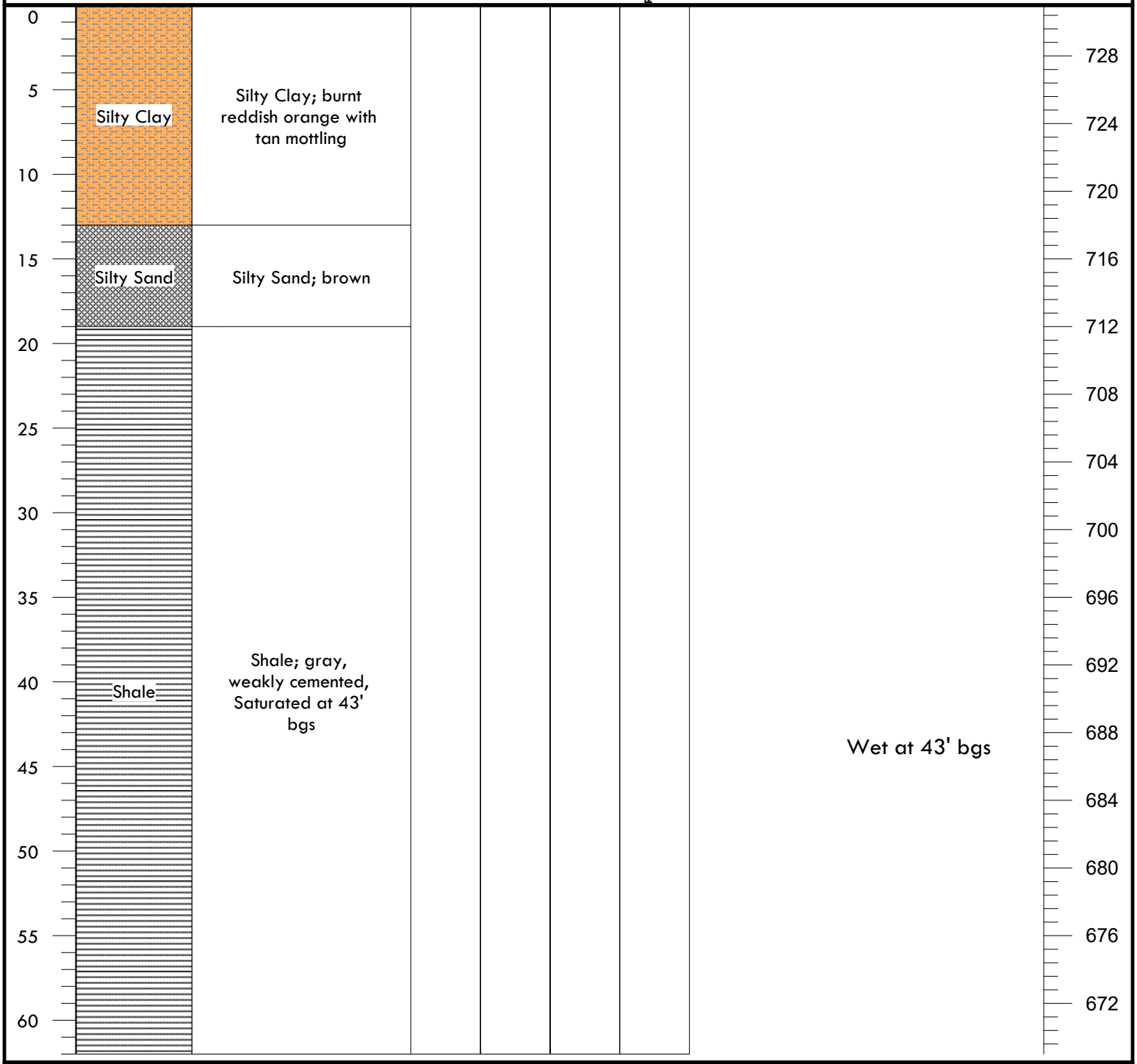
SCS ENGINEERS

LOG OF BORING NO.: **B-5**

SHEET NUMBER: 1 of 1

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 731 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 62 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499499.9 NORTHING: 427663.5
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 43 fbgs
START DATE: 11/30/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 688 ft
FINISH DATE: 12/1/2020	WELL DIAMETER: NA	WATER LEVEL DATE: NA



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

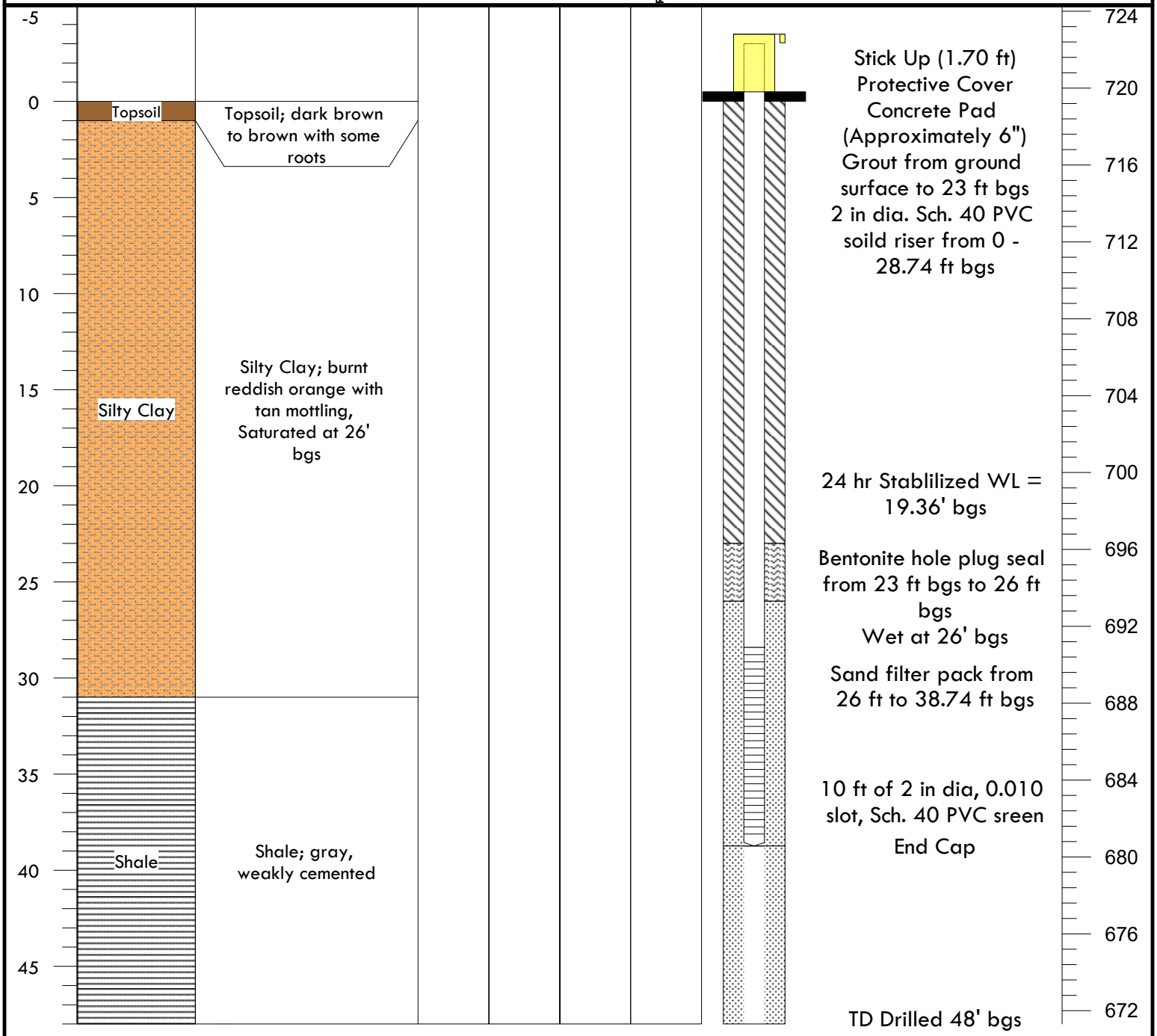
SCS ENGINEERS

LOG OF BORING NO.: **P-6**

SHEET NUMBER: 1 of 1

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 719.31 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 721.01 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 48 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500001.93 NORTHING: 427672.52
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 19.36 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 699.95 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/15/2021



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-7**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 751.3 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 74 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2497777.5 NORTHING: 427999.9
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 57 fbgs
START DATE: 12/15/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 694.3 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Topsoil	Topsoil; dark brown to brown with some roots	SPT	0	1,1,1				748
5			SPT	5	3,4,4				744
10	Sandy Silt	Sandy Silt; burnt reddish orange with tan mottling	SPT	10	4,3,3				740
15			SPT	15	4,7,10				736
20			SPT	20	8,13,13				732
25		Shale; greenish gray, weakly cemented	SPT	25	19,20,25				728
30			SPT	30	19,50/5"				724
35			SPT	35	50/5.5"				720
40			SPT	40	50/4"				716
45			SPT	45	50/3.5"				712
50	Shale	Shale; gray, weakly cemented, Saturated at 57' bgs							708
55									704
60									700
									696
								Wet at 57' bgs	692

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-7**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Timothy Swyden	SURFACE ELEVATION: 751.3 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 74 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2497777.5
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 427999.9
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 57 fbgs
START DATE: 12/15/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 694.3 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65									688
70								TD Drilled 74' bgs	684
									680

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-8**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 767.7 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 100 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498006 NORTHING: 428039.4
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 20.81 fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 746.89 ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Sand	Sand; tan	Cuttings	0					765
5			Cuttings	5					760
10		Sand; orange	Cuttings	10					755
15			Cuttings	15					750
20	Sandstone	Sandstone; orange to reddish brown	Cuttings	20				24 hr Stabilized WL = 20.81' bgs	745
25			Cuttings	25					740
30			Cuttings	30					735
35	Shale	Shale; gray	Cuttings	35					730
40			Cuttings	40					725
45			Cuttings	45					720
50			Cuttings	50					715
55			Cuttings	55					710
60			Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-8** SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 767.7 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 100 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498006 NORTHING: 428039.4
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 20.81 fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 746.89 ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	60					705
65			Cutti ngs	65				Wet at 68' bgs	700
70			Cutti ngs	70					695
75			Cutti ngs	75					690
80			Cutti ngs	80					685
85	Limestone	Limestone; gray, reacts with HCL	Cutti ngs	85					680
90	Shale	Shale; dark gray	Cutti ngs	90					675
95			Cutti ngs	95					670
100								TD Drilled 100' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-9**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 779.44 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 781.88 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 102 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498499.68 NORTHING: 427999.72
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 54.52 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 724.92 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/20/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Sandy Silt	Sandy Silt; burnt reddish orange with tan mottling	SPT	0	1,2,5			Grout from ground surface to 80 ft bgs	
5			SPT	5	5,6,6			2 in dia. Sch. 40 PVC soild riser from 0 - 85.88 ft bgs	775
10			SPT	10	8,13, 17				770
15			SPT	15	9,8,9				765
20			SPT	20	9,12, 15				760
25			SPT	25	12,3 4,23				755
30			SPT	30	19,2 4,35				750
35			Core	35	19,3 5,50 /6"				745
40			Core	40	50/ 6"				740
45			Core	45	50/ 6"				735
50									730
55								24 hr Stablilized WL = 54.52' bgs	725
60									720

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

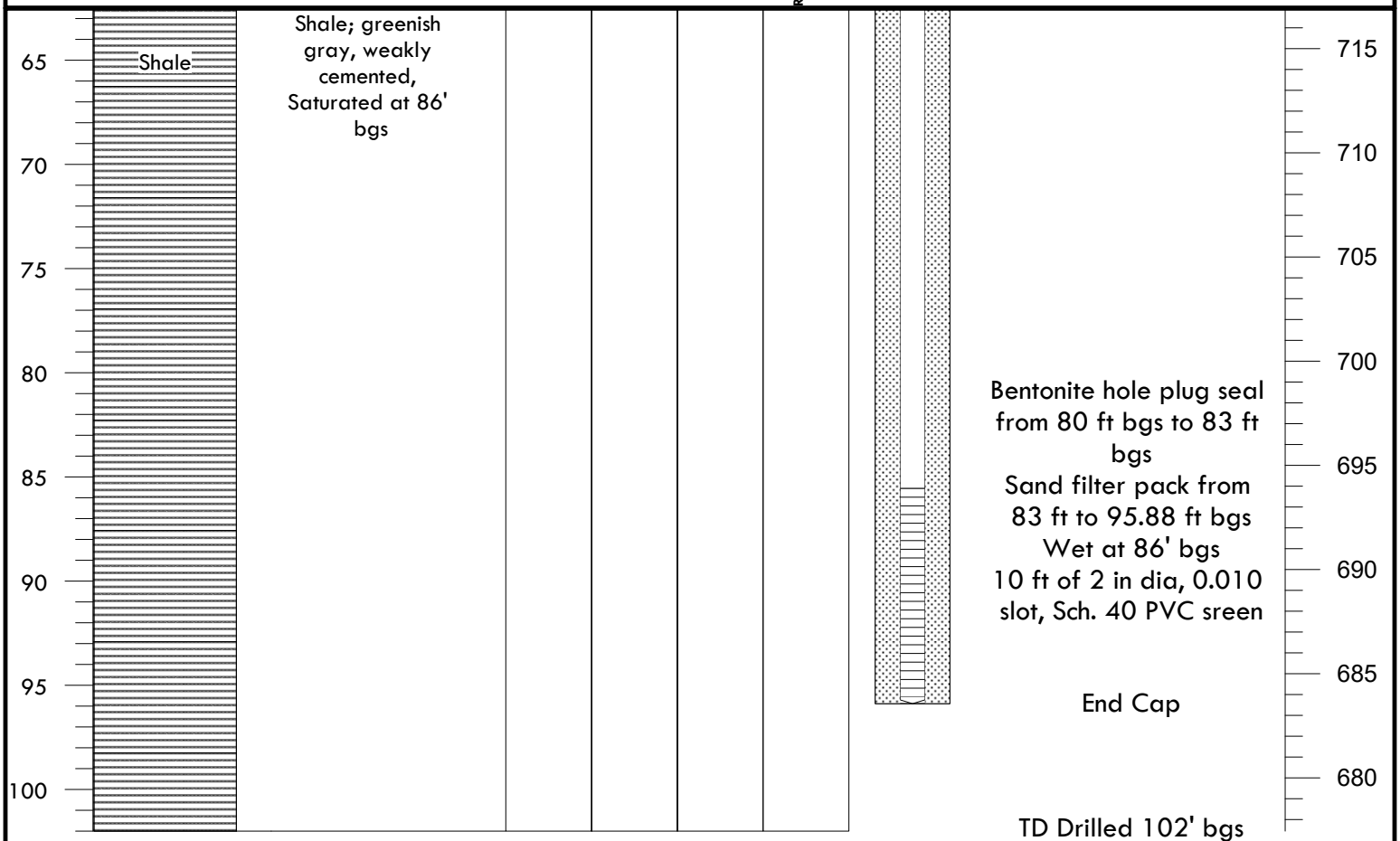
SCS ENGINEERS

LOG OF BORING NO.: **P-9**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Timothy Swyden	SURFACE ELEVATION: 779.44 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 781.88 ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 102 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498499.68 NORTHING: 427999.72
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 54.52 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 724.92 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/20/2021



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-10**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 756.2 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 75 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498999.9 NORTHING: 427989.9
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 61 fbgs
START DATE: 12/7/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 695.2 ft
FINISH DATE: 12/7/2020	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0									756
5			SPT	5	5,6,6				752
10	Silty Sand	Silty Sand; burnt reddish orange with tan mottling	SPT	10	6,7,10				748
15			SPT	15	11,15,16				744
20			SPT	20	10,12,13				740
25	Sandy Silt	Sandy Silt; tan	SPT	25	15,17,18				736
30	Clay	Clay; burnt reddish orange	SPT	30	8,8,10				732
35			SPT	35	5,6,6				728
40			SPT	40	6,6,5				724
45		Clay; brown	SPT	45	39,50/6"				720
50									716
55									712
60	Shale	Shale; gray, weakly cemented, Saturated at 61'							708
									704
									700
									696

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-10**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Timothy Swyden	SURFACE ELEVATION: 756.2 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 75 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2498999.9
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 427989.9
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 61 fbgs
START DATE: 12/7/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 695.2 ft
FINISH DATE: 12/7/2020	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65		bgs						Wet at 61' bgs	692
70									688
75								TD Drilled 75' bgs	684

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-11**

SHEET NUMBER: 1 of 1

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 730.7 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 62 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499500 NORTHING: 428000
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 28 fbgs
START DATE: 11/30/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 702.7 ft
FINISH DATE: 11/30/2020	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Sand	Silty Sand; burnt reddish orange with tan mottling							728
5									724
10									720
15	Shale	Shale; gray, weakly cemented, Saturated at 28' bgs						Wet at 28' bgs	716
20									712
25									708
30									704
35									700
40									696
45									692
50									688
55									684
60									680
									676
									672

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-12**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 786.85 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 789.16 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 108.3 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2497779.78 NORTHING: 428505.84
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 46.08 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 740.77 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 8/2/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Topsoil / Silty Clay	Topsoil; dark brown to brown with some roots	SPT	0	1,1,1			Grout from ground surface to 92 ft bgs	785
5	Silty Clay	Silty Clay; burnt reddish orange with tan mottling	SPT	5	50/ 6"			2 in dia. Sch. 40 PVC soild riser from 0 - 98.28 ft bgs	780
10	Silty Clay		SPT	10	50/ 6"				775
15	Sandstone	Sandstone; tank, weakly cemented	Core	12					770
20	Sandstone		Core	15					765
25	Sandstone		Core	20					760
30	Sandstone		Core	25					755
35	Shale		Core	30					750
40	Shale		Core	35					745
45	Shale		Core	40					740
50	Shale	Shale; gray, poorly cemented	Core	45				24 hr Stablilized WL = 46.08' bgs	735
55	Shale								730
60	Shale								725

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-12**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 786.85 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 789.16 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 108.3 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2497779.78 NORTHING: 428505.84
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 46.08 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 740.77 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 8/2/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65									720
70									715
75	Limestone	Limestone; well cemented, "Checkerboard Limestone" layer							710
80		Shale; gray, well cemented, pebble clasts up to one inch diameter							705
85									700
90	Shale	Shale; gray, well cemented, Saturated at 98' bgs						Bentonite hole plug seal from 92 ft bgs to 95 ft bgs Sand filter pack from 95 ft to 108.28 ft bgs Wet at 98' bgs 10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen	695
95									690
100									685
105								End Cap TD Drilled 108.28' bgs	680

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-13**

SHEET NUMBER: 1 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 811.9 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 128 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498001.2 NORTHING: 428501.6
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 40.52 fbgs
START DATE: 6/24/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 771.38 ft
FINISH DATE: 6/24/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Sandy Clay	Sandy Clay; orange	Cuttings	0					810
5			Cuttings	5					
10	Silty Clay	Silty Clay; tan with orange and gray mottling	Cuttings	10					800
15			Cuttings	15					
20	Sandstone / Limestone	Sandstone; orange / Limestone; gray	Cuttings	20					790
25	Sandstone	Sandstone; orange, fine grained	Cuttings	25					
30	Limestone	Limestone; reddish brown, reacts with HCL	Cuttings	30					780
35			Cuttings	35					
40	Sandstone	Sandstone; orange, very hard	Cuttings	40				24 hr Stabilized WL = 40.52' bgs	770
45			Cuttings	45					
50			Cuttings	50					760
55	Shale	Shale; gray, friable	Cuttings	55					
60			Cutti						750

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-13**

SHEET NUMBER: 2 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 811.9 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 128 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498001.2 NORTHING: 428501.6
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 40.52 fbgs
START DATE: 6/24/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 771.38 ft
FINISH DATE: 6/24/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	60					
65	Sandstone	Sandstone; light gray, very fine grained	Cutti ngs	65					
70			Cutti ngs	70					740
75			Cutti ngs	75					
80			Cutti ngs	80					730
85	Limestone	Limestone; gray, reacts with HCL	Cutti ngs	85					
90			Cutti ngs	90					720
95			Cutti ngs	95					
100			Cutti ngs	100					710
105	Shale	Shale; gray	Cutti ngs	105					
110			Cutti ngs	110					700
115			Cutti ngs	115					
120			Cutti ngs	120					690
125									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-13**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 811.9 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 128 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2498001.2
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 428501.6
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 40.52 fbgs
START DATE: 6/24/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 771.38 ft
FINISH DATE: 6/24/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
125			Cuttings	125				Water not observed during drilling TD Drilled 128' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-14**

SHEET NUMBER: 1 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 813.4 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 129 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498499.9 NORTHING: 428500.1
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 124 fbgs
START DATE: 12/8/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 689.4 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; burnt reddish orange with tan mottling		0	1,1,3				810
5			SPT	5	10,15,13				
10	Sand	Sand; reddish tan, dry	SPT	10	5,4,5				800
15	Silty Clay	Silty Clay; burnt reddish orange with tan mottling	SPT	15	7,9,10				
20			SPT	20	8,50/4"				790
25			SPT	25	27,50/4.5				
30			SPT	30	50/2.5"				780
35			SPT	32					
40			SPT	35					770
45	Shale	Shale; greenish gray, weakly cemented	SPT	40					
50			SPT	45					760
55									
60									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-14**

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 813.4 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 129 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498499.9 NORTHING: 428500.1
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 124 fbgs
START DATE: 12/8/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 689.4 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65									750
70	Conglomerate	Conglomerate; gray, calcitic strong cemented, clasts up to one inch diameter							740
75									
80									730
85									
90	Shale	Shale; gray, poorly cemnted							720
95									
100									710
105									
110	Limestone	Limestone; well cemented, "Checkerboard Limestone" layer							700
115									
120	Shale	Shale; gray, well cemented, Saturated at 124' bgs							690
125									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-14**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Timothy Swyden	SURFACE ELEVATION: 813.4 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 129 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2498499.9
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 428500.1
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 124 fbgs
START DATE: 12/8/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 689.4 ft
FINISH DATE:	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
125								Wet at 124' bgs TD Drilled 129' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-16**

SHEET NUMBER: 1 of 1

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 744.4 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 55 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499500 NORTHING: 428499.9
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 29.62 fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 714.78 ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Clay	Clay; brown	Cuttings	0					744
5			Cuttings	5					740
10	Silty Clay	Silty Clay; orange	Cuttings	10					736
15			Cuttings	15					732
20			Cuttings	20					728
25	Sand	Sand; orange	Cuttings	25				Wet at 24' bgs	724
30	Silty Clay	Silty Clay; tan	Cuttings	30				24 hr Stabilized WL = 29.62' bgs	720
35			Cuttings	35					716
40	Shale	Shale; gray	Cuttings	40					712
45			Cuttings	45					708
50			Cuttings	50					704
55								TD Drilled 55' bgs	700
									696
									692

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-17**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 800.3 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 112 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2497772.3 NORTHING: 428993.4
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 78.55 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 721.75 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; tan with some orange mottling	Cuttings	0					800
5			Cuttings	5					
10			Cuttings	10					790
15	Shale	Shale; dark brown to gray	Cuttings	15					
20	Sandstone	Sandstone; orange to tan	Cuttings	20					780
25	Shale	Shale; gray	Cuttings	25					
30	Sandstone	Sandstone; gray	Cuttings	30					770
35	Shale	Shale; gray transitions to brown	Cuttings	35					
40			Cuttings	40					760
45			Cuttings	45					
50			Cuttings	50					750
55			Cuttings	55					
60			Cutti						740

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-17** SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 800.3 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 112 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2497772.3 NORTHING: 428993.4
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 78.55 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 721.75 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
60			ngs	60					
65	Limestone	Limestone; gray reacts with HCL	Cutti ngs	65					
70			Cutti ngs	70					730
75			Cutti ngs	75				24 hr Stabilized WL = 78.55' bgs	
80			Cutti ngs	80					720
85			Cutti ngs	85					
90	Shale	Shale; dark gray	Cutti ngs	90					710
95			Cutti ngs	95					
100			Cutti ngs	100					700
105			Cutti ngs	105					
110			Cutti ngs	110				Water not observed during drilling TD Drilled 112' bgs	690

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-18**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 811 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 118 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498000 NORTHING: 428999.9
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 28.07 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 782.93 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; tan with some sandstone gravel	Cuttings	0			24 hr Stabilzed WL = 28.07' bgs		810
5			Cuttings	5					
10			Cuttings	10					800
15			Cuttings	15					
20	Sandstone	Sandstone; orange, fine grained	Cuttings	20					790
25			Cuttings	25					
30	Shale	Shale; gray, friable	Cuttings	30					780
35			Cuttings	35					
40			Cuttings	40					770
45			Cuttings	45					
50			Cuttings	50					760
55			Cuttings	55					
60			Cutti						750

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-18** SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 811 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 118 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498000 NORTHING: 428999.9
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 28.07 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 782.93 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	60					
65	Limestone	Limestone; light gray, reacts with HCL	Cutti ngs	65					
70			Cutti ngs	70					740
75			Cutti ngs	75					
80			Cutti ngs	80					730
85			Cutti ngs	85					
90			Cutti ngs	90					720
95	Shale	Shale; dark gray	Cutti ngs	95					
100			Cutti ngs	100					710
105			Cutti ngs	105					
110			Cutti ngs	110				Water not observed during drilling	700
115			Cutti ngs	115				TD Drilled 118' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-19** SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 798.48 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 791.87 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 98 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499000.79 NORTHING: 428999.55
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 56.8 fbgs
START DATE: 1/4/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 741.68 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/15/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; burnt reddish orange with tan mottling						Grout from ground surface to 78 ft bgs	
5			SPT	5	1,2,4				795
	Silty Sand	Silty Sand; tan						2 in dia. Sch. 40 PVC soild riser from 0 - 83.10 ft bgs	
10			SPT	10	18,2 4,30				790
15	Silty Clay	Silty Clay; burnt reddish orange with tan mottling	SPT	15	15,2 1,32				785
20	Sand	Sand; tan, dry	SPT	20	10,7, 6				780
25		Shale; greenish gray, weakly cemented	SPT	25	50/ 4.5"				775
			Core	27	50/ 3.5"				770
30			Core /SPT	30	50/ 1"				765
35			Core /SPT	35	50/ 2.5"				760
40			Core /SPT	40	50/ 3"				755
45			Core /SPT	45	50/ 2.5"				750
50									745
55								24 hr Stablilized WL = 56.80' bgs	
60	Shale								740

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-19**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Timothy Swyden	SURFACE ELEVATION: 798.48 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 791.87 ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 98 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499000.79 NORTHING: 428999.55
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 56.8 fbgs
START DATE: 1/4/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 741.68 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/15/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65		Shale; gray, weakly cemented, Saturated at 83' bgs							735
70									730
75									725
80								Bentonite hole plug seal from 78 ft bgs to 81 ft bgs	720
85								Sand filter pack from 81 ft to 93.10 ft bgs Wet at 83' bgs	715
90								10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen End Cap	710
95								TD Drilled 98' bgs	705

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-20** SHEET NUMBER: 1 of 1

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 747.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 56 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499511 NORTHING: 429004.2
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 28 fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 719.8 ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; brown transitions to orange at 2' bgs	Cuttings	0					744
5			Cuttings	5					740
10			Cuttings	10					736
15			Cuttings	15					732
20	Sandy Clay	Sandy Clay; orange to brown	Cuttings	20					728
25			Cuttings	25					724
30	Sandstone	Sandstone; reddish brown to orange, competant	Cuttings	30				Wet at 28' bgs	720
35	Shale	Shale; brown, transitions to gray at 36' bgs	Cuttings	35					716
40			Cuttings	40					712
45			Cuttings	45					708
50			Cuttings	50					704
55			Cuttings	55				TD Drilled 56' bgs	700
									696
									692

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-21**

SHEET NUMBER: 1 of 1

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 738.9 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 40 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499940.2 NORTHING: 429023.5
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 15.83 fbgs
START DATE: 7/6/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 723.07 ft
FINISH DATE: 7/6/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/7/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Topsoil	Topsoil; dark brown with rootlets	Cuttings	0					738
5			Cuttings	5					736
10	Silty Clay	Silty Clay; reddish brown to orange	Cuttings	10					734
15			Cuttings	15				Wet at 15' bgs 24 hr Stabilized WL = 15.83' bgs	732
20			Cuttings	20					730
25	Shale	Shale; tan transitions to dark gray at 32' bgs	Cuttings	25					728
30			Cuttings	30					726
35			Cuttings	35					724
40								TD Drilled 40' bgs	722
									720
									718
									716
									714
									712
									710
									708
									706
									704
									702
									700

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-22**

SHEET NUMBER: 1 of 2

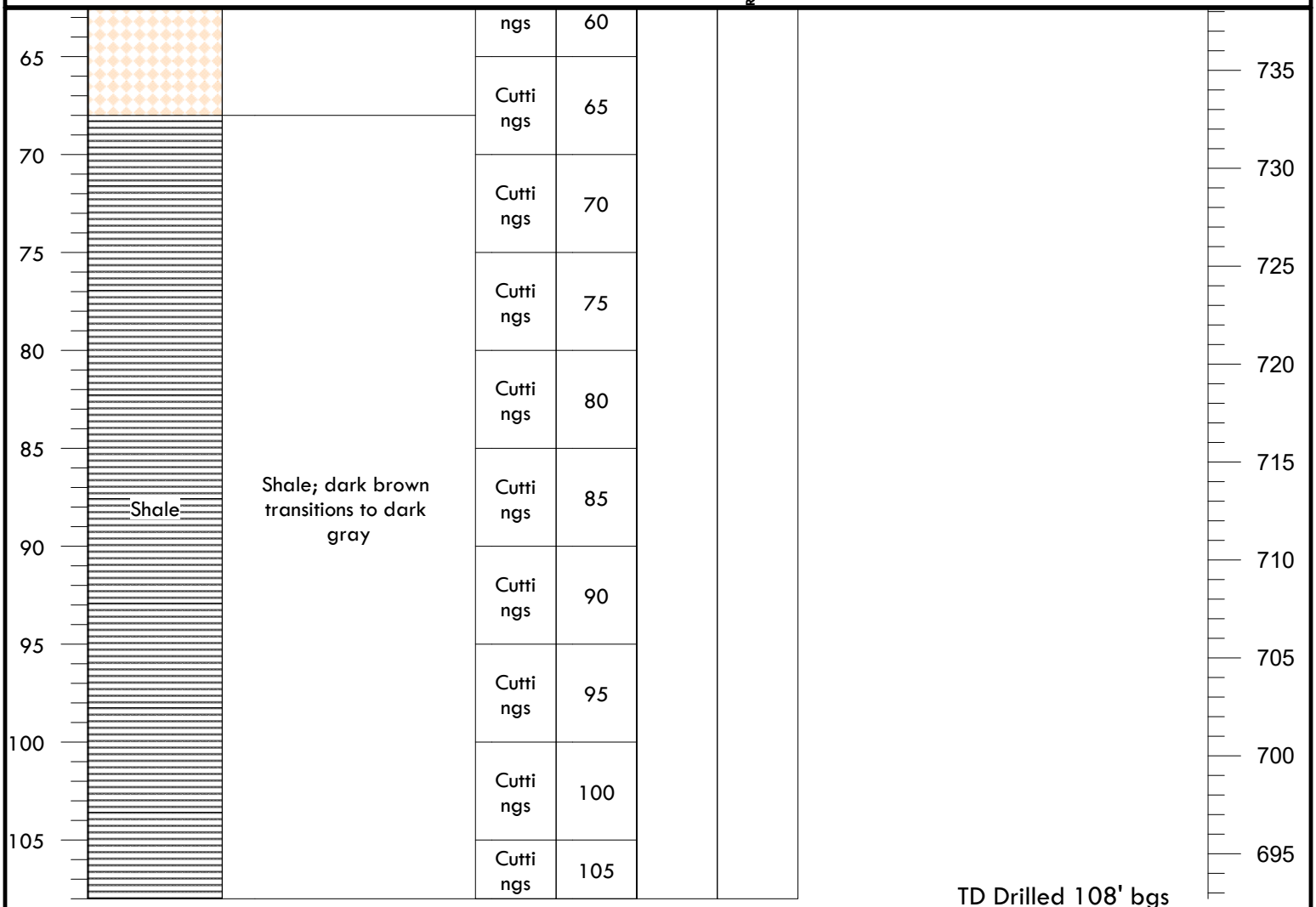
11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 800.7 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 108 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2497826.8 NORTHING: 429522.7
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 37.39 fbgs
START DATE: 6/24/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 763.31 ft
FINISH DATE: 6/24/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; tan	Cuttings	0					800
5	Clay	Clay; brown	Cuttings	5					795
10	Silty Clay	Silty Clay; orange to dark brown	Cuttings	10					790
15	Shale	Shale; brownish green to gray, friable	Cuttings	15					785
20			Cuttings	20					780
25	Limestone	Limestone; gray to dark gray, reacts with HCL	Cuttings	25					775
30	Sandstone	Sandstone; brown, fine grained	Cuttings	30					770
35	Shale	Shale; dark brown to dark gray, friable	Cuttings	35					765
40			Cuttings	40				24 hr Stabilized WL = 39.39' bgs	760
45	Sandstone	Sandstone; gray to brown	Cuttings	45					755
50			Cuttings	50					750
55			Cuttings	55				Wet at 57' bgs	745
60			Cutti						740

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS	LOG OF BORING NO.: **B-22**	SHEET NUMBER: 2 of 2
11219 Richardson Drive North Little Rock, AR	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 800.7 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 108 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2497826.8
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 429522.7
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 37.39 fbgs
START DATE: 6/24/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 763.31 ft
FINISH DATE: 6/24/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-23** SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 814.98 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 817.77 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 116 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498001.03 NORTHING: 429503.21
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 83.18 fbgs
START DATE: 4/7/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 731.8 ft
FINISH DATE: 4/9/2021	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/20/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Sandy Clay	Sandy Clay; orange to tan with sandstone gravels	SPT	0	8,5,3	6		Grout from ground surface to 80 ft bgs	
	Silty Clay								
5		Silty Clay; tan with orange and gray mottling, perched moisture 3-4	SPT	5	15,2 0,35	18			810
10	Clay	Clay; dark brown, some gray and orange mottling, blocky	SPT	10	26,4 0,50 /6"	18		2 in dia. Sch. 40 PVC soild riser from 0 - 86.11 ft bgs	
15	Silty Clay	Silty Clay; brown with tan mottling, friable	SPT	15	23,5 0/6"	12			800
20			SPT	20	23,5 0/6"	12			
25	Shale	Shale; gray to brown, some orange iron staining, friable	SPT	25	32,5 0/4"	10			790
30			SPT	30	28,5 0/4"	10			
35	Sandstone	Sandstone; dark gray with light gray seams, fine grained, competant	Core	33	50/ 0.5"	0			780
			SPT	33.5		36			
40	Siltstone	Siltstone; dark gray, competant	Core	36		60			
			Core	41		2			
45			SPT	43	50/ 2.5"	2			770
50	Shale	Shale; dark gray, friable	SPT	48	50/ 2"	2			
			Core	48		18			
			Core	51		6			
55									760
			Core	56		60			
60									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-23** SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Timothy Swyden	SURFACE ELEVATION: 814.98 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 817.77 ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 116 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498001.03 NORTHING: 429503.21
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 83.18 fbgs
START DATE: 4/7/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 731.8 ft
FINISH DATE: 4/9/2021	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/20/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65	Siltstone	Siltstone; dark gray, competant	Core	61		48			750
70	Sandstone	Sandstone; gray, fine grained, competant	Core	66		60			
	Shale	Shale; gray, weathered, friable	Core	71		60			
75	Limestone	Limestone; light gray, some small fossils							740
			Core	76		60			
80								Bentonite hole plug seal from 80 ft bgs to 83 ft bgs	
			Core	81		60		24 hr Stablilized WL = 83.18' bgs	
85									730
			Core	86		60		Sand filter pack from 83 ft to 96.11 ft bgs	
90								10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen	
			Core	91		48			
95	Shale	Shale; dark gray						End Cap	720
			Core	96		60		Wet at 97' bgs	
100									
			Core	101		60			
105									710
			Core	106		60			
110									
			Core	111		60			
115								TD Drilled 116' bgs	700

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-24**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 789.1 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 105 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499025.5 NORTHING: 429472.2
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 24.59 fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 764.51 ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0–10	Silty Clay	Silty Clay; tan, transitions to gray at 7' bgs	Cuttings	0, 5, 10			24 hr Stabilized WL = 24.59'		785, 780
10–15	Sandstone	Sandstone; orange, fine grained	Cuttings	10, 15					775
15–20	Silty Clay	Silty Clay; gray	Cuttings	15, 20					770
20–25	Sandstone	Sandstone; reddish brown to orange	Cuttings	20, 25					765
25–30			Cuttings	25, 30					760
30–35			Cuttings	30, 35					755
35–40			Cuttings	35, 40					750
40–45			Cuttings	40, 45					745
45–50			Cuttings	45, 50					740
50–55			Cuttings	50, 55					735
55–60			Cuttings	55, Cutti					730

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-24**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 789.1 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 105 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499025.5 NORTHING: 429472.2
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 24.59 fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 764.51 ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
60			ngs	60					725
65	Shale	Shale; gray	Cutti ngs	65					720
70			Cutti ngs	70					715
75			Cutti ngs	75					710
80			Cutti ngs	80					705
85			Cutti ngs	85					700
90			Cutti ngs	90					695
95			Cutti ngs	95					690
100			Cutti ngs	100					685
105									

Water not observed during driling
TD Drilled 105' bgs

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-25**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 791 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 96 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499479.5 NORTHING: 429497.3
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 56.76 fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 734.24 ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; tan	Cuttings	0					790
	Sandstone	Sandstone; orange							
5	Sand	Sand; tan to orange	Cuttings	5					785
10	Limestone	Limestone; gray, reacts with HCL	Cuttings	10					780
15	Sandstone	Sandstone; orange to reddish brown	Cuttings	15					775
20	Limestone	Limestone; gray, reacts with HCL	Cuttings	20					770
25			Cuttings	25					765
30			Cuttings	30					760
35			Cuttings	35					755
40	Shale	Shale; brown to tan, transitions to gray at 28' bgs	Cuttings	40					750
45			Cuttings	45					745
50			Cuttings	50					740
55			Cuttings	55				24 hr Stablilized WL = 56.76	735
60	Limestone	Limestone; gray,	Cutti						730

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

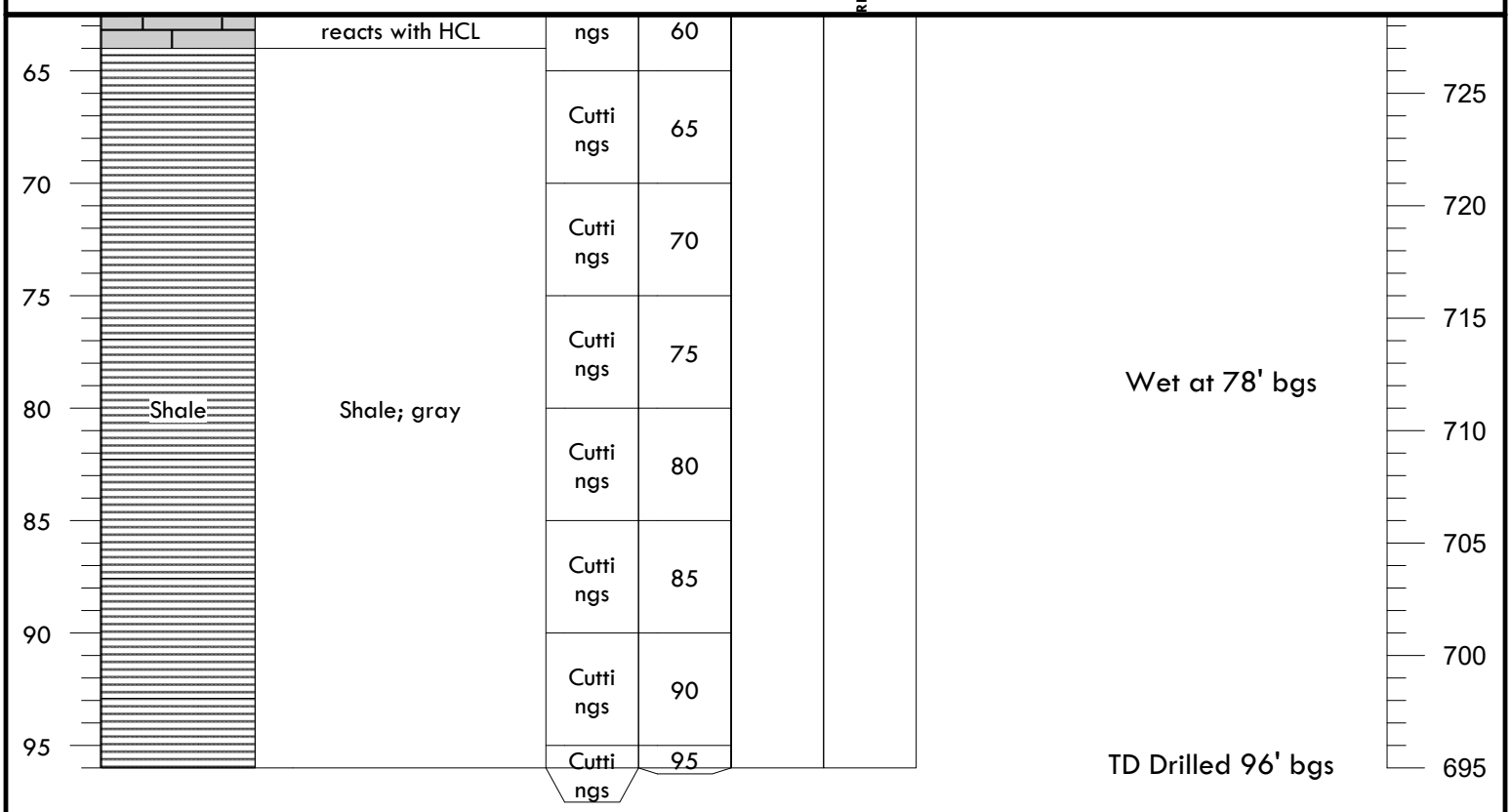
SCS ENGINEERS

LOG OF BORING NO.: **B-25**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 791 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 96 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499479.5 NORTHING: 429497.3
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 56.76 fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 734.24 ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-26**

SHEET NUMBER: 1 of 1

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 758.7 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 59 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499994.3 NORTHING: 429479.1
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 36.35 fbgs
START DATE: 7/6/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 722.35 ft
FINISH DATE: 7/6/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/7/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Topsoil	Topsoil; dark brown with rootlets	Cuttings	0					756
5		Silty Clay; reddish brown to orange	Cuttings	5					752
10	Silty Clay		Cuttings	10					748
15		Silty Clay; tan transitions to gray with some sandstone gravels at 20' bgs	Cuttings	15					744
20			Cuttings	20					740
25			Cuttings	25					736
30			Cuttings	30					732
35			Cuttings	35				24 hr Stabilized WL = 36.35	728
40	Shale	Shale; gray, friable	Cuttings	40					724
45			Cuttings	45					720
50			Cuttings	50					716
55			Cuttings	55				Wet at 55' bgs TD Drilled 59' bgs	712 708 704 700

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-27**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 806.54 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 809.37 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 98 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498047.85 NORTHING: 429990.14
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 19.24 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 787.3 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/20/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; burnt reddish orange with tan mottling	SPT	0	2,2,1			Grout from ground surface to 78 ft bgs	805
5			SPT	5	10,1 4,30			2 in dia. Sch. 40 PVC soild riser from 0 - 83.46 ft bgs	800
10	Sandstone	Sandstone; tank, moderately cemented	SPT	10	7,13, 18				795
15			SPT	15	10,1 5,20				790
20			SPT	20	14,2 7,31			24 hr Stablilized WL = 19.24' bgs	785
25			SPT	25	50/ 2.5"				780
30			SPT	30	50/ 3"				775
35			SPT	35	50/ 2.5"				770
40	Shale	Shale; gray, weakly cemented	SPT	40	50/ 2.5"				765
45			SPT	45	50/ 3"				760
50									755
55									750
60									745

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

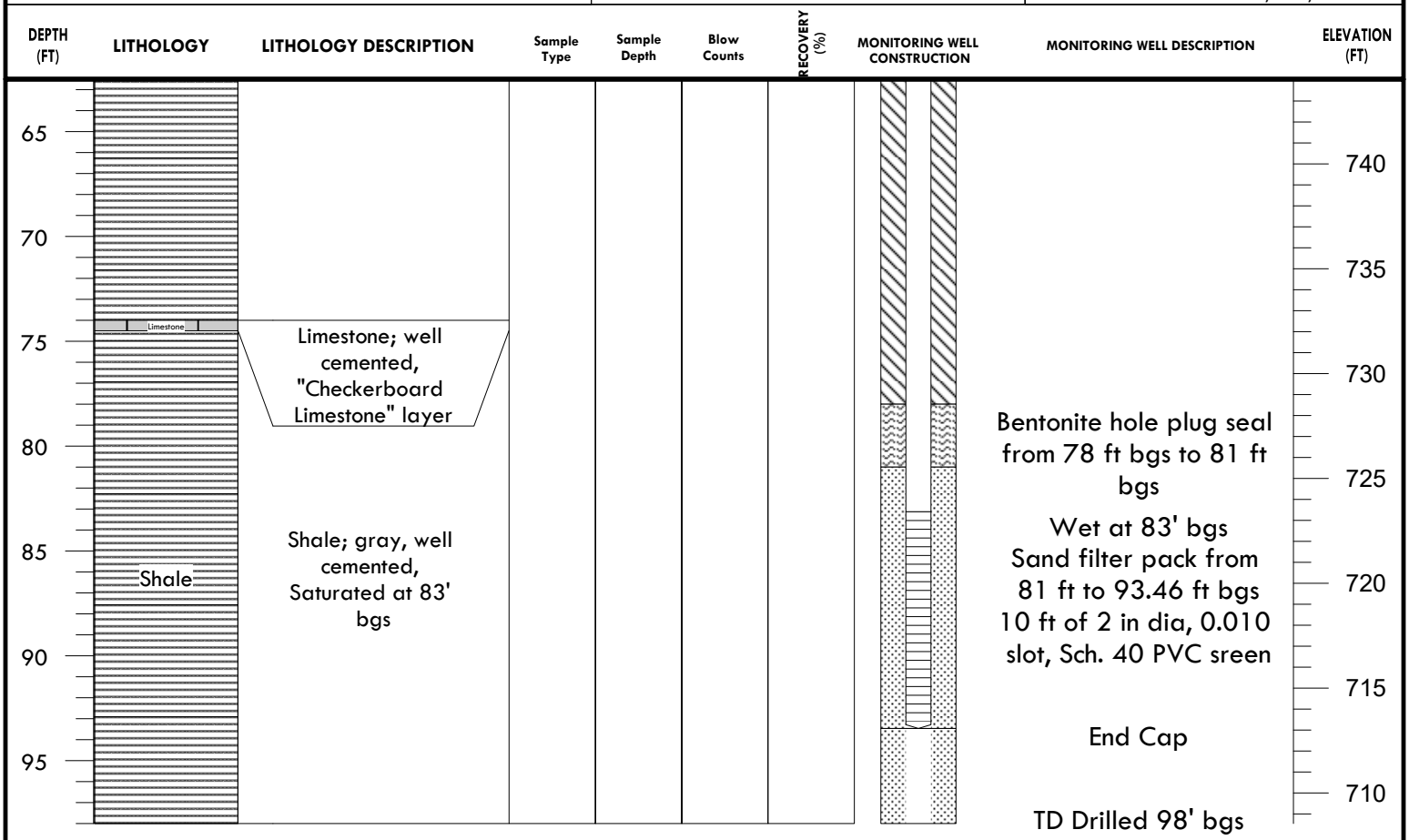
SCS ENGINEERS

LOG OF BORING NO.: **P-27**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Timothy Swyden	SURFACE ELEVATION: 806.54 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 809.37 ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 98 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2498047.85
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 429990.14
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 19.24 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 787.3 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/20/2021



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-28**

SHEET NUMBER: 1 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 889.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498544.7 NORTHING: 429987.6
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 65.19 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 824.61 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay, tan to orange	Cuttings	0					
5	Sandstone	Sandstone; tan to orange	Cuttings	5					
10			Cuttings	10					880
15		Silty Clay; brown with orange mottling	Cuttings	15					
20	Silty Clay		Cuttings	20					870
25		Silty Clay; gray to brown	Cuttings	25					
30			Cuttings	30					860
35			Cuttings	35					
40			Cuttings	40					850
45			Cuttings	45					
50			Cuttings	50					840
55			Cuttings	55					
60	Shale	Shale; gray to brown, friable	Cutti						830

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-28**

SHEET NUMBER: 2 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 889.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498544.7 NORTHING: 429987.6
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 65.19 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 824.61 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	60					
65			Cutti ngs	65				24 hr Stabilized WL = 65.19	
70			Cutti ngs	70					820
75			Cutti ngs	75					
80			Cutti ngs	80					810
85			Cutti ngs	85				Wet at 87' bgs	
90	Sandstone	Sandstone; orange transitions to gray	Cutti ngs	90					800
95			Cutti ngs	95					
100			Cutti ngs	100					790
105			Cutti ngs	105					
110			Cutti ngs	110					780
115			Cutti ngs	115					
120	Shale	Shale; dark gray	Cutti ngs	120					770
125									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-28**

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 889.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498544.7 NORTHING: 429987.6
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 65.19 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 824.61 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
125			Cuttings	125					
130	Limestone	Limestone; light gray, reacts with HCL	Cuttings	130					760
135			Cuttings	135					
140			Cuttings	140					750
145			Cuttings	145					
150			Cuttings	150					740
155			Cuttings	155					
160	Shale	Shale; dark gray	Cuttings	160					730
165			Cuttings	165					
170			Cuttings	170					720
175			Cuttings	175					
180			Cuttings	180					710
185			Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-28**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 889.8 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498544.7 NORTHING: 429987.6
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 65.19 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 824.61 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	185					
190	Limestone	Limestone; gray, reacts with HCL	Cutti ngs	190					700
195	Shale	Shale, dark gray, some thinly interbedded sandstone	Cutti ngs	195					
200								TD Drilled 200' bgs	690

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-29**

SHEET NUMBER: 1 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 875.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 170 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498958.2 NORTHING: 430018
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 79.65 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 796.15 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; orange with sandstone gravels	Cuttings	0					
5	Sandstone	Sandstone; orange	Cuttings	5					870
10		Silty Clay; orange transitions to brown	Cuttings	10					
15			Cuttings	15					860
20			Cuttings	20					
25	Silty Clay	Silty Clay; brown to gray	Cuttings	25					850
30			Cuttings	30					
35			Cuttings	35					840
40			Cuttings	40					
45			Cuttings	45					830
50			Cuttings	50					
55	Shale	Shale; gray, friable	Cuttings	55					820
60			Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-29**

SHEET NUMBER: 2 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 875.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 170 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498958.2 NORTHING: 430018
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 79.65 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 796.15 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	60					
65			Cutti ngs	65					810
70	Limestone	Limestone, gray, reacts with HCL	Cutti ngs	70					
75			Cutti ngs	75					800
80	Shale	Shale; gray, thinly bedded	Cutti ngs	80				24 hr Stabilized WL = 79.65' bgs	
85	Limestone	Limestone, gray, very hard	Cutti ngs	85					790
90			Cutti ngs	90					
95	Shale	Shale; dark gray	Cutti ngs	95					780
100			Cutti ngs	100					
105	Sandstone	Sandstone, tan to orange, fine grained	Cutti ngs	105				Wet at 108' bgs	770
110			Cutti ngs	110					
115		Sandstone; gray	Cutti ngs	115					760
120	Limestone	Limestone; light gray, reacts with HCL	Cutti ngs	120					
125									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-29**

SHEET NUMBER: 3 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 875.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 170 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498958.2 NORTHING: 430018
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 79.65 fbgs
START DATE: 6/23/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 796.15 ft
FINISH DATE: 6/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
125	Shale	Shale; dark gray	Cuttings	125					750
130			Cuttings	130					
135			Cuttings	135					740
140			Cuttings	140					
145			Cuttings	145					730
150			Cuttings	150					
155			Cuttings	155					720
160			Cuttings	160					
165			Cuttings	165					710
170								TD Drilled 170' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-30** SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 821.46 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 824.13 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 115 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499500.27 NORTHING: 430001
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 89.79 fbgs
START DATE: 4/9/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 731.67 ft
FINISH DATE: 4/14/2021	WELL DIAMETER: 2"	WATER LEVEL DATE: 8/2/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; reddish brown with organics	SPT	0	2,1,3	12		Grout from ground surface to 97 ft bgs	820
5	Sandstone	Sandstone; orange	SPT	5	4,8,5 0/5"	15		2 in dia. Sch. 40 PVC soild riser from 0 - 102.73 ft bgs	
10	Silty Clay	Silty Clay; brown with orange and tan mottling, organics present	SPT	10	3,3,6	18			810
15	Sandy Clay	Sandy Clay; brown with orange mottling, some sandstone interbedded	SPT	15	3,6,1 3	18			
20	Shale	Shale; gray, friable	SPT	20	33,5 0/5"	18			800
25			SPT	25	50/ 4"	4			
30	Sandstone	Sandstone; gray, fine grained, competant	Core	28	50/ 1.5"	36			790
35	Shale	Shale; gray, friable	SPT Core	28.5 33		15 60			
40			Core	38		60			780
45	Sandstone	Sandstone; orange, fine grained, thinly bedded	Core	43		60			
50		Sandstone; tan with orange mottling, interbedded with thin gray silt, fine grained, competant	Core	48		60			770
55			Core	53		60			
60	Limestone	Limestone; gray to dark gray,	Core	58		60			760

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-30** SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 821.46 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 824.13 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 115 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499500.27 NORTHING: 430001
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 89.79 fbgs
START DATE: 4/9/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 731.67 ft
FINISH DATE: 4/14/2021	WELL DIAMETER: 2"	WATER LEVEL DATE: 8/2/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65		competant, reacts with HCL	Core	63		60			
70	Shale	Shale; dark gray	Core	68		60			750
75			Core	73		60			
80			Core	78		60			740
85			Core	83		60			
90			Core	88		60		24 hr Stablilized WL = 89.79' bgs	730
95			Core	93		50			
100			Core	98		60		Bentonite hole plug seal from 97 ft bgs to 100 ft bgs	720
105			Core	103		60		End Cap Wet at 103' bgs Sand filter pack from 100 ft to 112.73 ft bgs	
110			Core	108		36		10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen	710
115			Core	113		48		TD Drilled 115' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-31**

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 833 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 120 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498553.9 NORTHING: 430493.8
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 31.09 fbgs
START DATE: 6/22/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 801.91 ft
FINISH DATE: 6/22/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0–10	Silty Clay	Silty Clay; orange to tan, sandstone gravels	Cuttings						830, 820
15–20	Shale	Shale; tan to greenish gray, friable	Cuttings						810
20–30	Shale	Shale; dark gray	Cuttings						800
30–50	Sandstone	Sandstone; orange to tan	Cuttings					24 hr Stabilized WL = 31.09' bgs	790
50–60	Limestone	Limestone; dark gray, reacts in HCL	Cuttings						780
60	Shale		Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-31**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 833 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 120 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498553.9 NORTHING: 430493.8
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 31.09 fbgs
START DATE: 6/22/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 801.91 ft
FINISH DATE: 6/22/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65		Shale; light gray	ngs						770
			Cutti ngs						
70	Sandstone	Sandstone; tan to brown	Cutti ngs						760
75			Cutti ngs					Wet at 76' bgs	
80			Cutti ngs						
			Cutti ngs						750
85			Cutti ngs						
90			Cutti ngs						
									740
95	Shale	Shale; dark gray	Cutti ngs						
100			Cutti ngs						
									730
105			Cutti ngs						
110			Cutti ngs						
									720
115			Cutti ngs						
120								TD Drilled 120' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-32**

SHEET NUMBER: 1 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 897.7 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499018.3 NORTHING: 430487.5
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 119 fbgs
START DATE: 6/22/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 778.7 ft
FINISH DATE: 6/22/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Sandstone	Sandstone; tan to orange	Cuttings	0					
5		Silty Clay; reddish orange	Cuttings	5					890
10			Cuttings	10					
15	Silty Clay	Sitly Clay; tan with some thin greenish shale interbedded	Cuttings	15					880
20			Cuttings	20					
25			Cuttings	25					870
30			Cuttings	30					
35			Cuttings	35					860
40			Cuttings	40					
45			Cuttings	45					850
50			Cuttings	50					
55			Cuttings	55					840
60		Shale; light gray to	Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-32** SHEET NUMBER: 2 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 897.7 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499018.3 NORTHING: 430487.5
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 119 fbgs
START DATE: 6/22/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 778.7 ft
FINISH DATE: 6/22/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65	Shale	tan, friable	ngs	60					
70			Cutti ngs	65					830
75			Cutti ngs	70					
80			Cutti ngs	75					820
85			Cutti ngs	80					
90			Cutti ngs	85					810
95			Cutti ngs	90					
100			Cutti ngs	95					800
105	Limestone	Limestone; gray, very hard, reacts with HCL	Cutti ngs	100					
110			Cutti ngs	105					790
115			Cutti ngs	110					
120			Cutti ngs	115					780
125			Cutti ngs	120				Wet at 119' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-32** SHEET NUMBER: 3 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 897.7 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499018.3 NORTHING: 430487.5
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 119 fbgs
START DATE: 6/22/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 778.7 ft
FINISH DATE: 6/22/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
125	Sandstone	Sandstone; light gray, fine grained	Cuttings	125					770
130			Cuttings	130					
135			Cuttings	135					760
140			Cuttings	140					
145	Limestone	Limestone; light to dark gray, reacts with HCL	Cuttings	145					750
150	Shale	Shale; brown transitions to gray	Cuttings	150					
155			Cuttings	155					740
160			Cuttings	160					
165			Cuttings	165					730
170			Cuttings	170					
175			Cuttings	175					720
180			Cuttings	180					
185			Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-32**

SHEET NUMBER: 4 of 4

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 897.7 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2499018.3
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 430487.5
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 119 fbgs
START DATE: 6/22/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 778.7 ft
FINISH DATE: 6/22/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	185					710
190			Cutti ngs	190					
195			Cutti ngs	195					700
200								TD Drilled 200' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-33**

SHEET NUMBER: 1 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 855.3 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 142 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499502.6 NORTHING: 430514.4
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 82 fbgs
START DATE: 6/24/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 773.3 ft
FINISH DATE: 6/24/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; orange to tan with some sandstone gravels	Cuttings	0					
5			Cuttings	5					850
10		Silty Clay; brown to brownish green	Cuttings	10					
15			Cuttings	15					840
20			Cuttings	20					
25			Cuttings	25					830
30	Shale	Shale; gray	Cuttings	30					
35			Cuttings	35					820
40			Cuttings	40					
45	Limestone	Limestone; dark gray, reacts with HCL	Cuttings	45					810
50			Cuttings	50					
55	Sandstone	Sandstone; gray, fine grained	Cuttings	55					800
60			Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-33** SHEET NUMBER: 2 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 855.3 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 142 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499502.6 NORTHING: 430514.4
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 82 fbgs
START DATE: 6/24/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 773.3 ft
FINISH DATE: 6/24/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	60					
65	Shale	Shale; dark gray	Cutti ngs	65					790
70	Sandstone	Sandstone; light gray, fine grained	Cutti ngs	70					
75			Cutti ngs	75					780
80	Shale	Shale; dark gray	Cutti ngs	80				Wet at 82' bgs	
85	Sandstone	Sandstone; light gray, fine grianed	Cutti ngs	85					770
90			Cutti ngs	90					
95	Limestone	Limestone; dark gray, reacts with HCL	Cutti ngs	95					760
100			Cutti ngs	100					
105			Cutti ngs	105					750
110			Cutti ngs	110					
115			Cutti ngs	115					740
120			Cutti ngs	120					
125									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-33**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 855.3 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 142 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499502.6 NORTHING: 430514.4
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 82 fbgs
START DATE: 6/24/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 773.3 ft
FINISH DATE: 6/24/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
125	Shale	Shale; dark gray	Cuttings	125					730
130			Cuttings	130					
135			Cuttings	135					720
140			Cuttings	140				TD Drilled 142' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-34** SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 815.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 108 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500000 NORTHING: 430500
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 87 fbgs
START DATE: 4/14/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 728.8 ft
FINISH DATE: 4/15/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0			SPT	0	3,7,9	18			815
5			SPT	5	8,11, 6	18			810
10	Shale	Shale; gray, thinly bedded, friable	SPT	10	9,16, 15	18			805
15			SPT	15	6,7,6	18			800
20			SPT	20	6,7,7	18			795
25	Silty Clay	Silty Clay; dark brown, orange mottling	SPT	25	5,5,5	18			790
30			SPT	30	6,18, 17	18			785
35	Clay	Clay; dark brown, with orange and gray mottling	SPT	35	16,2 7,29	18			780
40		Shale; brown, thinly bedded, friable	SPT	40	30,5 0/5. 5"	12			775
45			SPT	45	50/ 6"	6			770
50	Shale		SPT	50	50/ 4"	4			765
55		Shale; gray, thinly bedded, friable	SPT	55	50/ 3.5"	3.5			760
60			SPT	60	50/	3			755

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-34**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 815.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 108 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500000 NORTHING: 430500
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 87 fbgs
START DATE: 4/14/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 728.8 ft
FINISH DATE: 4/15/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			Core	60	3"	36			
65			Core	63		60			750
	Limestone	Limestone; gray, reacts with HCL							
70			Core	68		60			745
	Shale	Shale; gray							
75			Core	73		60			740
80			Core	78		60			735
	Siltstone	Siltstone; gray, hard competant							
85			Core	83		60			730
	Shale	Shale; gray, thinly bedded, friable						Wet at 87' bgs	
90			Core	88		60			725
95			Core	93		60			720
100	Siltstone	Siltstone; gray, hard competant	Core	98		48			715
105			Core	103		60			710
								TD Drilled 108' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-35** SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 808 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 123 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500495 NORTHING: 430565.5
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: NA fbgs
START DATE: 4/15/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: NA ft
FINISH DATE: 4/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; gray	SPT	0	1,1,2	18			
	Clay	Clay; reddish brown with orange and gray mottling							
5			SPT	5	5,6,6	18			
	Shale	Shale; gray, friable							800
10	Sandstone	Sandstone, orange, competant	SPT	10	50/ 2"	2			
	Sand	Sand; tan to ornage with thin interbedded sandstone and gray silt layers							
15			SPT	15	8,7,8	12			
									790
20	Sandy Clay	Sandy Clay; brown, interbeded withi thin sandstone layers	SPT	20	9,9,8	12			
25			SPT	25	50/ 0"	0			
	Sandstone	Sandstone, orange to tan							780
30			SPT	30	13,5 0/3. 5"	6			
35	Silty Clay	Silty Clay; tan to brown with orange and gray mottling	SPT	34	8,14, 22	18			
									770
40			SPT	40	8,25, 22	18			
45			SPT	45	28,3 6,50 /6"	18			
	Clay	Clay; brown with gray mottling, some moisture at 40'	SPT	48	17,2 0,28	18			760
50									
55			SPT	53	17,4 7,50 /4"	16			
									750
60			SPT	58	38,5 0/4. 5"	9.5			
		Clay; brown with thinly interbedded							

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-35** SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 808 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 123 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500495 NORTHING: 430565.5
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: NA fbgs
START DATE: 4/15/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: NA ft
FINISH DATE: 4/23/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
		gray shale layers	SPT	63	50/ 4.5"	4.5			
65									
			SPT	68	50/ 4"	4			740
70									
			SPT	73	50/ 4"	4			
75									
			SPT	78	50/ 3.5"	3.5			730
80	Shale	Shale; dark gray, friable	Core	78		36			
			SPT	83	50/ 2.5"	2.5			
85									
			SPT	88	50/ 2.5"	2.5			720
90									
			SPT	93	50/ 3"	3			
95									
			SPT	98	50/ 3"	3			710
100									
	Sandstone	Sandstone, tan	SPT	103	50/ 0"	0			
105									
			SPT	108	50/ 0.5"	0.5			700
110									
			SPT	113	50/ 1"	1			
115	Shale	Shale; gray, competant							
			SPT	118	50/ 2"	2			690
120									

Water not observed during drilling
TD Drilled 123' bgs

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-36**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 830.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 109 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498752.4 NORTHING: 430925.8
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 66.61 fbgs
START DATE: 6/22/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 764.19 ft
FINISH DATE: 6/22/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; orange with sandstone gravels	Cuttings	0					830
5			Cuttings	5					825
10			Cuttings	10					820
15	Shale	Shale; Gray to tan	Cuttings	15					815
20			Cuttings	20					810
25			Cuttings	25					805
30	Limestone	Limestone; dark gray, reacts in HCL	Cuttings	30					800
35			Cuttings	35					795
40	Shale	Shale; Gray, friable	Cuttings	40					790
45	Limestone	Limestone; gray reacts in HCL	Cuttings	45					785
50			Cuttings	50					780
55			Cuttings	55					775
60			Cutti						770

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-36** SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 830.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 109 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2498752.4 NORTHING: 430925.8
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 66.61 fbgs
START DATE: 6/22/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 764.19 ft
FINISH DATE: 6/22/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	60					
65	Sandstone	Sandstone; gray, fine grained	Cutti ngs	65				24 hr Stabilized WL = 66.61' bgs	765
70			Cutti ngs	70					760
75			Cutti ngs	75					755
80			Cutti ngs	80				Wet at 82' bgs	750
85			Cutti ngs	85					745
90			Cutti ngs	90					740
95	Shale	Shale; dark gray	Cutti ngs	95					735
100			Cutti ngs	100					730
105			Cutti ngs	105				TD Drilled 109' bgs	725

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-37** SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 846.2 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 849.01 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 124 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499000.47 NORTHING: 430933.72
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 85.14 fbgs
START DATE: 4/5/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 761.06 ft
FINISH DATE: 4/7/2021	WELL DIAMETER: 2"	WATER LEVEL DATE: 8/2/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; reddish brown, with tan mottleing some thin sandstone layers	SPT	0	3,37, 18	10		Grout from ground surface to 90 ft bgs	
5			SPT	5	6,8,12	18		2 in dia. Sch. 40 PVC soild riser from 0 - 106.25 ft bgs	840
	Clay	Clay; tan with orang mottling and black organics							
10			SPT	10	11,20,30	18			
15			SPT	15	21,36,50/6"	12			830
20			SPT	20	22,50/6"	12			
25			SPT	25	23, 50/5.5"	12			820
30	Shale	Shale; greenish gary, weakly cemented, friable	SPT	30	50/5"	5			
35			SPT	35	50/4.5"	4.5			810
40			SPT	40	50/5"	5			
45			SPT	43	50/1"	1			800
50			SPT	48	50/3.5"	3			
55	Sandstone	Sanstone, light gray to gray, competant	SPT	53	Refusal	0			790
			Core	53		36			
			Core	56		60			
60	Shale	Shale; gray, competant, near							

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-37**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 846.2 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 849.01 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 124 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499000.47 NORTHING: 430933.72
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 85.14 fbgs
START DATE: 4/5/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 761.06 ft
FINISH DATE: 4/7/2021	WELL DIAMETER: 2"	WATER LEVEL DATE: 8/2/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65		contact, transitioning to friable at 61'	Core	61		60			780
70	Sandstone	Sandstone; fine to very fine grained, light gray, competant	Core	66		60			
75	Siltstone	Siltstone; gray with some thin layers of shale, black organics present (coal)	Core	71		60			770
80	Shale	Shale; dark gray thinly bedded with thin silt and sand layers, black organics present	Core	76		60			
85	Sandstone / Shale	Sandstone; gray, fine grained, competant	Core	81		60			760
90		Shale; dark gray with some thin interbedded silts and sands, some organics >5%	Core	86		60			
95	Sandstone	Sandstone; gray with dark gray thin beds, very fine to fine grained, competant	Core	91		60			750
100			Core	96		60			
105			Core	101		60			740
110			Core	106		60			
115	Siltstone	Siltstone; dark brown with some thin shale layers	Core	111		60			730
120			Core	116		60			
			Core	121		60			

24 hr Stablilized WL = 85.14' bgs

Bentonite hole plug seal from 90 ft bgs to 93 ft bgs

Sand filter pack from 93 ft to 106.25 ft bgs

10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen

End Cap

Water not observed during drilling
TD Drilled 124' bgs

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-38**

SHEET NUMBER: 1 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 903.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Two Eight Drilling, Inc.	LOCATION: EASTING: 2499484.9 NORTHING: 430940.3
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 64.21 fbgs
START DATE: 6/21/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 839.59 ft
FINISH DATE: 6/21/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Topsoil	Topsoil, light brown	Cuttings	0					900
5	Silty Clay	Silty Clay; orange with some gravels	Cuttings	5					
10			Cuttings	10					890
15			Cuttings	15					
20			Cuttings	20					880
25			Cuttings	25					
30			Cuttings	30					870
35			Cuttings	35					
40			Cuttings	40					860
45			Cuttings	45					
50			Cuttings	50					850
55	Shale	Shale; gray to dark gray	Cuttings	55					
60			Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-38** SHEET NUMBER: 2 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 903.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Two Eight Drilling, Inc.	LOCATION: EASTING: 2499484.9 NORTHING: 430940.3
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 64.21 fbgs
START DATE: 6/21/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 839.59 ft
FINISH DATE: 6/21/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
60			ngs	60					840
65			Cutti ngs	65				24 hr Stabilized WL = 64.21' bgs	
70			Cutti ngs	70					830
75			Cutti ngs	75					
80			Cutti ngs	80					820
85			Cutti ngs	85					
90			Cutti ngs	90					810
95			Cutti ngs	95					
100	Limestone	Limestone, gray, reacts in HCL	Cutti ngs	100					800
105			Cutti ngs	105					
110			Cutti ngs	110					790
115			Cutti ngs	115					
120			Cutti ngs	120					780
125	Shale	Shale, dark gray,							

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-38** SHEET NUMBER: 3 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 903.8 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Two Eight Drilling, Inc.	LOCATION: EASTING: 2499484.9 NORTHING: 430940.3
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 64.21 fbgs
START DATE: 6/21/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 839.59 ft
FINISH DATE: 6/21/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
125		friable	Cuttings	125					
130			Cuttings	130					770
135			Cuttings	135				Wet at 138' bgs	
140	Sandstone	Sandstone; light grey	Cuttings	140					760
145			Cuttings	145					
150			Cuttings	150					750
155			Cuttings	155					
160	Limestone	Limestone, gray, reacts in HCL	Cuttings	160					740
165			Cuttings	165					
170			Cuttings	170					730
175			Cuttings	175					
180	Shale	Shale, dark brown	Cuttings	180					720
185			Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-38**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 903.8 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 200 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Two Eight Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2499484.9
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 430940.3
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 64.21 fbgs
START DATE: 6/21/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 839.59 ft
FINISH DATE: 6/21/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/6/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	185					
190			Cutti ngs	190					
195			Cutti ngs	195					710
200								TD Drilled 200' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-39** SHEET NUMBER: 1 of 2

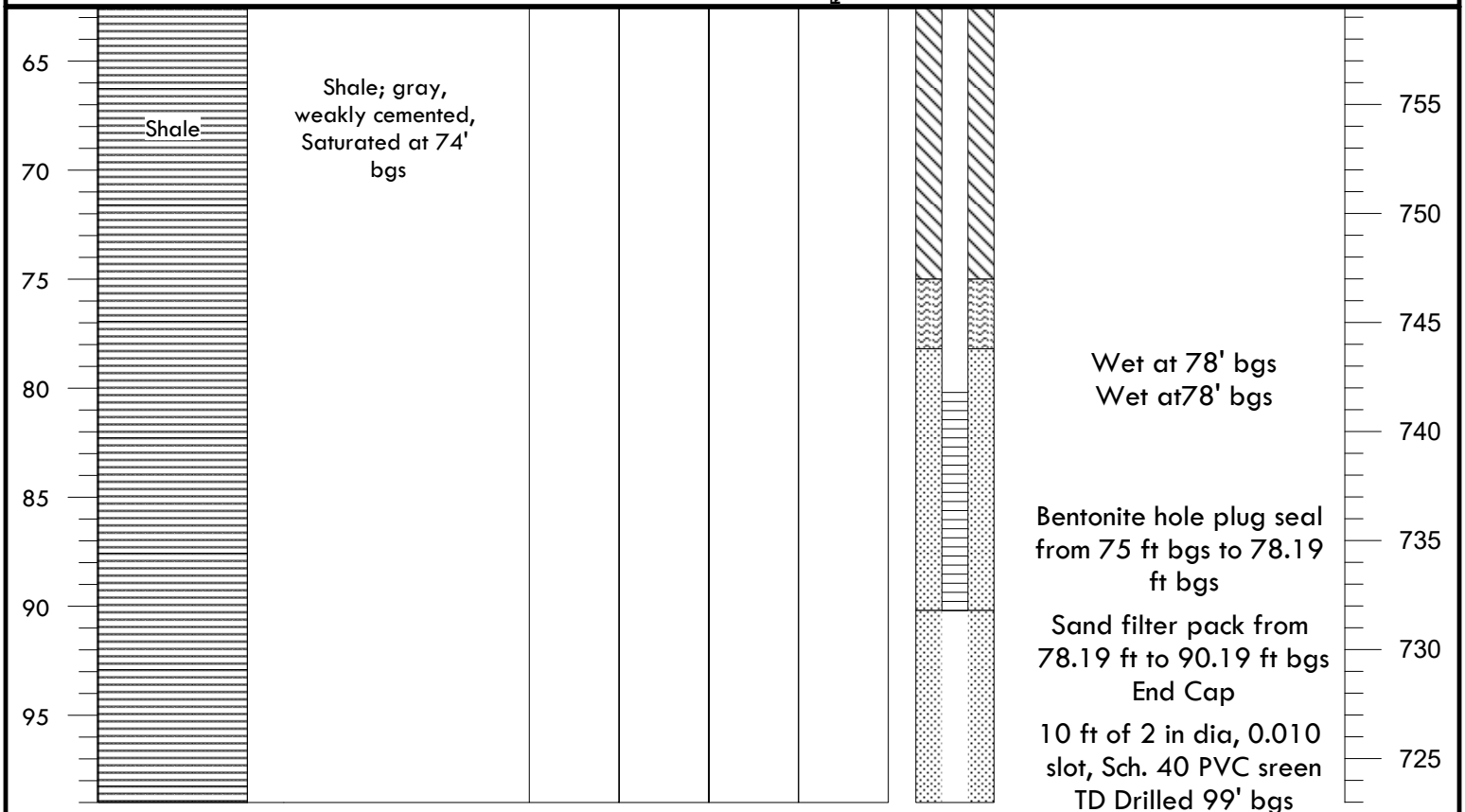
11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 821.98 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 821.98 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 99 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500000.48 NORTHING: 430955.82
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 78 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 743.98 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Sandy Silt	Sandy Silt; burnt reddish orange with tan mottling		0	3,4,4			Grout from ground surface to 75 ft bgs	820
5			SPT	5	3,4,6			2 in dia. Sch. 40 PVC soild riser from 0 - 80.19 ft bgs	815
10	Sandstone	Sandstone; tan, moderately cemented	SPT	10	50/ 6"				810
15			SPT	15	50/ 1.5"				805
20			Core /SPT	20	50/ 1"				800
25			Core /SPT	25	50/ 2"				795
30			Core /SPT	30	50/ 6"				790
35			Core /SPT	35	50/ 0.5"				785
40			Core /SPT	40	50/ 4"			24 hr Stablilized WL = 40.83' bgs	780
45			Core /SPT	45	50/ 1"				775
50									770
55									765
60									760

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS	LOG OF BORING NO.: **P-39**	SHEET NUMBER: 2 of 2
11219 Richardson Drive North Little Rock, AR	DRILLER: Timothy Swyden	SURFACE ELEVATION: 821.98 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 821.98 ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 99 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500000.48 NORTHING: 430955.82
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 78 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 743.98 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: NA



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-40**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 799.4 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 78 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500500.2 NORTHING: 430966.7
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: NA fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: NA ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; reddish brown	Cuttings	0					796
5			Cuttings	5					792
10		Silty Clay; brown to tan with gray mottling	Cuttings	10					788
15			Cuttings	15					784
20			Cuttings	20					780
25			Cuttings	25					776
30			Cuttings	30					772
35	Shale	Shale; brown transitions to gray at 34' bgs	Cuttings	35					768
40			Cuttings	40					764
45			Cuttings	45					760
50			Cuttings	50					756
55			Cuttings	55					752
60			Cutti						748
									744
									740

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-40**

SHEET NUMBER: 2 of 2

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 799.4 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 78 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2500500.2
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 430966.7
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: NA fbgs
START DATE: 6/25/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: NA ft
FINISH DATE: 6/25/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
			ngs	60					736
65			Cutti ngs	65					732
70			Cutti ngs	70				Water not observed during drilling	728
75			Cutti ngs	75					724
								TD Drilled 78' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-41**

SHEET NUMBER: 1 of 3

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 873.6 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 145 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2501000.1 NORTHING: 430984.7
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: NA fbgs
START DATE: 7/6/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: NA ft
FINISH DATE: 7/6/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; orange	Cuttings	0					870
5	Sandstone	Sandstone; orange to reddish brown	Cuttings	5					
10	Sandy Clay	Sandy Clay; tan to orange with some thinly bedded sandstone	Cuttings	10					860
15	Limestone	Limestone; gray, reacts with HCL	Cuttings	15					
20	Sandstone	Sandstone; orange to light gray	Cuttings	20					850
25	Limestone	Limestone; gray to reddish brown, reacts with HCL	Cuttings	25					
30	Shale	Shale; gray, friable	Cuttings	30					840
35			Cuttings	35					
40			Cuttings	40					830
45			Cuttings	45					
50			Cuttings	50					820
55	Limestone	Limestone; gray, reacts with HCL	Cuttings	55					
60			Cutti						

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-41**

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 873.6 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 145 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2501000.1 NORTHING: 430984.7
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: NA fbgs
START DATE: 7/6/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: NA ft
FINISH DATE: 7/6/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
60			ngs	60					810
65			Cutti ngs	65					
70			Cutti ngs	70					800
75			Cutti ngs	75					
80			Cutti ngs	80					790
85			Cutti ngs	85					
90			Cutti ngs	90					780
95			Cutti ngs	95					
100	Shale	Shale; dark gray	Cutti ngs	100					770
105			Cutti ngs	105					
110			Cutti ngs	110					760
115			Cutti ngs	115					
120			Cutti ngs	120					750
125									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **B-41**

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 873.6 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 145 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2501000.1 NORTHING: 430984.7
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: NA fbgs
START DATE: 7/6/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: NA ft
FINISH DATE: 7/6/2021	WELL DIAMETER: NA	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
125	Limestone	Limestone; light gray, reacts with HCL	Cuttings	125				Water not observed during drilling TD Drilled 145' bgs	740
130			Cuttings	130					
135			Cuttings	135					
140			Cuttings	140					730
145									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **P-42**

SHEET NUMBER: 1 of 2

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 841.74 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 844.46 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 118 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2501496.87 NORTHING: 431004.77
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 92.96 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 748.78 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/20/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
0	Silty Clay	Silty Clay; burnt reddish orange with tan mottling	SPT	0	1,3,3			Grout from ground surface to 85 ft bgs	840
5			SPT	5	4,7,10			2 in dia. Sch. 40 PVC soild riser from 0 - 90.40 ft bgs	
10		Shale; greenish gray, weakly cemented	SPT	10	13,22,37				830
15			SPT	15	22,31,42				
20			SPT	20	27,39,41				820
25			Core /SPT	25	50/ 4"				
30			Core /SPT	30	50/ 4"				810
35			Core /SPT	35	50/ 4"				
40			Core /SPT	40	50/ 4"				800
45	Shale		Core /SPT	45	50/ 5"				
50		Shale; gray, weakly cemented							790
55									
60									780

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS	LOG OF BORING NO.: **P-42**	SHEET NUMBER: 2 of 2
11219 Richardson Drive North Little Rock, AR	DRILLER: Timothy Swyden	SURFACE ELEVATION: 841.74 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 844.46 ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 118 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION:
PROJECT NUMBER: 27220345.00		EASTING: 2501496.87
PROJECT LOCATION: Sand Springs, Oklahoma		NORTHING: 431004.77
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 92.96 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 748.78 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/20/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
65									
70									770
75									
80									760
85	Sandstone	Sandstone; tank, moderaly cemented						Bentonite hole plug seal from 85 ft bgs to 88 ft bgs	
90								Sand filter pack from 88 ft to 100.40 ft bgs	750
95								24 hr Stablilized WL = 92.96' bgs	
100	Shale	Shale; gray, weakly cemented, Saturated at 94' bgs						Wet at 94' bgs 10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen End Cap	740
105									
110									730
115								TD Drilled 118' bgs	

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

Appendix C

Geophysical Logs

Century WIRELINE SERVICES

P1

COMPANY AMERICAN ENVIRONMENTAL LANDFIL
WELL P1
WELL EXT
FIELD LANDFILL
COUNTY OSAGE
STATE OKLAHOMA
COUNTRY USA
API NO.

COMPANY : AMERICAN ENVIRONMENTAL LANDFIL
WELL : P1
WELL EXT :
FIELD : LANDFILL
COUNTY : OSAGE
STATE : OKLAHOMA
COUNTRY : USA
API NO. :
UNIQ ID :

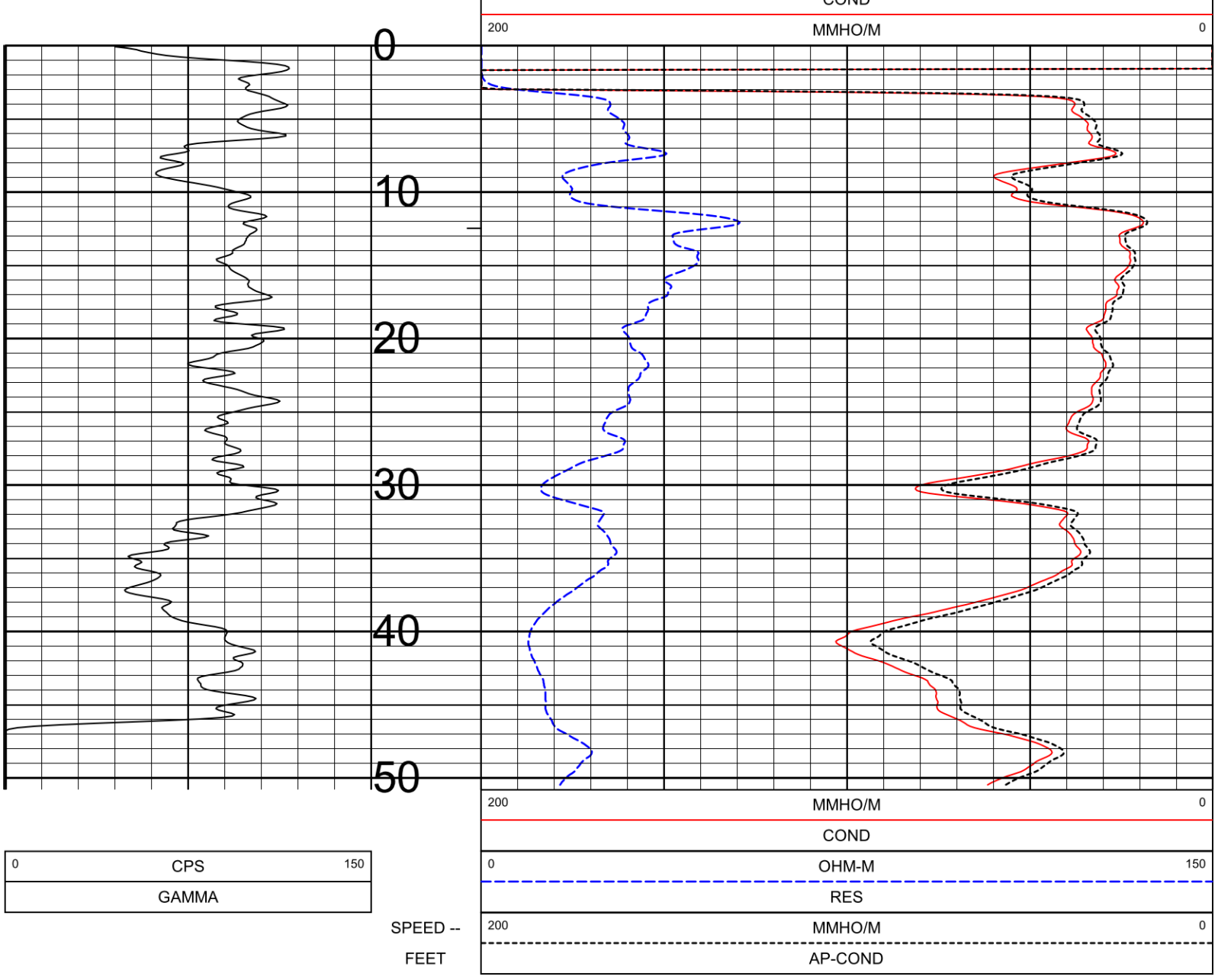
LOCATION : SECTION: TOWNSHIP: RANGE:
LAT GPS UTM
LON GPS UTM

DISPLAY7_JL63s

			Elevations:		Other Services:
PERMANENT DATUM	GL		KB	FT	
DRL MEASURED FROM	GL		DF	FT	
LOG MEASURED FROM	GL		GL	FT	
ELEV. PERM. DATUM		FT			

DATE	08/17/21 11:39		
DEPTH DRILLER	56.43	FT	
DEPTH LOGGER		FT	
FIRST READING		FT	
LAST READING		FT	
BIT SIZE	5.5	IN	
CASING -- DRILLER	56.43	FT	
CASING -- LOGGER		FT	
CASING O.D.	2	IN	
CASING TYPE	SURFACE		
FLUID TYPE	MUD		
FLUID DENSITY		LB/GAL	
FLUID VISCOSITY			
FLUID PH			
MUD SOURCE			
RM @ MEAS TEMP	@ F		
RMF @ MEAS TEMP	@ F		
RMC @ MEAS TEMP	@ F		
CIRC STOPPED			
RIG NUMBER	1107		
RECORDED BY	R.SIPES		
WITNESSED BY	PAUL NORVELL		
REMARKS 1			
REMARKS 2			
REMARKS 3			

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



TOOL CALIBRATION P1 08/17/21 11:39
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Century WIRELINE SERVICES

P4

COMPANY AMERICAN ENVIRONMENTAL LANDFIL
WELL P4
WELL EXT
FIELD LANDFILL
COUNTY OSAGE
STATE OKLAHOMA
COUNTRY USA
API NO.

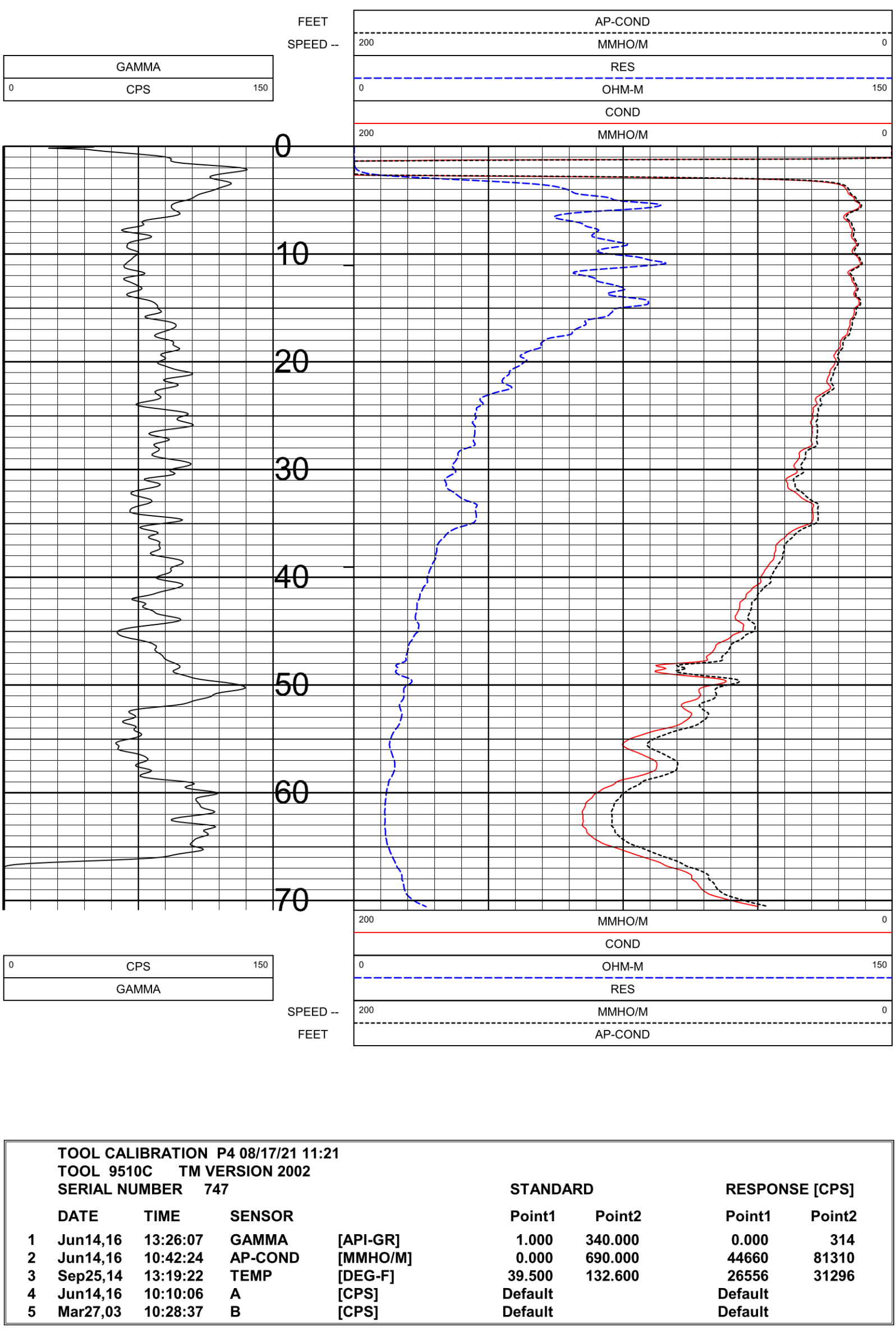
COMPANY	: AMERICAN ENVIRONMENTAL LANDFIL
WELL	: P4
WELL EXT	:
FIELD	: LANDFILL
COUNTY	: OSAGE
STATE	: OKLAHOMA
COUNTRY	: USA
API NO.	:
UNIQ ID	:
LOCATION	: SECTION: TOWNSHIP: RANGE:
LAT GPS UTM	
LON GPS UTM	

DISPLAY7_JL63s

		Elevations:		Other Services:
PERMANENT DATUM	GL	KB	FT	
DRL MEASURED FROM	GL	DF	FT	
LOG MEASURED FROM	GL	GL	FT	
ELEV. PERM. DATUM	FT			

DATE	08/17/21 11:21		
DEPTH DRILLER	76.5	FT	
DEPTH LOGGER		FT	
FIRST READING		FT	
LAST READING		FT	
BIT SIZE	5.5	IN	
CASING -- DRILLER	76.5	FT	
CASING -- LOGGER		FT	
CASING O.D.	2	IN	
CASING TYPE	SURFACE		
FLUID TYPE	MUD		
FLUID DENSITY		LB/GAL	
FLUID VISCOSITY			
FLUID PH			
MUD SOURCE			
RM @ MEAS TEMP	@ F		
RMF @ MEAS TEMP	@ F		
RMC @ MEAS TEMP	@ F		
CIRC STOPPED			
RIG NUMBER	1107		
RECORDED BY	R.SIPES		
WITNESSED BY	PAUL NORVELL		
REMARKS 1			
REMARKS 2			
REMARKS 3			

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



TOOL CALIBRATION P4 08/17/21 11:21
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Century WIRELINE SERVICES

P6

COMPANY	AMERICAN ENVIRONMENTAL LANDFIL
WELL	P6
WELL EXT	
FIELD	LANDFILL
COUNTY	OSAGE
STATE	OKLAHOMA
COUNTRY	USA
API NO.	

COMPANY	: AMERICAN ENVIRONMENTAL LANDFIL
WELL	: P6
WELL EXT	:
FIELD	: LANDFILL
COUNTY	: OSAGE
STATE	: OKLAHOMA
COUNTRY	: USA
API NO.	:
UNIQ ID	:

LOCATION	:	SECTION:	TOWNSHIP: RANGE:
LAT GPS UTM			
LON GPS UTM			

DISPLAY7_JL63s

		Elevations:		Other Services:
PERMANENT DATUM	GL	KB	FT	
DRL MEASURED FROM	GL	DF	FT	
LOG MEASURED FROM	GL	GL	FT	
ELEV. PERM. DATUM	FT			

DATE	08/17/21	10:50		
DEPTH DRILLER	40.44	FT		
DEPTH LOGGER		FT		
FIRST READING		FT		
LAST READING		FT		
BIT SIZE	5.5	IN		
CASING -- DRILLER	40.44	FT		
CASING -- LOGGER		FT		
CASING O.D.	2	IN		
CASING TYPE	SURFACE			
FLUID TYPE	MUD			
FLUID DENSITY		LB/GAL		
FLUID VISCOSITY				
FLUID PH				
MUD SOURCE				
RM @ MEAS TEMP	@ F			
RMF @ MEAS TEMP	@ F			
RMC @ MEAS TEMP	@ F			
CIRC STOPPED				
RIG NUMBER	1107			
RECORDED BY	R.SIPES			
WITNESSED BY	PAUL NORVELL			
REMARKS 1				
REMARKS 2				
REMARKS 3				

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

TOOL CALIBRATION P6 08/17/21 10:50
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Century WIRELINE SERVICES

P9

COMPANY	AMERICAN ENVIRONMENTAL LANDFIL
WELL	P9
WELL EXT	
FIELD	LANDFILL
COUNTY	OSAGE
STATE	OKLAHOMA
COUNTRY	USA
API NO.	

COMPANY	:	AMERICAN ENVIRONMENTAL LANDFIL	
WELL	:	P9	
WELL EXT	:		
FIELD	:	LANDFILL	
COUNTY	:	OSAGE	
STATE	:	OKLAHOMA	
COUNTRY	:	USA	
API NO.	:		
UNIQ ID	:		
LOCATION	:	SECTION: TOWNSHIP: RANGE:	
LAT GPS UTM			
LON GPS UTM			

DISPLAY7_JL63s

PERMANENT DATUM	GL	Elevations:	
DRL MEASURED FROM	GL	KB	FT
LOG MEASURED FROM	GL	DF	FT
ELEV. PERM. DATUM		GL	FT
	FT		

Other Services:

DATE	08/17/21 12:24	
DEPTH DRILLER	98.32	FT
DEPTH LOGGER		FT
FIRST READING		FT
LAST READING		FT
BIT SIZE	8.25	IN
CASING -- DRILLER	98.32	FT
CASING -- LOGGER		FT
CASING O.D.	2	IN
CASING TYPE	SURFACE	
FLUID TYPE	MUD	
FLUID DENSITY		LB/GAL
FLUID VISCOSITY		
FLUID PH		
MUD SOURCE		
RM @ MEAS TEMP	@ F	
RMF @ MEAS TEMP	@ F	
RMC @ MEAS TEMP	@ F	
CIRC STOPPED		
RIG NUMBER	1107	
RECORDED BY	R.SIPES	
WITNESSED BY	PAUL NORVELL	
REMARKS 1		
REMARKS 2		
REMARKS 3		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

TOOL CALIBRATION P9 08/17/21 12:24
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

P12

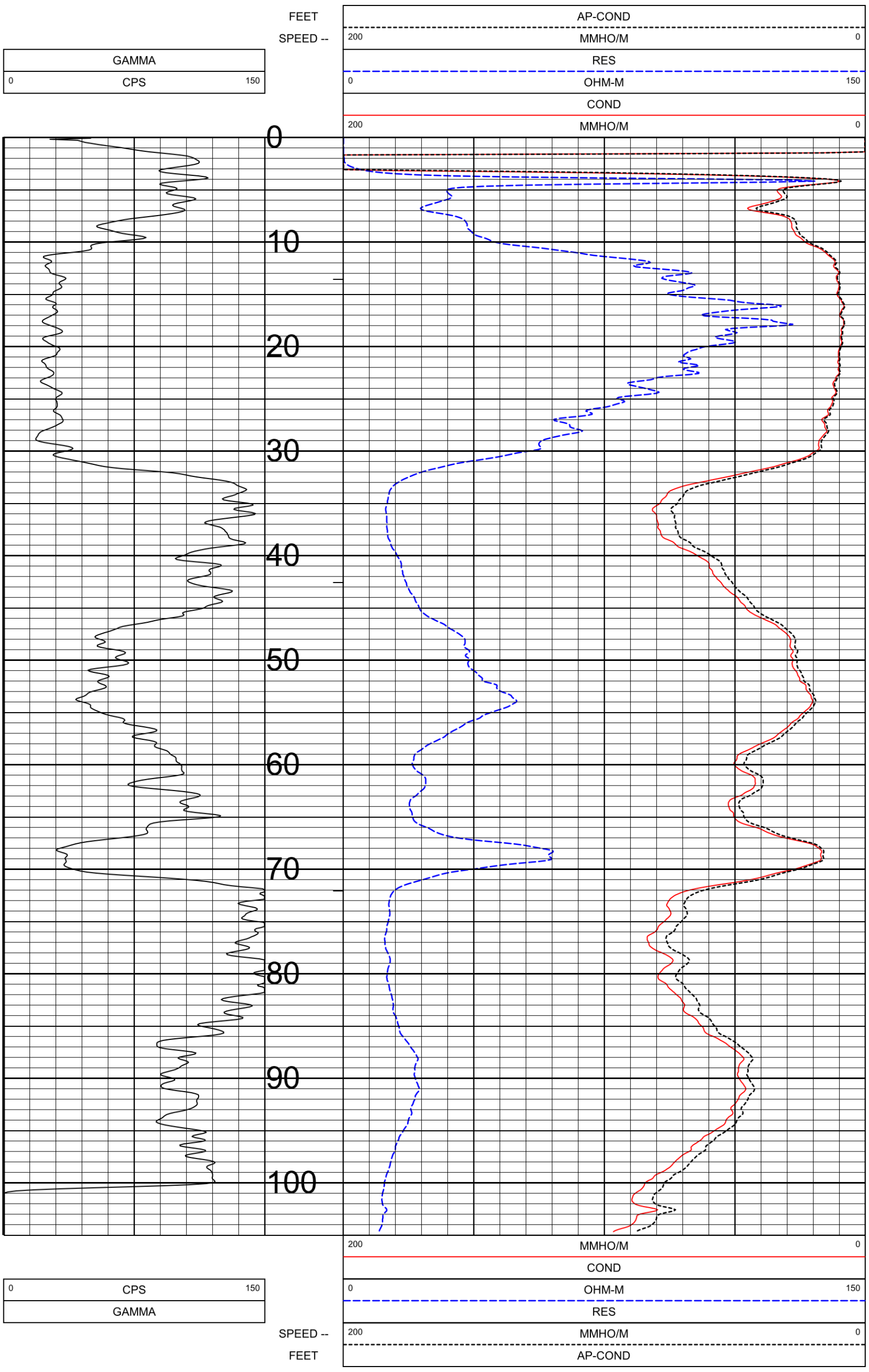
COMPANY	: AMERICAN ENVIRONMENTAL LANDFIL
WELL	: P12
WELL EXT	:
FIELD	: LANDFILL
COUNTY	: OSAGE
STATE	: OKLAHOMA
COUNTRY	: USA
API NO.	:
UNIQ ID	:

COMPANY	AMERICAN ENVIRONMENTAL LANDFIL		
WELL	P12		
WELL EXT			
FIELD	LANDFILL		
COUNTY	OSAGE		
STATE	OKLAHOMA		
COUNTRY	USA		
API NO.			
		SECTION:	TOWNSHIP: RANGE:
LOCATION	:		
LAT GPS UTM			
LON GPS UTM			

DISPLAY7_JL63s

		Elevations:		Other Services:
PERMANENT DATUM	GL	KB	FT	
DRL MEASURED FROM	GL	DF	FT	
LOG MEASURED FROM	GL	GL	FT	
ELEV. PERM. DATUM	FT			

DATE	08/17/21 12:06			
DEPTH DRILLER	110.59	FT		
DEPTH LOGGER		FT		
FIRST READING		FT		
LAST READING		FT		
BIT SIZE	5.5	IN		
CASING -- DRILLER	110.59	FT		
CASING -- LOGGER		FT		
CASING O.D.	2	IN		
CASING TYPE	SURFACE			
FLUID TYPE	MUD			
FLUID DENSITY		LB/GAL		
FLUID VISCOSITY				
FLUID PH				
MUD SOURCE				
RM @ MEAS TEMP	@ F			
RMF @ MEAS TEMP	@ F			
RMC @ MEAS TEMP	@ F			
CIRC STOPPED				
RIG NUMBER	1107			
RECORDED BY	R.SIPES			
WITNESSED BY	PAUL NORVELL			
REMARKS 1				
REMARKS 2				
REMARKS 3				



TOOL CALIBRATION P12 08/17/21 12:06
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Century WIRELINE SERVICES

P15

COMPANY AMERICAN ENVIRONMENTAL LANDFIL
WELL P15
WELL EXT
FIELD LANDFILL
COUNTY OSAGE
STATE OKLAHOMA
COUNTRY USA
API NO.

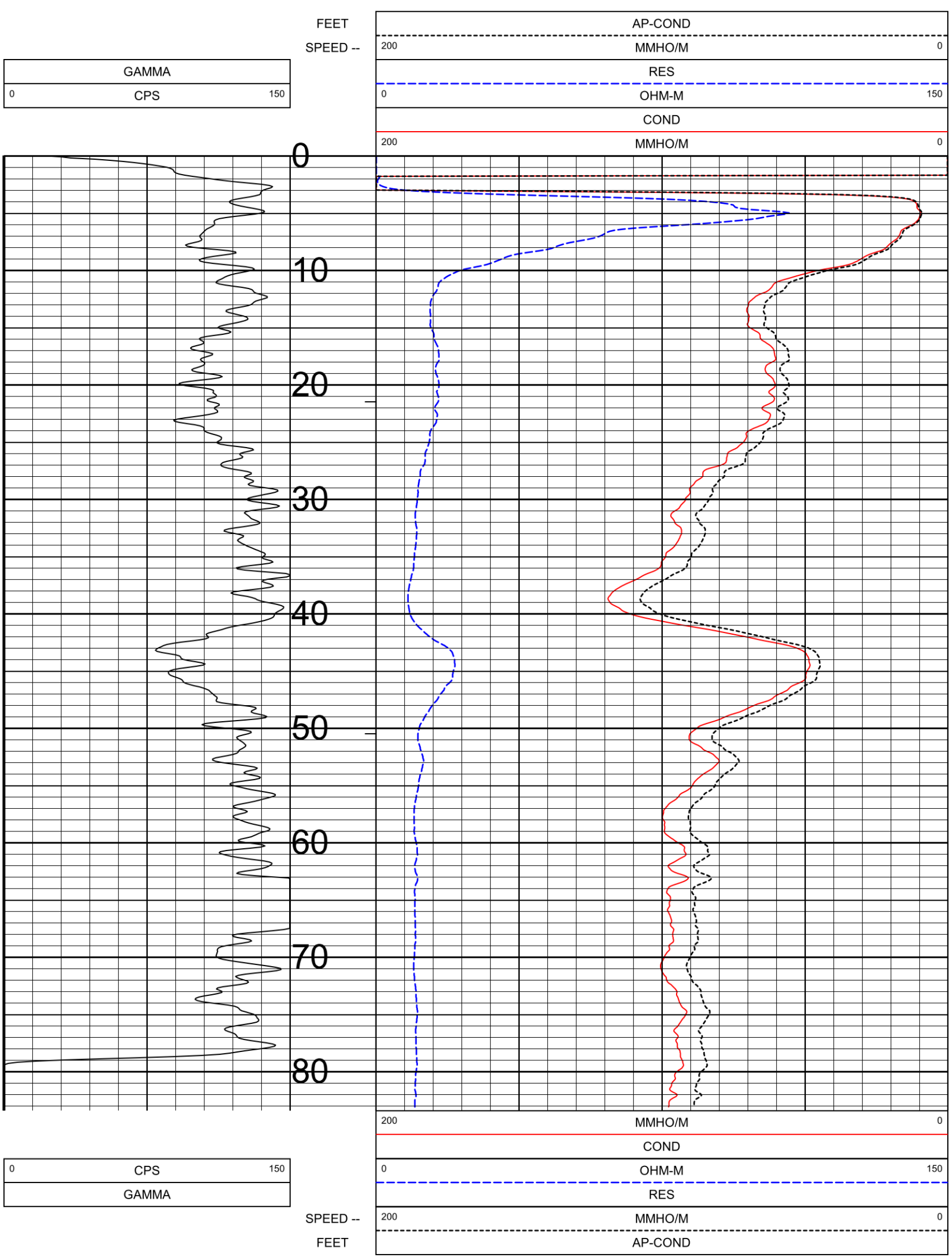
COMPANY	AMERICAN ENVIRONMENTAL LANDFIL
WELL	P15
WELL EXT	
FIELD	LANDFILL
COUNTY	OSAGE
STATE	OKLAHOMA
COUNTRY	USA
API NO.	
UNIQ ID	
SECTION:	TOWNSHIP: RANGE:
LOCATION	
LAT GPS UTM	
LON GPS UTM	

DISPLAY7_JL63s

PERMANENT DATUM	GL	Elevations:	Other Services:
DRL MEASURED FROM	GL	KB	FT
LOG MEASURED FROM	GL	DF	FT
ELEV. PERM. DATUM		GL	FT
	FT		

DATE	08/17/21 12:41	
DEPTH DRILLER	88.98 FT	
DEPTH LOGGER	FT	
FIRST READING	FT	
LAST READING	FT	
BIT SIZE	8.25 IN	
CASING -- DRILLER	88.98 FT	
CASING -- LOGGER	FT	
CASING O.D.	2 IN	
CASING TYPE	SURFACE	
FLUID TYPE	MUD	
FLUID DENSITY	LB/GAL	
FLUID VISCOSITY		
FLUID PH		
MUD SOURCE		
RM @ MEAS TEMP	@ F	
RMF @ MEAS TEMP	@ F	
RMC @ MEAS TEMP	@ F	
CIRC STOPPED		
RIG NUMBER	1107	
RECORDED BY	R.SIPES	
WITNESSED BY	PAUL NORVELL	
REMARKS 1		
REMARKS 2		
REMARKS 3		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



TOOL CALIBRATION P15 08/17/21 12:41
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Century WIRELINE SERVICES

P19

COMPANY	AMERICAN ENVIRONMENTAL LANDFIL
WELL	P19
WELL EXT	
FIELD	LANDFILL
COUNTY	OSAGE
STATE	OKLAHOMA
COUNTRY	USA
API NO.	

COMPANY	: AMERICAN ENVIRONMENTAL LANDFIL
WELL	: P19
WELL EXT	:
FIELD	: LANDFILL
COUNTY	: OSAGE
STATE	: OKLAHOMA
COUNTRY	: USA
API NO.	:
UNIQ ID	:
LOCATION	: SECTION: TOWNSHIP: RANGE:
LAT GPS UTM	:
LON GPS UTM	:

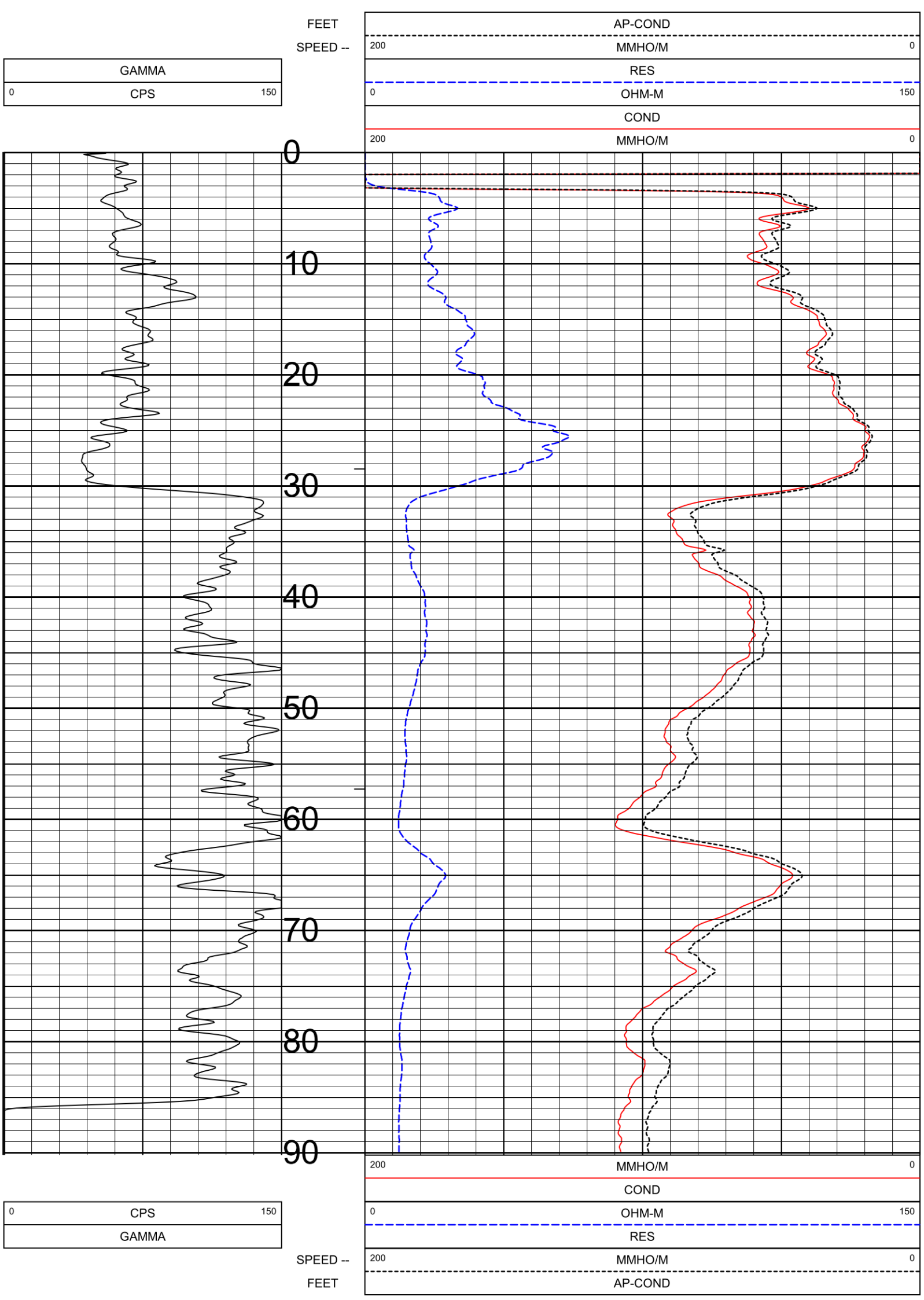
DISPLAY7_JL63s

PERMANENT DATUM	GL	Elevations:	
DRL MEASURED FROM	GL	KB	FT
LOG MEASURED FROM	GL	DF	FT
ELEV. PERM. DATUM		GL	FT
	FT		

Other Services:

DATE	08/17/21	12:54			
DEPTH DRILLER	95.49	FT			
DEPTH LOGGER		FT			
FIRST READING		FT			
LAST READING		FT			
BIT SIZE	8.25	IN			
CASING -- DRILLER	95.49	FT			
CASING -- LOGGER		FT			
CASING O.D.	2	IN			
CASING TYPE	SURFACE				
FLUID TYPE	MUD				
FLUID DENSITY		LB/GAL			
FLUID VISCOSITY					
FLUID PH					
MUD SOURCE					
RM @ MEAS TEMP	@ F				
RMF @ MEAS TEMP	@ F				
RMC @ MEAS TEMP	@ F				
CIRC STOPPED					
RIG NUMBER	1107				
RECORDED BY	R.SIPES				
WITNESSED BY	PAUL NORVELL				
REMARKS 1					
REMARKS 2					
REMARKS 3					

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



TOOL CALIBRATION P19 08/17/21 12:54
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Century WIRELINE SERVICES

P23

COMPANY AMERICAN ENVIRONMENTAL LANDFIL
WELL P23
WELL EXT
FIELD LANDFILL
COUNTY OSAGE
STATE OKLAHOMA
COUNTRY USA
API NO.

COMPANY : AMERICAN ENVIRONMENTAL LANDFIL
WELL : P23
WELL EXT :
FIELD : LANDFILL
COUNTY : OSAGE
STATE : OKLAHOMA
COUNTRY : USA
API NO. :
UNIQ ID :

LOCATION : SECTION: TOWNSHIP: RANGE:
LAT GPS UTM
LON GPS UTM

DISPLAY7_JL63s

PERMANENT DATUM	GL	Elevations:	
DRL MEASURED FROM	GL	KB	FT
LOG MEASURED FROM	GL	DF	FT
ELEV. PERM. DATUM		GL	FT
	FT		

Other Services:

DATE	08/17/21 14:35		
DEPTH DRILLER	98.90	FT	
DEPTH LOGGER		FT	
FIRST READING		FT	
LAST READING		FT	
BIT SIZE	8.25	IN	
CASING -- DRILLER	98.90	FT	
CASING -- LOGGER		FT	
CASING O.D.	2	IN	
CASING TYPE	SURFACE		
FLUID TYPE	MUD		
FLUID DENSITY		LB/GAL	
FLUID VISCOSITY			
FLUID PH			
MUD SOURCE			
RM @ MEAS TEMP	@ F		
RMF @ MEAS TEMP	@ F		
RMC @ MEAS TEMP	@ F		
CIRC STOPPED			
RIG NUMBER	1107		
RECORDED BY	R.SIPES		
WITNESSED BY	PAUL NORVELL		
REMARKS 1			
REMARKS 2			
REMARKS 3			

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

TOOL CALIBRATION P23 08/17/21 14:35
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Century WIRELINE SERVICES

P27

COMPANY AMERICAN ENVIRONMENTAL LANDFIL
WELL P27
WELL EXT
FIELD LANDFILL
COUNTY OSAGE
STATE OKLAHOMA
COUNTRY USA
API NO.

COMPANY	AMERICAN ENVIRONMENTAL LANDFIL
WELL	P27
WELL EXT	
FIELD	LANDFILL
COUNTY	OSAGE
STATE	OKLAHOMA
COUNTRY	USA
API NO.	
UNIQ ID	
SECTION:	TOWNSHIP: RANGE:
LOCATION	
LAT GPS UTM	
LON GPS UTM	

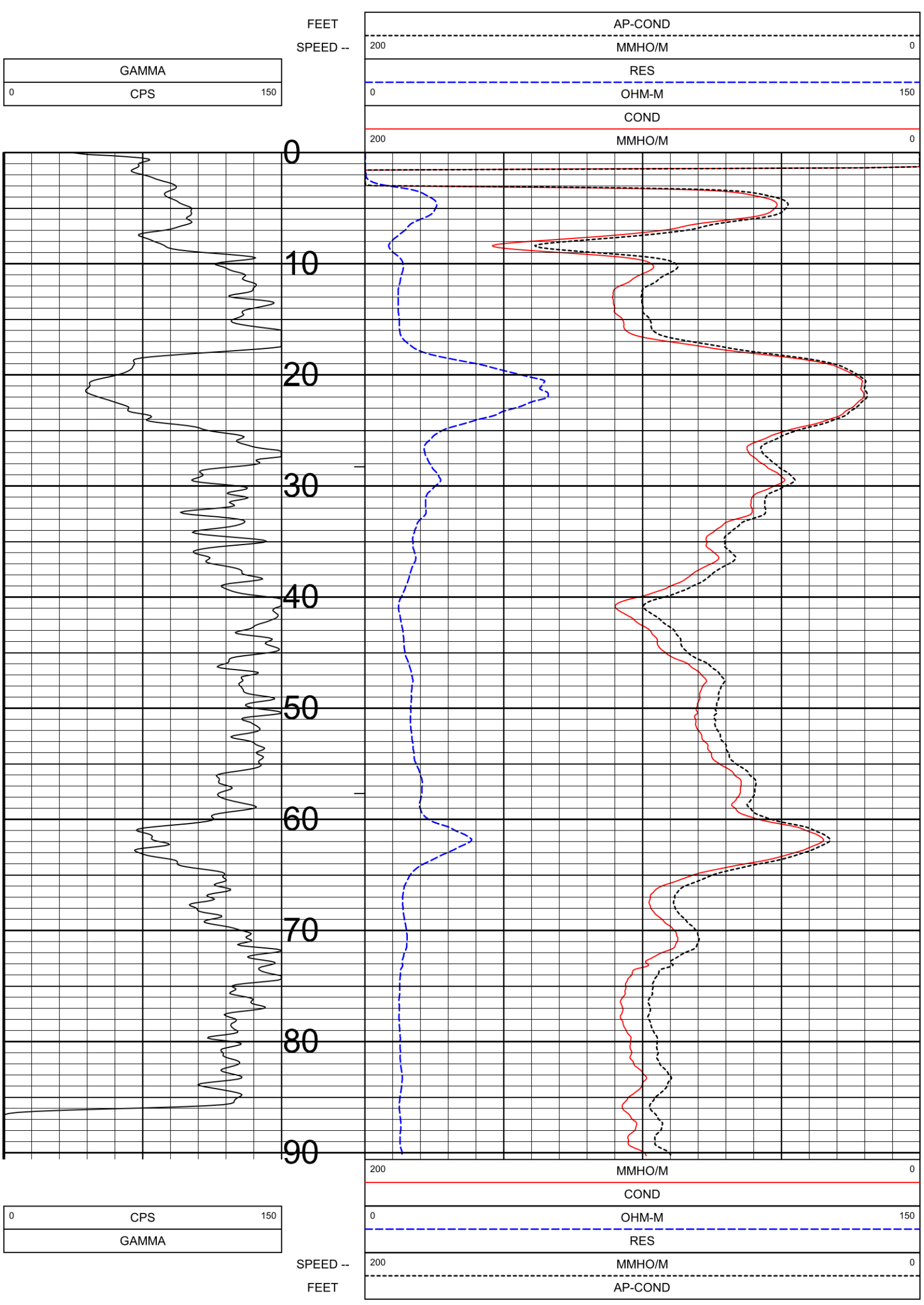
DISPLAY7_JL63s

PERMANENT DATUM	GL	Elevations:	
DRL MEASURED FROM	GL	KB	FT
LOG MEASURED FROM	GL	DF	FT
ELEV. PERM. DATUM		GL	FT
	FT		

Other Services:

DATE	08/17/21 14:20	
DEPTH DRILLER	96.29 FT	
DEPTH LOGGER	FT	
FIRST READING	FT	
LAST READING	FT	
BIT SIZE	8.25 IN	
CASING -- DRILLER	96.29 FT	
CASING -- LOGGER	FT	
CASING O.D.	2 IN	
CASING TYPE	SURFACE	
FLUID TYPE	MUD	
FLUID DENSITY	LB/GAL	
FLUID VISCOSITY		
FLUID PH		
MUD SOURCE		
RM @ MEAS TEMP	@ F	
RMF @ MEAS TEMP	@ F	
RMC @ MEAS TEMP	@ F	
CIRC STOPPED		
RIG NUMBER	1107	
RECORDED BY	R.SIPES	
WITNESSED BY	PAUL NORVELL	
REMARKS 1		
REMARKS 2		
REMARKS 3		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



TOOL CALIBRATION P27 08/17/21 14:20
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

P30

COMPANY	AMERICAN ENVIRONMENTAL LANDFIL
WELL	P30
WELL EXT	
FIELD	LANDFILL
COUNTY	OSAGE
STATE	OKLAHOMA
COUNTRY	USA
API NO.	

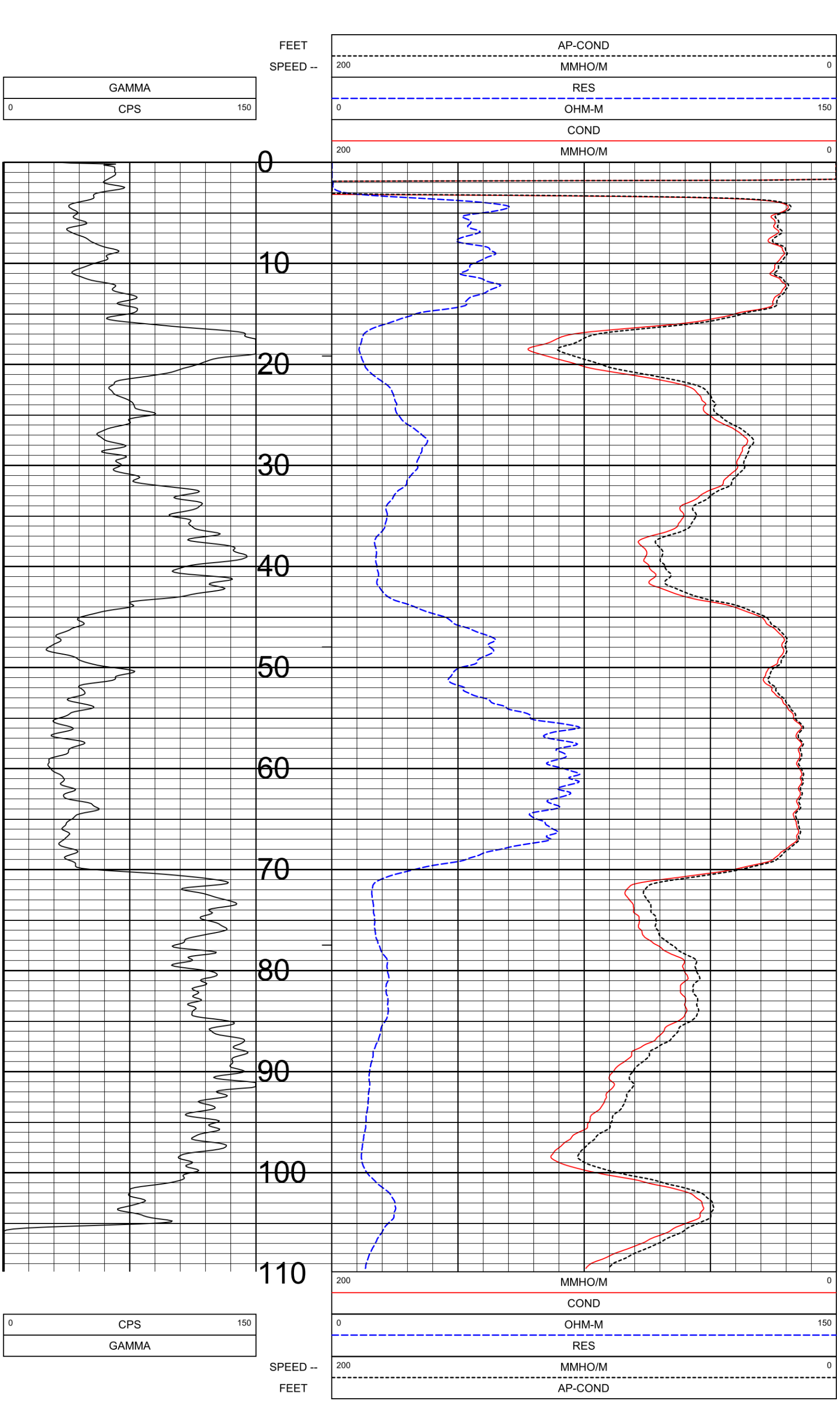
COMPANY	: AMERICAN ENVIRONMENTAL LANDFIL
WELL	: P30
WELL EXT	:
FIELD	: LANDFILL
COUNTY	: OSAGE
STATE	: OKLAHOMA
COUNTRY	: USA
API NO.	:
UNIQ ID	:
LOCATION	: SECTION: TOWNSHIP: RANGE:
LAT GPS UTM	
LON GPS UTM	

DISPLAY7_JL63s

		Elevations:		Other Services:
PERMANENT DATUM	GL	KB	FT	
DRL MEASURED FROM	GL	DF	FT	
LOG MEASURED FROM	GL	GL	FT	
ELEV. PERM. DATUM	FT			

DATE	08/17/21 13:32		
DEPTH DRILLER	115.3	FT	
DEPTH LOGGER		FT	
FIRST READING		FT	
LAST READING		FT	
BIT SIZE	8.25	IN	
CASING -- DRILLER	115.3	FT	
CASING -- LOGGER		FT	
CASING O.D.	2	IN	
CASING TYPE	SURFACE		
FLUID TYPE	MUD		
FLUID DENSITY		LB/GAL	
FLUID VISCOSITY			
FLUID PH			
MUD SOURCE			
RM @ MEAS TEMP	@ F		
RMF @ MEAS TEMP	@ F		
RMC @ MEAS TEMP	@ F		
CIRC STOPPED			
RIG NUMBER	1107		
RECORDED BY	R.SIPES		
WITNESSED BY	PAUL NORVELL		
REMARKS 1			
REMARKS 2			
REMARKS 3			

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



TOOL CALIBRATION P30 08/17/21 13:32
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

P37

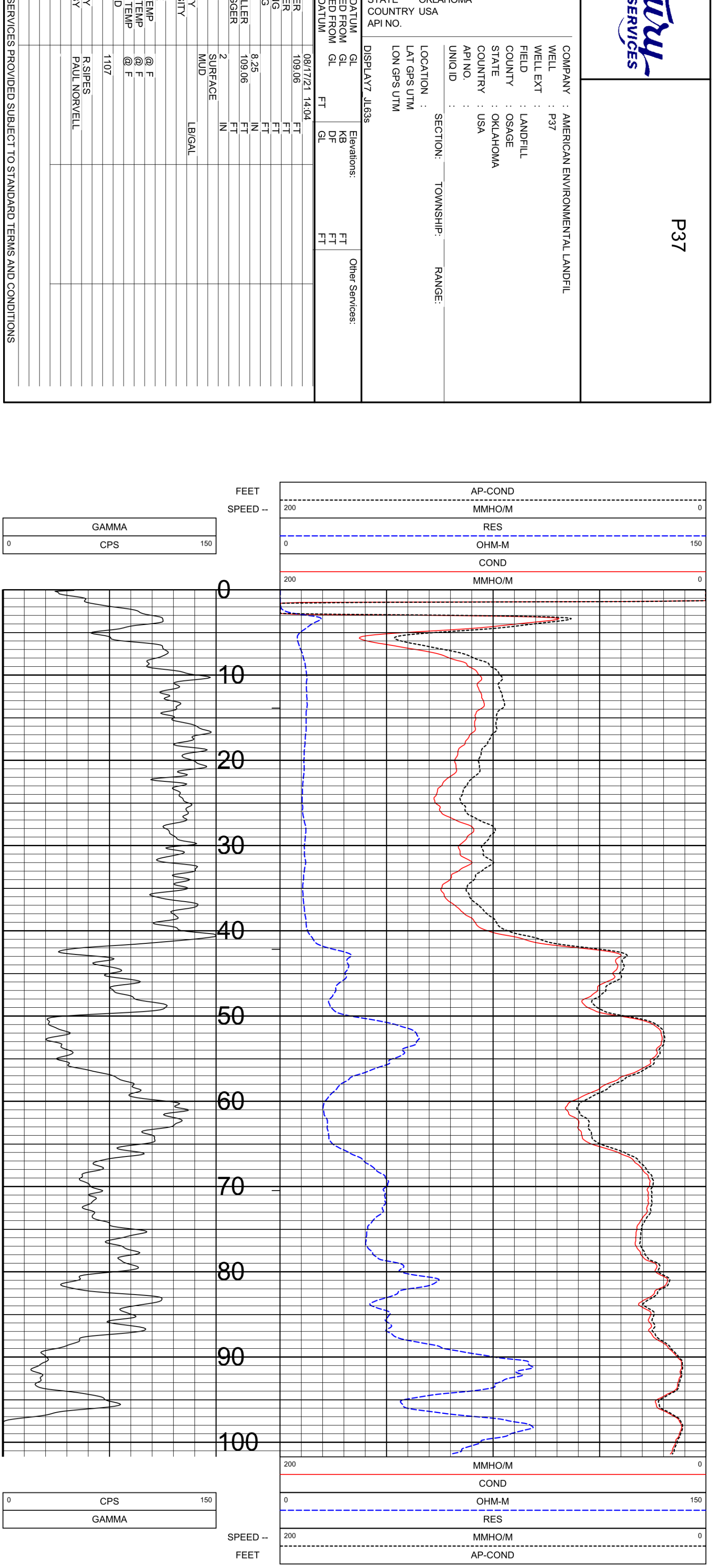
COMPANY	AMERICAN ENVIRONMENTAL LANDFIL
WELL	P37
WELL EXT	
FIELD	LANDFILL
COUNTY	OSAGE
STATE	OKLAHOMA
COUNTRY	USA
API NO.	

COMPANY	: AMERICAN ENVIRONMENTAL LANDFIL		
WELL	: P37		
WELL EXT	:		
FIELD	: LANDFILL		
COUNTY	: OSAGE		
STATE	: OKLAHOMA		
COUNTRY	: USA		
API NO.	:		
UNIQ ID	:		
		SECTION: TOWNSHIP:	RANGE:
LOCATION	:		
LAT GPS UTM			
LON GPS UTM			

DISPLAY7_JL63s

		Elevations:		Other Services:
PERMANENT DATUM	GL	KB	FT	
DRL MEASURED FROM	GL	DF	FT	
LOG MEASURED FROM	GL	GL	FT	
ELEV. PERM. DATUM	FT			

DATE	08/17/21 14:04			
DEPTH DRILLER	109.06	FT		
DEPTH LOGGER	109.06	FT		
FIRST READING		FT		
LAST READING		FT		
BIT SIZE	8.25	IN		
CASING -- DRILLER	109.06	FT		
CASING -- LOGGER		FT		
CASING O.D.	2	IN		
CASING TYPE	SURFACE			
FLUID TYPE	MUD			
FLUID DENSITY		LB/GAL		
FLUID VISCOSITY				
FLUID PH				
MUD SOURCE				
RM @ MEAS TEMP	@ F			
RMF @ MEAS TEMP	@ F			
RMC @ MEAS TEMP	@ F			
CIRC STOPPED				
RIG NUMBER	1107			
RECORDED BY	R.SIPES			
WITNESSED BY	PAUL NORVELL			
REMARKS 1				
REMARKS 2				
REMARKS 3				



TOOL CALIBRATION P37 08/17/21 14:04
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Century WIRELINE SERVICES

P39

COMPANY AMERICAN ENVIRONMENTAL LANDFIL
WELL P39
WELL EXT
FIELD LANDFILL
COUNTY OSAGE
STATE OKLAHOMA
COUNTRY USA
API NO.

COMPANY	AMERICAN ENVIRONMENTAL LANDFIL
WELL	P39
WELL EXT	
FIELD	LANDFILL
COUNTY	OSAGE
STATE	OKLAHOMA
COUNTRY	USA
API NO.	
UNIQ ID	
SECTION:	TOWNSHIP: RANGE:
LOCATION	
LAT GPS UTM	
LON GPS UTM	

DISPLAY7_JL63s

PERMANENT DATUM	GL	Elevations:	
DRL MEASURED FROM	GL	KB	FT
LOG MEASURED FROM	GL	DF	FT
ELEV. PERM. DATUM		GL	FT
	FT		

Other Services:

DATE	08/17/21 13:48			
DEPTH DRILLER	90.19	FT		
DEPTH LOGGER		FT		
FIRST READING		FT		
LAST READING		FT		
BIT SIZE	8.25	IN		
CASING -- DRILLER	90.19	FT		
CASING -- LOGGER		FT		
CASING O.D.	2	IN		
CASING TYPE	SURFACE			
FLUID TYPE	MUD			
FLUID DENSITY		LB/GAL		
FLUID VISCOSITY				
FLUID PH				
MUD SOURCE				
RM @ MEAS TEMP	@ F			
RMF @ MEAS TEMP	@ F			
RMC @ MEAS TEMP	@ F			
CIRC STOPPED				
RIG NUMBER	1107			
RECORDED BY	R.SIPES			
WITNESSED BY	PAUL NORVELL			
REMARKS 1				
REMARKS 2				
REMARKS 3				

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

TOOL CALIBRATION P39 08/17/21 13:48
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

P42

Century WIRELINE SERVICES

COMPANY	: AMERICAN ENVIRONMENTAL LANDFIL
WELL	: P42
WELL EXT	:
FIELD	: LANDFILL
COUNTY	: OSAGE
STATE	: OKLAHOMA
COUNTRY	: USA
API NO.	:
UNIQ ID	:

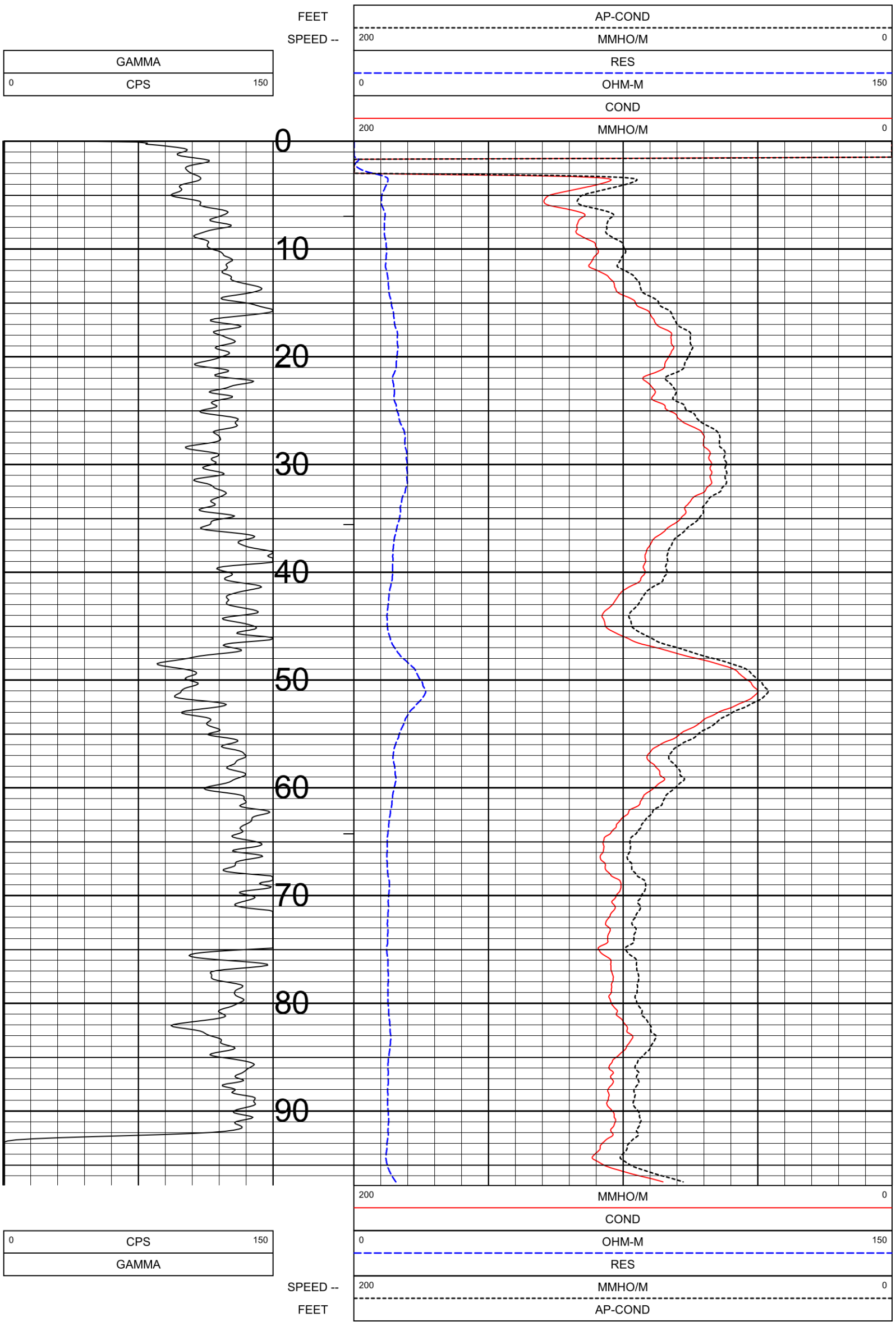
COMPANY	AMERICAN ENVIRONMENTAL LANDFIL		
WELL	P42		
WELL EXT			
FIELD	LANDFILL		
COUNTY	OSAGE		
STATE	OKLAHOMA		
COUNTRY	USA		
API NO.			
LOCATION	:	SECTION: TOWNSHIP:	RANGE:
LAT GPS UTM			
LON GPS UTM			

DISPLAY7_JL63s

PERMANENT DATUM	GL	Elevations:		Other Services:
DRL MEASURED FROM	GL	KB	FT	
LOG MEASURED FROM	GL	DF	FT	
ELEV. PERM. DATUM		GL	FT	

DATE	08/17/21 15:05		
DEPTH DRILLER	103.02	FT	
DEPTH LOGGER		FT	
FIRST READING		FT	
LAST READING		FT	
BIT SIZE	8.25	IN	
CASING -- DRILLER	103.02	FT	
CASING -- LOGGER		FT	
CASING O.D.	2	IN	
CASING TYPE	SURFACE		
FLUID TYPE	MUD		
FLUID DENSITY		LB/GAL	
FLUID VISCOSITY			
FLUID PH			
MUD SOURCE			
RM @ MEAS TEMP	@ F		
RMF @ MEAS TEMP	@ F		
RMC @ MEAS TEMP	@ F		
CIRC STOPPED			
RIG NUMBER	1107		
RECORDED BY	R.SIPES		
WITNESSED BY	PAUL NORVELL		
REMARKS 1			
REMARKS 2			
REMARKS 3			

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



TOOL CALIBRATION P42 08/17/21 15:05
TOOL 9510C TM VERSION 2002
SERIAL NUMBER 747

	DATE	TIME	SENSOR		STANDARD Point1	STANDARD Point2	RESPONSE [CPS] Point1	RESPONSE [CPS] Point2
1	Jun14,16	13:26:07	GAMMA	[API-GR]	1.000	340.000	0.000	314
2	Jun14,16	10:42:24	AP-COND	[MMHO/M]	0.000	690.000	44660	81310
3	Sep25,14	13:19:22	TEMP	[DEG-F]	39.500	132.600	26556	31296
4	Jun14,16	10:10:06	A	[CPS]	Default		Default	
5	Mar27,03	10:28:37	B	[CPS]	Default		Default	

Appendix D

Geotechnical Laboratory Results

SCS/AEL LATERAL EXPANSION/OK
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer 0.002 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %		Moisture %	Dry (lb/cuft)		
B-16	Bulk	-	CL	17.8	27	14	13	0.32	94.5	59.4	-	119.3	11.9	-	13.0	111.8	3.0E-06	-
B-23	Bulk	-	CH	43.5	54	21	33	0.68	99.5	88.5	-	104.5	18.3	-	18.7	98.7	3.4E-08	-
B-40	Bulk	-	CL	20.1	44	14	30	0.20	99.5	86.9	-	111.8	16.4	-	16.8	105.7	3.4E-08	-

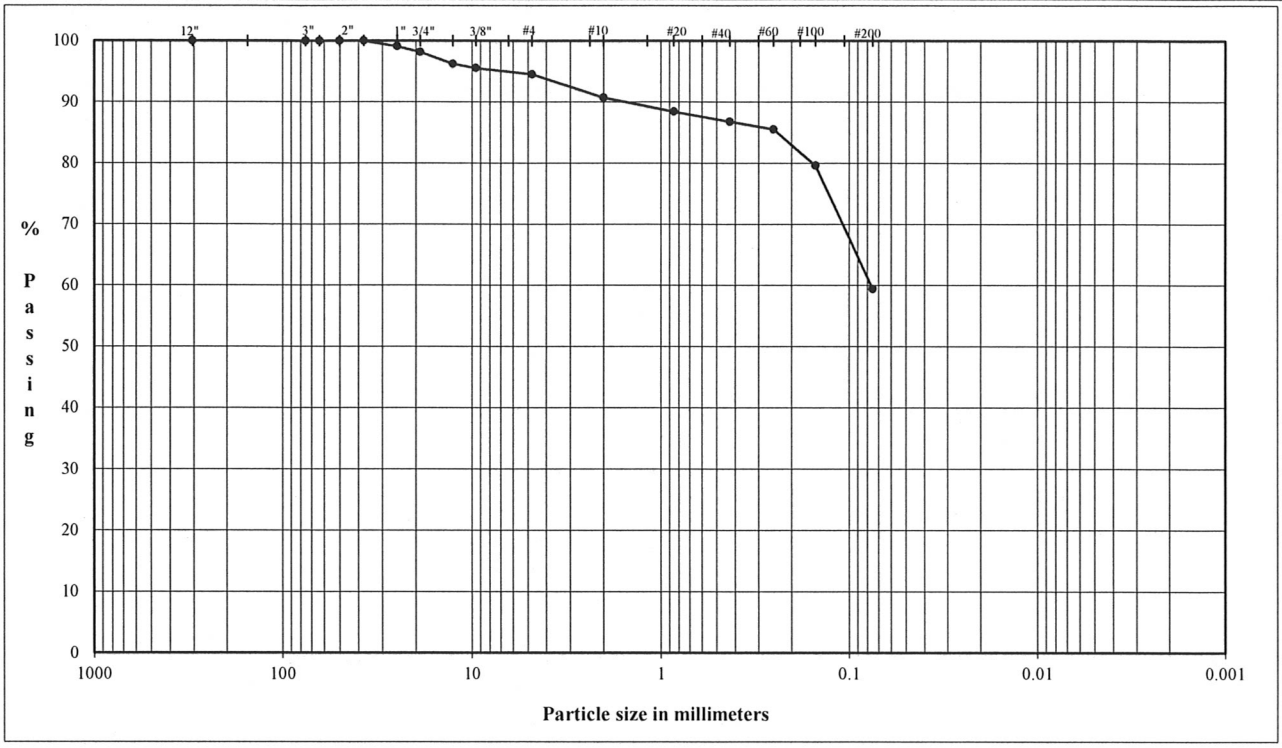
ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

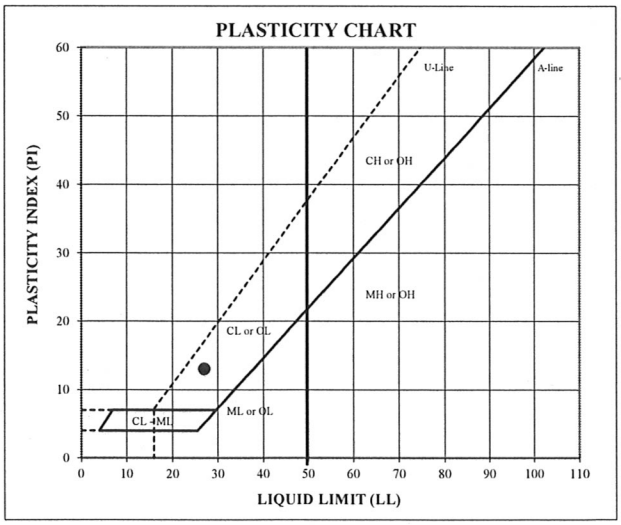
PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
SAMPLE ID: **B-16** - Depth: -
TYPE: **Bulk**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.0**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**99.1**		
0.75"	19.0	**98.2**	Coarse Gravel	**1.8**
0.50"	12.7	**96.2**		
0.375"	9.5	**95.5**		
#4	4.8	**94.5**	Fine Gravel	**3.7**
#10	2.0	**90.7**	Coarse Sand	**3.8**
#20	0.85	**88.4**		
#40	0.43	**86.8**	Medium Sand	**3.9**
#60	0.25	**85.5**		
#100	0.15	**79.6**		
#200	0.075	**59.4**	Fine Sand	**27.4**
			Fines	**59.4**



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
17.8	**27**	**14**	**13**	**0.32**

DESCRIPTION: SILTY CLAY and SAND, fine to coarse, some fine to coarse gravel; yellowish brown

USCS: CL

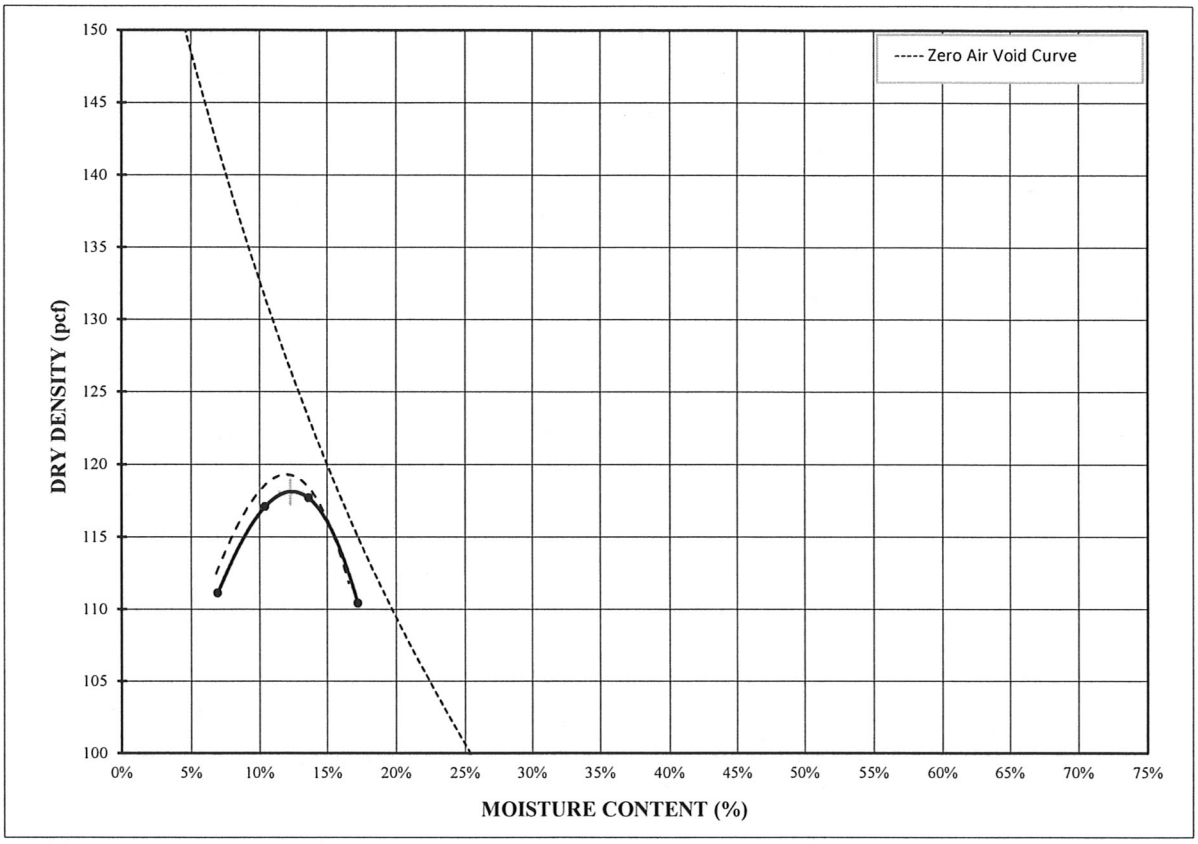
LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

TECH	LS
DATE	6/9/22
CHECK	
REVIEW	
APPROVE	

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
PROJECT NUMBER: **31404515-001**
SAMPLE ID: **B-16** DEPTH: - SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	111.1	6.9%
2	117.1	10.4%
3	117.7	13.6%
4	110.4	17.2%

Maximum Dry Density (pcf)	**118.1**
Optimum Moisture (%)	**12.3**
Corrected Maximum Dry Density (pcf)	**119.3**
Corrected Optimum Moisture (%)	**11.9**
As-Received Moisture Content	**17.8%**
% Retained on # 4 sieve	**5.5%**
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	
Specific Gravity (assumed/tested)	**2.7**

DESCRIPTION SILTY CLAY and SAND, fine to coarse, some fine to coarse gravel; yellowish brown

USCS CL

CHECK
REVIEW
APPROVE

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	SCS/AEL LATERAL EXPANSION/OK	Board #	5	COMMENTS	The sample was remolded to 94.7% of the Maximum Dry Density and OPTM + 0.7% (using ASTM D 698).
PROJECT NUMBER	31404515-001	Flow Pump	2		
SAMPLE ID	B-16	Flow Pump Speed	5		
SAMPLE TYPE	Bulk	Technician	FT		

Sample Data, Initial				Sample Data, Final	
Height, inches	2.991	B-Value, f	0.99	Height, inches	3.023
Diameter, inches	2.790	Cell Pres.	90.0	Diameter, inches	2.810
Area, cm²	39.44	Bot. Pres.	80.0	Area, cm²	40.01
Volume, cm³	299.65	Top Pres.	80.0	Volume, cm³	307.21
Mass, g	606.60	Tot. B.P.	80.0	Mass, g	629.55
Moisture Content, %	12.99	Head, max.	74.56	Moisture Content, %	17.26
Dry Density, pcf	111.80	Head, min.	74.56	Dry Density, pcf	109.05
Spec. Gravity (assumed)	2.700	Max. Grad.	9.71	Volume Solids, cm³	198.85
Volume Solids, cm³	198.85	Min. Grad.	9.71	Volume Voids, cm³	108.37
Volume Voids, cm³	100.80			Void Ratio	0.54
Void Ratio	0.51			Saturation, %	85.5%
Saturation, %	69.2%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	606.60	638.00
Wt Soil & Tare, f	g	536.89	545.35
Wt Tare	g	0.00	8.55
Wt Moisture Lost	g	69.71	92.65
Wt Dry Soil	g	536.89	536.80
Water Content	%	12.99%	17.26%

DESCRIPTION: SILTY CLAY and SAND, fine to coarse, some fine to coarse gravel; yellowish brown

Flow Pump Rate: 1.17E-03 cm³/sec

USCS: CL

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
06/15/22	44727	8	0	20.1	0	0	0	0	1.06	74.56	9.71	3.0E-06
06/15/22	44727	8	5	20.1	5	5	300	300	1.06	74.56	9.71	3.0E-06
06/15/22	44727	8	10	20.1	5	10	300	600	1.06	74.56	9.71	3.0E-06
06/15/22	44727	8	15	20.1	5	15	300	900	1.06	74.56	9.71	3.0E-06 *
06/15/22	44727	8	20	20.1	5	20	300	1200	1.06	74.56	9.71	3.0E-06 *
06/15/22	44727	8	25	20.1	5	25	300	1500	1.06	74.56	9.71	3.0E-06 *
06/15/22	44727	8	30	20.1	5	30	300	1800	1.06	74.56	9.71	3.0E-06 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

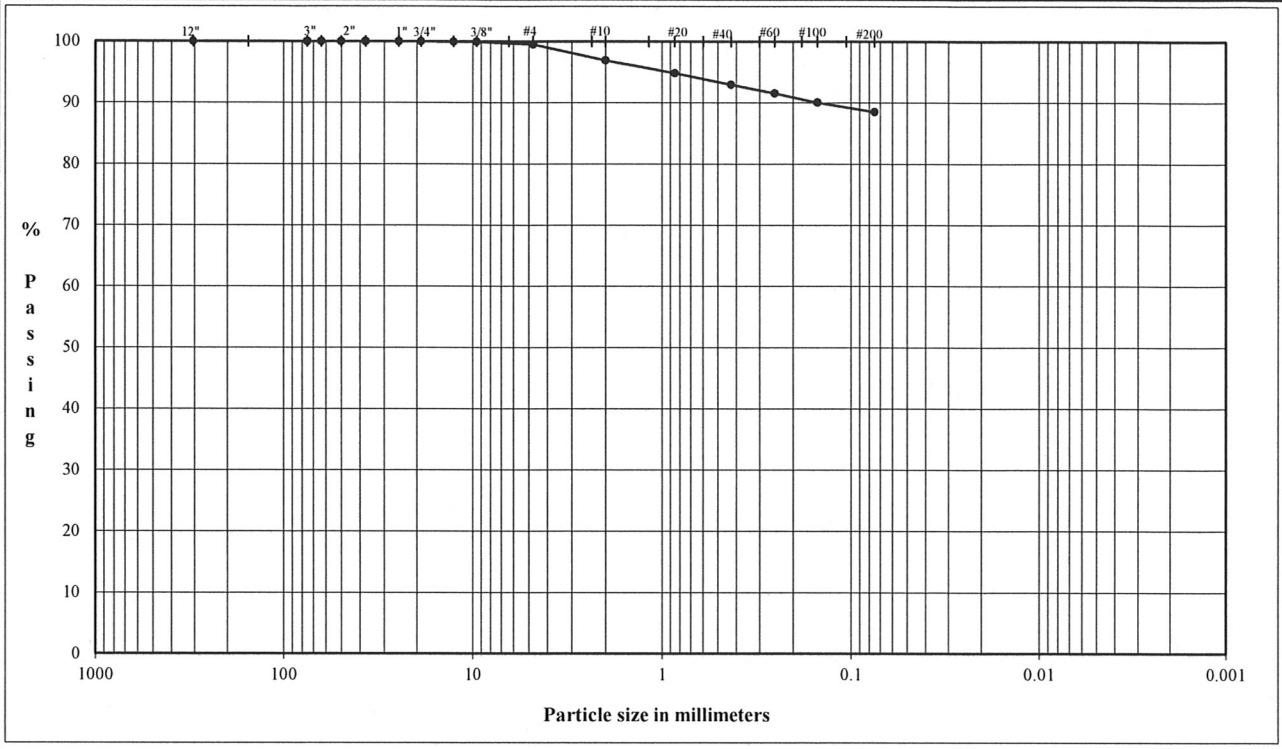
PERMEABILITY REPORTED AS ** 3.0E-06 cm/sec **

DATE	6/15/22
CHECK	
REVIEW	
APPROVE	

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

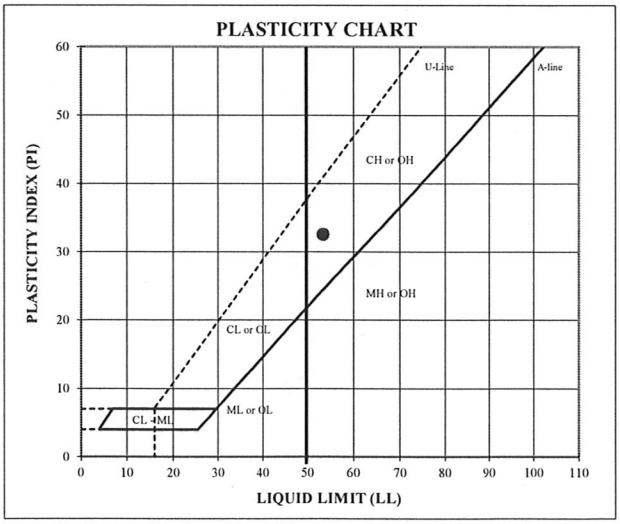
PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
SAMPLE ID: **B-23** - Depth: -
TYPE: **Bulk**



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.0**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**100.0**	Coarse Gravel	**0.0**
0.50"	12.7	**100.0**		
0.375"	9.5	**99.9**		
#4	4.8	**99.5**	Fine Gravel	**0.5**
#10	2.0	**96.9**	Coarse Sand	**2.6**
#20	0.85	**94.8**		
#40	0.43	**92.9**	Medium Sand	**4.0**
#60	0.25	**91.5**		
#100	0.15	**90.0**		
#200	0.075	**88.5**	Fine Sand	**4.4**
			Fines	**88.5**



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
43.5	**54**	**21**	**33**	**0.68**

DESCRIPTION: CLAY, some fine to coarse sand, trace fine gravel; pale yellow

USCS: CH

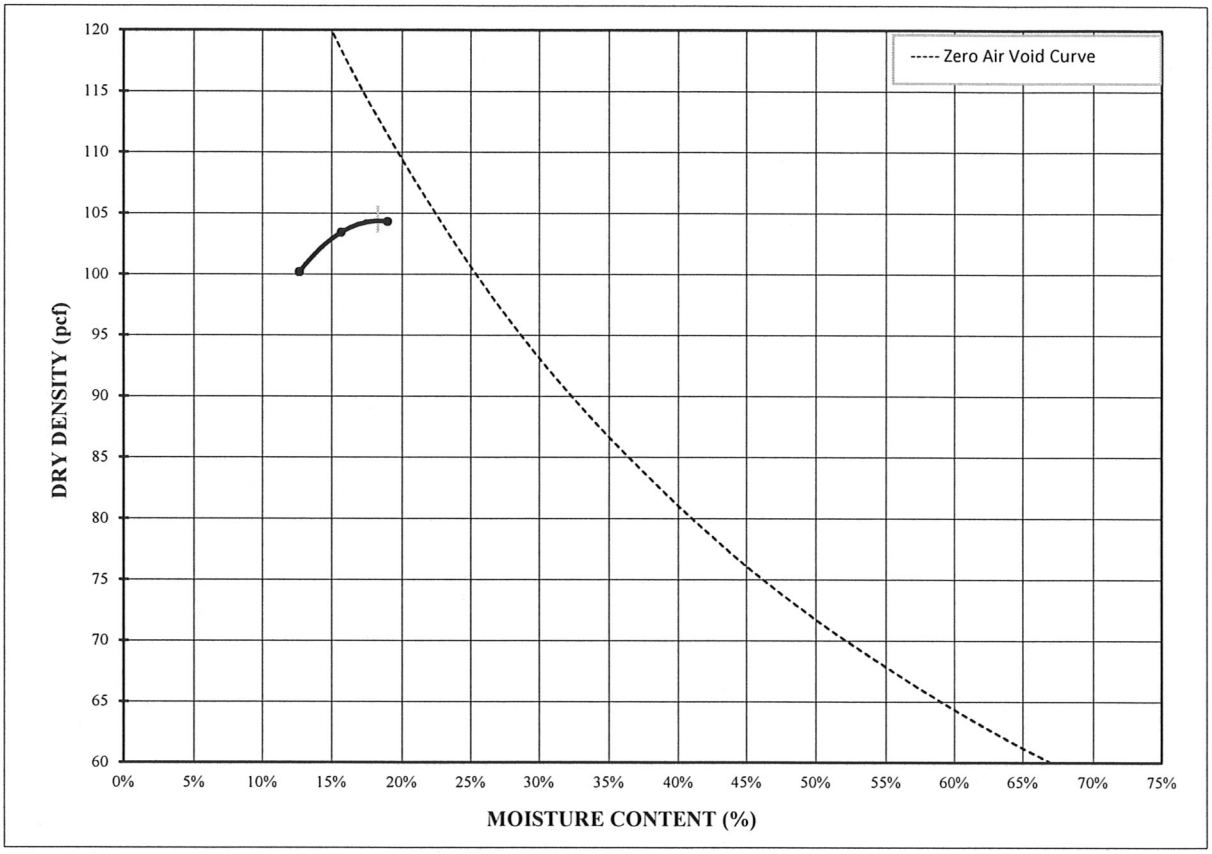
LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

TECH	LS
DATE	6/9/22
CHECK	
REVIEW	
APPROVE	

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
PROJECT NUMBER: **31404515-001**
SAMPLE ID: **B-23** DEPTH: **-** SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	100.2	12.7%
2	103.4	15.7%
3	104.3	19.0%

Maximum Dry Density (pcf)	**104.5**
Optimum Moisture (%)	**18.3**
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	**43.5%**
% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	
Specific Gravity (assumed/tested)	**2.7**

DESCRIPTION CLAY, some fine to coarse sand, trace fine gravel; pale yellow

USCS CH

CHECK JP
REVIEW
APPROVE

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	SCS/AEL LATERAL EXPANSION/OK	**Board #**	12	**COMMENTS**	The sample was remolded to 94.5% of the Maximum Dry Density and OPTM + 0.4% (using ASTM D 698).
PROJECT NUMBER	31404515-001	**Flow Pump**	2		
SAMPLE ID	B-23	**Flow Pump Speed**	10		
SAMPLE TYPE	Bulk	**Technician**	FT		

Sample Data, Initial				**Sample Data, Final**	
Height, inches	3.006	**B-Value, f**	1.00	**Height, inches**	3.085
Diameter, inches	2.790	**Cell Pres.**	90.0	**Diameter, inches**	2.797
Area, cm²	**39.44**	**Bot. Pres.**	80.0	**Area, cm²**	**39.64**
Volume, cm³	**301.15**	**Top Pres.**	80.0	**Volume, cm³**	**310.62**
Mass, g	565.42	**Tot. B.P.**	80.0	**Mass, g**	602.53
Moisture Content, %	**18.70**	**Head, max.**	**132.24**	**Moisture Content, %**	**26.49**
Dry Density, pcf	**98.70**	**Head, min.**	**132.24**	**Dry Density, pcf**	**95.70**
Spec. Gravity (assumed)	2.700	**Max. Grad.**	**16.88**	**Volume Solids, cm³**	**176.43**
Volume Solids, cm³	**176.43**	**Min. Grad.**	**16.88**	**Volume Voids, cm³**	**134.19**
Volume Voids, cm³	**124.72**			**Void Ratio**	**0.76**
Void Ratio	**0.71**			**Saturation, %**	**94.0%**
Saturation, %	**71.4%**				

WATER CONTENTS		**Sample Initial**	**Sample Final**
Wt Soil & Tare, i	g	**565.42**	610.83
Wt Soil & Tare, f	g	**476.36**	484.70
Wt Tare	g	**0.00**	8.48
Wt Moisture Lost	g	**89.06**	**126.13**
Wt Dry Soil	g	**476.36**	**476.22**
Water Content	%	**18.70%**	**26.49%**

Flow Pump Rate 2.25E-05 cm³/sec

USCS CH

DESCRIPTION

CLAY, some fine to coarse sand, trace fine gravel; pale yellow

TIME FUNCTIONS, SECONDS								dP				
DATE	**DAY**	**HOUR**	**MIN**	**TEMP (°C)**	**dt (min)**	**dt,acc (min)**	**dt (sec)**	**dt,acc (sec)**	**Reading (psi)**	**Head (cm)**	**Gradient**	**Permeability (cm/sec)**
06/15/22	**44727**	16	0	20.1	**0**	**0**	**0**	**0**	1.88	**132.24**	**16.88**	**3.4E-08**
06/15/22	**44727**	16	5	20.1	**5**	**5**	**300**	**300**	1.88	**132.24**	**16.88**	**3.4E-08**
06/15/22	**44727**	16	10	20.1	**5**	**10**	**300**	**600**	1.88	**132.24**	**16.88**	**3.4E-08**
06/15/22	**44727**	16	15	20.1	**5**	**15**	**300**	**900**	1.88	**132.24**	**16.88**	**3.4E-08** *
06/15/22	**44727**	16	20	20.1	**5**	**20**	**300**	**1200**	1.88	**132.24**	**16.88**	**3.4E-08** *
06/15/22	**44727**	16	25	20.1	**5**	**25**	**300**	**1500**	1.88	**132.24**	**16.88**	**3.4E-08** *
06/15/22	**44727**	16	30	20.1	**5**	**30**	**300**	**1800**	1.88	**132.24**	**16.88**	**3.4E-08** *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 3.4E-08 cm/sec **

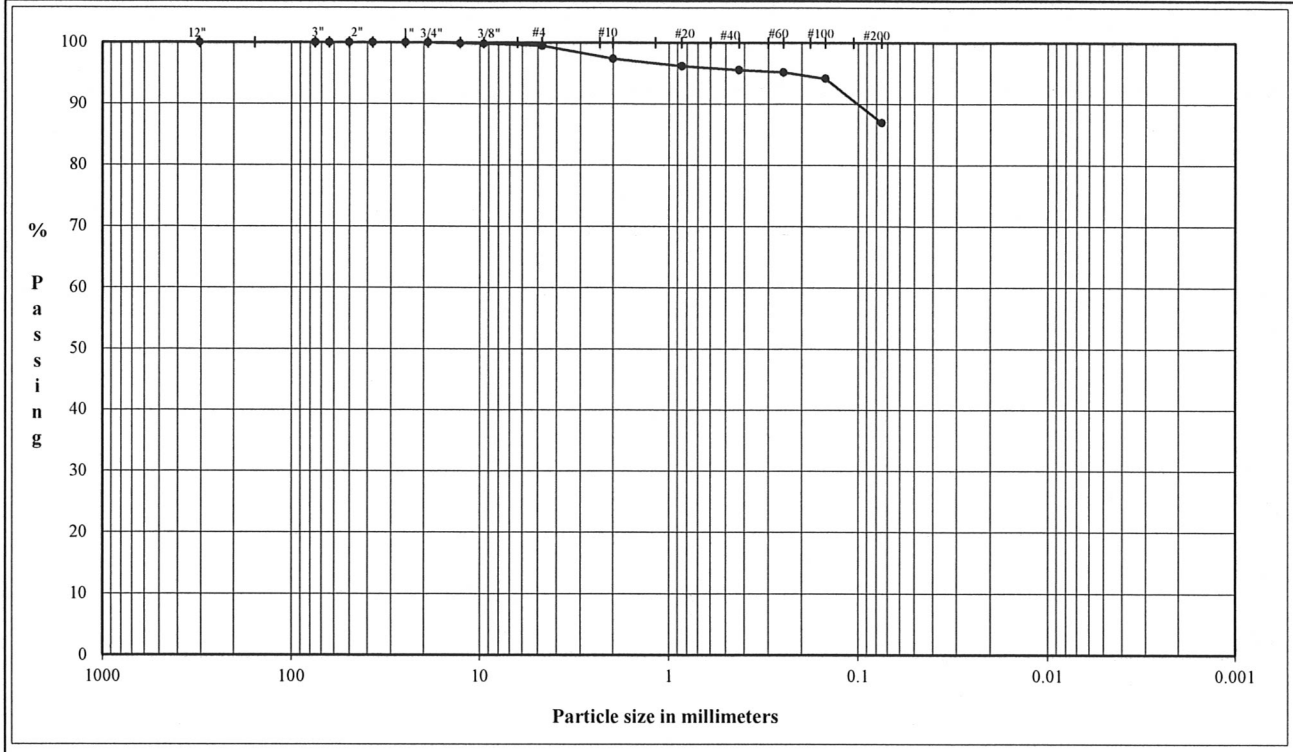
DATE	6/15/22
CHECK	
REVIEW	
APPROVE	

Golder Associates USA Inc.

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

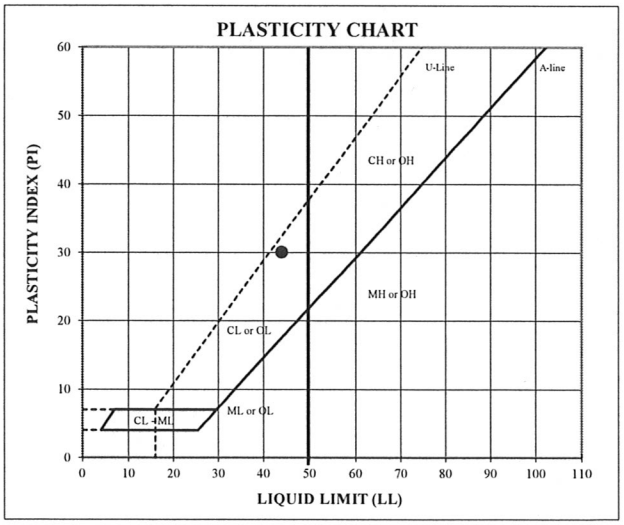
PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
SAMPLE ID: **B-40** - Depth: -
TYPE: **Bulk**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.0**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**100.0**	Coarse Gravel	**0.0**
0.50"	12.7	**99.9**		
0.375"	9.5	**99.8**		
#4	4.8	**99.5**	Fine Gravel	**0.5**
#10	2.0	**97.4**	Coarse Sand	**2.1**
#20	0.85	**96.2**		
#40	0.43	**95.6**	Medium Sand	**1.8**
#60	0.25	**95.2**		
#100	0.15	**94.2**		
#200	0.075	**86.9**	Fine Sand	**8.6**
			Fines	**86.9**



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
20.1	**44**	**14**	**30**	**0.20**

DESCRIPTION: sandy SILTY CLAY, trace fine gravel; brown

USCS: CL

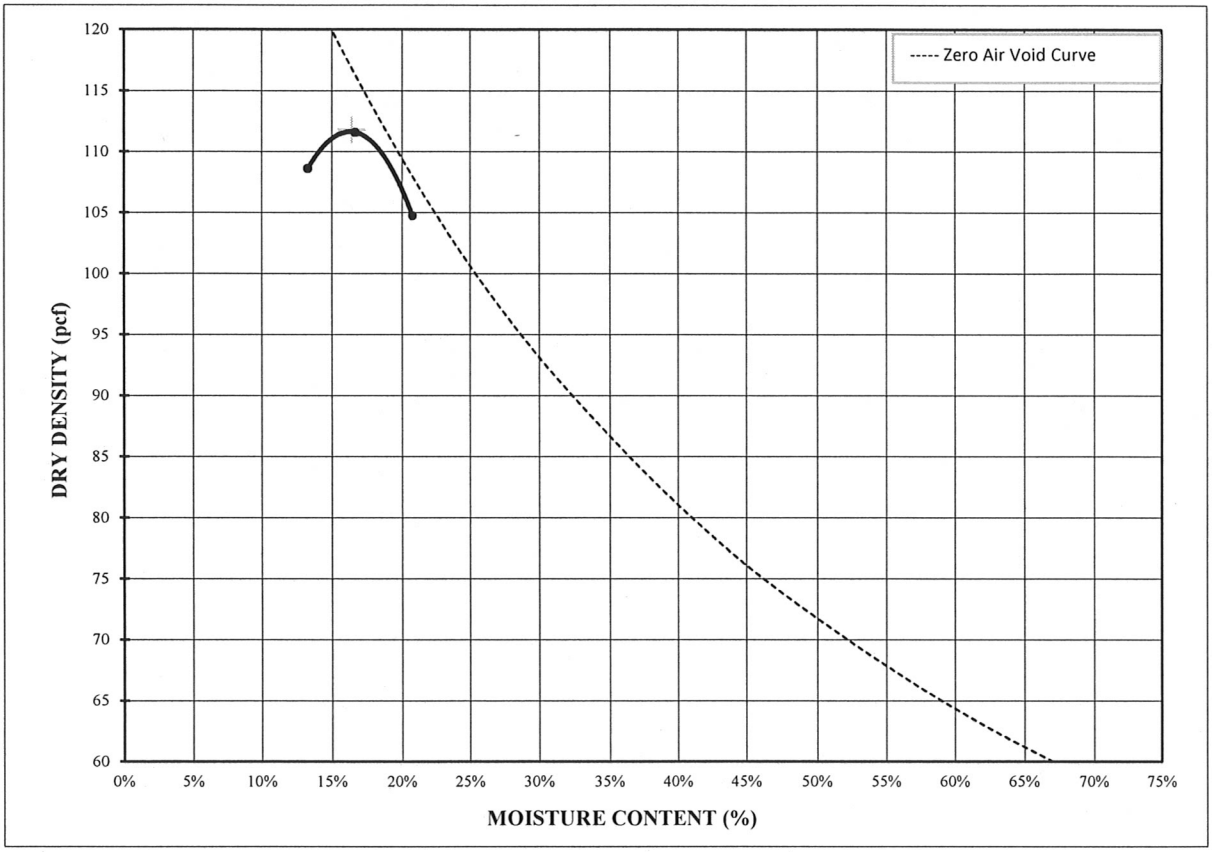
LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

TECH	LS
DATE	6/9/22
CHECK	
REVIEW	
APPROVE	

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
PROJECT NUMBER: **31404515-001**
SAMPLE ID: **B-40** DEPTH: **-** SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	108.6	13.3%
2	111.6	16.6%
3	104.7	20.8%

Maximum Dry Density (pcf)	**111.8**
Optimum Moisture (%)	**16.4**
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	**20.1%**
% Retained on # 4 sieve	**0.5%**
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	
Specific Gravity (assumed/tested)	**2.7**

DESCRIPTION sandy SILTY CLAY, trace fine gravel; brown

USCS CL

CHECK
REVIEW
APPROVE

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	SCS/AEL LATERAL EXPANSION/OK	Board #	11	COMMENTS	The sample was remolded to 94.6% of the Maximum Dry Density and OPTM + 0.4% (using ASTM D 698).
PROJECT NUMBER	31404515-001	Flow Pump	2		
SAMPLE ID	B-40 -	Flow Pump Speed	10		
SAMPLE TYPE	Bulk	Technician	FT		

Sample Data, Initial				Sample Data, Final	
Height, inches	3.001	B-Value, f	1.00	Height, inches	3.005
Diameter, inches	2.790	Cell Pres.	90.0	Diameter, inches	2.792
Area, cm²	39.44	Bot. Pres.	80.0	Area, cm²	39.50
Volume, cm³	300.65	Top Pres.	80.0	Volume, cm³	301.49
Mass, g	595.21	Tot. B.P.	80.0	Mass, g	619.46
Moisture Content, %	16.83	Head, max.	128.02	Moisture Content, %	21.59
Dry Density, pcf	105.74	Head, min.	128.02	Dry Density, pcf	105.45
Spec. Gravity (assumed)	2.700	Max. Grad.	16.77	Volume Solids, cm³	188.70
Volume Solids, cm³	188.70	Min. Grad.	16.77	Volume Voids, cm³	112.79
Volume Voids, cm³	111.96			Void Ratio	0.60
Void Ratio	0.59			Saturation, %	97.5%
Saturation, %	76.6%				

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	595.21	701.25
Wt Soil & Tare, f	g	509.48	591.29
Wt Tare	g	0.00	81.91
Wt Moisture Lost	g	85.73	109.96
Wt Dry Soil	g	509.48	509.38
Water Content	%	16.83%	21.59%

DESCRIPTION: sandy SILTY CLAY, trace fine gravel; brown

Flow Pump Rate: 2.25E-05 cm³/sec

USCS: CL

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
06/15/22	44727	12	0	20.1	0	0	0	0	1.82	128.02	16.77	3.4E-08
06/15/22	44727	12	5	20.1	5	5	300	300	1.82	128.02	16.77	3.4E-08
06/15/22	44727	12	10	20.1	5	10	300	600	1.82	128.02	16.77	3.4E-08
06/15/22	44727	12	15	20.1	5	15	300	900	1.82	128.02	16.77	3.4E-08 *
06/15/22	44727	12	20	20.1	5	20	300	1200	1.82	128.02	16.77	3.4E-08 *
06/15/22	44727	12	25	20.1	5	25	300	1500	1.82	128.02	16.77	3.4E-08 *
06/15/22	44727	12	30	20.1	5	30	300	1800	1.82	128.02	16.77	3.4E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 3.4E-08 cm/sec **

DATE	6/15/22
CHECK	
REVIEW	
APPROVE	

SCS/AEL LATERAL EXPANSION/OK
SUMMARY OF DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution				Compaction		Gs	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer 3" Sieve	% Finer 3/4" Sieve	% Finer No. 4 Sieve	% Finer No. 200 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %		Moisture %	Dry (lb/cuft)		
B-8	Bulk	-	SP-SM	5.7	-	-	-	-	100.0	100.0	100.0	8.3	-	-	-	-	89.6	2.6E-02	-

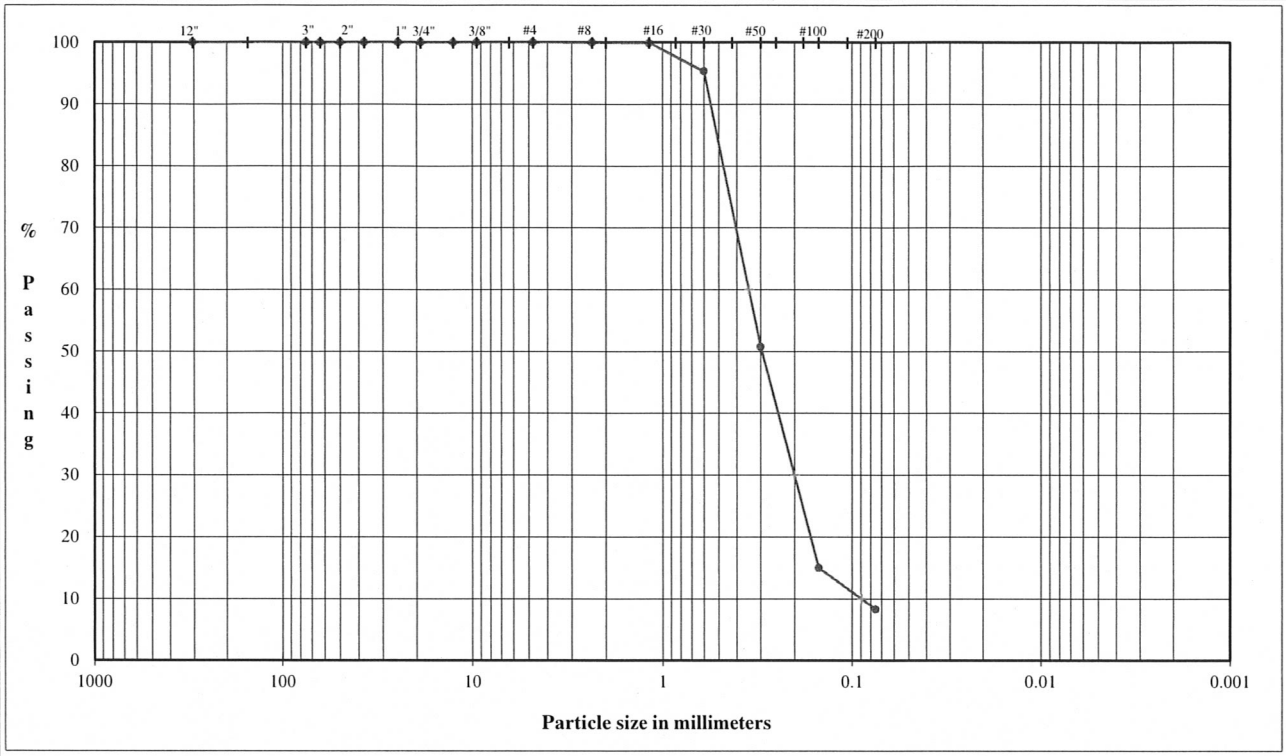
ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

PARTICLE SIZE DISTRIBUTION

ASTM C117, C136

PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
SAMPLE ID: **B-8** - Depth: -
TYPE: **Bulk**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**		
3.0"	75	**100.0**	Cobbles	**0.0**
2.5"	63.5	**100.0**		
2.0"	50	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25	**100.0**		
0.75"	19	**100.0**	Coarse Gravel	**0.0**
0.50"	12.7	**100.0**		
0.375"	9.5	**100.0**		
#4	4.75	**100.0**	Fine Gravel	**0.0**
#8	2.36	**100.0**	Coarse Sand	**0.0**
#16	1.18	**99.9**		
#30	0.60	**95.3**	Medium Sand	**26.8**
#50	0.30	**50.7**		
#100	0.15	**15.0**		
#200	0.075	**8.3**	Fine Sand	**64.9**
			Fines	**8.3**

D_{60}= 0.35	D_{30}= 0.20	D_{10}= 0.09
Cu = D60/D10 =	**3.9**	< 6
Cc = D30^2/(D10*D60) =	**1.3**	> 1

DESCRIPTION: SAND, fine to medium, some fines; reddish brown

USCS: SP-SM

M_c 5.7%

TECH	TB
DATE	6/8/22
CHECK	
REVIEW	
APPROVE	

CONSTANT HEAD PERMEABILITY TEST
ASTM D 2434

PROJECT TITLE	SCS/AEL LATERAL EXPANSION/OK	**SAMPLE ID**	B-8
PROJECT NUMBER	31402515-001	**SAMPLE TYPE**	Bulk
REMARKS	-	**SAMPLE DEPTH**	-

	TIME IN SECONDS	VOLUME (ml)	TEMP. °C	(ml/sec)	
1.	179.93	27	20.5	0.15	
2.	180.03	27	20.5	0.15	
3.	180.03	27	20.5	0.15	*
4.	180.07	27	20.5	0.15	*
5.	180.00	27	20.5	0.15	*
6.	179.96	27	20.5	0.15	*

INITIAL UNIT WEIGHT DETERMINATION

APPARATUS & WET SAMPLE (g):	2996.0
APPARATUS WEIGHT (g):	2031.0
WET SAMPLE WEIGHT (g):	965.0
SAMPLE LENGTH (in):	5.8
SAMPLE DIAMETER (in):	3.0
SAMPLE AREA (in^2):	7.07
SAMPLE AREA (cm^2):	45.60
SAMPLE VOLUME (in^3):	41.03
SAMPLE VOLUME (ft^3):	0.024
WET DENSITY (pcf):	89.6
DRY DENSITY (pcf):	89.6

INITIAL MOISTURE CONTENT

WET SAMPLE & TARE (g):	100.00
DRY SAMPLE & TARE (g):	100.00
WEIGHT OF TARE (g):	0.00
WEIGHT OF WATER (g):	0.00
DRY SAMPLE WEIGHT (g):	100.00
MOISTURE CONTENT (%):	0.00

FINAL DIMENSIONS

SAMPLE LENGTH (in):	5.8
SAMPLE DIAMETER (in):	3.0
AVERAGE Q VALUE (ml/sec):	0.15
AVERAGE TEMP (°C):	20.5
TEMPERATURE CORRECTION:	0.988
HEAD OF WATER (in):	0.7
HYDRAULIC GRADIENT (i):	0.12

$K_{\text{VALUE CORRECTED FOR 20 DEGREES C}}$ = 2.6E-02 cm/sec

TECH	VB
DATE	6/10/22
CHECK	
REVIEW	
APPROVE	

Golder Associates USA Inc.

SCS/AEL LATERAL EXPANSION/OK
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Carbonate Content %	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer 3/4 in. Sieve	% Finer No. 4 Sieve	% Finer No. 200 Sieve	Maximum Dry Density (lb/cuft)	Optimum Moisture %		Moisture %	Dry (lb/cuft)		
B-2	Bulk	-	(ML)	13.2	-	-	-	-	100.0	100.0	56.8	-	-	-	-	-	-	-
B-8	Bulk	-	SP-SM	5.7	-	-	-	-	100.0	100.0	8.3	-	-	-	-	89.6	2.61E-02	-

ABBREVIATIONS:
LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

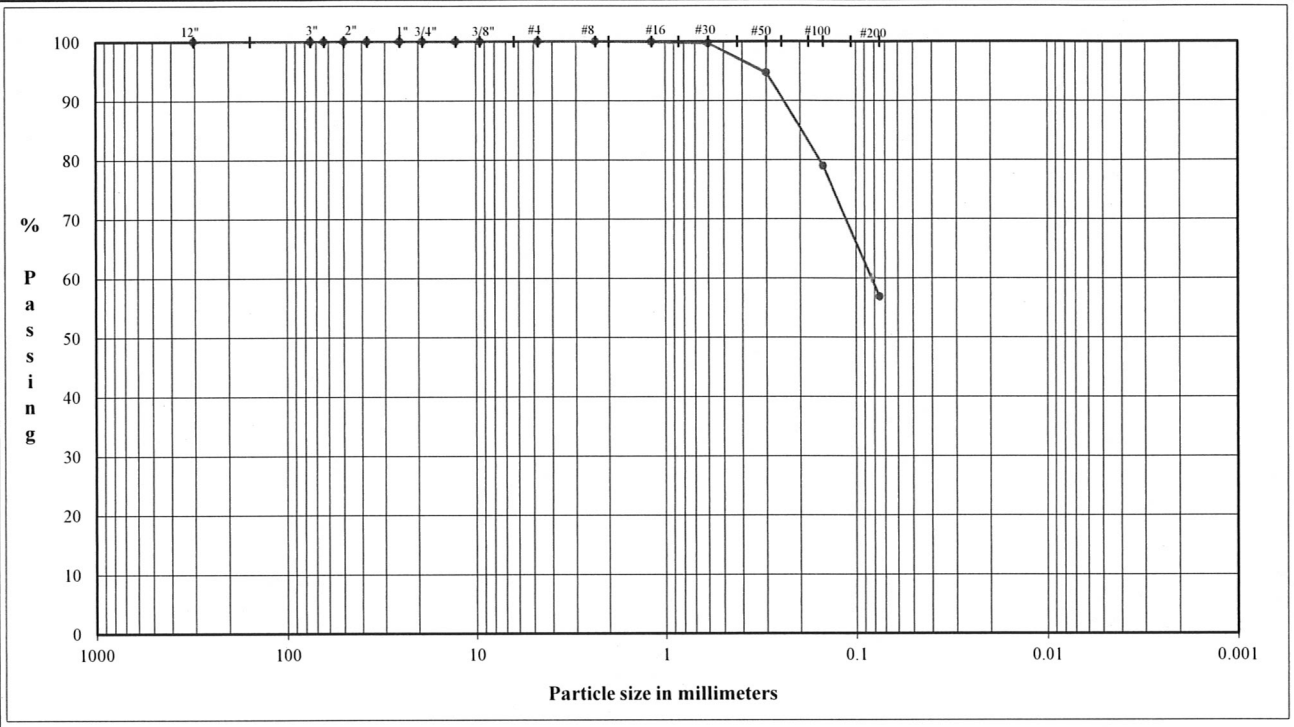
NOTES:
T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

JUNE 2022 31404515-001

PARTICLE SIZE DISTRIBUTION

ASTM C117, C136

PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
SAMPLE ID: **B-2** - Depth: -
TYPE: **Bulk**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**		
3.0"	75	**100.0**	Cobbles	**0.0**
2.5"	63.5	**100.0**		
2.0"	50	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25	**100.0**		
0.75"	19	**100.0**	Coarse Gravel	**0.0**
0.50"	12.7	**100.0**		
0.375"	9.5	**100.0**		
#4	4.75	**100.0**	Fine Gravel	**0.0**
#8	2.36	**100.0**	Coarse Sand	**0.0**
#16	1.18	**100.0**		
#30	0.60	**99.7**	Medium Sand	**2.8**
#50	0.30	**94.7**		
#100	0.15	**78.9**		
#200	0.075	**56.8**	Fine Sand	**40.4**
			Fines	**56.8**

D_{60}= 0.08	D_{30}= #N/A	D_{10}= #N/A
Cu = D60/D10 =	**#N/A**	#N/A
Cc = D30^2/(D10*D60) =	**#N/A**	#N/A

DESCRIPTION: SILT and SAND, fine to coarse sand; yellowish red.

USCS: (ML)

M_c 13.2%

TECH	VB
DATE	6/10/22
CHECK	
REVIEW	
APPROVE	

Golder Associates USA Inc.

SCS/AEL LATERAL EXPANSION/OK
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Carbonate Content %	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer 3/4 in. Sieve	% Finer No. 4 Sieve	% Finer No. 200 Sieve	Maximum Dry Density (lb/cuft)	Optimum Moisture %		Moisture %	Dry (lb/cuft)		
B-2	Bulk	-	(ML)	13.2	-	-	-	-	100.0	100.0	56.8	-	-	-	-	-	-	-
B-8	Bulk	-	SP-SM	5.7	-	-	-	-	100.0	100.0	8.3	-	-	-	-	89.6	2.61E-02	-

ABBREVIATIONS:
LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

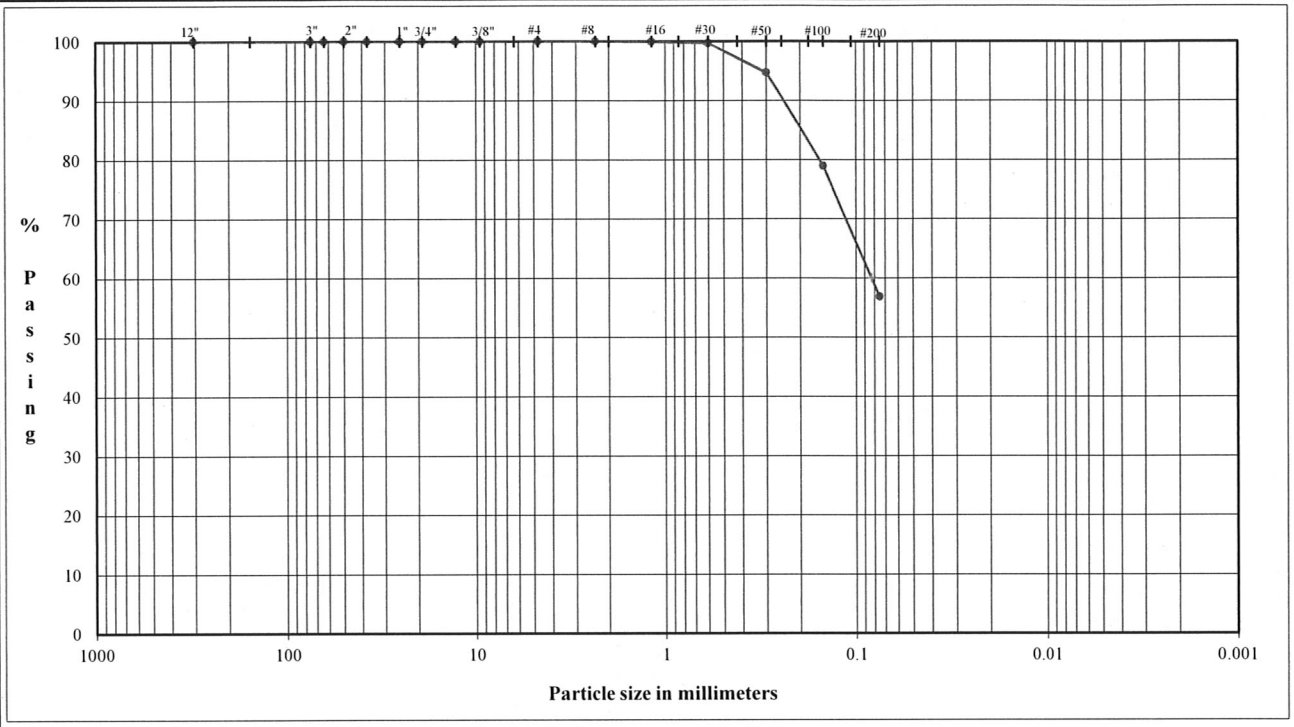
NOTES:
T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

JUNE 2022 31404515-001

PARTICLE SIZE DISTRIBUTION

ASTM C117, C136

PROJECT NAME: **SCS/AEL LATERAL EXPANSION/OK**
SAMPLE ID: **B-2** - Depth: -
TYPE: **Bulk**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	**100.0**		
3.0"	75	**100.0**	Cobbles	**0.0**
2.5"	63.5	**100.0**		
2.0"	50	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25	**100.0**		
0.75"	19	**100.0**	Coarse Gravel	**0.0**
0.50"	12.7	**100.0**		
0.375"	9.5	**100.0**		
#4	4.75	**100.0**	Fine Gravel	**0.0**
#8	2.36	**100.0**	Coarse Sand	**0.0**
#16	1.18	**100.0**		
#30	0.60	**99.7**	Medium Sand	**2.8**
#50	0.30	**94.7**		
#100	0.15	**78.9**		
#200	0.075	**56.8**	Fine Sand	**40.4**
			Fines	**56.8**

D_{60}= 0.08	D_{30}= #N/A	D_{10}= #N/A
Cu = D60/D10 =	**#N/A**	#N/A
Cc = D30^2/(D10*D60) =	**#N/A**	#N/A

DESCRIPTION: SILT and SAND, fine to coarse sand; yellowish red.

USCS: (ML)

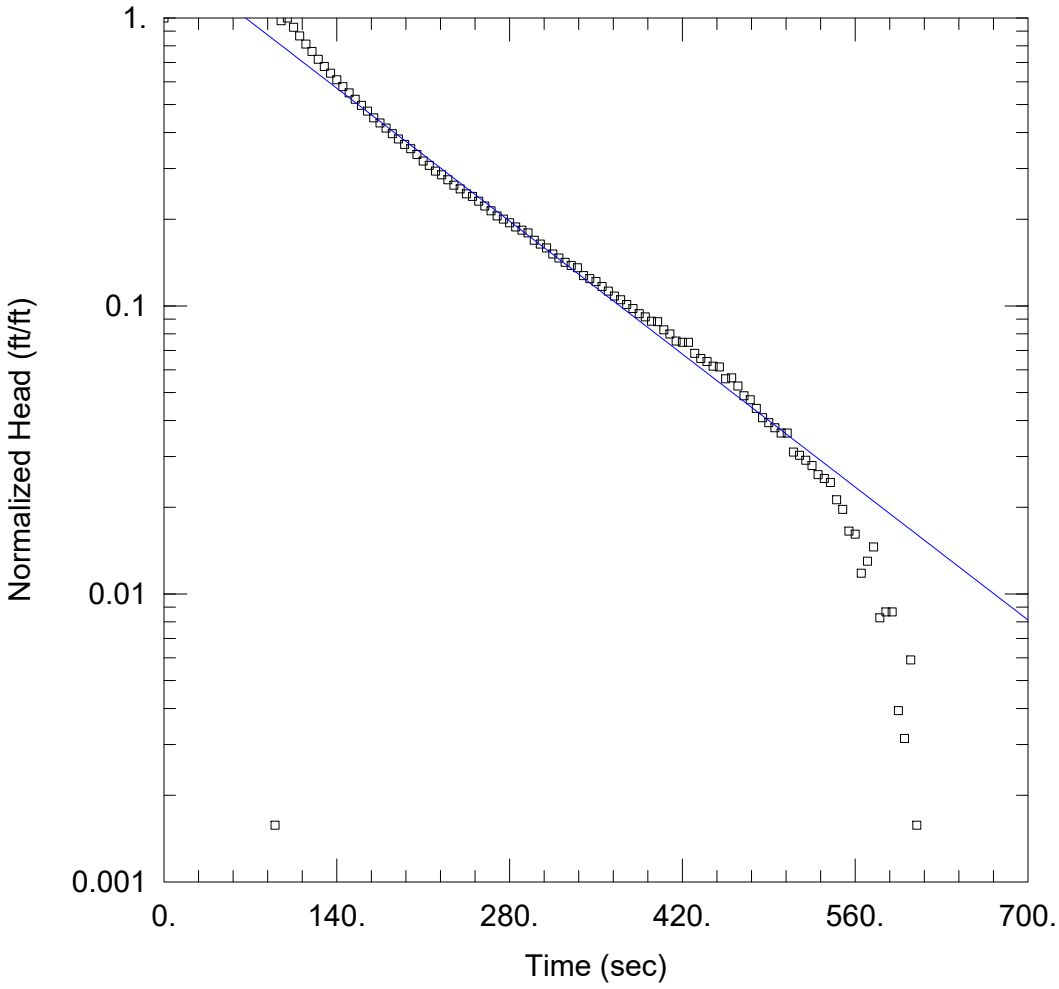
M_c 13.2%

TECH	VB
DATE	6/10/22
CHECK	
REVIEW	
APPROVE	

Golder Associates USA Inc.

Appendix E

AQTESOLV Analysis Graphs



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\250p1in.aqt
Date: 05/09/23 Time: 11:39:00

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-1 in
Test Date: 2021-07-21

AQUIFER DATA

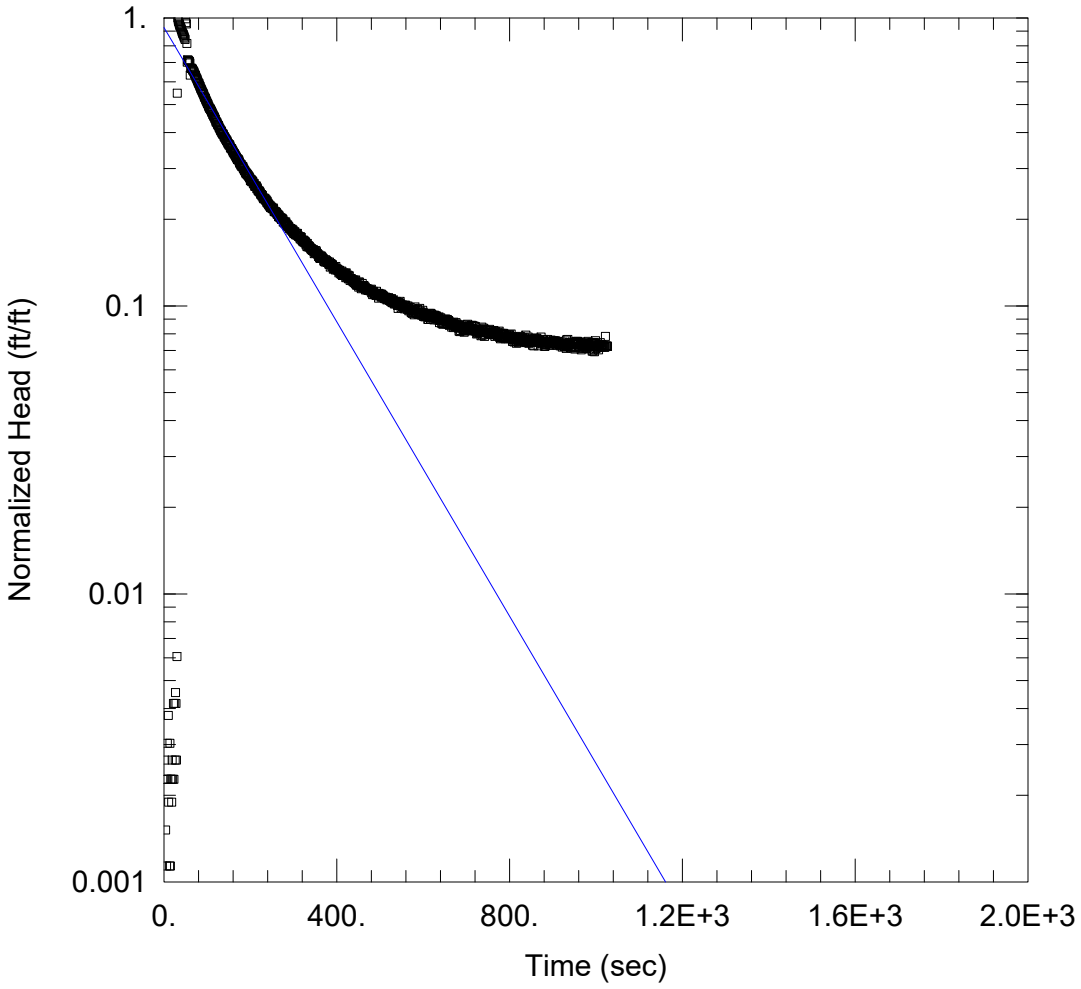
Saturated Thickness: 227. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-1 In)

Initial Displacement: 2.542 ft
Total Well Penetration Depth: 53.81 ft
Casing Radius: 0.085 ft
Static Water Column Height: 23.04 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.793 ft/day
y0 = 4.195 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\250p1out.aqt
Date: 05/09/23 Time: 13:40:01

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-1 out
Test Date: 2021-07-21

AQUIFER DATA

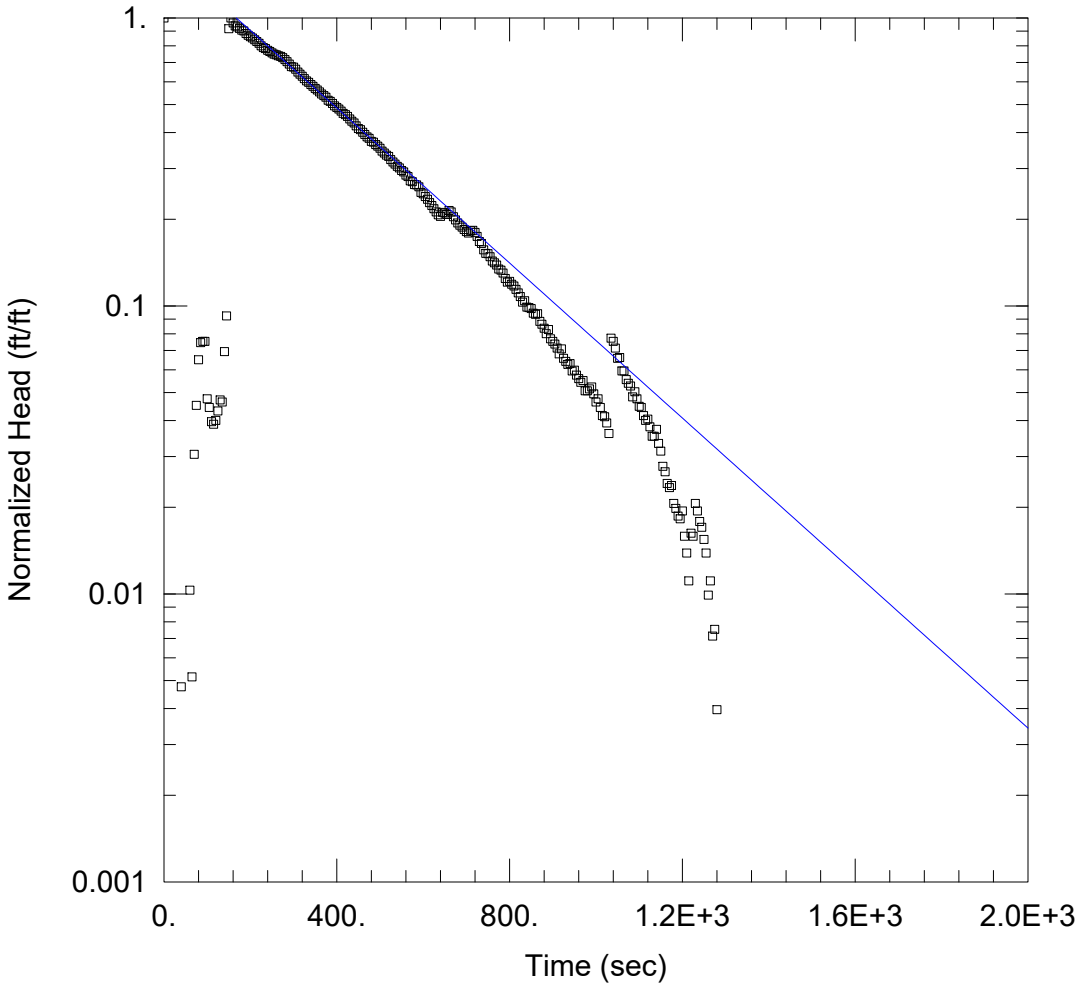
Saturated Thickness: 227. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-1 Out)

Initial Displacement: -2.641 ft
Total Well Penetration Depth: 53.81 ft
Casing Radius: 0.085 ft
Static Water Column Height: 22.95 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.6146 ft/day
y0 = -2.446 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\250p4in.aqt
Date: 05/09/23 Time: 13:40:39

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-4 in
Test Date: 2021-07-21

AQUIFER DATA

Saturated Thickness: 221.7 ft Anisotropy Ratio (Kz/Kr): 1.

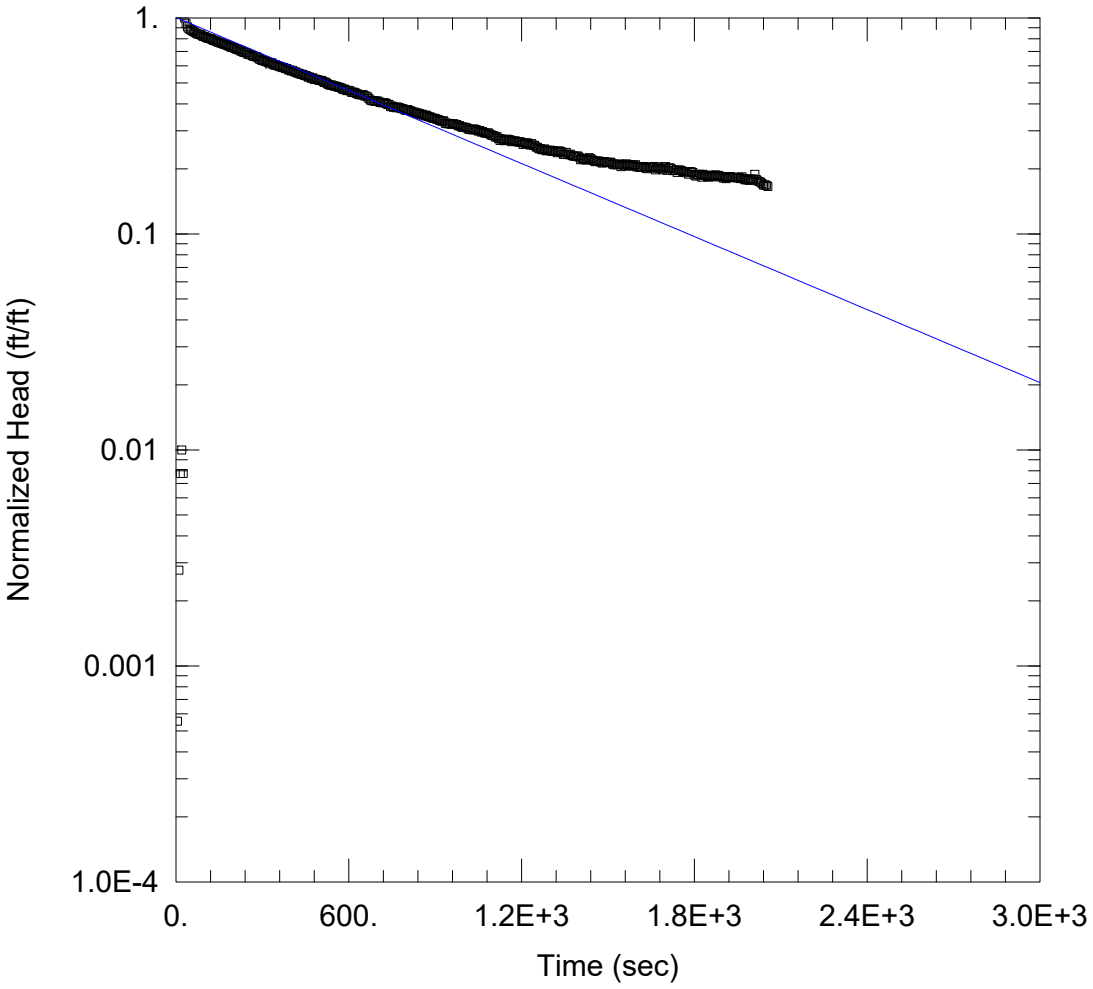
WELL DATA (P-4 Out)

Initial Displacement: 2.523 ft
Total Well Penetration Depth: 73.44 ft
Casing Radius: 0.085 ft
Static Water Column Height: 28.35 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.3342 ft/day y0 = 4.241 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\250p4outt.aqt
Date: 05/09/23 Time: 13:41:20

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-4 out
Test Date: 2021-07-21

AQUIFER DATA

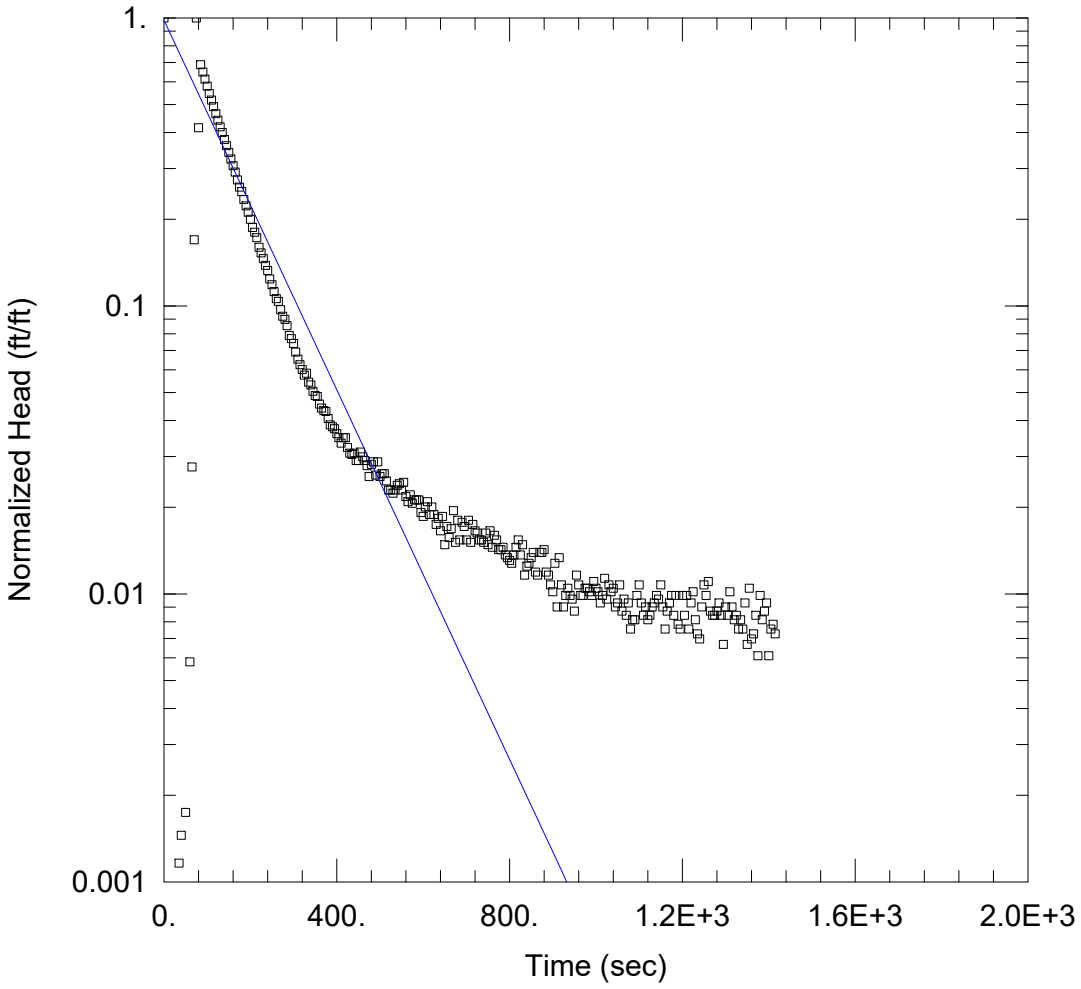
Saturated Thickness: 221.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P4 out)

Initial Displacement: -1.802 ft
Total Well Penetration Depth: 73.44 ft
Casing Radius: 0.085 ft
Static Water Column Height: 28.25 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.1399 ft/day
y0 = -1.81 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\250p6in.aqt
Date: 05/09/23 Time: 13:41:58

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-6 in
Test Date: 2021-07-21

AQUIFER DATA

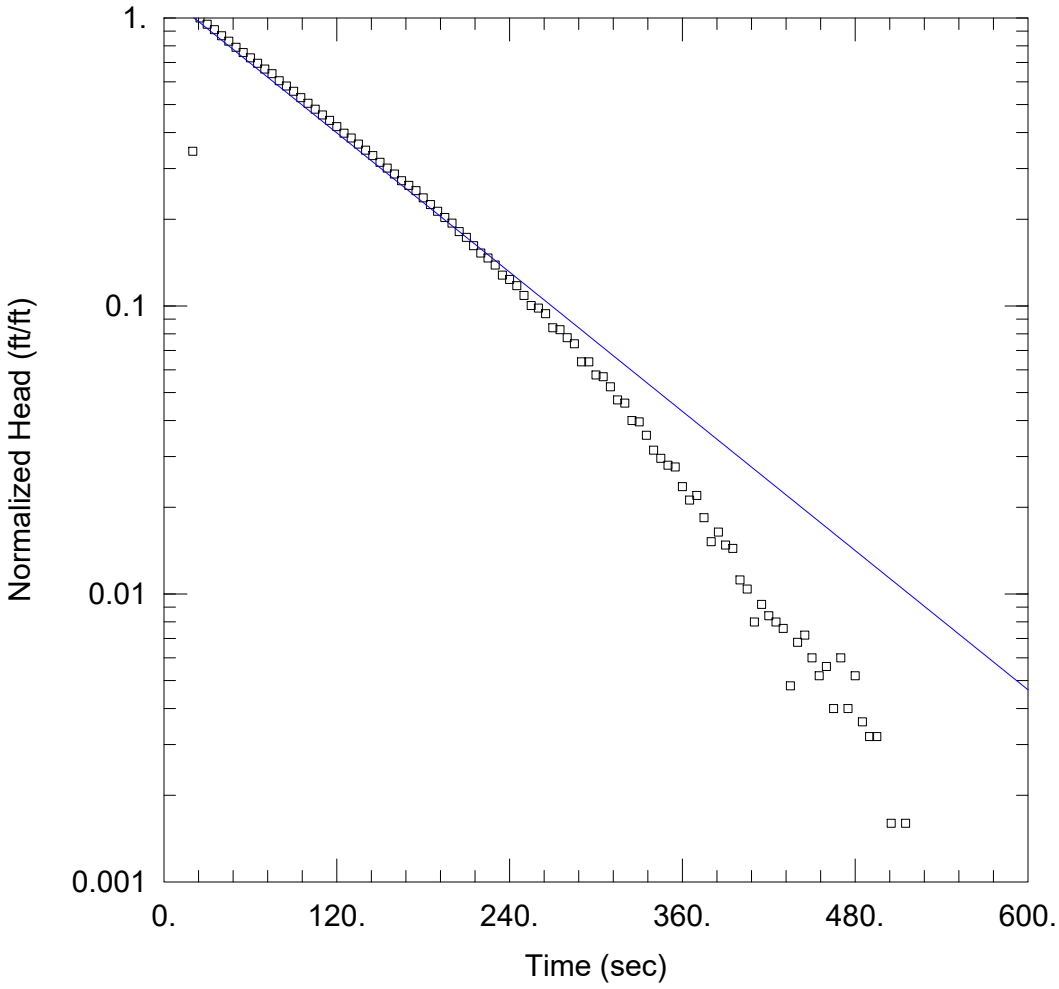
Saturated Thickness: 228.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P6 in)

Initial Displacement: 3.442 ft
Total Well Penetration Depth: 38.74 ft
Casing Radius: 0.085 ft
Static Water Column Height: 21.06 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.7443 ft/day
y0 = 3.38 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\250p6out.aqt
Date: 05/09/23 Time: 13:43:11

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-6 out
Test Date: 2021-07-21

AQUIFER DATA

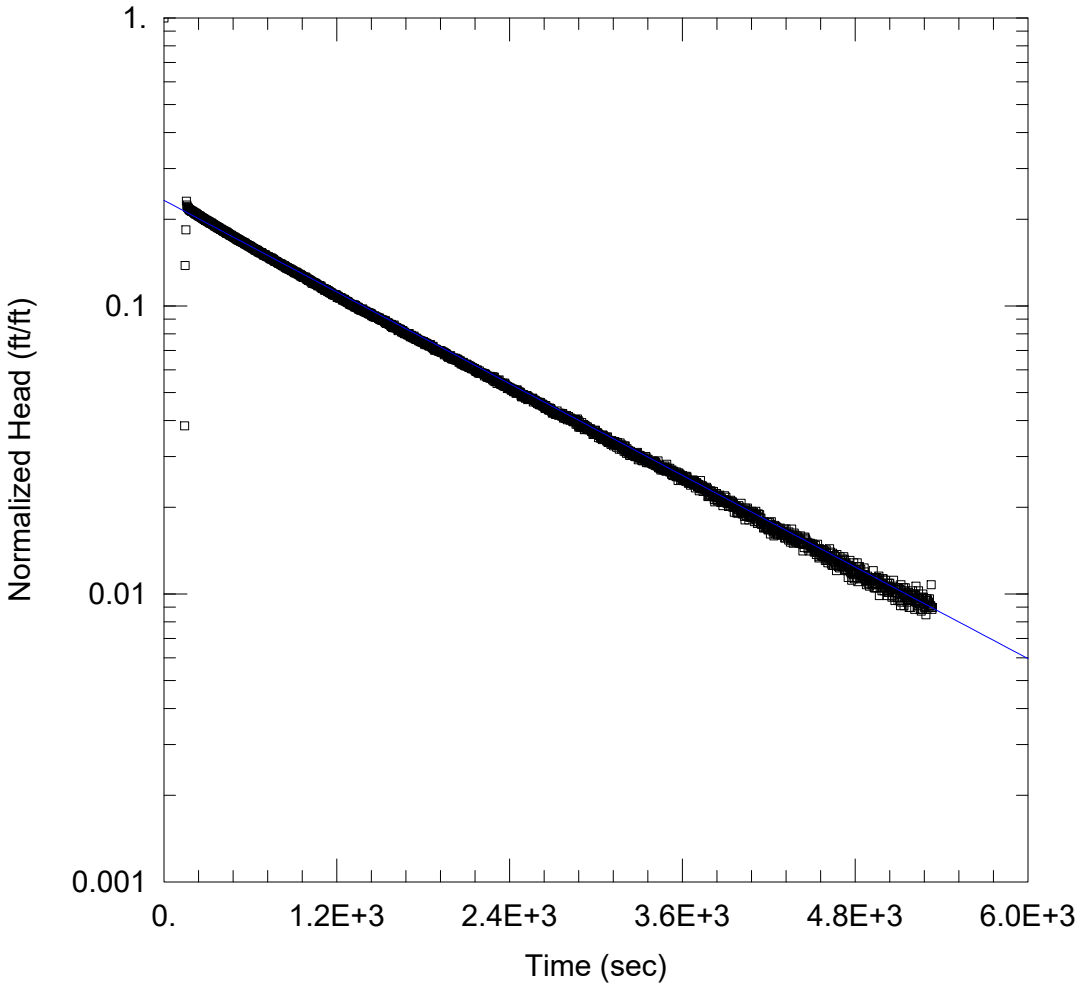
Saturated Thickness: 228.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P6 out)

Initial Displacement: -2.502 ft
Total Well Penetration Depth: 38.74 ft
Casing Radius: 0.085 ft
Static Water Column Height: 21.09 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.9345 ft/day
y0 = -3.037 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\250p9in.aqt
Date: 05/09/23 Time: 13:43:56

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-9 in
Test Date: 2021-07-21

AQUIFER DATA

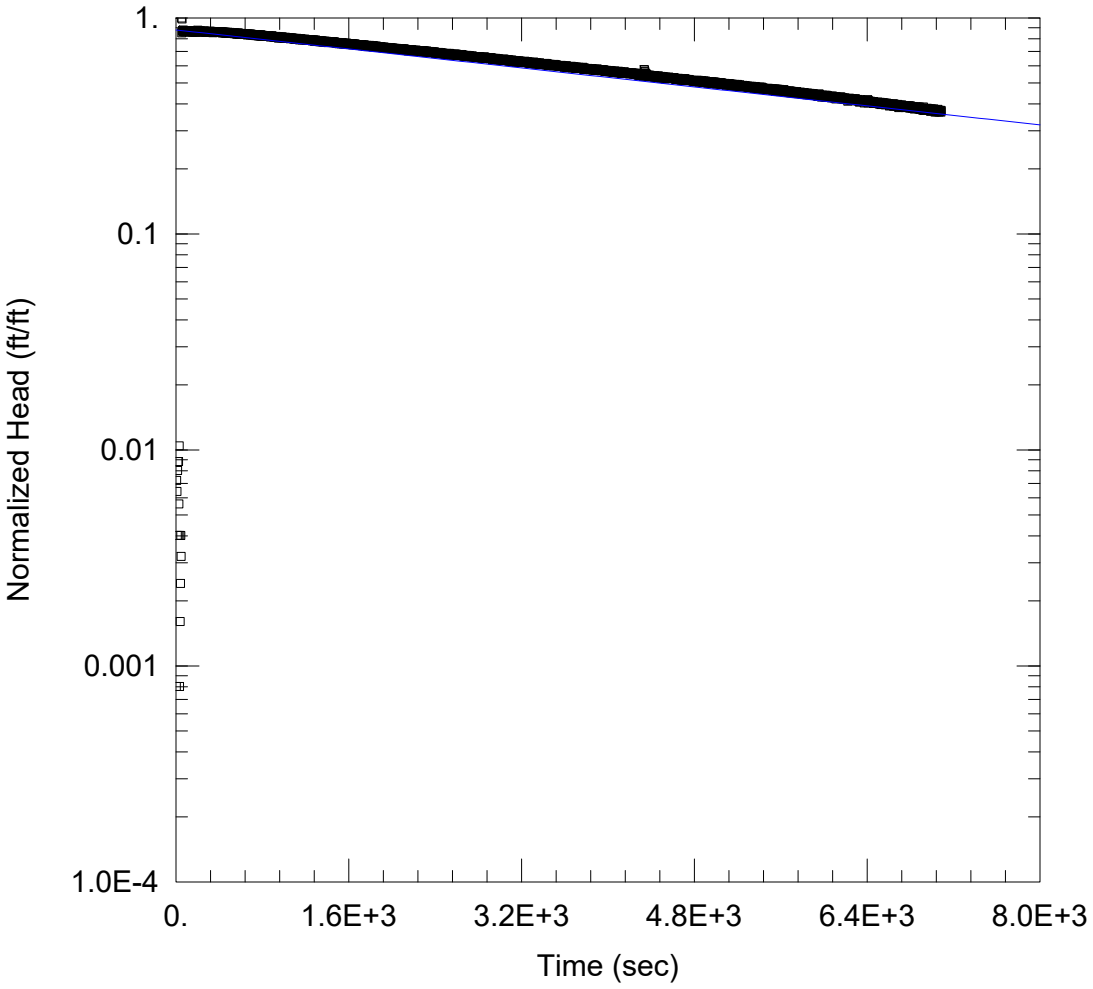
Saturated Thickness: 208.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P9 in)

Initial Displacement: 7.802 ft
Total Well Penetration Depth: 95.88 ft
Casing Radius: 0.085 ft
Static Water Column Height: 41.62 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.06758 ft/day
y0 = 1.815 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\250p9out.aqt
Date: 05/09/23 Time: 13:45:22

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-9 out
Test Date: 2021-07-21

AQUIFER DATA

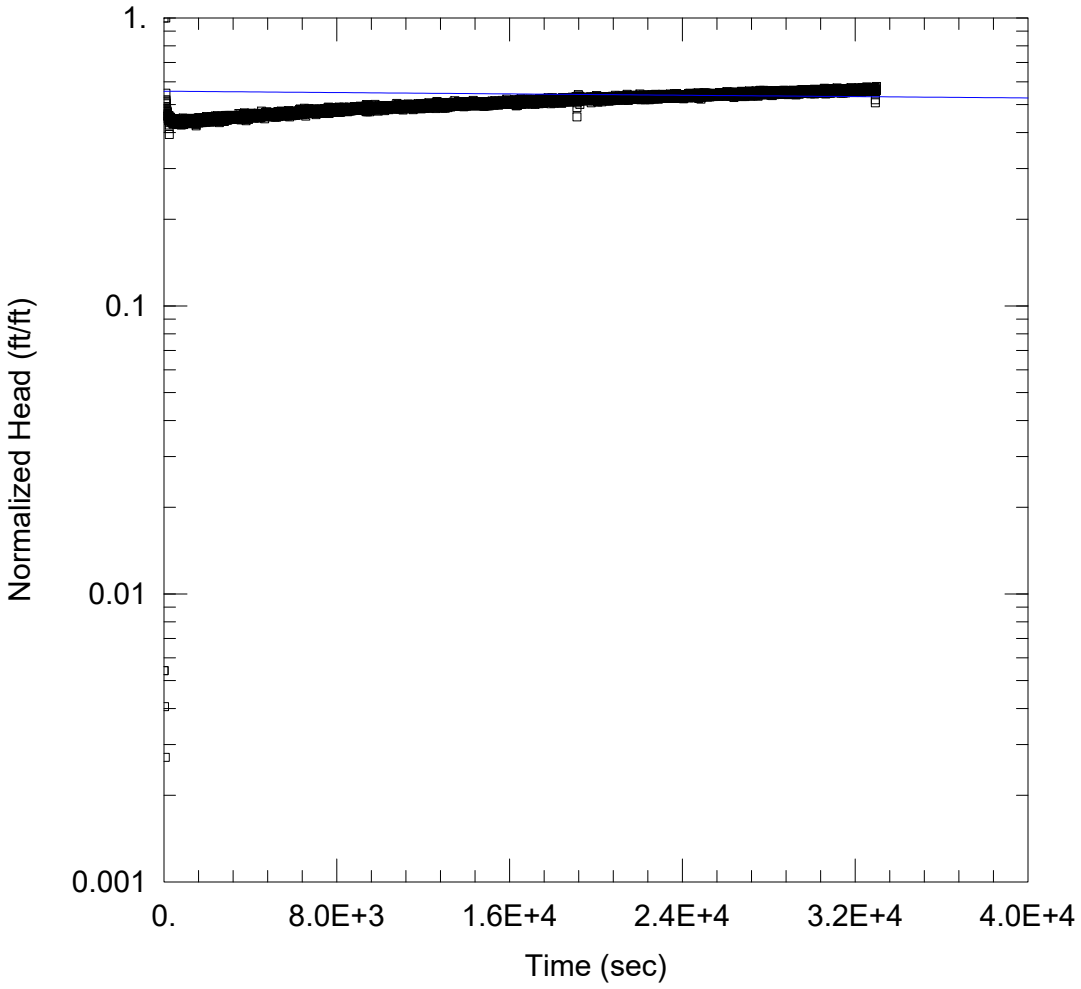
Saturated Thickness: 208.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P9 out)

Initial Displacement: -1.245 ft
Total Well Penetration Depth: 95.88 ft
Casing Radius: 0.085 ft
Static Water Column Height: 41.33 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.014 ft/day
y0 = -1.095 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p12in.aqt
Date: 05/09/23 Time: 13:46:11

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-12 in
Test Date: 2021-07-21

AQUIFER DATA

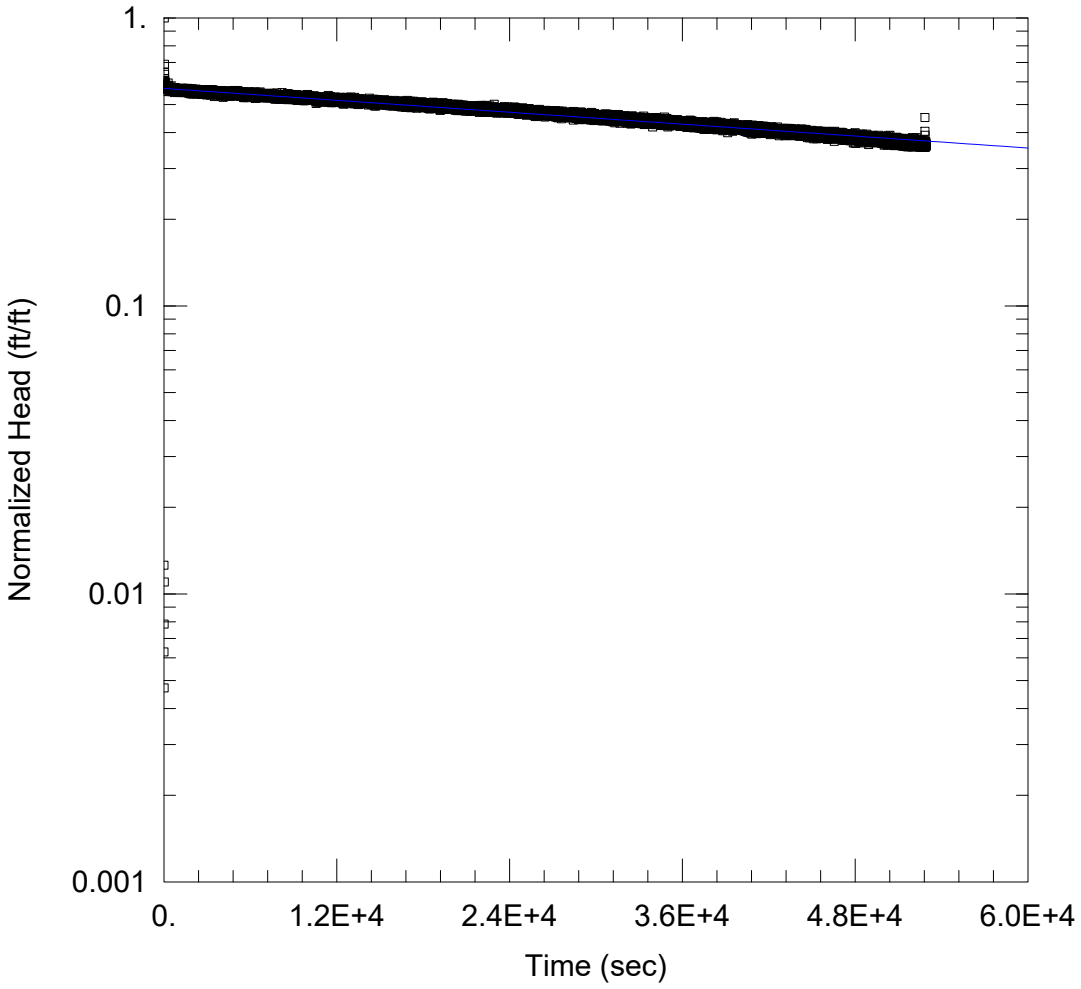
Saturated Thickness: 246.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (p12 in)

Initial Displacement: 0.739 ft
Total Well Penetration Depth: 108.3 ft
Casing Radius: 0.085 ft
Static Water Column Height: 3.318 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.0001502 ft/day
y0 = 0.4113 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p12out.aqt
Date: 05/09/23 Time: 13:47:11

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-12 in
Test Date: 2021-07-21

AQUIFER DATA

Saturated Thickness: 246.3 ft Anisotropy Ratio (Kz/Kr): 1.

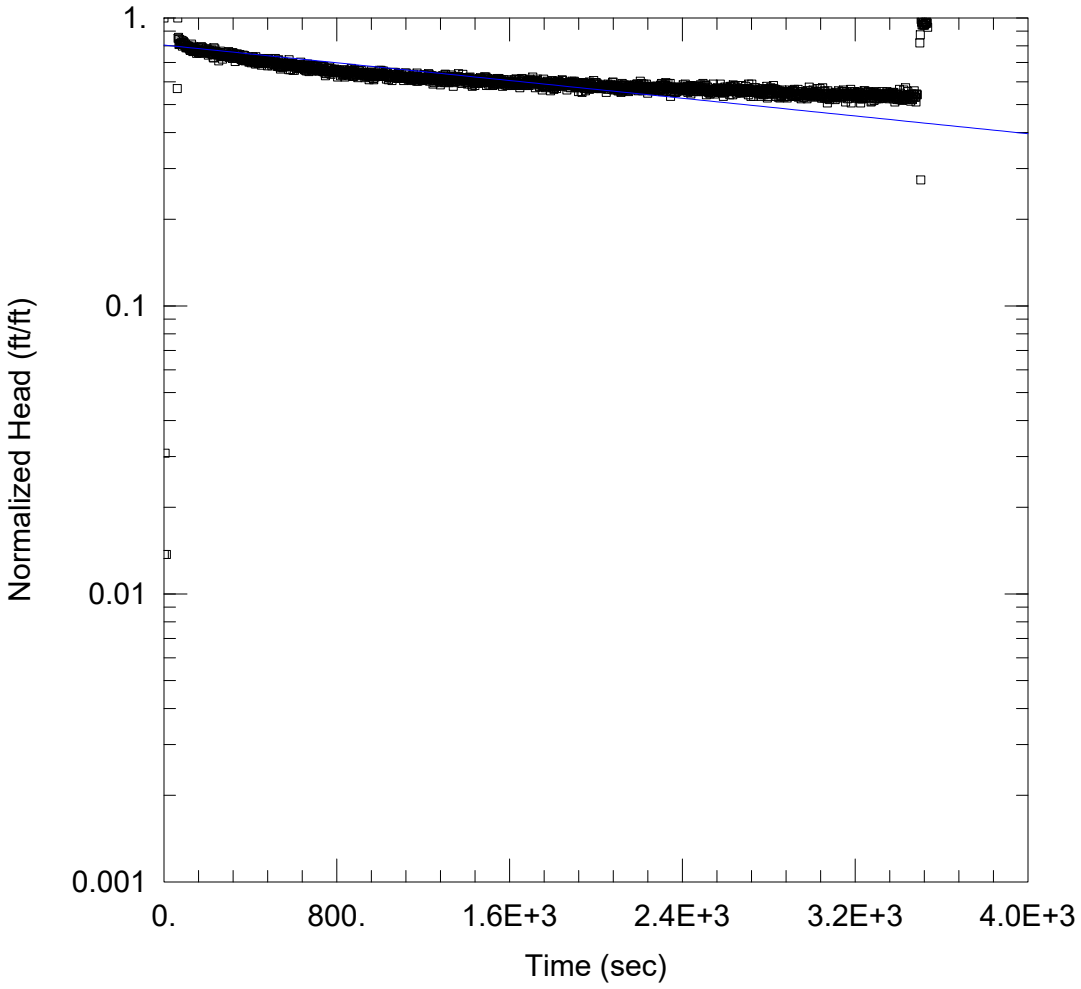
WELL DATA (p12 out)

Initial Displacement: -0.636 ft
Total Well Penetration Depth: 108.3 ft
Casing Radius: 0.085 ft
Static Water Column Height: 3.742 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.0008887 ft/day y0 = -0.362 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p15in.aqt
Date: 05/09/23 Time: 13:48:48

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-15 in
Test Date: 2021-07-21

AQUIFER DATA

Saturated Thickness: 247.3 ft Anisotropy Ratio (Kz/Kr): 1.

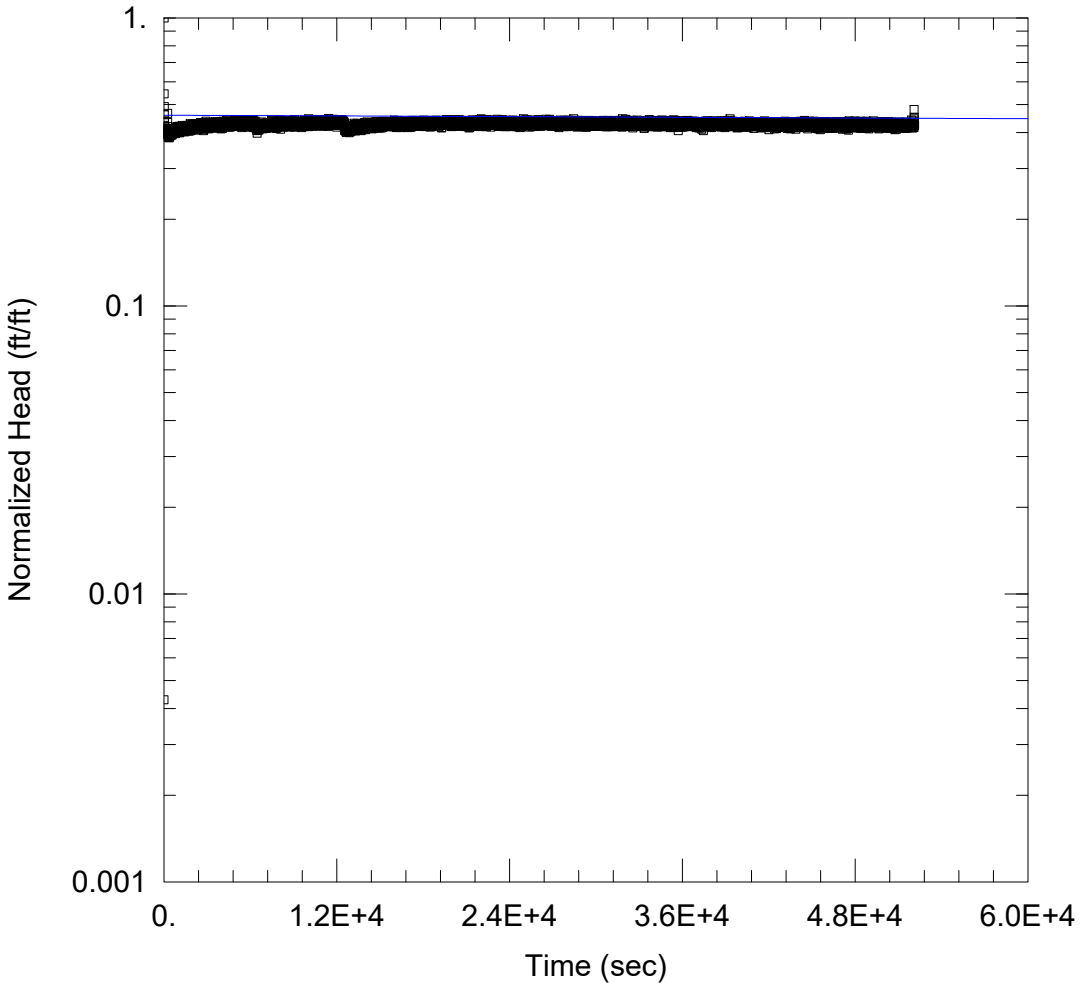
WELL DATA (P-15 In)

Initial Displacement: 0.292 ft
Total Well Penetration Depth: 86.33 ft
Casing Radius: 0.085 ft
Static Water Column Height: 2.711 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.01941 ft/day y0 = 0.235 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p15out.aqt
Date: 05/09/23 Time: 13:49:48

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-15 out
Test Date: 2021-07-21

AQUIFER DATA

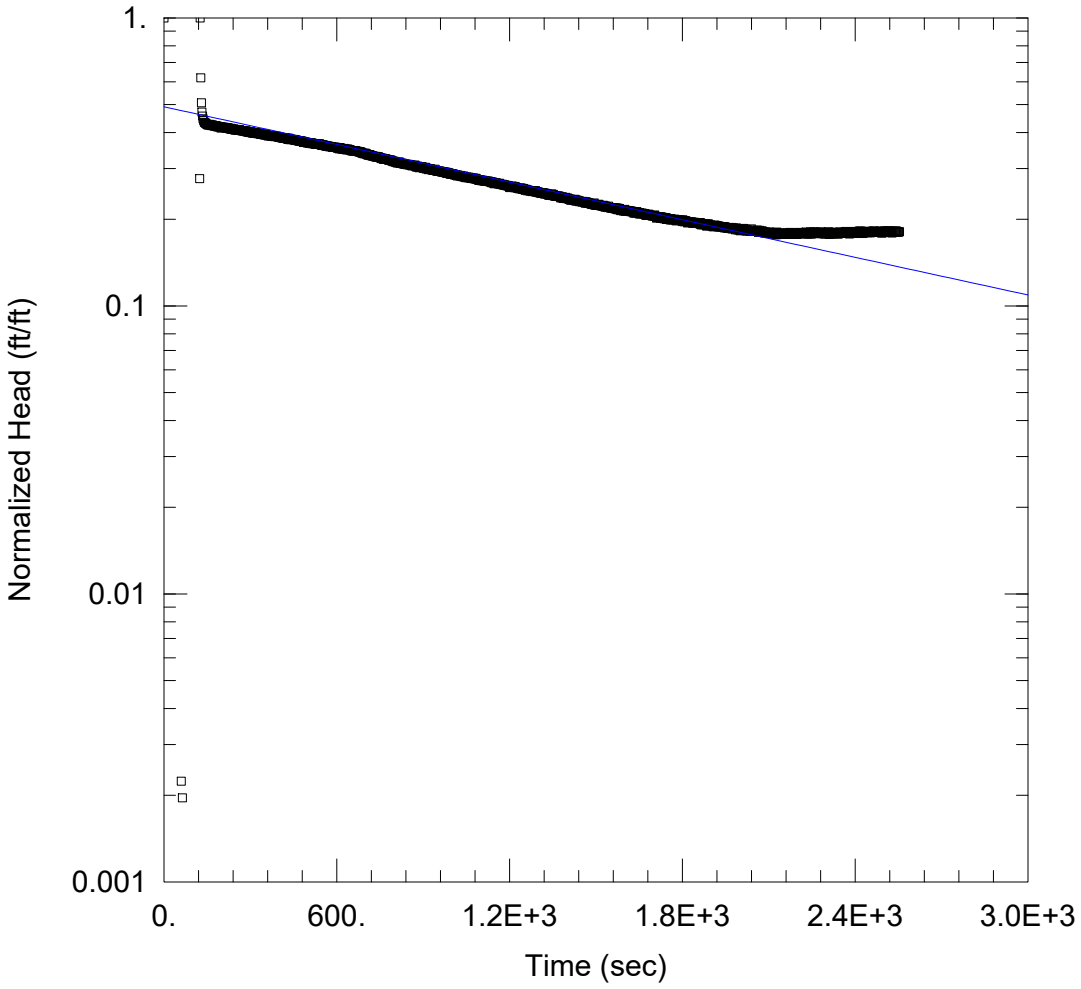
Saturated Thickness: 246.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P15 Out)

Initial Displacement: -0.699 ft
Total Well Penetration Depth: 86.33 ft
Casing Radius: 0.085 ft
Static Water Column Height: 3.389 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 5.107E-5 ft/day
y0 = -0.3211 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p19in.aqt
Date: 05/09/23 Time: 13:50:38

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-19 in
Test Date: 2021-07-21

AQUIFER DATA

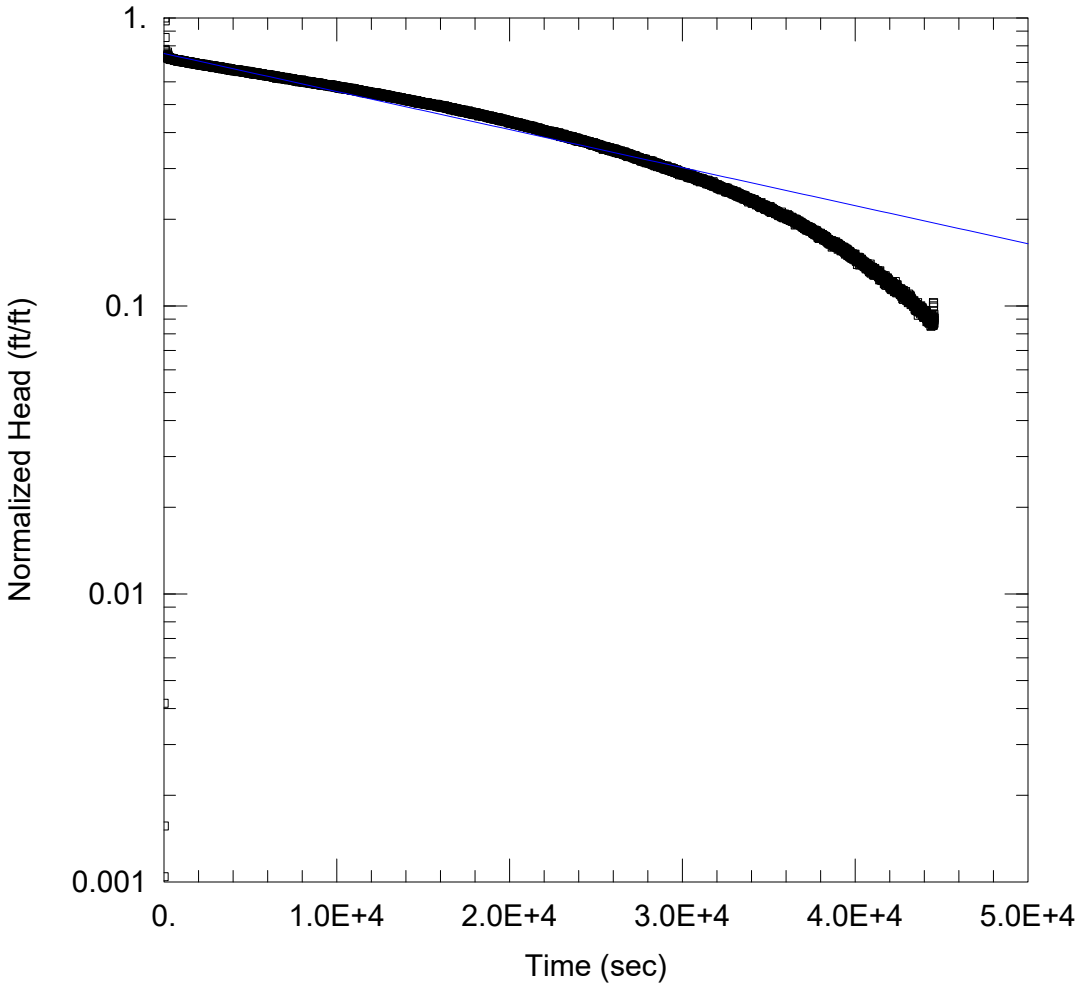
Saturated Thickness: 236.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P19 in)

Initial Displacement: 3.574 ft
Total Well Penetration Depth: 93.1 ft
Casing Radius: 0.085 ft
Static Water Column Height: 13.79 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.05533 ft/day
y0 = 1.756 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p19out.aqt
Date: 05/09/23 Time: 13:51:23

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-19 out
Test Date: 2021-07-21

AQUIFER DATA

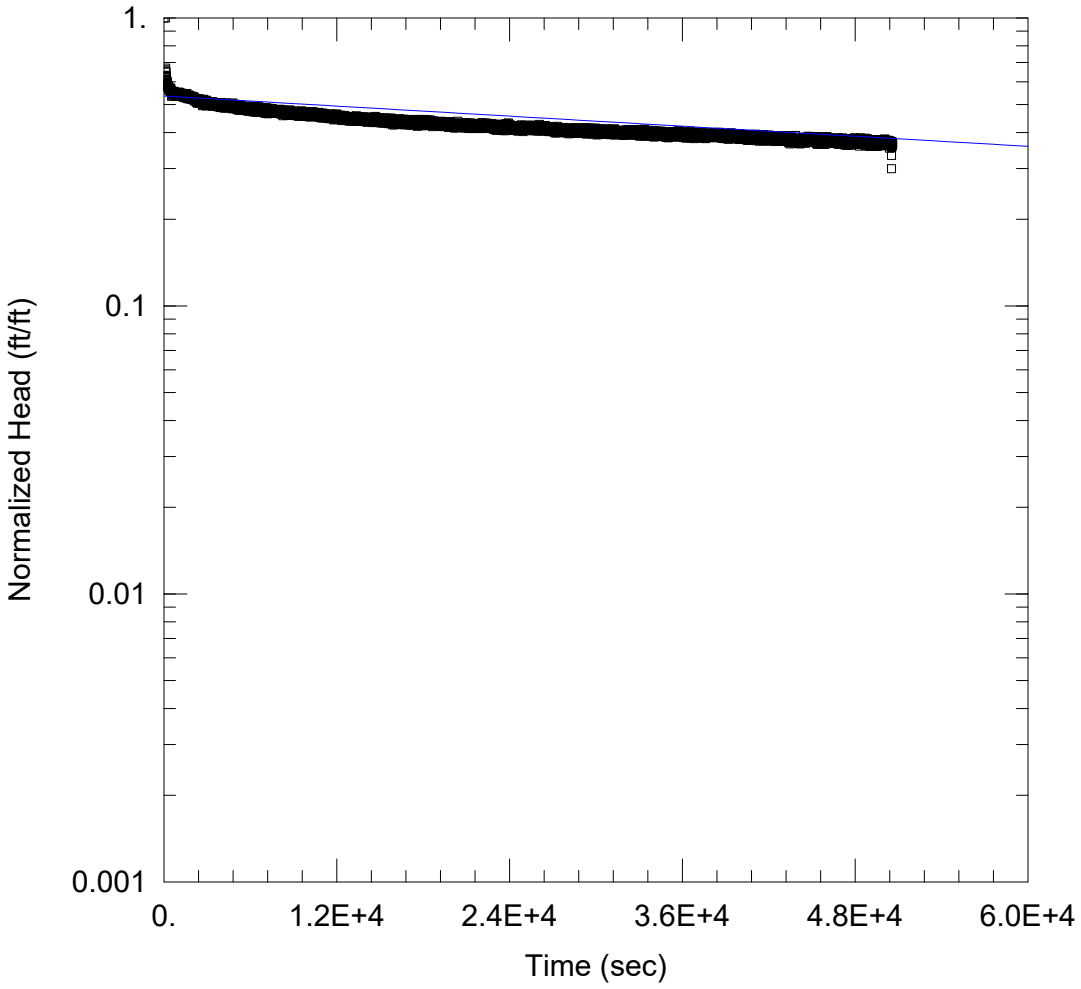
Saturated Thickness: 235.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P19 out)

Initial Displacement: -1.918 ft
Total Well Penetration Depth: 93.1 ft
Casing Radius: 0.085 ft
Static Water Column Height: 14.45 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.003356 ft/day
y0 = -1.443 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p23 in.aqt
Date: 05/09/23 Time: 13:54:54

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-23 in
Test Date: 2021-07-21

AQUIFER DATA

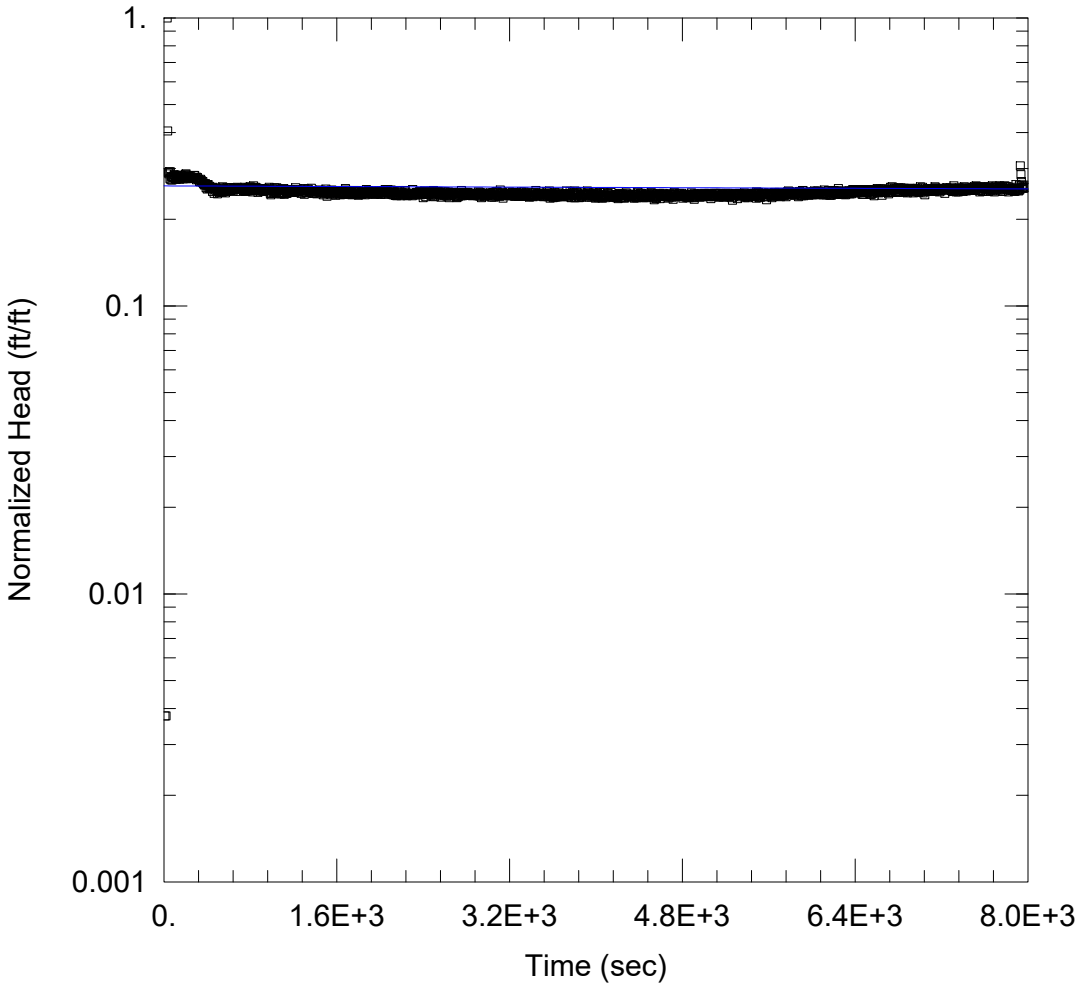
Saturated Thickness: 246. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P23 in)

Initial Displacement: 0.811 ft
Total Well Penetration Depth: 96.11 ft
Casing Radius: 0.085 ft
Static Water Column Height: 4.03 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.0007415 ft/day
y0 = 0.4343 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p23out.aqt
Date: 05/09/23 Time: 13:55:25

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-23 out
Test Date: 2021-07-21

AQUIFER DATA

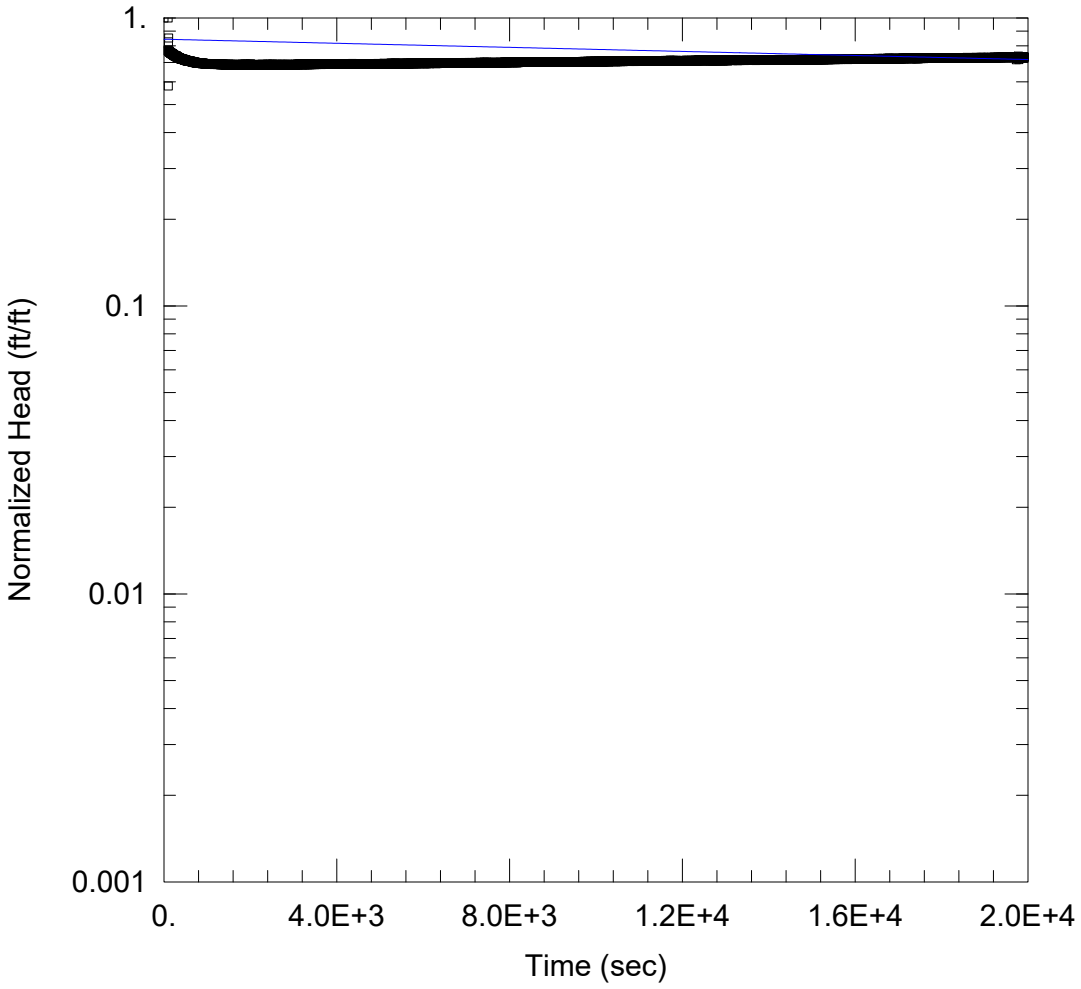
Saturated Thickness: 245.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (p23 out)

Initial Displacement: -1.061 ft
Total Well Penetration Depth: 96.11 ft
Casing Radius: 0.085 ft
Static Water Column Height: 4.328 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.0003348 ft/day
y0 = -0.277 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\P-27 in.aqt
Date: 05/09/23 Time: 13:56:19

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-27 In
Test Date: 7-21-2021

AQUIFER DATA

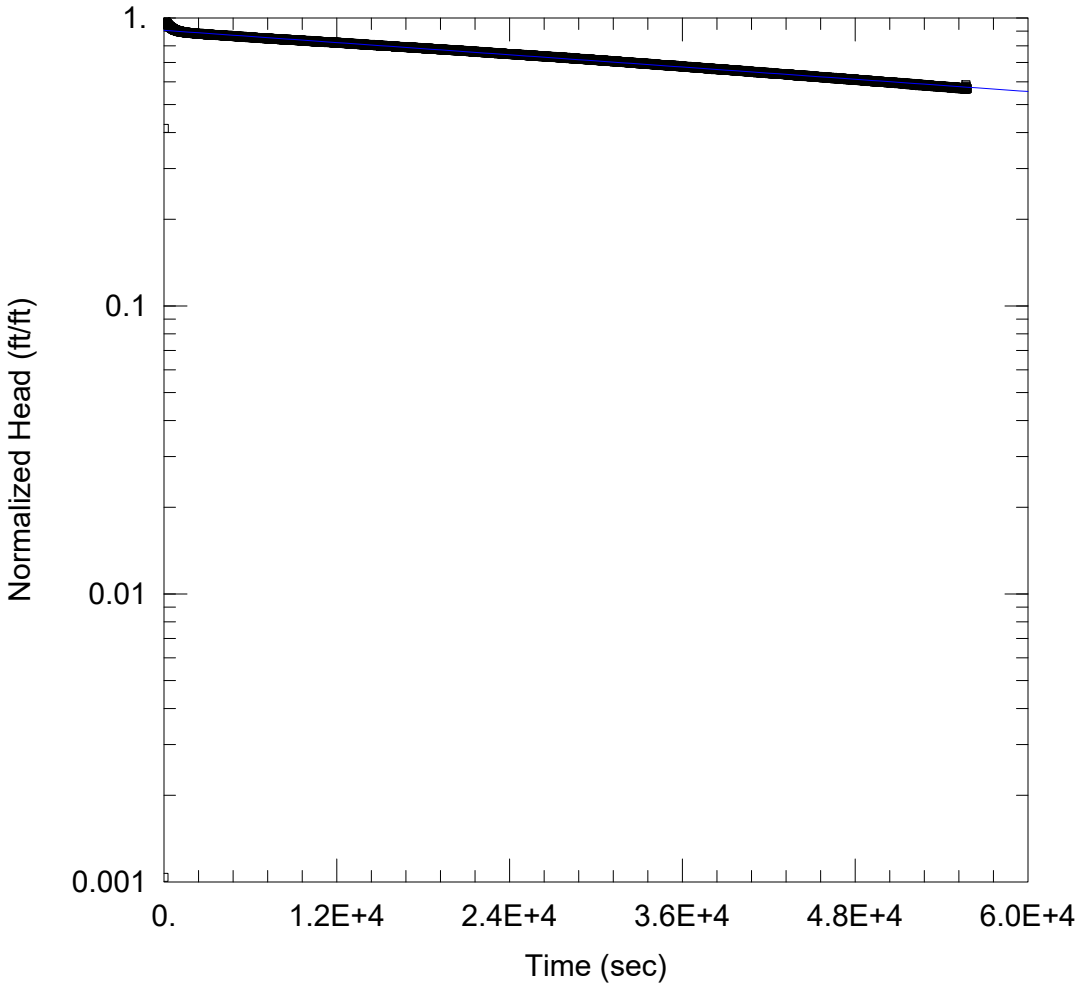
Saturated Thickness: 242. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-27 In)

Initial Displacement: 3.672 ft
Total Well Penetration Depth: 98. ft
Casing Radius: 0.085 ft
Static Water Column Height: 50.05 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.0009013 ft/day
y0 = 3.097 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p27out.aqt
Date: 05/09/23 Time: 13:57:10

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-27 out
Test Date: 2021-07-21

AQUIFER DATA

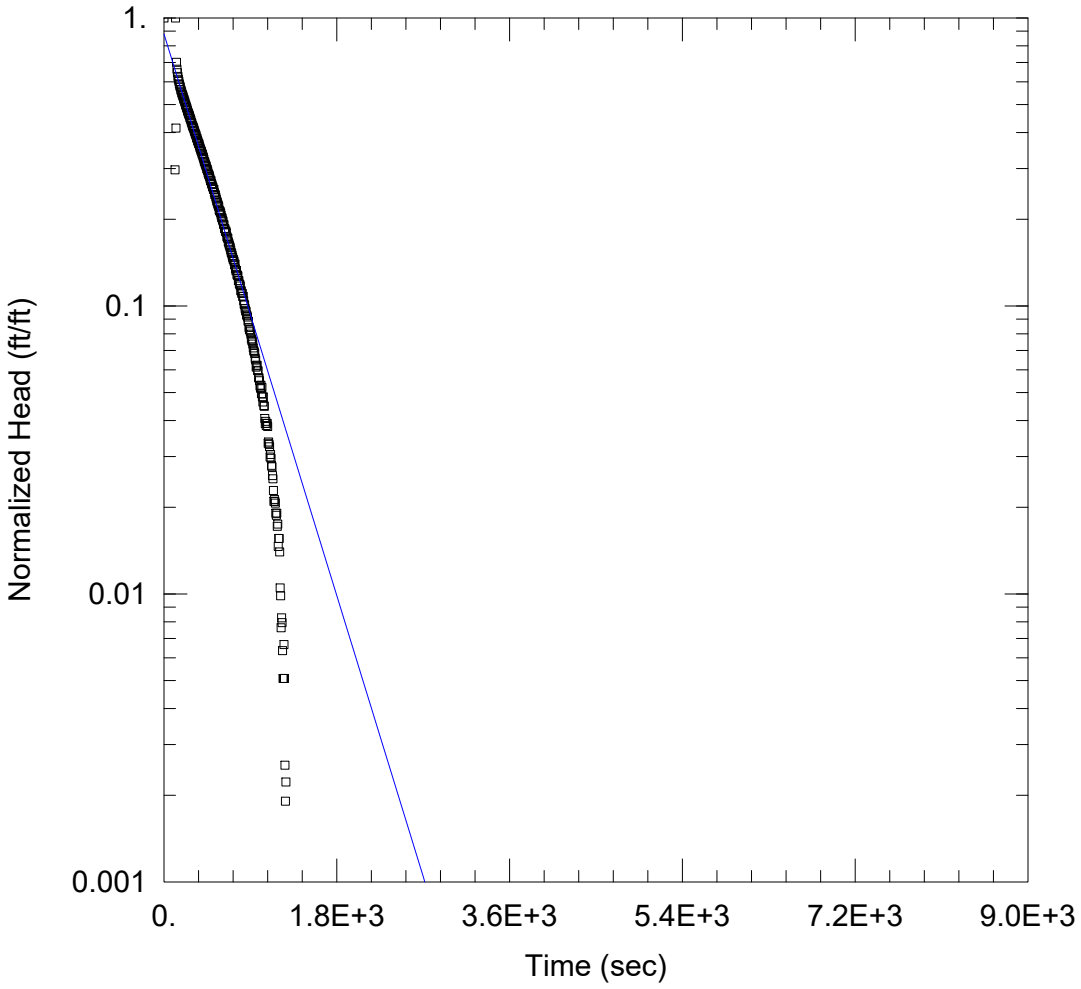
Saturated Thickness: 199.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P27 Out)

Initial Displacement: -2.892 ft
Total Well Penetration Depth: 93.46 ft
Casing Radius: 0.085 ft
Static Water Column Height: 52.74 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.0008997 ft/day
y0 = -2.619 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p30in.aqt
Date: 05/09/23 Time: 13:57:52

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-30 in
Test Date: 2021-07-21

AQUIFER DATA

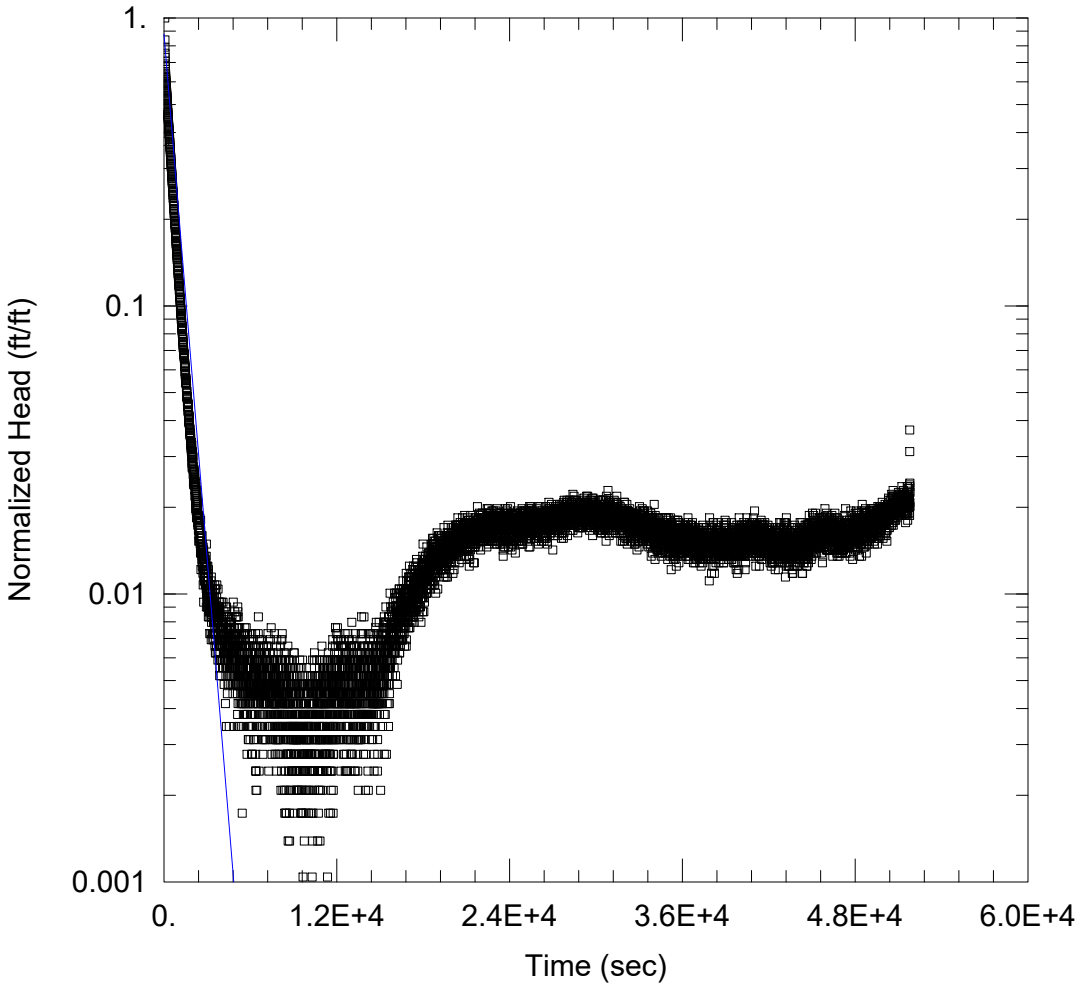
Saturated Thickness: 224.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-30 In)

Initial Displacement: 3.147 ft
Total Well Penetration Depth: 112.7 ft
Casing Radius: 0.085 ft
Static Water Column Height: 25.63 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.2802 ft/day
y0 = 2.769 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p30out.aqt
Date: 05/09/23 Time: 13:58:31

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-30 out
Test Date: 2021-07-21

AQUIFER DATA

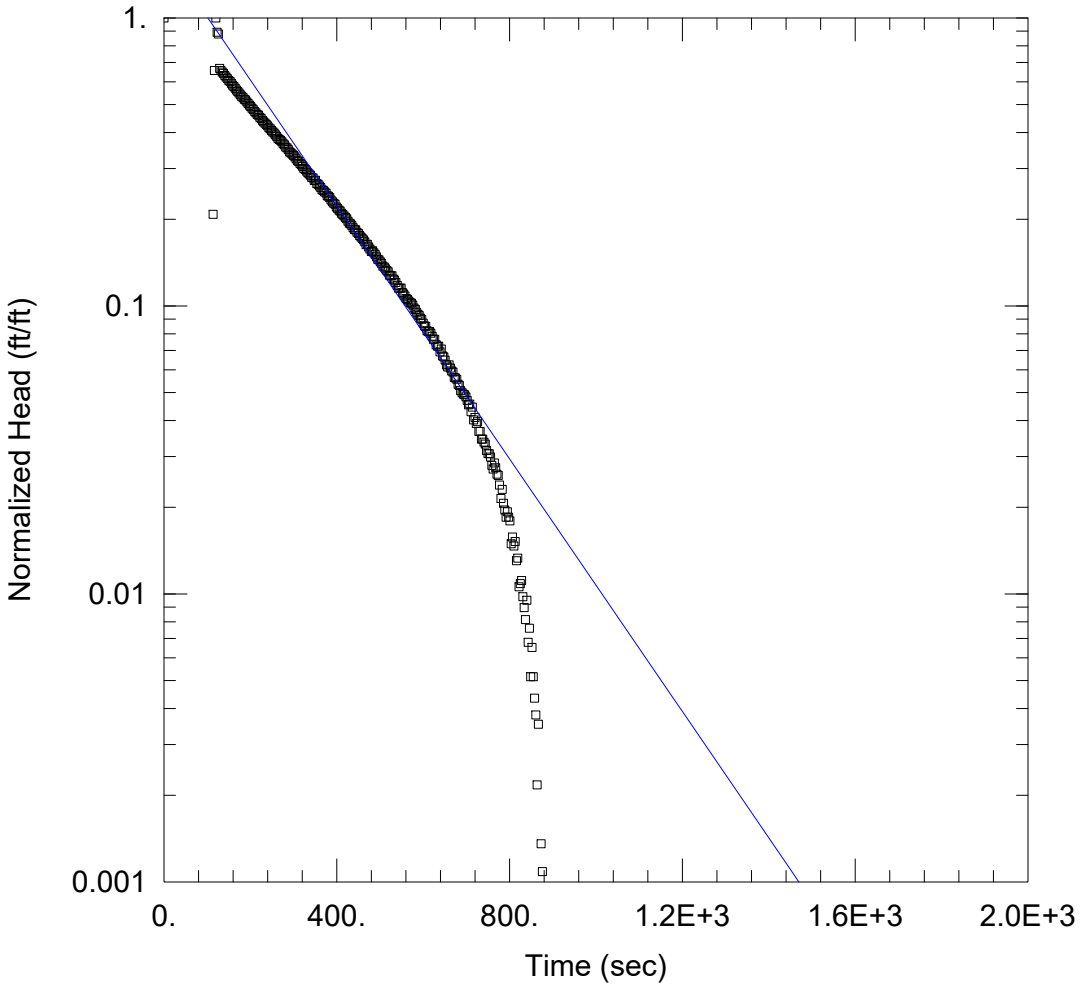
Saturated Thickness: 224.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P30 out)

Initial Displacement: -2.885 ft
Total Well Penetration Depth: 112.7 ft
Casing Radius: 0.085 ft
Static Water Column Height: 25.37 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.1572 ft/day
y0 = -2.539 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p37in.aqt
Date: 05/09/23 Time: 13:59:29

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-37 in
Test Date: 2021-07-21

AQUIFER DATA

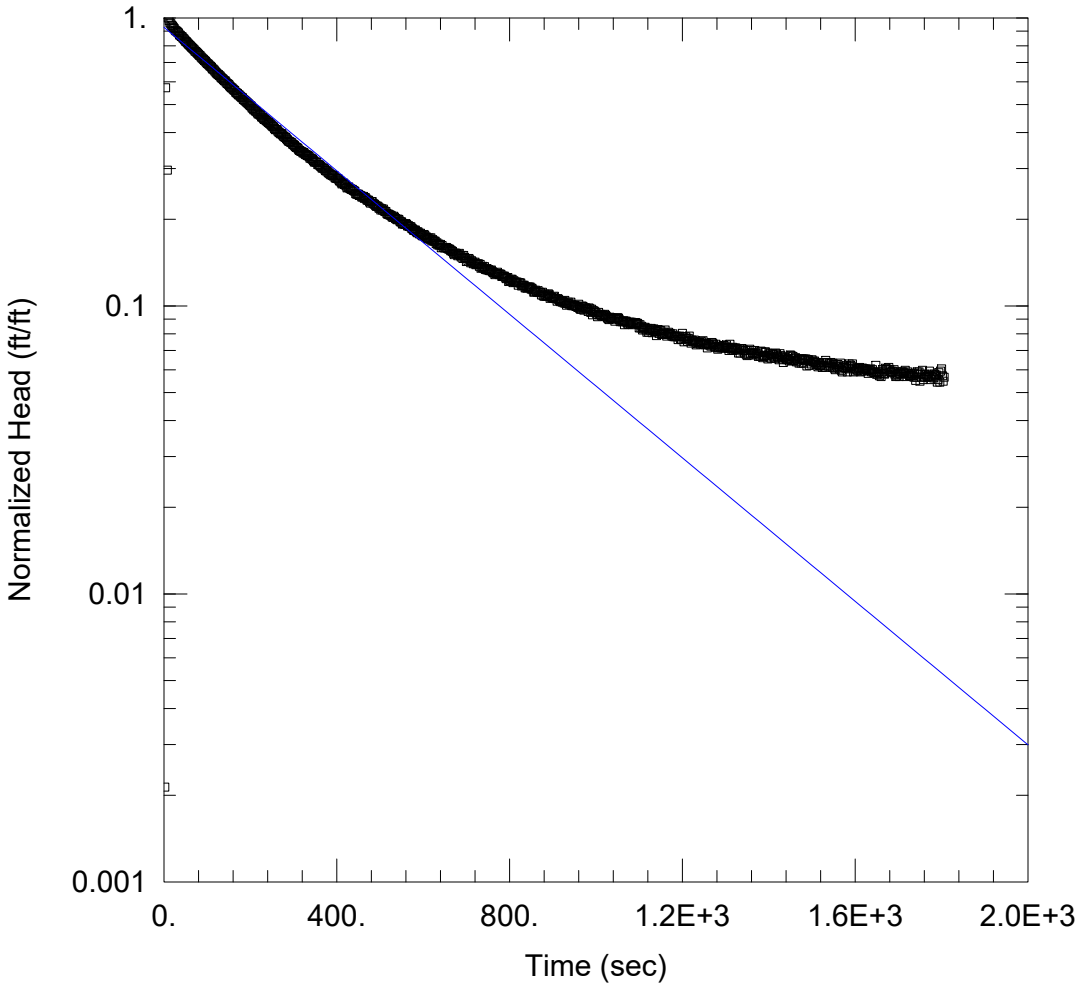
Saturated Thickness: 225.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P37 in)

Initial Displacement: 3.683 ft
Total Well Penetration Depth: 116.3 ft
Casing Radius: 0.085 ft
Static Water Column Height: 24.15 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.5687 ft/day
y0 = 6.154 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p37out.aqt
Date: 05/09/23 Time: 14:00:04

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-37 out
Test Date: 2021-07-21

AQUIFER DATA

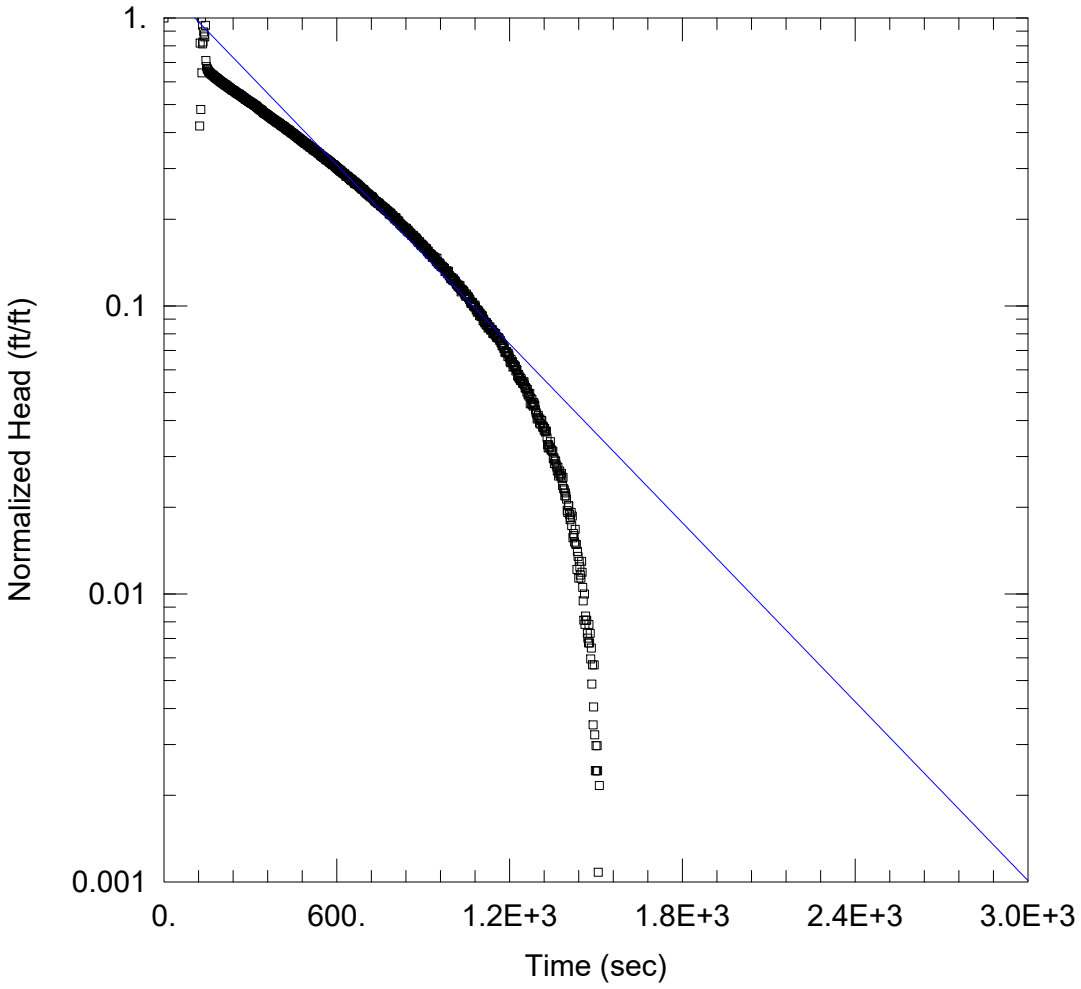
Saturated Thickness: 226. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P37 out)

Initial Displacement: -2.813 ft
Total Well Penetration Depth: 116.3 ft
Casing Radius: 0.085 ft
Static Water Column Height: 24.03 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.3231 ft/day
y0 = -2.61 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\P-39 In.aqt
Date: 05/09/23 Time: 14:00:49

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-39 In
Test Date: 7-21-2021

AQUIFER DATA

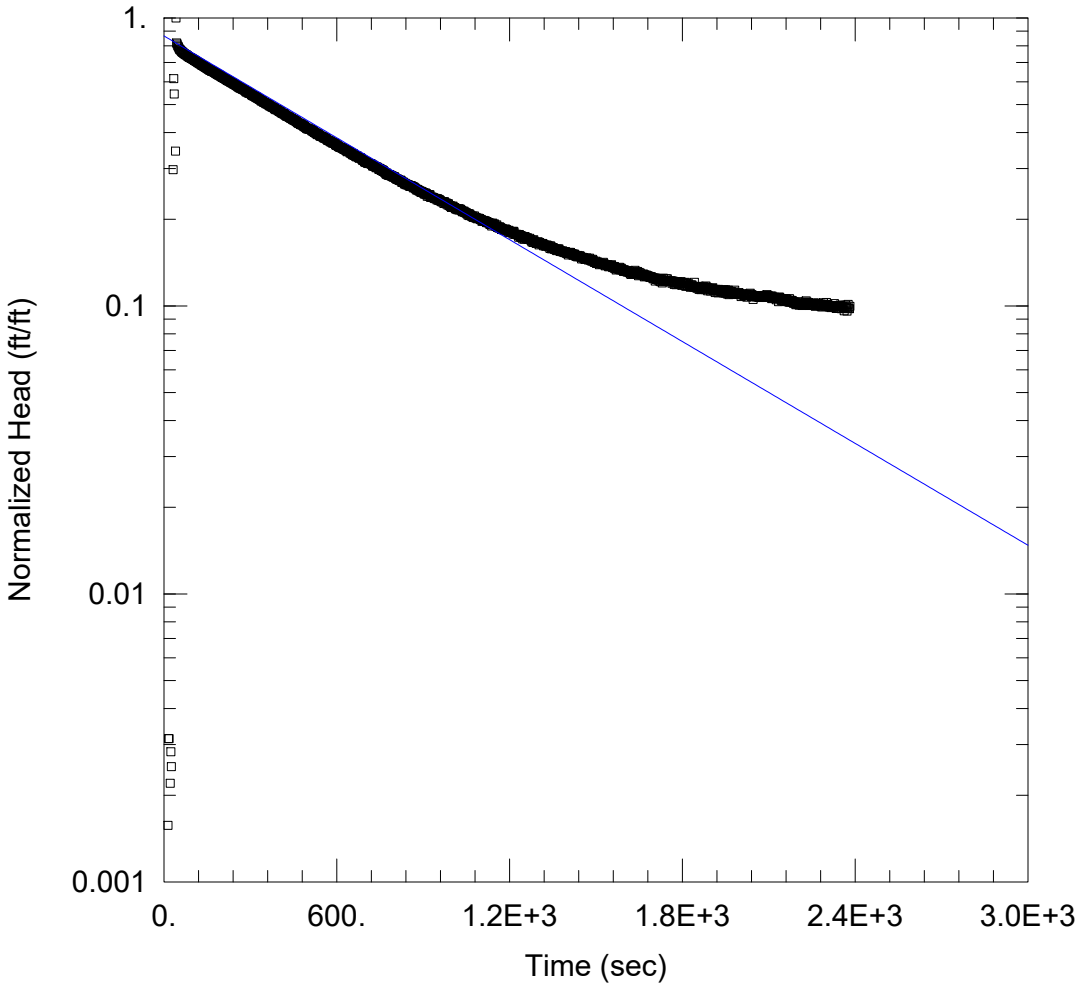
Saturated Thickness: 242. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-39 In)

Initial Displacement: 3.702 ft
Total Well Penetration Depth: 99. ft
Casing Radius: 0.085 ft
Static Water Column Height: 35.11 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.2646 ft/day
y0 = 4.779 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\P-39 Out.aqt
Date: 05/09/23 Time: 14:01:15

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-39 Out
Test Date: 7-21-2021

AQUIFER DATA

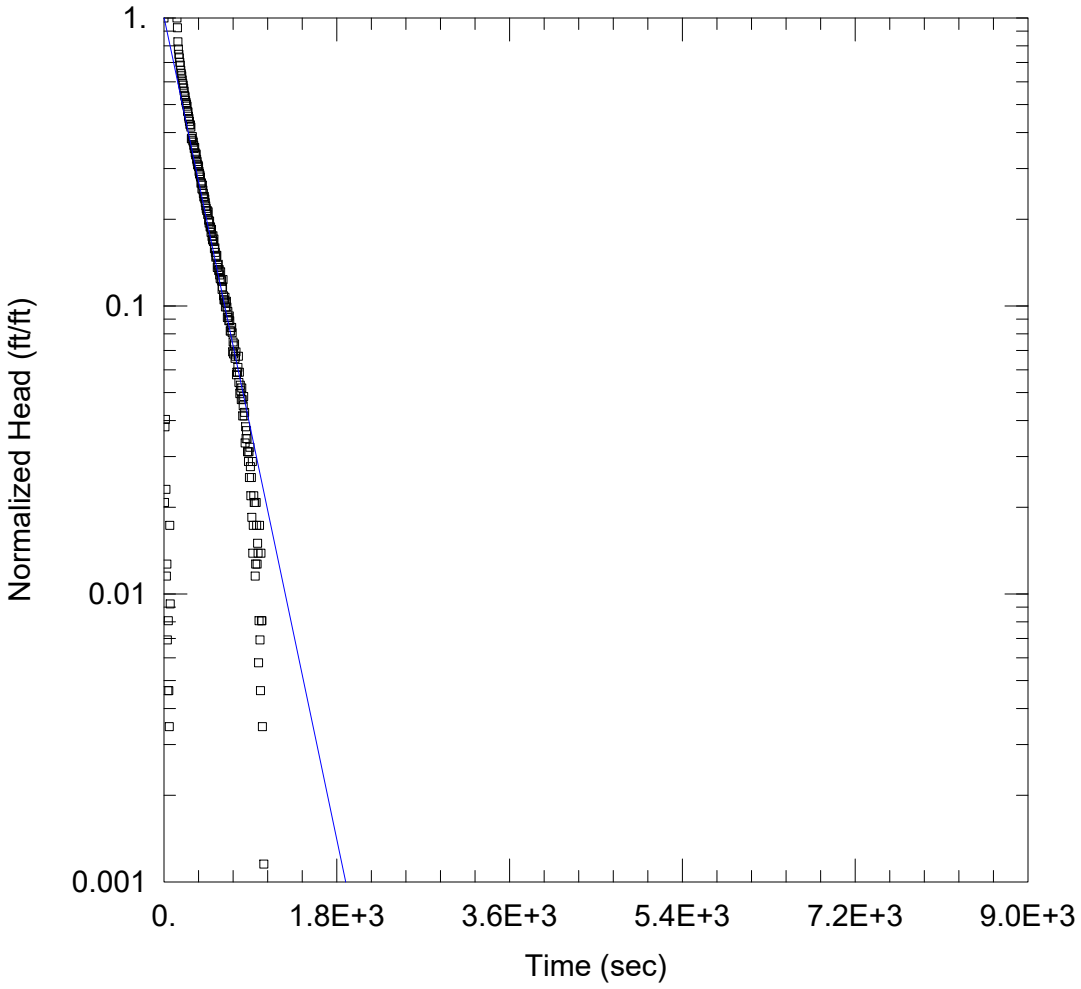
Saturated Thickness: 242. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P-39 Out)

Initial Displacement: -3.181 ft
Total Well Penetration Depth: 99. ft
Casing Radius: 0.085 ft
Static Water Column Height: 34.87 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.1507 ft/day
y0 = -2.754 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p42in.aqt
Date: 05/09/23 Time: 14:02:18

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-42 in
Test Date: 2021-07-21

AQUIFER DATA

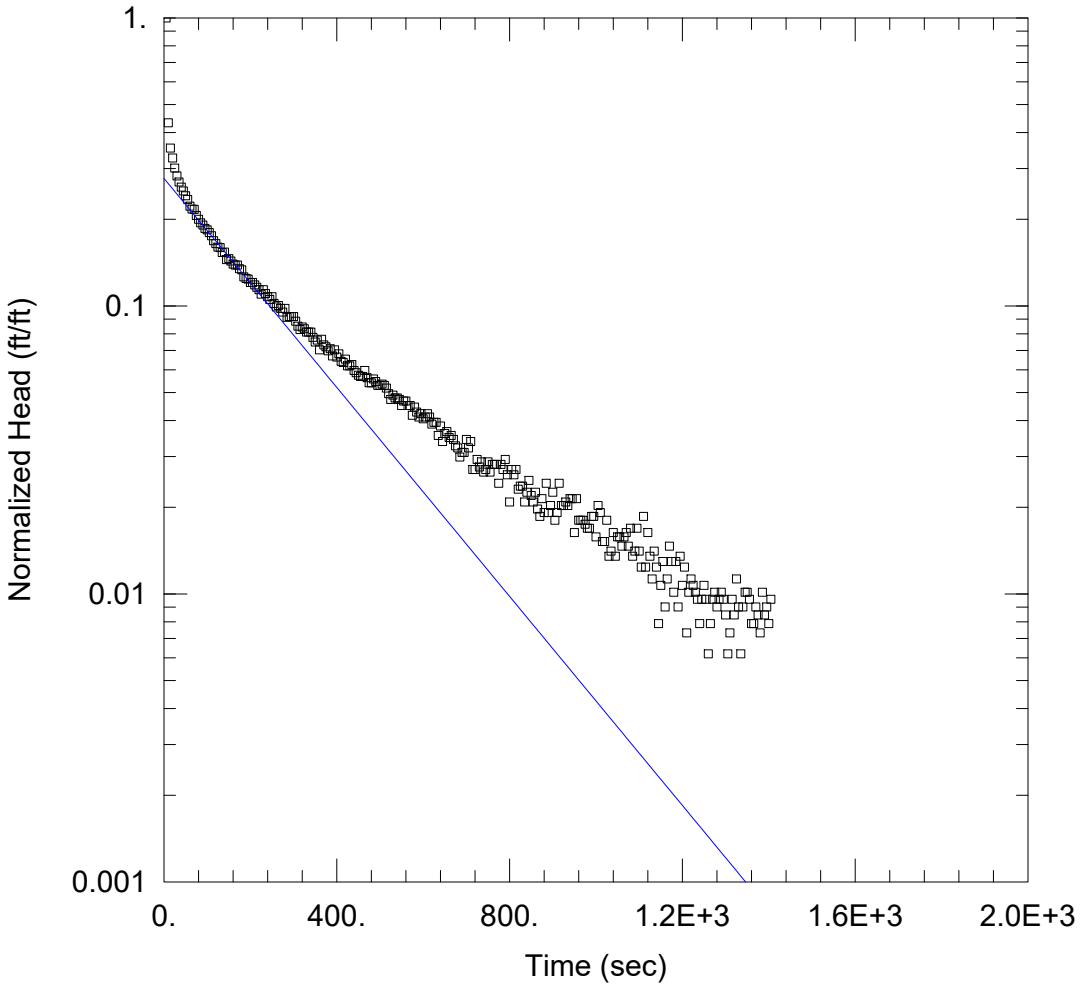
Saturated Thickness: 241.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P42 in)

Initial Displacement: 0.867 ft
Total Well Penetration Depth: 100.4 ft
Casing Radius: 0.085 ft
Static Water Column Height: 8.889 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.4061 ft/day
y0 = 0.8755 ft



WELL TEST ANALYSIS

Data Set: T:\AEL\HydroGEO Report\Slug Test\Data files\p42out.aqt
Date: 05/09/23 Time: 14:03:05

PROJECT INFORMATION

Company: SCS Engineers
Client: AEL
Location: Sand Springs
Test Well: P-42 out
Test Date: 2021-07-21

AQUIFER DATA

Saturated Thickness: 241.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P42 out)

Initial Displacement: -1.775 ft
Total Well Penetration Depth: 100.4 ft
Casing Radius: 0.085 ft
Static Water Column Height: 8.816 ft
Screen Length: 10. ft
Well Radius: 0.099 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.4643 ft/day
y0 = -0.4919 ft