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American Electric Power Service Corporation

Landfill – CCR Location Restriction Evaluation

H. W. Pirkey Power Plant
2400 FM 3251
Harrison County
Hallsville, Texas

July 6, 2016

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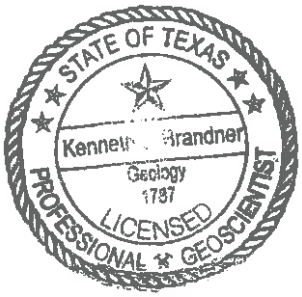

Kenneth Brandner, P.E., P.G.
Senior Project Engineer

Matthew J. Lamb
Project Manager

John Holm, P.E.
Principal Engineer

Landfill – CCR Location Restriction Evaluation

H.W. Pirkey Power Plant
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Harrison County
Hallsville, Texas

Prepared for:
AEP

Prepared by:
ARCADIS U.S., Inc.
100 E Campus View Blvd
Suite 200
Columbus
Ohio 43235-1447
Tel 614 985 9100
Fax 614 985 9170

Our Ref.:
OH015976.0010

Date:
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Acronyms and Abbreviation

AEP	American Electric Power Service Cooperation
amsl	above mean sea level
ARCADIS	ARCADIS U.S., Inc.
BAP	bottom ash pond
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
FAP	fly ash pond
FGD	flue gas desulfurization
ft	feet
PTI	Permit to Install
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality

1. Objective

This report was prepared by ARCADIS U.S., Inc. (ARCADIS) for American Electric Power Service Corporation (AEP) to assess the location of the existing on-site Landfill relative to the location restrictions included in the Coal Combustion Residual (CCR) requirements, as specified in the Code of Federal Regulations (CFR) 40 CFR 257.60 to 257.64, at the AEP H.W. Pirkey Generating Plant (Plant) located at 2400 FM 3251 in Hallsville, Harrison County, Texas (**Figure 1**). The CCR requirements include an evaluation of the adequacy of the groundwater monitoring well network to characterize groundwater quality up and down gradient of the CCR unit and an evaluation of whether the CCR unit meets up to 5 location restrictions, which include: the base of the CCR unit is 5 feet (ft) above the uppermost aquifer, the CCR unit may not be located in a wetland, within 200 ft of the damage zone of a fault that has displacement during the Holocene, within a seismic impact zones, or in an unstable area. However, because the subject CCR unit for this report (Landfill) is an existing Landfill, this CCR unit is subject to one location restriction: unstable area.

Four regulated CCR units associated with the Plant were identified for review, which include the West Bottom Ash Pond (BAP), East BAP, Stack Out Area, and Landfill (**Figure 2**). This report summarizes the evaluation of the location restriction criteria at the existing Landfill (Site). The evaluation of the groundwater monitoring well network in the uppermost aquifer for the Landfill is not included in this report and will be completed under separate cover.

This evaluation included a review of AEP-provided data associated with previously completed subsurface investigation activities in the vicinity of the Landfill CCR unit, as well as publically-available geologic and hydrogeologic data. The following report also presents the current Conceptual Site Model based on documents reviewed and will further describe the uppermost aquifer.

2. Background Information

The following section provides background information for the AEP H.W. Pirkey Generating Plant Landfill.

2.1 Facility Location Description

The AEP H.W. Pirkey Plant is located in southern Harrison County, approximately 5 miles southeast of Hallsville, Texas, and approximately 8 miles southwest of Marshall, Texas. The Landfill CCR unit is located in the southwestern portion of the Plant, and approximately 400 feet west of Brandy Branch Reservoir (**Figures 1** and **2**).

2.2 Description of Landfill CCR Unit

The following section will discuss the embankment configuration, area, volume, construction and operational history, and surface water control associated with the Landfill.

2.2.1 Embankment Configuration

The Landfill was constructed in the southwestern portion of the Plant, and as shown on the U.S. Geological Survey 1983 topographic map (**Figure 1**), the southwestern portion of the Plant contained an unnamed intermittent tributary of Hatley Creek prior to Landfill construction in 1984. The Landfill was constructed within the unnamed tributary creek which had a bottom elevation ranging from approximately 290 feet amsl on the south side of the Landfill to 300 feet amsl on the north side of the Landfill. The native soil sidewalls of the tributary creek at the Landfill location have a maximum elevation of approximately 355 feet amsl. Therefore, as shown on Geologic Cross Section C-C' (**Figure 6**), the Landfill is partially incised within the tributary creek, and the tributary creek native soil sidewalls serve as a natural embankment for the lower portion of the Landfill.

The original Landfill design included emplacement of CCR materials in the Landfill with 3:1 slopes (3 feet horizontal, 1 foot vertical) with an approximate 10 foot wide bench for every 20 foot vertical rise of CCR material (VFL Technology Corporation, 1984). Apex Geoscience conducted a geotechnical investigation of the Landfill CCR materials in 2012, and concluded the CCR material embankments would be stable on 3:1 slopes (Apex Geoscience, 2013).

In addition to the Landfill CCR material embankments, earthen embankments are present around portions of the Landfill to control storm water flow. The earthen embankments are constructed using compacted clay on 3:1 slopes. ETTL Engineers & Consultants Inc (ETTL) conducted a geotechnical evaluation of the perimeter

embankments in 2005, and concluded the perimeter embankments would be stable on slopes no steeper than 3:1 unless the slopes are stabilized with geogrid reinforcement (ETTL, 2005).

The Landfill Stormwater Runoff Pond (non-CCR Unit) was constructed downslope (south) of the Landfill in 1993 and 1994. The Landfill Stormwater Runoff Pond has perimeter compacted soil embankments up to approximately 19 feet in height. Apex Geoscience conducted a geotechnical investigation of the Landfill Stormwater Runoff Pond embankments in 2011. Apex Geoscience recommended raising the elevation of the Landfill Stormwater Runoff Pond embankments to an elevation of 302 feet amsl using soils compacted to at least 95% standard proctor density, with an emergency spillway at a crest elevation of 298 feet amsl. The Apex Geoscience report concluded the Landfill Stormwater Runoff Pond embankments would be stable (Apex Geoscience, April 2011).

2.2.2 Area/Volume

The Landfill is approximately 130 acres in size and was designed to receive 12,207,000 cubic yards (7,566 acre feet) of CCR materials including fly ash, bottom ash, economizer ash, and stabilized FGD sludge (VFL Technology Corporation, 1984). The design maximum CCR material height in the Landfill is approximately 140 feet (Apex Geoscience, 2013).

2.2.3 Construction and Operational History

The H.W. Pirkey Power Plant was constructed in 1983 and 1984, and began operation in 1985. Throughout the life of the Plant, CCR materials (fly ash, bottom ash, economizer ash, stabilized FGD sludge) have been generated. The CCR materials that are not taken offsite for beneficial reuse are disposed of in the Landfill. The Landfill was constructed in several phases beginning with the northeast portion (Phase 1) in 1984. The Landfill was expanded (east-central portion) in 1985 and 1987. The Landfill was subsequently expanded to the west and south during the 1990's, including construction of the Landfill Stormwater Runoff Pond (non-CCR unit) directly south of the Landfill in 1993 and 1994. The Landfill was further expanded to the west between 2005 and 2015 to its current size of approximately 130 acres as shown on **Figure 3**.

In 2005, ETTL conducted a geotechnical evaluation of the Landfill and Landfill Stormwater Runoff Pond, including installation of 30 soil borings, ten cone penetration test (CPT) borings, and geotechnical testing of soil samples. The ETTL report concluded the Landfill CCR materials would be stable at 3:1 slopes; and foundation settlement would be within acceptable limits (ETTL, 2005). The ETTL report recommended that Landfill expansion activities include a composite liner system consisting of a 2-foot-thick compacted clay liner or geosynthetic clay liner (GCL) as the

bottom component; and a top liner component consisting of a PVC, high-density polyethylene (HDPE), or a very low density polyethylene (VLDPE) liner. ETTL also recommended Landfill expansion activities include installation of a Landfill leachate collection system consisting of permeable bottom ash emplaced above the Landfill liner. These recommendations were implemented during Landfill expansion phases.

2.2.4 Surface Water Control

Surface water in the area of the Landfill flows in a general southerly direction to the Landfill Stormwater Runoff Pond located directly south of the Landfill. The Landfill Stormwater Runoff Pond, which is approximately 16 acres in size, also receives Landfill leachate that is gravity drained from the Landfill via underground lateral perforated pipes and permeable bottom ash materials that were installed above portions of the Landfill liner. An emergency spillway is present at the southern end of the Landfill Stormwater Runoff Pond at an elevation of approximately 298 feet amsl. The top of the Landfill Stormwater Runoff Pond is located at an elevation of approximately 302 feet amsl, therefore the Landfill Stormwater Runoff Pond has approximately four feet of freeboard (Apex Geoscience, April 2011). Water in the Landfill Stormwater Runoff Pond discharges into an unnamed intermittent tributary of Hatley Creek via Outfall 004 in accordance with Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0002496000.

2.3 Previous Investigations

The initial soils investigation and design of the Plant was provided in a January 31, 1983 report prepared by Sargent & Lundy entitled "*Henry W. Pirkey Power Plant, Design Summary for Lignite Storage Area and Wastewater Pond Facilities*". This investigation included advancement of soil borings throughout the Plant, including the Landfill Area.

A soils investigation of the Landfill was conducted by Southwestern Laboratories in 1984. The investigation included installation of 45 soil borings and geotechnical analyses of soil samples. The report recommended installation of three feet of compacted clay as the bottom liner for the Landfill (Southwestern Laboratories, July 1984).

An engineering design report for the Landfill was prepared by VFL Technology Corporation in 1984. The Landfill design included a bottom compacted clay liner three feet in thickness, and Landfill side slopes of 3:1 (VFL Technology Corporation, 1984).

In 1985, Southwestern Laboratories conducted a geotechnical evaluation of the clay liner that was installed at the base of the Landfill, including installation of four soil borings and permeability testing of soil samples. The report concluded the clay liner

was three feet thick with a permeability less than 1 x 10^{-7} centimeters per second (cm/sec) (Southwestern Laboratories, 1985).

In 1993, Alliance Inc. conducted a geotechnical investigation of the clay liner installed at the base of the Landfill following a Landfill expansion phase in 1993. The report concluded the clay liner was three feet or more in thickness, and the clay liner met the permeability specifications of <1 x 10^{-7} cm/sec (Alliance Inc., 1993).

In 1995, Central and South West Services prepared design specifications for Landfill expansion to the west and south. The design specifications included a geosynthetic clay liner overlain by a 0.060 inch (60 mil) HDPE liner (Central and South West Services, 1995).

In 2005, ETTL conducted a geotechnical evaluation of the Landfill and Landfill Stormwater Runoff Pond, including installation of 30 soil borings, ten CPT borings, and geotechnical testing of soil samples. The geotechnical data was obtained to design Landfill expansions in 2005 through 2007. The ETTL report concluded the Landfill CCR materials would be stable at 3:1 slopes; and foundation settlement would be within acceptable limits (ETTL, 2005). The ETTL report recommended the Landfill expansion include a composite liner system consisting of a 2-foot-thick compacted clay liner or GCL as the bottom component; and a top liner component consisting of a PVC, HDPE, or a VLDPE liner. ETTL also recommended the Landfill expansion include a leachate collection system consisting of permeable bottom ash emplaced above the Landfill liner. These recommendations were implemented during Landfill expansion phases.

In 2010 and January 2011, Apex Geoscience expanded the groundwater monitoring well system at the Plant, including installation of monitoring wells AD-16 through AD-29. Apex Geoscience also conducted video surveillance of the existing monitoring wells and plugged monitoring wells MW-1, MW-5, MW-6, MW-9, MW-11, MW-14, MW-15, M-2, and M-3 (Apex Geoscience, March 2011).

In 2011, Apex Geoscience conducted a geotechnical investigation of the Landfill Stormwater Runoff Pond. The report recommended raising the elevation of the Landfill Stormwater Runoff Pond embankments to an elevation of 302 feet amsl using soils compacted to at least 95% standard proctor density, and an emergency spillway with a crest elevation of 298 feet amsl (Apex Geoscience, April 2011). These recommendations were implemented during subsequent Landfill Stormwater Runoff Pond construction activities.

In 2012, Apex Geoscience conducted a geotechnical investigation for Landfill expansion activities planned at the western portion of the Landfill where surface lignite mining operations had previously been conducted to a depth of 50 to 100 feet using a

dragline, and the spoils (reclaimed soil) were returned to the excavation. The report concluded the Landfill embankments would be stable with side slopes of 3:1 (Apex Geoscience, 2013).

In 2015, Auckland Consulting further expanded the groundwater monitoring well system at the Plant, including installation of monitoring wells AD-30 through AD-35 (Auckland Consulting, 2016).

2.4 Hydrogeologic Setting

The site area is located within the West Gulf Coastal Plain. Cretaceous formations crop out in belts that extend in a northeasterly direction parallel to the Gulf of Mexico, and dip gently southeast. The central and northern portions of the Plant are located on the outcrop of the Eocene-age Recklaw Formation. The Recklaw Formation consists predominantly of clay and fine grained sand, and attains a maximum thickness of approximately 100 feet (Broom, 1966).

The Recklaw Formation is underlain by the Eocene-age Carrizo Sand, which outcrops in the topographically low southern portion of the Site in the area of the Landfill Stormwater Runoff Pond. The Carrizo Sand consists of fine to medium grained sand interbedded with silt and clay, and attains a thickness of up to approximately 100 feet in Harrison county, Texas (Broom, 1966). As shown on Geologic Cross Sections C-C' (**Figure 6**) and D-D' (**Figure 7**), a thick sand stratum is located below and adjacent to the Landfill between an elevation of approximately 270 feet and 330 feet amsl. This sand stratum likely corresponds to the Carrizo Sand based on geologic maps of the Site area (Broom, 1966; Flawn, 1965).

The Carrizo Sand is underlain by the Eocene-age Wilcox Formation, which outcrops in topographically low areas near the Sabine River to the south and southeast of the Plant (Flawn, 1965). The Wilcox Formation consists of interbedded sand and clay with seams of lignite, and attains a thickness of approximately 700 feet (Broom, 1966). As shown on Geologic Cross Section D-D' (**Figure 7**), a lignite seam was encountered below an elevation of approximately 270 feet amsl during drilling of monitoring well AD-24 at the south end of the Site. This lignite seam likely corresponds to the top of the Wilcox Formation based on geologic maps of the Site area (Broom, 1966; Flawn, 1965).

These features are further illustrated on five lines of cross section that were prepared through the Landfill Area, with three lines trending from west to east (A-A'; B-B'; C-C'), and the other two lines trending from north to south (D-D'; E-E'). The cross section location map is included as **Figure 3** and the lines of cross section are included as **Figure 4** (A-A') through **Figure 8** (E-E').

2.4.1 Climate and Water Budget

Average temperatures in Harrison County, Texas range from 47.1° Fahrenheit (F) in January to 83.8°F in July, and the mean annual growing season is 238 days. Average annual precipitation (including liquid water equivalent from snowfall) is approximately 47 inches (Broom, 1966).

2.4.2 Regional and Local Geologic Setting

The central and northern portions of the Plant are located on the outcrop of the Eocene-age Recklaw Formation. The Recklaw Formation is underlain by the Eocene-age Carrizo Sand, which outcrops in the topographically low southern end of the Plant where the Landfill and Landfill Stormwater Runoff Pond are located (Broom, 1966; Flawn, 1965).

Detailed regional geologic characterization can be found in several published reports including Texas Water Development Report 27 "*Ground-Water Resources of Harrison County, Texas*" (Broom, 1966), The University of Texas at Austin Bureau of Economic Geology "*Geologic Atlas of Texas – Tyler Sheet*" (Flawn, 1965), and U.S. Geological Survey Open-File Report 88-450K "*Petroleum Geology and the Distribution of Conventional Crude Oil, Natural Gas, and Natural Gas Liquids, East Texas Basin*" (USGS, 1988).

Detailed regional and site geologic characterization can also be found in the 2010 ETTL report entitled "*Geotechnical Investigation, Pirkey Power Station, Existing Ash, Surge, Lignite and Limestone Runoff, and Landfill Stormwater Ponds Embankment Investigation, Hallsville, Texas*" (ETTL, 2010).

2.4.3 Surface Water and Surface Water Groundwater Interactions

Figure 9 is a potentiometric surface map based on January 2016 water level data for the uppermost water bearing unit at the Site, and water level elevations in the Site monitoring wells are summarized on **Table 1**. As shown on **Figure 9**, shallow groundwater flow direction in the Landfill area is southwesterly at an average hydraulic gradient of approximately 0.01 foot per foot.

The Landfill is located approximately 400 feet west of Brandy Branch Reservoir, which was dammed during Plant construction in the 1980's. The normal pool level of Brandy Branch Reservoir is approximately 340 feet amsl. As shown on **Figure 9**, shallow groundwater flow direction at the Site generally follows surface topography to the west and southwest toward Hatley Creek, which is located in a topographically low area approximately one mile west of the Site. Therefore shallow groundwater in the Landfill area does not discharge into Brandy Branch Reservoir. Brandy Branch Reservoir likely

recharges the uppermost water bearing unit in the southern portion of the Site, where the pool level in the Reservoir (340 feet amsl) is higher than water level elevations in monitoring wells located southwest (downslope) of the Reservoir.

2.4.4 Water Users

A water well inventory conducted by Banks Information Solutions showed 12 water wells had been drilled within a ½-mile radius of the Site (Banks, 2015). The nearest water well was reportedly drilled directly east of the Landfill in 2004 by Bennett Drilling for use as a rig supply well. The water well was screened from 330 to 426 feet below ground surface, therefore this water well is completed in a deeper water bearing unit relative to the uppermost water-bearing unit at the Site.

The second closest water well was reportedly drilled directly south of the Landfill by Amoco Production Company in 1991 for use as an oil field rig supply well. The water well was screened from 163 to 243 feet below ground surface, therefore this water well is completed in a deeper water bearing unit relative to the uppermost water-bearing unit at the Site.

The third closest water well was reportedly drilled approximately 200 feet southwest of the Landfill by Matador Operating in 2000 for use as an industrial well. The water well was screened from 340 to 420 feet below ground surface, therefore this water well is completed in a deeper water bearing unit relative to the uppermost water-bearing unit at the Site.

All of the water wells identified within a ½-mile radius of the Site were drilled to total depths of 160 feet or deeper except one water well (Well ID: 35-37-4E) that was drilled to a total depth of 55 feet in 1982. This water well was completed with concrete tile from the surface to total depth, and is located approximately ¼-mile east (up gradient) of the Pirkey Power Plant.

3. Unstable Areas

CCR Rule 40 CFR Part 257.64 requires that existing landfills must not be located within an unstable area unless the owner or operator demonstrates that the design of the unit will ensure the integrity of the structural components of the unit.

3.1 Definition of Unstable Area and local Conditions

3.1.1 CCR Rule Definition

CCR Rule 40 CFR Part 257.53 defines an unstable area as a location that is susceptible to natural or human-induced events or forces capable of impairing the

integrity of the CCR unit. These may include poor foundation conditions, areas susceptible to mass movements (landslides), and karst terrains.

3.1.2 Poor Foundation Soils

ETTL conducted a geotechnical investigation and foundation settlement evaluation of the Landfill foundation in 2005. The investigation included evaluation of the western portion of the Landfill where lignite mining operations previously occurred. The ETTL evaluation concluded the predicted Landfill settlement would not exceed approximately 4.3 feet and would not adversely affect the performance of the Landfill liner or leachate collection system, and the Landfill excavation, interim fill, and final cover would be stable on slopes of 3:1 or 4:1 (ETTL, 2005).

Apex Geoscience conducted a geotechnical investigation and foundation settlement evaluation of the Landfill in 2012, including advancement of two CPT borings in the western portion of the Landfill where lignite mining operations had previously occurred. The report predicted estimated settlement of 39.07 inches (3.26 feet) and concluded the Landfill would be stable with side slopes of 3:1 (Apex Geoscience, 2013).

3.1.3 Mass Movements

Geotechnical evaluations of the Landfill by ETTL in 2005 and Apex Geoscience in 2012 concluded that the Landfill would not be subject to mass movements that could impair the integrity of the Landfill based on the existing Landfill side slopes of 3:1 (ETTL, 2005; Apex Geoscience, 2013).

3.1.4 Karst

The site area is located on the outcrop of unconsolidated Cretaceous Formations consisting predominantly of sand and clay (Broom, 1966; Flawn, 1965). The Landfill is not located in a karst area.

3.1.5 Subsurface Mining

Naturally occurring lignite is present in portions of the Site area, and a naturally occurring lignite seam was identified at an elevation of approximately 270 feet amsl at monitoring well AD-24 as shown on Geologic Cross Section D-D' (**Figure 7**). The Texas Water Development Board Ground-Water Resources Report for Harrison County, Texas, states that the Wilcox Formation, which underlies the Carrizo Sand, contains lignite (Broom, 1966).

Lignite mining operations using a drag line had occurred in the western portion of the Landfill prior to Landfill construction in this area (VFL Technology Corporation, 1984).

The drag line mining method is a surface mining method. A geotechnical evaluation of the previously mined western portion of the Landfill was conducted by ETTL in 2005. The ETTL report indicated the western portion of the Landfill had been mined in the past to a depth of 50 to 100 feet using a dragline, and the spoils (reclaimed soil) were returned to the excavation. The geotechnical evaluation included installation of 30 soil borings, ten CPT borings, and geotechnical testing of soil samples. The ETTL report concluded the Landfill would be stable based on the Landfill liner system (compacted clay or GCL overlain by HDPE or VLDPE), leachate drainage system (lateral underdrain consisting of permeable bottom ash), and Landfill side slopes no steeper than 3:1 (ETTL, 2005).

3.2 Compliance with Unstable Areas Restriction

Based on our August 19, 2015 site visit and review of available information, including the 2005 geotechnical evaluation of the Landfill by ETTL, and the 2012 geotechnical evaluation of the Landfill by Apex Geoscience, this CCR unit complies with the requirement for not being located in an unstable area.

4. Summary, Conclusions, and PE Certification

I, Kenneth J. Brandner, certify that this report was prepared under my direction and supervision, and that the information contained herein is true and accurate to the best of my knowledge. Based on my experience and knowledge of the site, as well as the evaluations discussed within this report, the H.W. Pirkey Power Plant Landfill complies with the requirements of the location restrictions sections of 40 CFR 257 Subpart D that apply to existing landfills and therefore the CCR unit is not located in a restricted location.

Kenneth J. Brandner
Printed Name of Registered Professional Engineer

Kenneth J Brandner
Signature

69586	Texas	7-6-16
Registration No.	Registration State	Date

5. References

Alliance, Inc., "Henry W. Pirkey Power Plant Sludge Disposal Area Expansion, Phase I, Section IV", September 1993.

AMEC, "Report of Dam Safety Assessment of Coal Combustion Surface Impoundments, American Electric Power (AEP) and Southwest Electric Power Company (SWEPCO) H.W. Pirkey Power Plant, Hallsville, TX", August 2011.

Apex Geoscience Inc., "USWAG Monitoring Wells and Groundwater Evaluation, AEP Pirkey Power Station, Hallsville, Texas", March 2011.

Apex Geoscience Inc., "Geotechnical Investigation, Landfill Sedimentation Pond – Expansion, AEP/Pirkey Power Station, Hallsville, Texas", April 2011.

Apex Geoscience Inc., "Geotechnical Evaluation, Pirkey Power Station – Sludge Disposal Area, 2015 Expansion Phase – Addendum No. 2, Hallsville, Texas", November 27, 2012 (Revised January 17, 2013).

Auckland Consulting LLC, "Monitoring Well Installation – 2015, Pirkey Generating Station, Hallsville, Texas", January 26, 2016.

Banks Information Solutions, "Water Well Report, Pirkey Power Plant, 2400 FM 3251, Hallsville, Texas, Harrison County", October 8, 2015.

Broom, M.E., and B. N. Myers, "Ground-Water Resources of Harrison County, Texas", Texas Water Development Board Report 27, August 1966.

Central and South West Services, Inc., "Coal Fly Ash/Flue Gas Desulfurization Material Landfill, Pirkey Power Station, Harrision County, Texas", June 8, 1995.

ETTL Engineers & Consultants Inc., "Geology and Geotechnical Report, Henry W. Pirkey Power Plant Sludge Disposal Area, 2005 and 2007 Expansion Phase, Harrison County, Texas", March 2005.

ETTL Engineers & Consultants Inc., "Geotechnical Investigation, Pirkey Power Station, Existing Ash, Surge, Lignite and Limestone Runoff, and Landfill Stormwater Ponds Embankment Investigation, Hallsville, Texas", October 2010.

Fetter, C.W., "Applied Hydrogeology", University of Wisconsin – Oshkosh, 1980.

Flawn, Peter T., "Geologic Atlas of Texas, Tyler Sheet", The University of Texas at Austin Bureau of Economic Geology, March 1965.

George, Peter G., et. al., "Aquifers of Texas", Texas Water Development Board Report 380, July 2011.

Johnson & Pace Incorporated, "Lignite Pond and Landfill Runoff Pond Berm Plan & Profile", March 2010.

Johnson & Pace Incorporated, "Hydrology & Hydraulic Report, North Surge Pond, East & West Ash Ponds, Secondary Ash Pond, Landfill Pond, H.W. Pirkey Power Plant, Hallsville, Texas", May 2011.

Johnson & Pace Incorporated, "East Bottom Ash Pond June 2011 As-Built Plan & Profile, H.W. Pirkey Power Plant, Hallsville, Texas", June 2011.

Sargent & Lundy, "Henry W. Pirkey Power Plant, Design Summary for Lignite Storage Area and Wastewater Pond Facilities", January 31, 1983.

Sargent & Lundy, "Henry W. Pirkey Power Plant Unit 1, Wastewater Ponds – Liner Verification & Monitoring Wells", September 14, 1984.

Southwestern Laboratories, "Subsurface Exploration for Section 1 Phase 1 of Sludge Disposal Area, Henry W. Pirkey Power Plant", July 1984.

Southwestern Laboratories, "Subsurface Exploration, Waste Water Ponds, Pirkey Power Plant, Hallsville, Texas", September 7, 1984.

Southwestern Laboratories, "Liner Verification, Sludge Disposal Area, Pirkey Power Plant", April 18, 1985.

Texas Commission on Environmental Quality, "Groundwater Classification, RG-366/TRRP-8", March 2010.

USGS, Aquifers and Groundwater. 2015. Available online at www.usgs.gov.

USGS, "Petroleum Geology and the Distribution of Conventional Crude Oil, Natural Gas, and Natural Gas Liquids, East Texas Basin", Open-File Report 88-450K, 1988.

USGS, "Texas Seismic Hazard Map", 2014.

VFL Technology Corporation, "Engineering Design and Operations Report, Pirkey Station Solid Waste Disposal Site", November 1, 1984.

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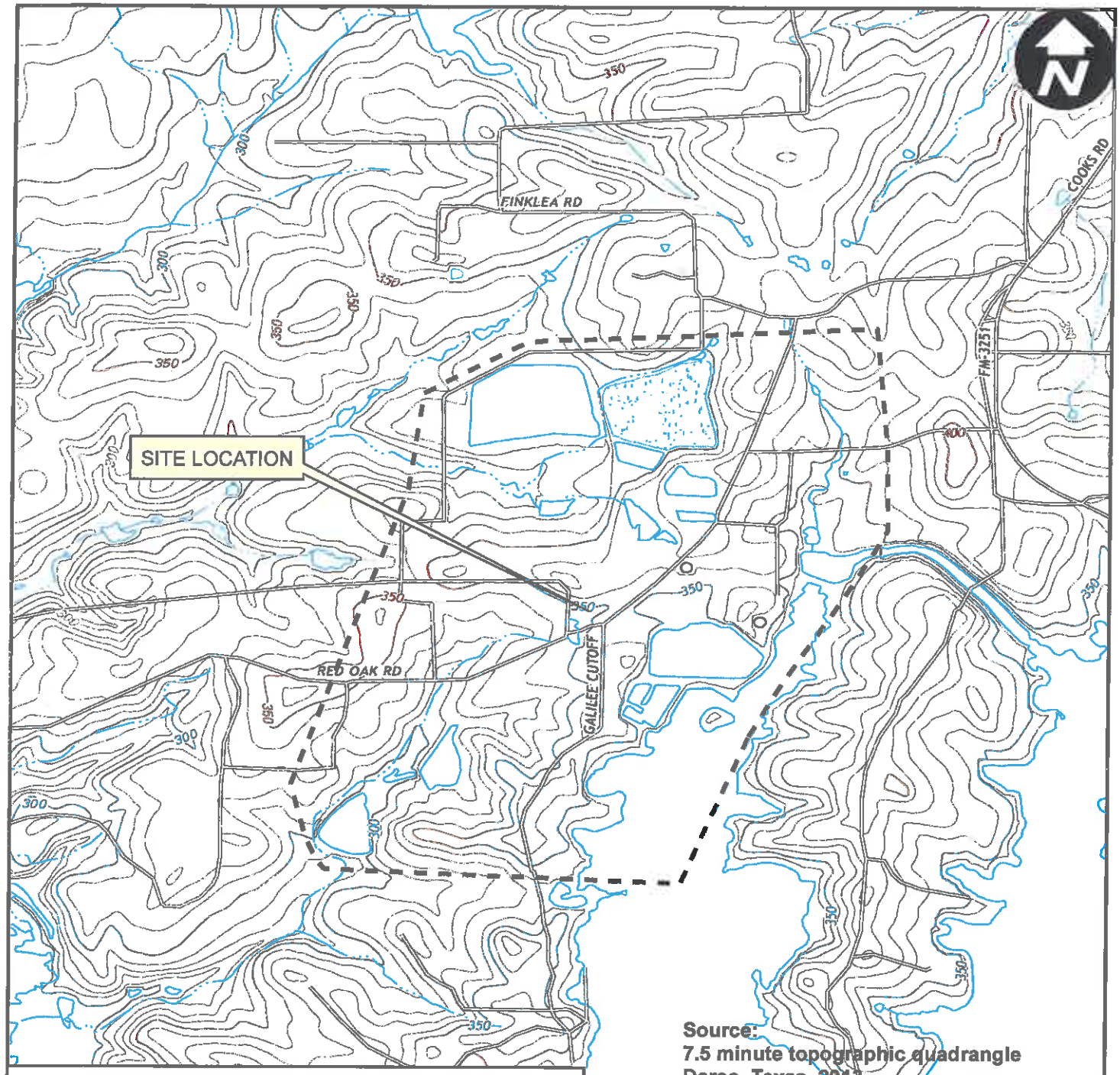
Table 1
Water Level Data
AEP Pirkey Power Plant - CCR Storage Areas
Hallsville, Harrison County, Texas

Well ID	Latitude	Longitude	Ground Surface Elevation[a]	Top of Casing Elevation[a]	Borehole depth ft. bls	Date Installed	Screen Material	Well diameter inches	Top of Screen[b]		Bottom of Screen[b]		4/13/2011	12/15/2011	6/20/2012	1/23/2013	7/7/2013	1/22/2014	7/9/2014	1/28/2015	1/20/2016
									Depth ft. bls	Elevation ft. msl	Depth ft. bls	Elevation ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl
Monitoring Wells																					
MW-2/AD-2	32° 27' 54.753"	94° 29' 25.282"	341.25	344.04	40	10/7/83	Sch. 40 PVC	4	20	321.25	40	301.25	326.90	327.12	327.17	327.26	326.62	327.70	327.19	328.62	328.55
MW-3/AD-3	32° 28' 6.829"	94° 29' 21.498"	372.76	375.30	57	11/4/83	Sch. 40 PVC	4	37	335.76	57	315.76	342.95	341.59	343.70	341.10	343.27	341.42	343.96	345.01	347.03
MW-4/AD-4	32° 27' 59.247"	94° 29' 4.692"	363.69	366.79	46	10/10/83	Sch. 40 PVC	4	26	337.69	46	317.69	351.45	351.24	352.44	354.42	349.22	355.58	353.33	359.00	359.16
MW-7/AD-7	32° 27' 43.611"	94° 29' 15.611"	359.61	362.79	40	10/3/83	Sch. 40 PVC	4	20	339.61	40	319.61	344.34	343.75	344.15	344.90	343.35	346.61	346.23	349.17	349.31
MW-8/AD-8	32° 27' 25.095"	94° 29' 14.925"	356.92	359.84	35	10/4/83	Sch. 40 PVC	4	20	336.92	35	321.92	341.65	340.29	341.65	340.72	341.25	341.67	343.36	344.03	347.21
MW-10/AD-10	32° 27' 52.446"	94° 29' 16.545"	359.48	362.21	40	10/10/83	Sch. 40 PVC	4	20	339.48	40	319.48	342.03	341.90	342.19	341.41	339.85	342.27	342.22	344.39	343.97
MW-12/AD-12	32° 27' 51.702"	94° 29' 3.238"	378.84	381.99	51	1/30/86	Sch. 40 PVC	4	31	347.84	51	327.84	358.95	357.99	359.33	368.07	357.41	369.97	367.04	372.75	371.05
MW-13/AD-13	32° 27' 46.002"	94° 29' 5.71"	361.98	364.76	40.5	2/23/88	Sch. 40 PVC	4	30.5	331.48	40.5	321.48	349.46	348.91	349.52	350.81	348.61	351.97	351.29	354.47	354.15
AD-16	32° 27' 40.871"	94° 29' 38.637"	356.81	360.05	35	12/30/10	Sch. 40 PVC	2	15.0	341.81	35.0	321.81	338.08	335.50	337.58	335.43	336.67	339.53	340.84	343.34	347.68
AD-17	32° 28' 2.315"	94° 29' 39.45"	342.65	346.09	30	12/30/10	Sch. 40 PVC	2	10.0	332.65	30.0	312.65	322.66	322.29	323.31	323.51	323.06	325.19	324.15	328.42	326.78
AD-18	32° 28' 9.245"	94° 29' 6.469"	360.48	363.42	25	1/3/11	Sch. 40 PVC	2	15.0	345.48	25.0	335.48	355.53	351.54	357.21	355.47	357.23	360.03	358.06	359.88	360.52
AD-19	32° 27' 50.512"	94° 29' 13.973"	359.50	362.82	30	12/30/10	Sch. 40 PVC	2	10.0	349.50	30.0	329.50	344.07	343.58	344.29	344.62	342.60	345.11	345.76	347.92	347.40
AD-20	32° 27' 51.346"	94° 29' 21.576"	352.30	355.79	35	12/28/10	Sch. 40 PVC	2	15.0	337.30	35.0	317.30	334.50	334.63	334.69	334.78	333.38	335.38	334.87	336.88	336.07
AD-21	32° 27' 45.403"	94° 29' 19.195"	347.23	350.72	30	12/27/10	Sch. 40 PVC	2	10.0	337.23	30.0	317.23	340.43	340.02	340.22	341.57	339.16	342.36	341.67	345.45	343.82
AD-22	32° 27' 41.349"	94° 29' 17.779"	355.57	358.51	30	12/16/10	Sch. 40 PVC	2	10.0	345.57	30.0	325.57	343.64	343.16	343.74	344.83	342.90	346.49	345.77	350.24	350.29
AD-23	32° 27' 3.384"	94° 29' 41.258"	346.72	350.10	35	12/15/10	Sch. 40 PVC	2	15.0	331.72	35.0	311.72	319.65	318.94	319.29	318.66	318.87	319.80	319.79	319.84	321.23
AD-24	32° 27' 1.455"	94° 29' 56.388"	287.68	291.14	20	12/27/10	Sch. 40 PVC	2	5.0	282.68	20.0	267.68	282.92	284.29	285.10	285.63	285.06	288.30	287.10	288.56	---
AD-25	32° 27' 17.187"	94° 29' 58.998"	334.15	337.09	30	12/14/10	Sch. 40 PVC	2	10.0	324.15	30.0	304.15	324.51	321.90	323.14	321.94	322.15	322.56	324.24	326.42	327.00
AD-26	32° 27' 25.426"	94° 29' 54.775"	342.41	345.25	40	12/14/10	Sch. 40 PVC	2	10.0	332.41	40.0	302.41	324.53	323.77	323.62	322.32	322.09	323.24	322.51	323.04	326.06
AD-27	32° 27' 36.66"	94° 29' 47.272"	349.83	352.62	37.5	12/15/10	Sch. 40 PVC	2	17.5	332.33	37.5	312.33	325.82	324.54	326.13	325.39	325.35	326.39	327.91	329.69	330.89
AD-28	32° 27' 55.439"	94° 29' 39.418"	335.92	339.40	40	12/28/10	Sch. 40 PVC	2	15.0	320.92	35.0	300.92	319.67	319.16	319.92	320.21	319.69	320.65	320.22	322.16	321.39
AD-29	32° 28' 8.271"	94° 29' 31.939"	350.21	353.37	30	1/3/11	Sch. 40 PVC	2	10.0	340.21	30.0	320.21	334.68	333.37	334.74	337.47	336.84	338.55	335.85	340.57	338.48
AD-30[d]	32° 27' 56.49"	94° 29' 32.53"	339.04	342.02	25	12/8/15	Sch. 40 PVC	2	10.0	329.04	25.0	314.04	---	---	---	---	---	---	---	---	323.70
AD-31[d]	32° 28' 02.48"	94° 29' 20.90"	357.75	360.75	35	12/8/15	Sch. 40 PVC	2	20.0	337.75	35.0	322.75	---	---	---	---	---	---	---	---	346.60
AD-32[d]	32° 27' 56.20"	94° 29' 11.86"	357.23	359.18	33	12/11/15	Sch. 40 PVC	2	13.0	344.23	33.0	324.23	---	---	---	---	---	---	---	---	352.32
AD-33[d]	32° 27' 38.70"	94° 29' 15.82"	359.30	362.37	30	12/11/15	Sch. 40 PVC	2	15.0	344.30	30.0	329.30	---	---	---	---	---	---	---	---	351.13
AD-34[d]	32° 27' 10.13"	94° 29' 57.93"	304.64	307.61	25	12/11/15	Sch. 40 PVC	2	10.0	294.64	25.0	279.64	---	---	---	---	---	---	---	---	307.61
AD-35[d]	32° 27' 09.64"	94° 29' 42.74"	316.01	318.95	20	12/11/15	Sch. 40 PVC	2	3.0	313.01	18.0	298.01	---	---	---	---	---	---	---	---	309.85
Piezometers[c]																					
W-3 (PW-3)	32° 27' 57.6"	94° 29' 31.8"	356.30	356.30	38	10/20/09	Sch. 40 PVC	2	28.0	328.30	38.0	318.30	NM	NM	NM	NM	NM	NM	NM	NM	NM

(a) Source: Apex Geoscience Inc. (March 23, 2011).
(b) Screen length and screened intervals for AD-2 through AD-12 estimated from video surveillance (Apex Geoscience Inc., March 23, 2011).
(c) Souce: EETL (October 2010).
(d) Source: Auckland Consulting LLC (January 26, 2016). Monitoring wells AD-30 through AD-35 installed during December 2015.
Groundwater Elevation Source: AEP, Pirkey Monitoring Well Groundwater Elevations through January 2015.
NM - Not Measured



PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

SITE LOCATION MAP

ARCADIS

FIGURE
1

Document Path: Z:\GISPROJECTS_ENVAEP\Pirkey Plant\MXD\Figure 1 - Site Location Map.mxd

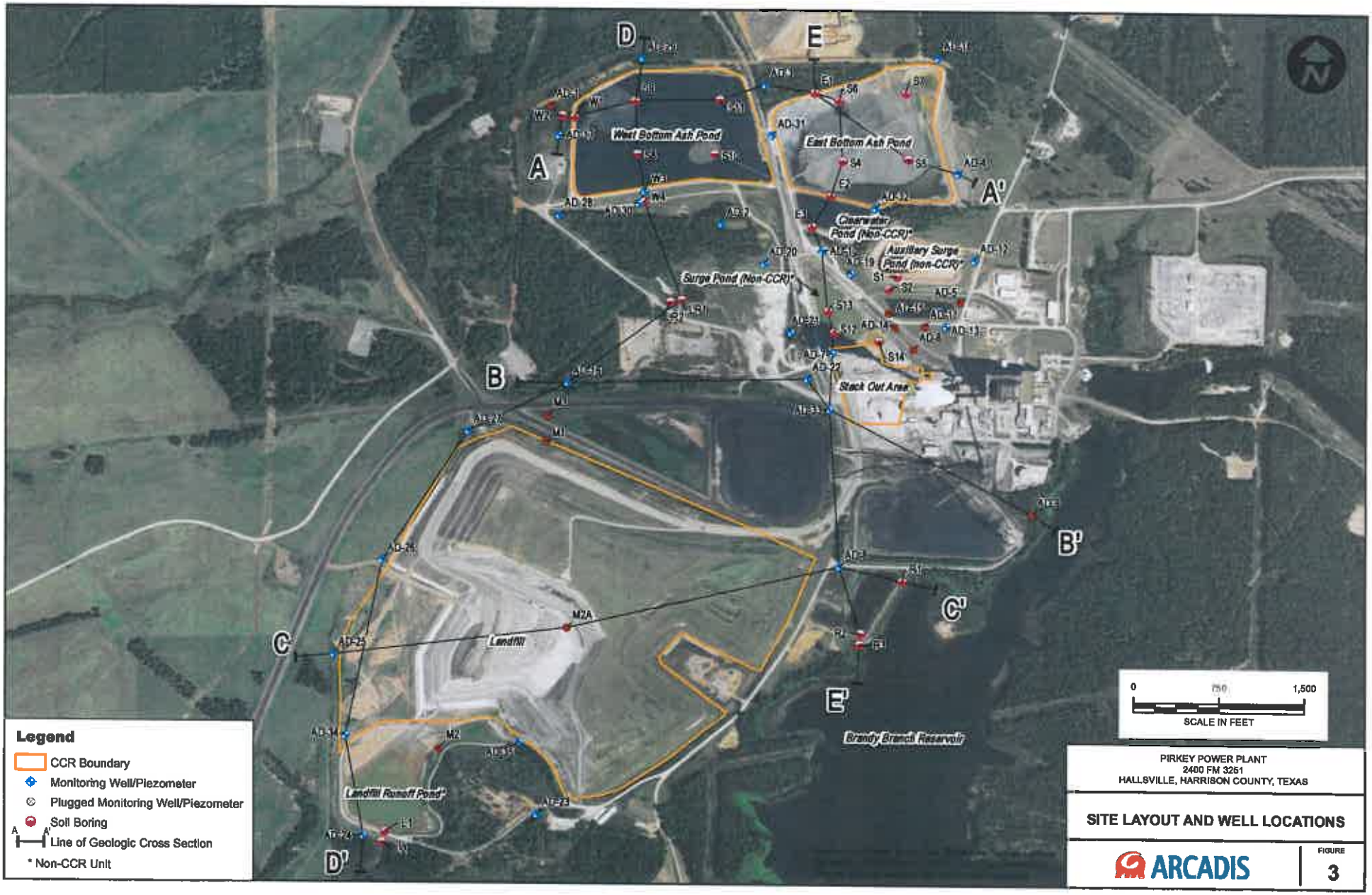
PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

PLANT AND CCR UNIT LOCATION MAP

ARCADIS

FIGURE 2

Document Path: Z:\GIS\PROJECTS_ENVIAEP\Pirkey Plant\MXD\Figure 2 - Plant and CCR Unit Location Map.mxd



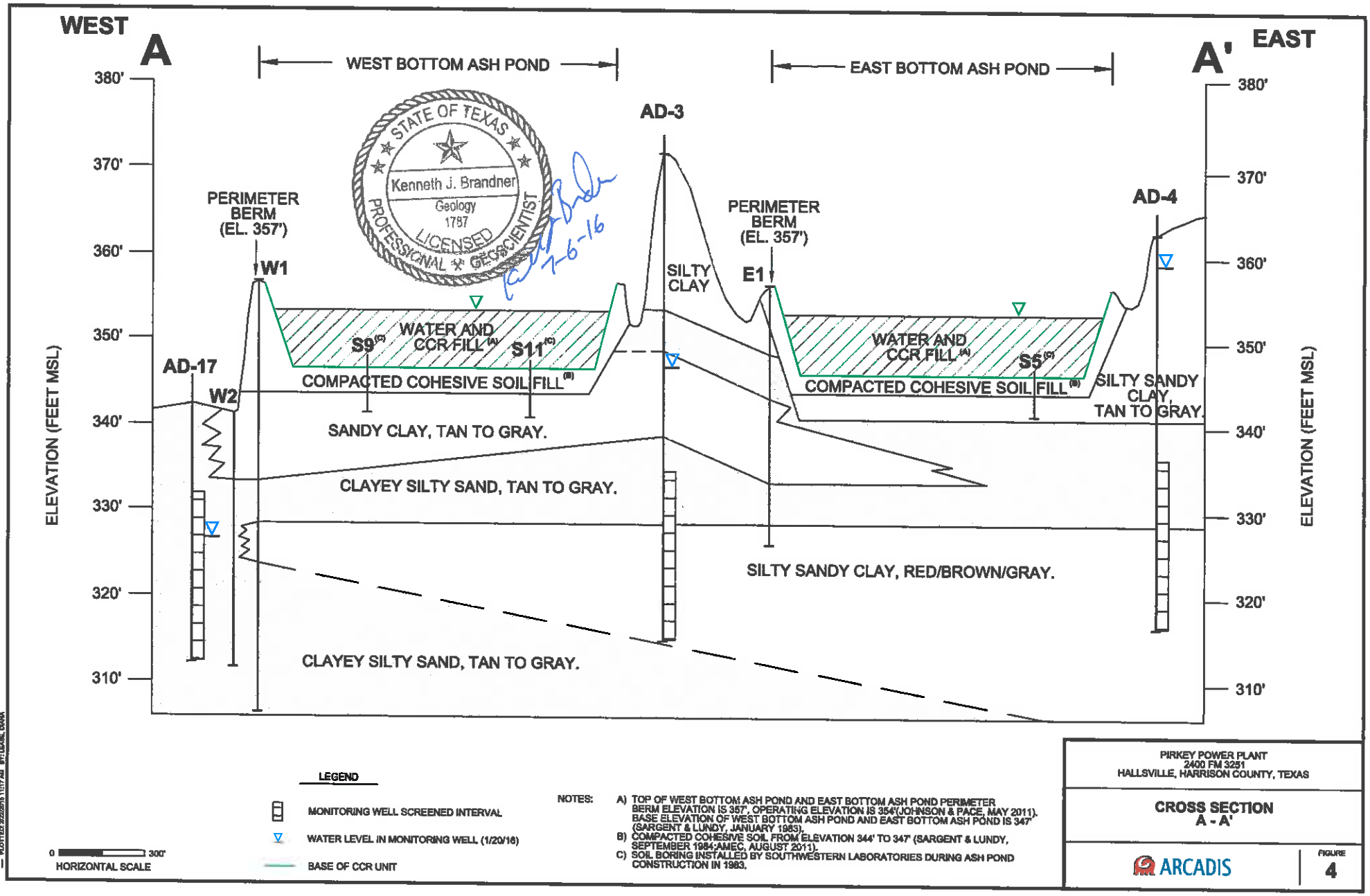
PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

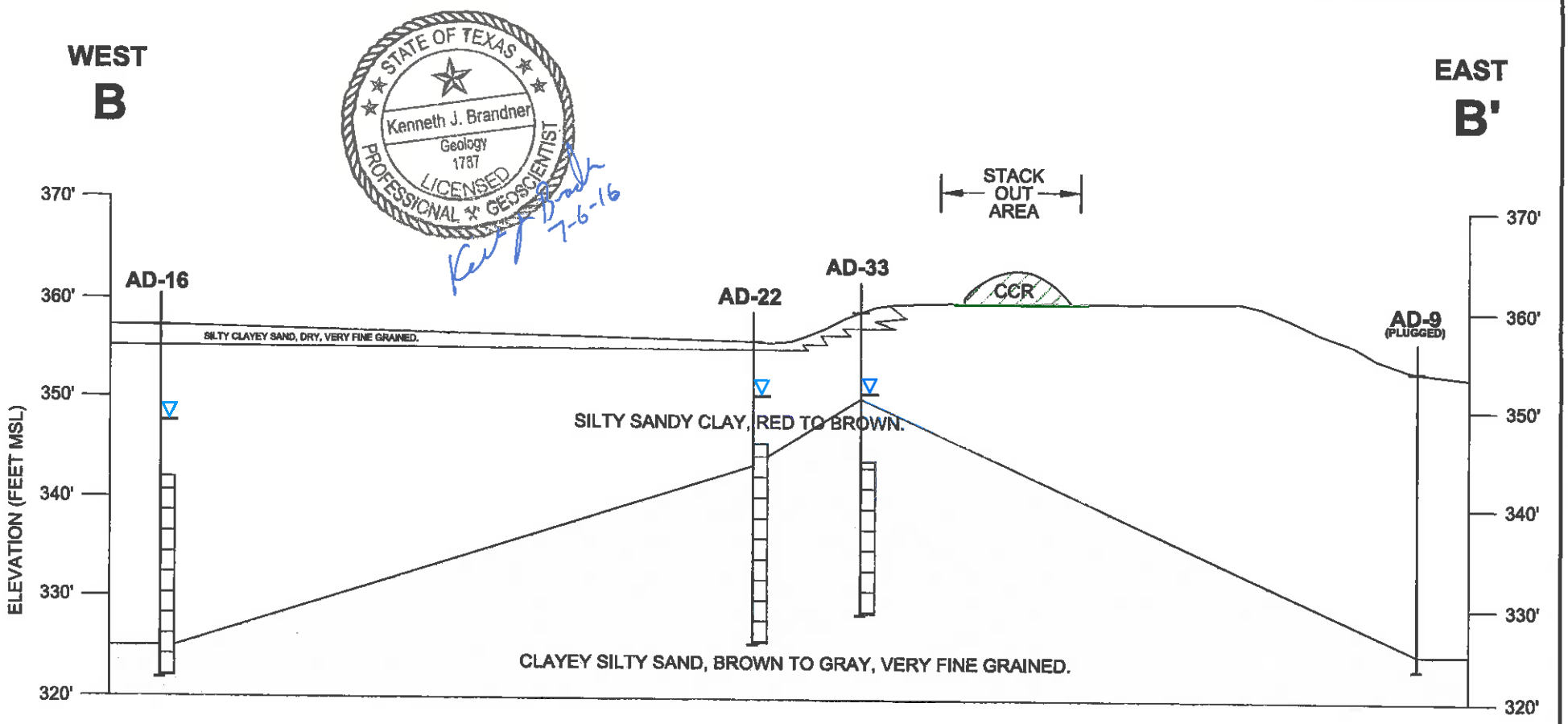
SITE LAYOUT AND WELL LOCATIONS

ARCADIS

FIGURE 3

Document Path: Z:\GIS\PROJECTS_ENVI\AEP\Pirkey Plant\MXD\Figure 3 - Site Layout and Well Locations.mxd


WEST
A
A'
EAST
WEST BOTTOM ASH POND
EAST BOTTOM ASH POND
380'
370'
360'
350'
340'
330'
320'
310'
ELEVATION (FEET MSL)
PERIMETER BERM (EL. 357')
W1
W2
E1
AD-17
AD-3
AD-4
SILTY CLAY
WATER AND CCR FILL (A)
S9 (C)
S11 (C)
S5 (C)
COMPACTED COHESIVE SOIL FILL (B)
SANDY CLAY, TAN TO GRAY.
CLAYEY SILTY SAND, TAN TO GRAY.
SILTY SANDY CLAY, TAN TO GRAY.
SILTY SANDY CLAY, RED/BROWN/GRAY.
CLAYEY SILTY SAND, TAN TO GRAY.
STATE OF TEXAS
Kenneth J. Brandner
Geology
1787
LICENSED
PROFESSIONAL GEOSCIENTIST
7-6-16
LEGEND
MONITORING WELL SCREENED INTERVAL
WATER LEVEL IN MONITORING WELL (1/20/16)
BASE OF CCR UNIT
0
300'
HORIZONTAL SCALE
NOTES:
A) TOP OF WEST BOTTOM ASH POND AND EAST BOTTOM ASH POND PERIMETER BERM ELEVATION IS 357'. OPERATING ELEVATION IS 354'(JOHNSON & PACE, MAY 2011). BASE ELEVATION OF WEST BOTTOM ASH POND AND EAST BOTTOM ASH POND IS 347' (SARGENT & LUNDY, JANUARY 1983).
B) COMPACTED COHESIVE SOIL FROM ELEVATION 344' TO 347' (SARGENT & LUNDY, SEPTEMBER 1984;AMEC, AUGUST 2011).
C) SOIL BORING INSTALLED BY SOUTHWESTERN LABORATORIES DURING ASH POND CONSTRUCTION IN 1983.
PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS
CROSS SECTION
A - A'
ARCADIS
FIGURE
4



LEGEND

- MONITORING WELL SCREENED INTERVAL
- WATER LEVEL IN MONITORING WELL (1/20/16)
- BASE OF CCR UNIT

0 300'
HORIZONTAL SCALE

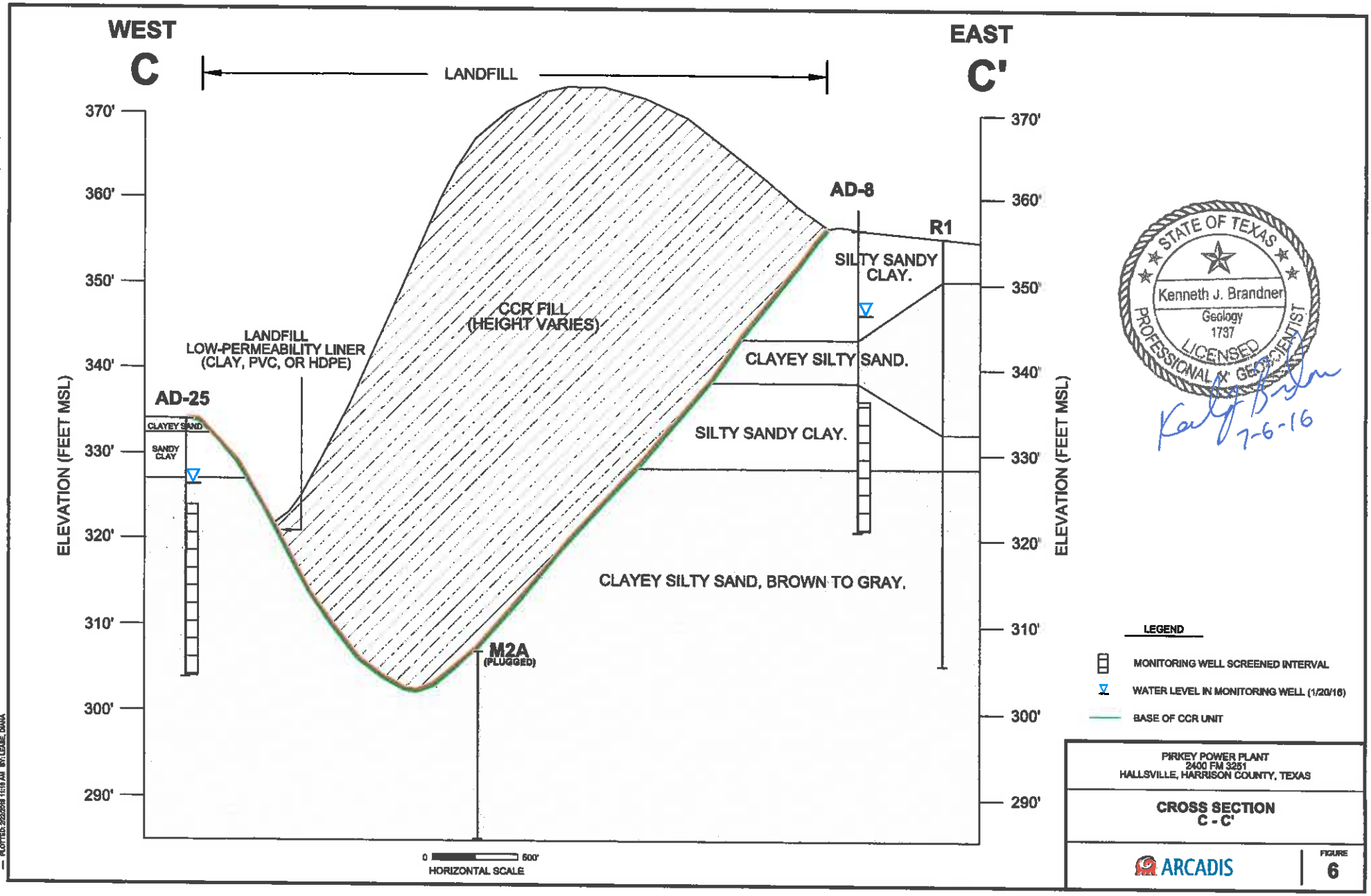
NOTES:
A) BASE OF STACK OUT AREA CCR UNIT LOCATED AT GRADE, ELEVATION TAKEN FROM MAY 2012 AND JUNE 23, 2015 TOPOGRAPHIC SURVEYS BY BEACON AVIATION.
B) ELEVATION OF CCR MATERIAL ABOVE STACK OUT AREA VARIES.

PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

CROSS SECTION
B - B'

ARCADIS

FIGURE
5



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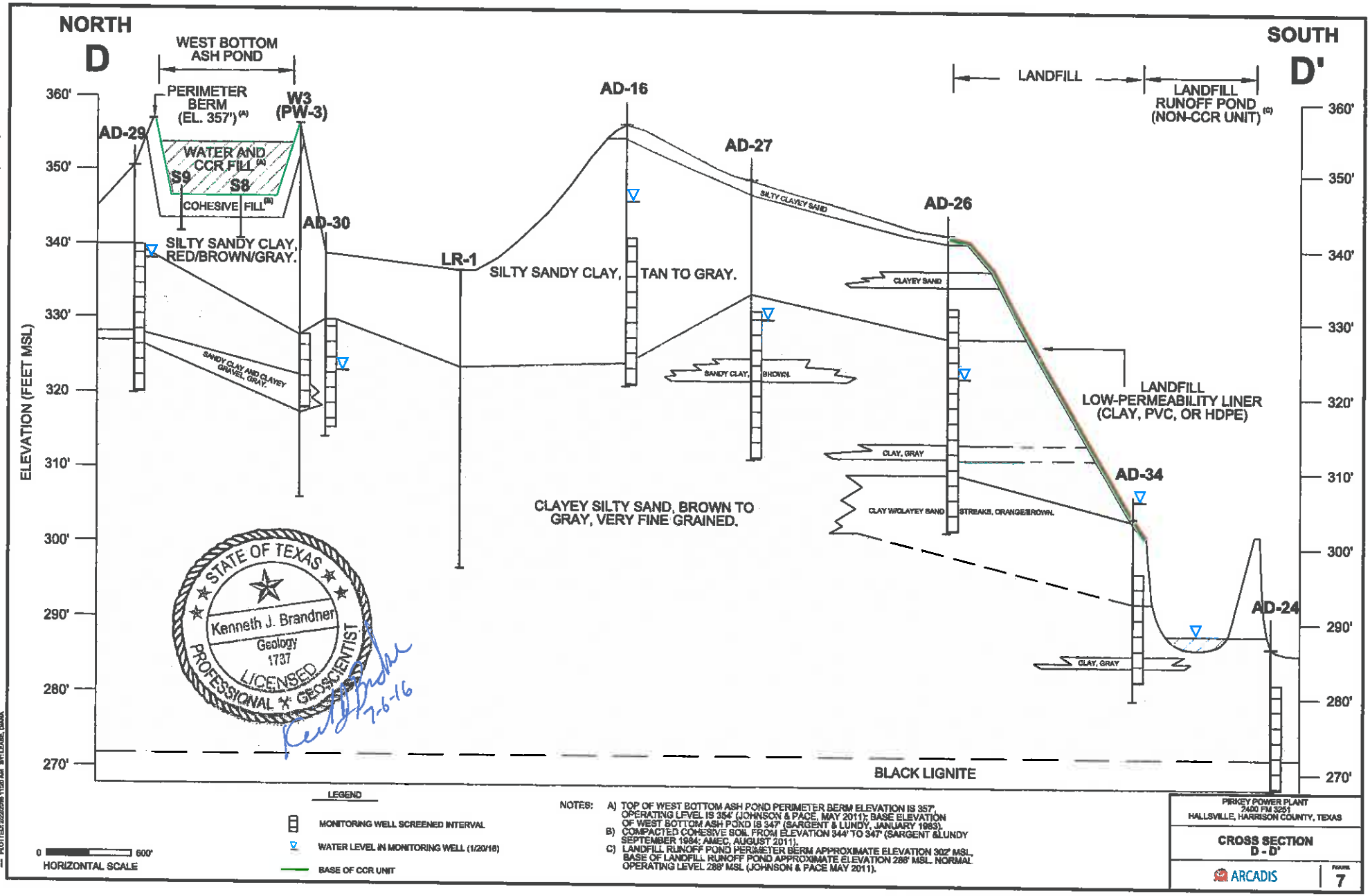
PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

CROSS SECTION
C - C'

ARCADIS

FIGURE
6



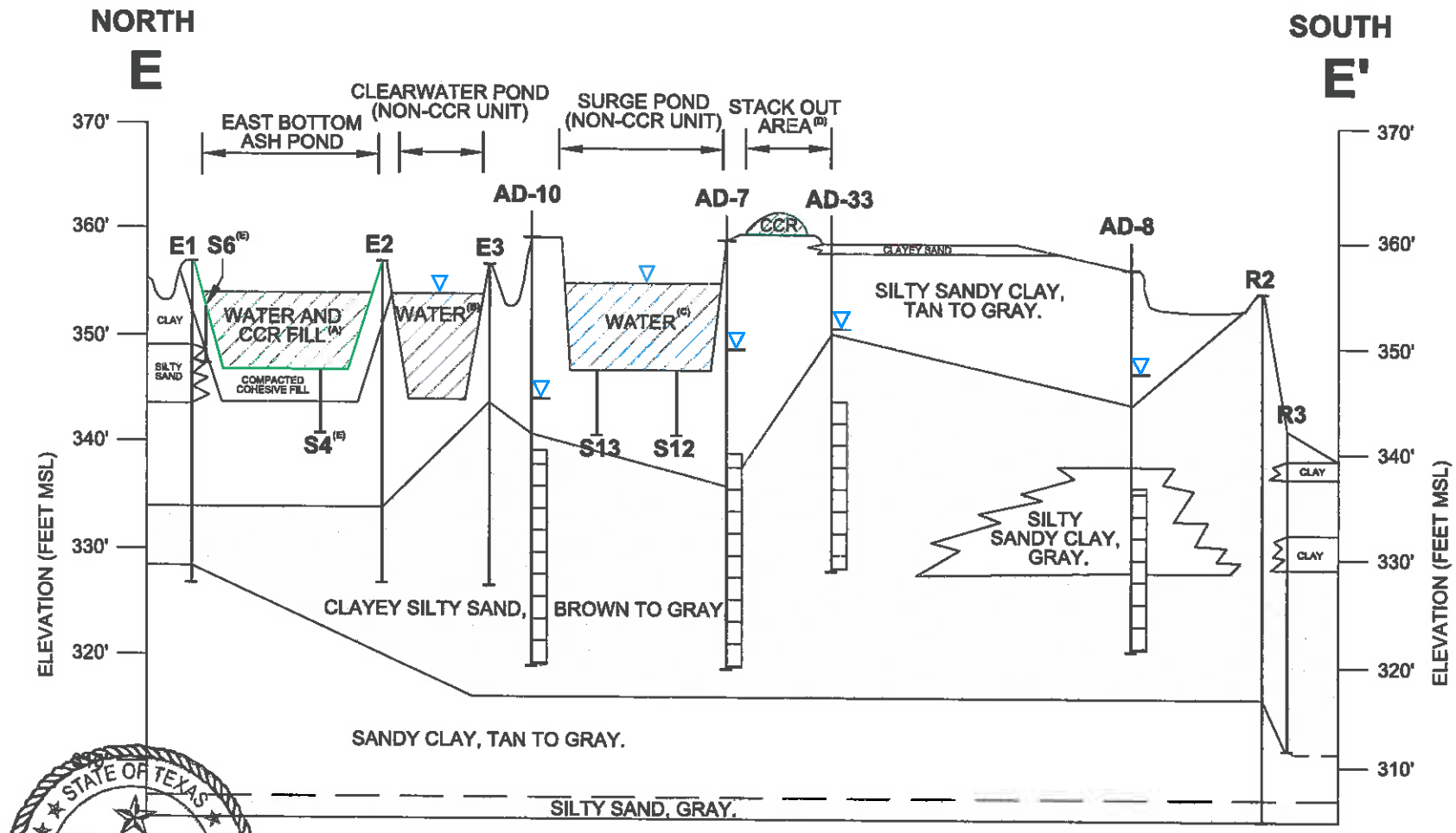
NOTES:
A) TOP OF WEST BOTTOM ASH POND PERIMETER BERM ELEVATION IS 357'. OPERATING LEVEL IS 354' (JOHNSON & PACE, MAY 2011); BASE ELEVATION OF WEST BOTTOM ASH POND IS 347' (SARGENT & LUNDY, JANUARY 1993).
B) COMPACTED COHESIVE SOIL FROM ELEVATION 344' TO 347' (SARGENT &LUNDY SEPTEMBER 1994; AMEC, AUGUST 2011).
C) LANDFILL RUNOFF POND PERIMETER BERM APPROXIMATE ELEVATION 302' MSL. BASE OF LANDFILL RUNOFF POND APPROXIMATE ELEVATION 286' MSL. NORMAL OPERATING LEVEL 289' MSL (JOHNSON & PACE MAY 2011).

PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

CROSS SECTION
D - D'

ARCADIS

FIGURE 7



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7-6-16

0 500'
HORIZONTAL SCALE

LEGEND

- MONITORING WELL SCREENED INTERVAL
- WATER LEVEL IN MONITORING WELL (1/20/16)
- BASE OF CCR UNIT

NOTES:

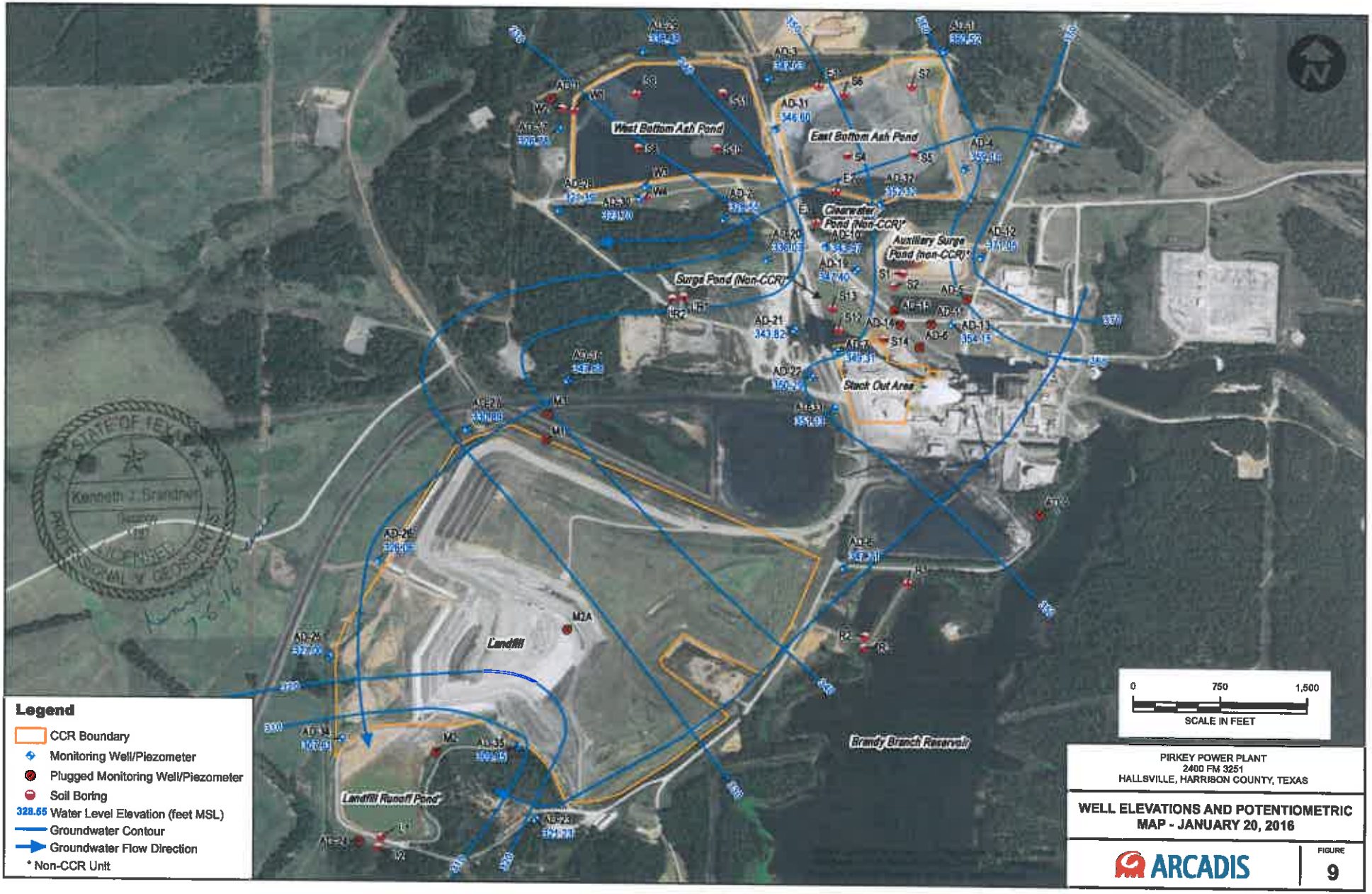
A) TOP OF EAST BOTTOM ASH POND PERIMETER BERM ELEVATION IS 357', OPERATING LEVEL IS 354' (JOHNSON & PACE, MAY 2011); BASE ELEVATION OF EAST BOTTOM ASH POND IS 347' (SARGENT & LUNDY, JANUARY 1983).
B) TOP OF CLEARWATER POND PERIMETER BERM ELEVATION IS 357',OPERATING LEVEL IS 354' (JOHNSON & PACE, MAY 2011). BASE ELEVATION OF CLEARWATER POND IS 344' (SARGENT & LUNDY, JANUARY 1983).
C) BASE ELEVATION OF SURGE POND (347-352'MSL) AND POND DESIGN LEVEL (355'MSL) TAKEN FROM JANUARY 31, 1983 SARGENT & LUNDY REPORT "DESIGN SUMMARY FOR LIGNITE STORAGE AREA AND WASTEWATER POND FACILITIES".
D) BASE OF STACK OUT AREA CCR UNIT LOCATED AT GRADE. ELEVATION TAKEN FROM MAY 2012 AND JUNE 23, 2015 TOPOGRAPHIC SURVEYS BY BEACON AVIATION.
E) SOIL BORING INSTALLED BY SOUTHWESTERN LABORATORIES DURING ASH POND CONSTRUCTION IN 1983.

PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

CROSS SECTION
E - E'

ARCADIS

FIGURE
8



Document Path: Z:\GIS\PROJECTS_ENVIAEP\Pirkey Plant\MXD\[Figure 9 - Well Elevations and Potentiometric Map - January 20, 2016.mxd

Appendix A

Boring/Well Construction Logs

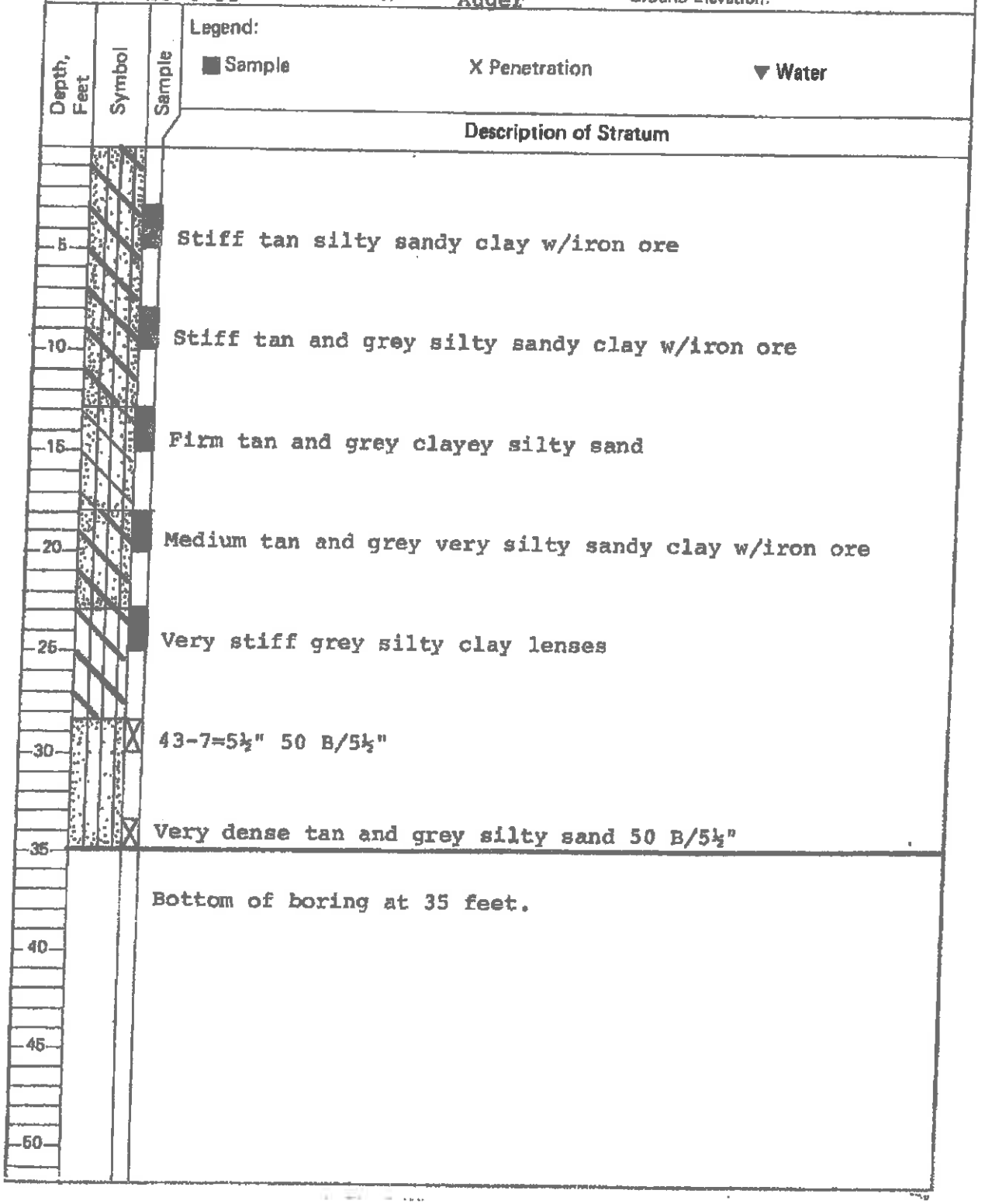
832964

LOG OF BORING

PROJECT: Waste Water Ponds
CLIENT: SWEPCO

BORING NO.: MW-8
LOCATION: Hallsville

Date: 10-4-83 Type: Auger Ground Elevation:



APEX PROJECT NO.: 110-089 ☐ BORING BORING NUMBER: ____ ■ MONITOR WELL MONITOR WELL NUMBER: AD-16

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/30/2010

PREPARED BY: Jeff Sammons LOGGED BY: Matt Lyon/Jeff Sammons

LATTITUDE: N 32°27.660' Datum: WGS-84 WELL LOCATION: North of Mine Haul Road
LONGITUDE: W94°29.642'

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1 2				0-2 SM	Silty sand, very fine grained, light brown	None	Dry
3 4 5 6 7 8				2-8 CL	Sandy clay, yellowish brown, reddish brown -some iron oxide concretions at 2.5' -light gray at 5'	None	Dry
9 10				8-10 CL	Clay, red, light yellowish brown, gray, fat, hard, some very fine laminated sand seams	None	Dry
11				10-11 CL	Sandy clay, red, light gray, yellowish brown, stiff to hard	None	Dry
12 13 14				11-14.25 CL	Clay, yellowish brown, some sand, reddish brown, light gray, hard -clayey sand seam at 14-14.25', yellowish brown, light gray	None	Dry Moist
15 16 17 18				14.25-18 CL	Sandy clay, red, light gray, gray, very thin sand lenses interbedded in clay	None	Moist to V. Moist
19 20 21 22 23 24 25 26 27 28 29 30 31 32			▽	18-29.5 CL	Clay, reddish gray, light gray, yellowish brown, hard, gray -2" reddish brown iron oxide cemented sand laminations at 19.75' -very moist, 1" gravelly sand lense, very fine gypsum crystals at 21' -sandy 22', 22.5', 24' -gray, yellowish brown at 24-24.5' - dark gray, very fine gypsum crystals, trace sand, hard, dry, at 25'	None	Moist V. Moist Dry
33 34 35				32-35 SC	Clayey sand, greenish gray, light gray, some very fine gypsum crystals, dense	None	Moist
36 37 38 39 40					Boring Terminated at 35'		

Cement Bentonite Filter Sand ▽ Water Level

Apex geoscience inc.

Total Depth: 35 feet
Filter Sand (Size/Interval): 13-35'
Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-13'
Surface Completion ☐ Flush ■ Above Ground

Riser interval: +3 (agg)-15'
Screen Interval: 15-35'
Water level: 23.37'
3'

Note: This log is not to be used separate from this report.

APEX PROJECT NO.: 110-089 ☐ BORING BORING NUMBER: ___ ■ MONITOR WELL MONITOR WELL NUMBER: AD-23

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/15/2010

PREPARED BY: David Bedford LOGGED BY: David Bedford

LATTITUDE: N 32°27'03.3" Datum: WGS-84 WELL LOCATION: ___
LONGITUDE: W94°29'41.3"

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1-9				0-9	SC	Clayey sand, brown, with yellowish brown and orangish brown laminations, very fine grained, very silty, few light gray clay streaks	None	Moist
10-14				9-14	ML	Siltstone with light gray clay streaks, light gray with orangish brown streaks, few small iron ore pebbles	None	Moist
15-20				14-20	SM	Sand, light gray with orangish brown streaks, very silty, very fine grained, few clay laminations	None	Slightly Moist
21-27				20-27	ML	Siltstone, light gray with orangish brown streaks	None None	Very Moist V. Moist
28-30				27-30.5	SM	Sand, light brown mottled with orangish brown, very fine grained, very silty	None	Wet
31-32			▽	30.5-31.5	SC	Slightly sandy clay, orangish brown mottle with orangish brown, silty, very fine grained (30-31.5')	None	Moist
33-35				31.5-35	CL	Lean clay, dense, small sandy streaks, dark gray, very fine grained (31.5-35')	None	Moist
36-40						Boring Terminated at 35'		

Cement | Bentonite | Filter Sand | Water Level

☒ *Apex geoscience inc.*

Total Depth: 35 feet
Filter Sand (Size/Interval): 13-35'
Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-13'
Surface Completion: Flush ■ Above Ground

Riser Interval: +3 (ags)-15'
Screen Interval: 15-35'
Water level: 30.83
3'

Note: This log is not to be used separate from this report.

APEX PROJECT NO.: 110-089 ☐ BORING BORING NUMBER: ___ ■ MONITOR WELL MONITOR WELL NUMBER: AD-24

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/27/2010

PREPARED BY: Jeff Sammons LOGGED BY: Jeff Sammons

LATITUDE: N 32°27.024' Datum: WGS-84
LONGITUDE: W94°29.940' WELL LOCATION: South of LF pond dam

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1 2			0-1.5	SM	Silty sand, very fine grained, some clay, brown and reddish brown, medium dense	None	Moist
3 4 5 6			1.5-6.5	SC	Clayey sand, silty, gray, yellowish brown, reddish brown, very fine grained, dense -some iron oxide concretions and gravel at 5-6', trace organic matter at 6', gray, dark gray, reddish brown, loose to med. dense	None	Dry Moist
7 8 9 10 11 12 13 14 15 16			6.5-16	SM	Silty sand, very fine grained, red, loose, trace clay -some gravel at 10' -hard cemented sandstone with iron oxide at 11' - some clay at 15-16', medium dense, gray, dark gray	None	Saturated Moist
17 18 19 20			16-20	Lignite	Lignite, black, loose, saturated at 16-17' - medium dense, moist at 17-20'	None	Saturated
21 22 23 24 25 26 27 28 29 30					Boring Terminated @ 20'		

Cement Bentonite Filter Sand ▽ Water Level

Apex geoscience inc.

Total Depth: 20 feet Riser Interval: +3 (ags)-5'
Filter Sand (Size/Interval): 3-20' Screen Interval: 5-20'
Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-3' Water level: 8.4
Surface Completion ☐ Flush ■ Above Ground 3'

Note: This log is not to be used separate from this report.

APEX PROJECT NO.: 110-089 ☐ BORING BORING NUMBER: ___ ■ MONITOR WELL MONITOR WELL NUMBER: AD-25

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/14/2010

PREPARED BY: David Bedford LOGGED BY: David Bedford

LATITUDE: N 32°27'17.2" Datum: WGS-84 WELL LOCATION: S. of Diesel ASTs
LONGITUDE: W94°29'59.1"

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1				0-1.5	SC	Clayey sand, brown, silty, very fine grained, moist	None	Moist
2				1.5-7	CH	Fat sandy clay, orangish brown, very fine grained, moist	None	Moist
3								
4								
5								
6								
7								
8				7-30	SC	Clayey sand, orangish brown mottled with dark gray, very fine grained, few light gray clay inclusions	None	Moist
9								
10								
11								
12								
13								
14			▽			Wet @ 14'		Wet
15								
16						15-20' - few pieces of dark gray cystalline rock		
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31						Boring Terminated at 30'		
32								
33								
34								
35								

Cement Bentonite Filter Sand ▽ Water Level

Apex geoscience inc.

Total Depth: 30 feet
Filter Sand (Size/Interval): 8-30'
Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-8'
Surface Completion ☐ Flush ■ Above Ground

Riser Interval: +3 (ags)-10'
Screen Interval: 10-30'
Water level: 12.69'
Above Ground 3'

Note: This log is not to be used separate from this report.

APEX PROJECT NO.: 110-089 ☐ BORING BORING NUMBER: ____ ■ MONITOR WELL MONITOR WELL NUMBER: AD-26

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/14/2010

PREPARED BY: David Bedford LOGGED BY: David Bedford

LATTITUDE: N 32°27'25.3" Datum: WGS-84
LONGITUDE: W94°29'54.8" WELL LOCATION: By silt fence and plastic lined trench

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1				0-1 SC	Slightly clayey sand, light brown, very fine grained, silty	None	Moist
2				1-3 CL	Sandy clay, lean, very fine grained, reddish brown	None	Moist
3							
4				3-5 CL	Lean, slightly sandy clay with clayey sand streaks, orangish brown, small coal pieces, very fine grained	None	Moist
5							
6				5-7 SC	Clayey sand, orangish brown, very fine grained, brown clay inclusions	None	Moist
7							
8				7-14 CL	Lean clay, orangish brown mottled with brown/light gray clayey sand streaks, very fine grained, few coal pieces	None	Moist
9							
10							
11							
12							
13							
14							
15				14-28 SC	Clayey sand, dark brown with orangish brown streaks, very fine grained, coal pieces	None	Slightly Wet
16							
17							
18							
19							
20			▽				Wet
21					20-22' - Large clay inclusions, brown		
22							Very Moist
23							
24							
25							
26					Wet from 25-26'		
27							
28							
29				28-30 CL	Lean clay, light gray with orangish brown streaks, few small sandy streaks, very fine grained	None	V. Moist
30							
31				30-32 SC	Clayey sand, light black, very fine grained, small pieces mica Wet from 30-30.5'	None	Wet Moist
32							
33				32-40 CL	Lean clay, orangish brown, small clayey sand streaks, very fine grained, brown streaks	None	Moist
34							
35							Slightly Wet
36							
37							
38							
39							
40							
					Boring Terminated at 40'		

Cement | Bentonite | Filter Sand | ▽ Water Level

Apex geoscience inc.

Total Depth: 40 feet Riser Interval: +3 (ags)-10'
Filter Sand (Size/Interval): 8-40' Screen Interval: 10-40'
Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-8' Water level: 19.45'
Surface Completion ☐ Flush ■ Above Ground 3'

Note: This log is not to be used separate from this report.

APEX PROJECT NO.: 110-089 ☐ BORING BORING NUMBER: ____ ■ MONITOR WELL MONITOR WELL NUMBER: AD-27

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/15/2010

PREPARED BY: David Bedford LOGGED BY: David Bedford

LATTITUDE: N 32°27'36.8" Datum: WGS-84 WELL LOCATION: By corner lined ditch
LONGITUDE: W94°29'47.3"

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1-2			0-2	SC	Clayey sand, orangish brown with dark gray laminations, very fine grained	None	Slightly Moist
3-15			2-15.5	CL	Lean clay, dense, few thin sandy streaks, reddish orange, very fine grained, mottled with light brownish gray; Orange to brown with orangish brown streaks, at 10' becomes brittle	None	Slightly Moist
16-23			15.5-23	SC	Clayey sand, greenish brown with orangish brown streaks, few thin tan clay streaks, very fine grained	None	Moist
24			23-24	SM	Sand, orangish brown, silty, very fine grained	None	Wet
25-27			24-27	CH	Fat clay, brown with orangish brown streaks, many sandy streaks, very fine grained	None	Very Moist
28-30			27-30	SM	Sand, greenish gray with orangish brown streaks, very fine to fine grained, wet	None	Wet
31-37			30-37.5	SC	Clayey sand with clay streaks, light greenish black, very fine grained; Wet red brittle shale from 35-35.2	None	Slightly Wet
38-40					Boring Terminated at 37.5'		

Cement | Bentonite | Filter Sand | ▽ Water Level

Apex geoscience inc.

Total Depth: 40 feet Riser Interval: +3 (ags)-17.5'
Filter Sand (Size/Interval): 15.5-37.5' Screen Interval: 17.5-37.5'
Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-15.5' Water level: 26.73'
Surface Completion ☐ Flush ■ Above Ground 3'

Note: This log is not to be used separate from this report.

Hydrex ENVIRONMENTAL, INC.

Monitor Well

Monitor Well No.: AD-34

PROJECT INFORMATION

PROJECT:	Pirkey Power Plant
PROJECT NO.:	I-84-1021
LOGGED BY:	Jeffrey D. Sammons, P.G.
SUPERVISING PG:	Jeffrey D. Sammons, P.G.
COMPLETION:	12/11/2015
DEVELOPMENT:	12/16/2015
SITE LOCATION:	2400 FM 3251, Hallsville, Texas
WELL OWNER:	AEP

DRILLING INFORMATION

DRILLER:	Buford Cotter
DRILLER'S LICENSE NO.:	60039
RIG TYPE:	Geoprobe 3230DT
METHOD OF DRILLING:	Hollow Stem Auger
SAMPLING METHODS:	Split Core
SURFACE ELEVATION:	307.61 (Top of Casing)
HOLE DIAMETER:	8.25"
LATITUDE	32 27' 10.13" LONGITUDE 94 28' 57.83"

STATE OF TEXAS — JEFFREY D. SAMMONS — GEOLOGY #10070 — LICENSED PROFESSIONAL GEOSCIENTIST — 1-21-16

Water Level Upon Installation ▽ Water Level at Time of Drilling ■ Geotechnical Lab Sample

TBPG No. 50027

DESCRIPTION	USCS	DEPTH	SAMPLE	% MOISTURE	% FINES	LL	PL	PI
CLAYEY SAND: very fine to fine sand, some silt, reddish brownish, light reddish brown, light gray, moist	SC	0						
FAT CLAY: trace sand and silt, some iron oxide concretions, dark reddish brown, reddish brown, and and light gray, moist	CH	1–4						
- some silt and very fine to fine sand at 5', light gray, light reddish brown, and light yellowish brown, moist to very moist		5		31	89	63	23	40
SANDY LEAN CLAY: some very fine to fine sand, dark gray, moist	CL	6–9						
- reddish brown, dark reddish brown, dark gray, light gray at 10' to 12.5'		10–12						
		12		23	64	28	18	8
SILTY SAND: very fine to fine sand, some clay, grey and dark gray, saturated	SM	13–15						
- increasing clay content with depth		16		22	29	25	NP	-
FAT CLAY: trace sand and silt, gray, moist	CH	17–20						
		21		23	60	55	27	28
CLAYEY SAND: fine to very fine sand, dark gray, moist to very moist	SC	22–25						

WELL CONSTRUCTION

- Locking Well Casing Cover
- Locking Well Cap
- Protective Well Casing
- Concrete Pad
- Ground Surface
- Cement
- Bentonite
- 2" Sch. 40 PVC Riser
- 20/40 Silica Sand
- 0.010" Slotted Sch. 40 PVC Well Screen
- PVC Bottom Cap

NOTES: This log should not be used separately from the original report. Not all USCS descriptors were laboratory verified.

Hydrex ENVIRONMENTAL, INC.

Monitor Well

Monitor Well No.: AD-35

PROJECT INFORMATION

PROJECT:	Pirkey Power Plant
PROJECT NO.:	I-84-1021
LOGGED BY:	Jeffrey D. Sammons, P.G.
SUPERVISING PG:	Jeffrey D. Sammons, P.G.
COMPLETION:	12/11/2015
DEVELOPMENT:	12/16/2015
SITE LOCATION:	2460 FM 3251, Hallsville, Texas
WELL OWNER:	AEP

DRILLING INFORMATION

DRILLER:	Buford Collier
DRILLER'S LICENSE NO.:	60089
RIG TYPE:	Geoprobe 3230DT
METHOD OF DRILLING:	Hollow Stem Auger
SAMPLING METHODS:	Split Core
SURFACE ELEVATION:	318.96 (Top of Casing)
HOLE DIAMETER:	8.25"
LATITUDE	32 27' 9.64"
LONGITUDE	94 28' 48.74"

STATE OF TEXAS — JEFFREY D. SAMMONS — GEOLOGY #10070 — LICENSED PROFESSIONAL GEOSCIENTIST — 1-21-16

▼ Water Level Upon Installation ▽ Water Level at Time of Drilling ■ Geotechnical Lab Sample

TBPG No. 50027

DESCRIPTION	USCS	DEPTH	SAMPLE	% MOISTURE	% FINES	LL	PL	PI
CLAYEY SAND: very fine to fine sand, some iron ore gravel, reddish brownish, dark reddish brown, yellowish brown, gray, moist	SC	0 - 2		13	46	32	15	17
SILTY SAND: very fine to fine sand, trace clay, trace iron ore gravel, light reddish brown, moist, increasing moisture content with depth	SM	2 - 10		12	28	16	NP	
- saturated at 10' to 11'								
CLAYEY SAND: very fine to fine sand, trace iron ore gravel, light reddish brown, very moist - thin seams of saturated very fine sand with trace of clay at 12.25' to 12.5' - light reddish brown and light gray, moist to very moist at 12.5' to 15'	SC	11 - 15		19	33	31	18	13
LEAN CLAY: interbedded clays and silts with laminations of very fine sand, light gray, gray and light reddish brown, moist to very moist	CL	15 - 20		21	93	34	20	14
- thin lenses of very moist very fine sand and partially cemented very fine sand at 17.5' and 18', reddish brown								

WELL CONSTRUCTION

- Locking Well Casing Cover
- Locking Well Cap
- Protective Well Casing
- Concrete Pad
- Ground Surface
- Cement
- 2" Sch. 40 PVC Riser
- Bentonite
- 20/40 Silica Sand
- 0.010" Slotted Sch. 40 PVC Well Screen
- PVC Bottom Cap

NOTES: This log should not be used separately from the original report. Not all USCS descriptors were laboratory verified.

LOG OF BORING

852164

PROJECT: Monitoring Well Instllation
CLIENT: Southwestern Electric Power Company

BORING NO.: M-1
LOCATION: Hallsville, TX
S 12+32.79; W 35+34.55

Date: 1/29/86 Type: Rotary

Ground Elevation: 337.67

Legend: ■ Sample X Penetration ▼ Water

Depth, Feet	Symbol	Sample	Description of Stratum
5			Brown and tan sandy clay
10			Brown and tan sandy clay w/iron ore
15			Brown and tan sandy clay w/iron ore
20			Gray silty sand
25			Gray silty sand
30			Gray silty sand
35			Bottom of Boring at 30 feet. Water encountered at 10 feet.
40			
45			
50			

SOUTHWESTERN LABORATORIES

LOG OF BORING

852164

PROJECT: Monitoring Well Installation
CLIENT: Southwestern Electric Power Company

BORING NO.: MW-2
LOCATION: Hallsville, TX
S 38+86.22; W 45+76.41

Date: 1/29/86 Type: Rotary Ground Elevation: 302.19

Legend: ■ Sample X Penetration ▼ Water

Depth, Feet	Symbol	Sample	Description of Stratum
5			Brown silty sand w/iron ore
10			Brown silty sand w/iron ore
15			Brown and gray silty sand
20			Gray silty sand
25			Gray silty sand
30			Bottom of Boring at 27 feet. Water encountered at 11 feet.
35			
40			
45			
50			

SOUTHWESTERN LABORATORIES

LOG OF BORING

852164
PROJECT: Sludge Disposal Area
CLIENT: Southwestern Electric Power Company

BORING NO.: M. 2A
LOCATION: Hallsville, TX

Date: 6/20/85 Type: Auger Ground Elevation: 308.40

Legend: ■ Sample X Penetration

Plant Site Coordinates: South 27+55.45 West 36+47.44

▼ Water

Depth, Feet	Symbol	Sample	Description of Stratum
0			Red-brown clayey sand
10			Graval
15		■	Gray clayey silty sand
20		■	Gray silty sand
25			Bottom of Boring at 22 feet. Water encountered at 12 feet. Bottom of Casing at 22 feet. Screen length 15 feet.
30			
35			
40			
45			
50			

SOUTHWESTERN LABORATORIES

Log of Boring

Number: M-3

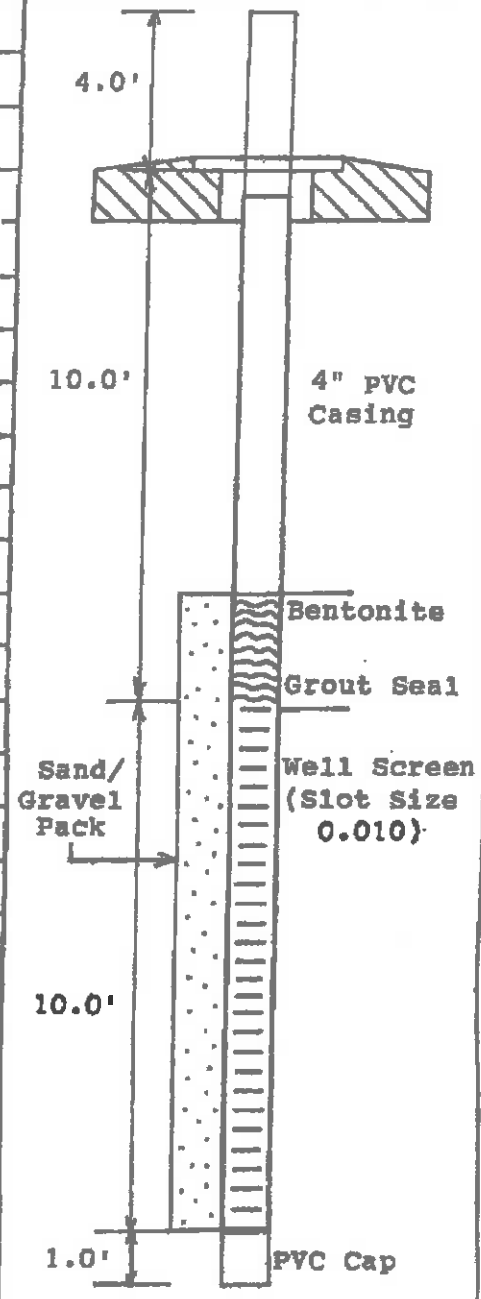
Location: Harrison Co., miles SW Marshall City Ha

Project: New Monitor Well Installation, H.W. Pirkey Power Plant

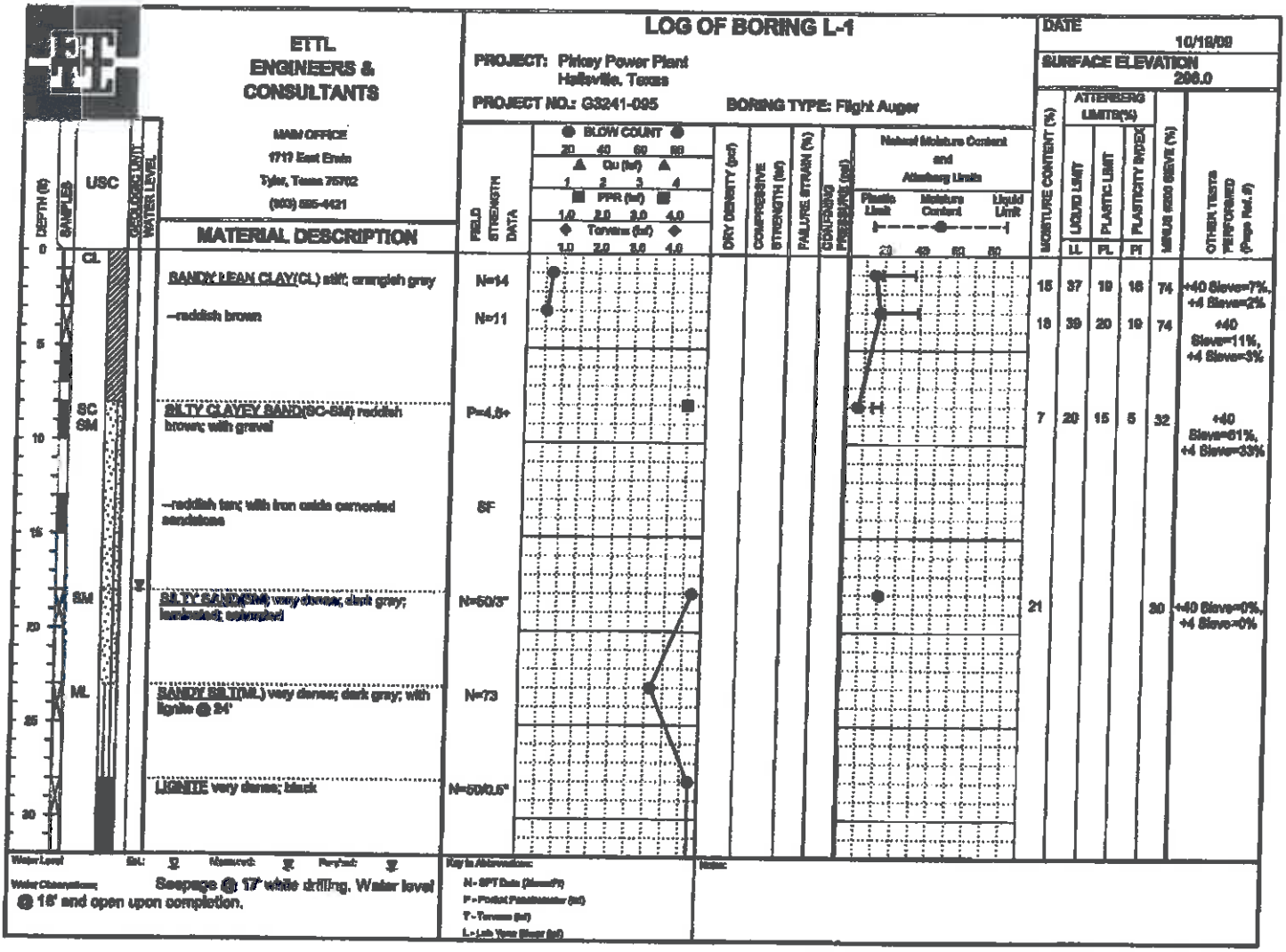
Type: Groundwater Monitor Well

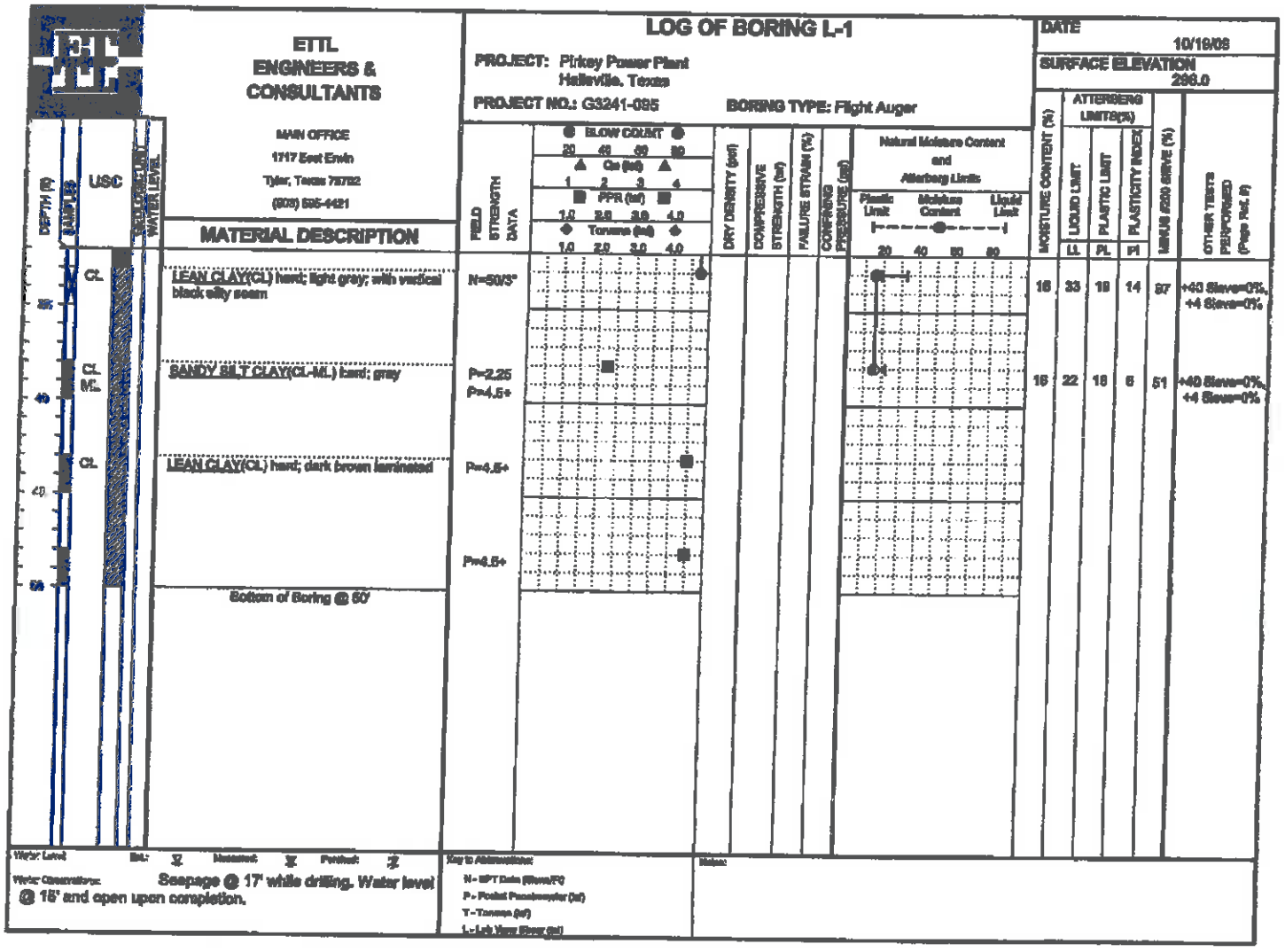
Surface Elevation: 275.0'

Depth	STRATUM DESCRIPTION
	Sod
	Brown Silty Clay
5	Brown Silty Sandy Clay
	Red & Gray Silty Clay
10	
15	Lignite
	Tan Silty Sandy Clay
20	
25	



Completion Depth	Date	Water Observations
20'	7-1-93	Water Encountered at 10.0'


ETTL
ENGINEERS &
CONSULTANTS
MAIN OFFICE
1712 East Erwin
Tyler, Texas 75702
(903) 595-4421
LOG OF BORING L-1
PROJECT: Pirkey Power Plant
Hallsville, Texas
PROJECT NO.: G3241-095
BORING TYPE: Flight Auger
DATE
10/19/09
SURFACE ELEVATION
208.0
MATERIAL DESCRIPTION
USC
SAMPLES
GROUNDWATER LEVEL
DEPTH (ft)
FIELD STRENGTH DATA
BLOW COUNT
Cu (tsf)
PPR (tsf)
Torvane (tsf)
DRY DENSITY (pcf)
COMPRESSIVE STRENGTH (tsf)
FAILURE STRAIN (%)
CONFINING PRESSURE (psi)
Natural Moisture Content and Atterberg Limits
Plastic Limit
Moisture Content
Liquid Limit
MOISTURE CONTENT (%)
ATTERBERG LIMITS(%)
LIQUID LIMIT
PLASTIC LIMIT
PLASTICITY INDEX
MINUS #200 SIEVE (%)
OTHER TESTS PERFORMED (Page Ref.#)
LL
PL
PI
CL
SC
SM
ML
SANDY LEAN CLAY(CL) stiff; orangish grey
--reddish brown
SILTY CLAYEY SAND(SC-SM) reddish brown; with gravel
--reddish tan; with iron oxide cemented sandstone
SILTY SAND(SM) very dense; dark gray; [illegible]
SANDY SILT(ML) very dense; dark gray; with lignite @ 24'
LIGNITE very dense; black
N=14
N=11
P=4.5+
SF
N=50/3"
N=73
N=50/0.5"
15 37 19 18 74 +40 Sieve=7%, +4 Sieve=2%
18 39 20 19 74 +40 Sieve=11%, +4 Sieve=3%
7 20 15 5 32 +40 Sieve=61%, +4 Sieve=33%
21 20 +40 Sieve=0%, +4 Sieve=0%
Water Level
Water Observations:
Seepage @ 17' while drilling. Water level @ 15' and open upon completion.
Key to Abbreviations:
N - SPT Data (blows/ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)
Notes:



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MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

LOG OF BORING L-1

PROJECT: Pirkey Power Plant
Hallsville, Texas

PROJECT NO.: G3241-095

BORING TYPE: Flight Auger

DATE: 10/19/06

SURFACE ELEVATION: 298.0

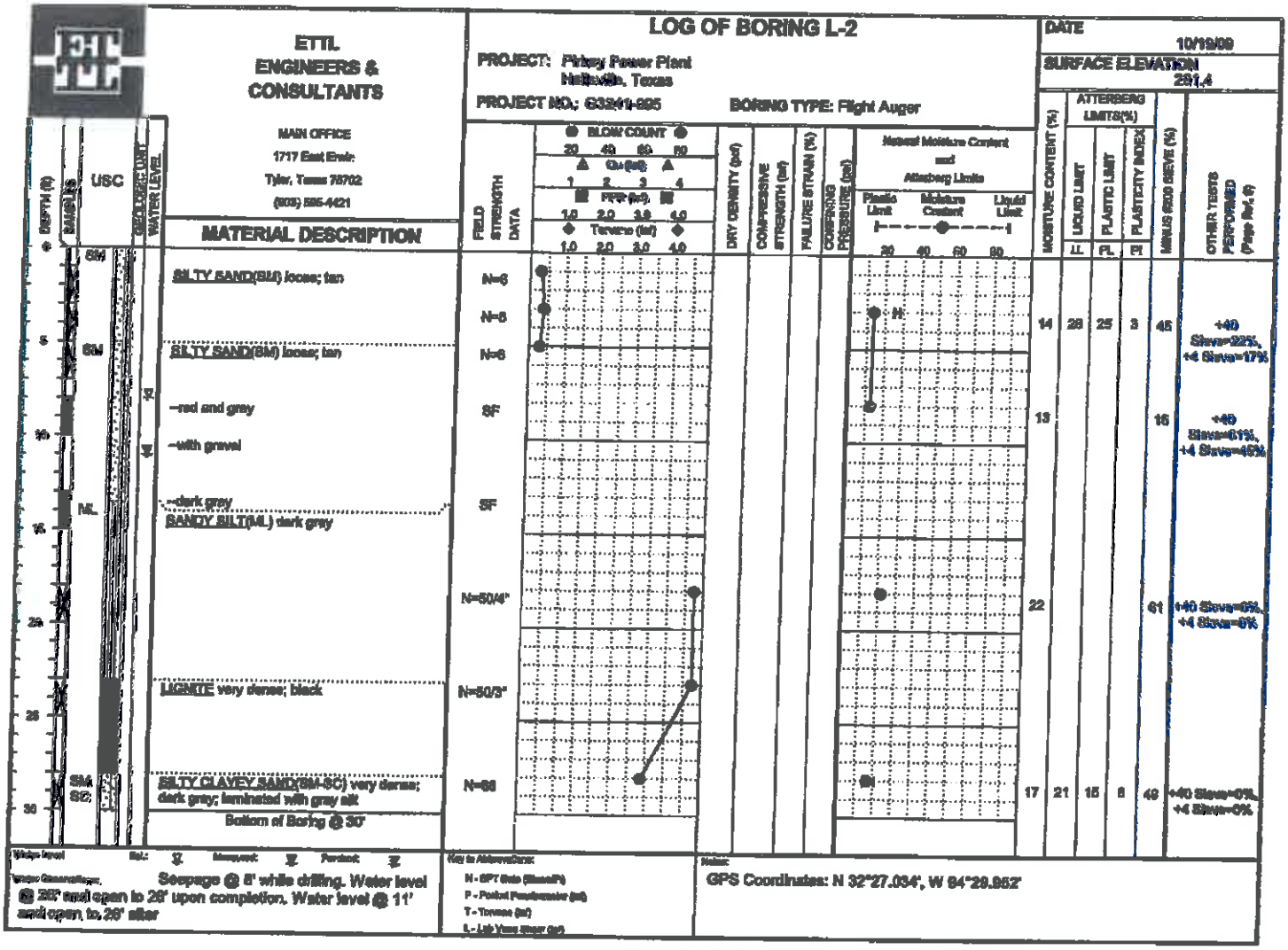
DEPTH (ft)	USCS	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LL	PL	PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
35	CL	LEAN CLAY(CL) hard; light grey; with vertical black silty seam	N=50/5"					16	33	19	14	87	+#3 Sieve=0%, +#4 Sieve=0%
40	CL-ML	SANDY SILT CLAY(CL-ML) hard; grey	P=2.25 P=4.5+					16	22	16	6	51	+#3 Sieve=0%, +#4 Sieve=0%
45	CL	LEAN CLAY(CL) hard; dark brown laminated	P=4.5+										
50		Bottom of Boring @ 50'	P=4.5+										

Water Level — Bit: ▽ Measured: ▽ Pocket: ▽

Water Observations: Seepage @ 17' while drilling. Water level @ 15' and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (psi)

Notes: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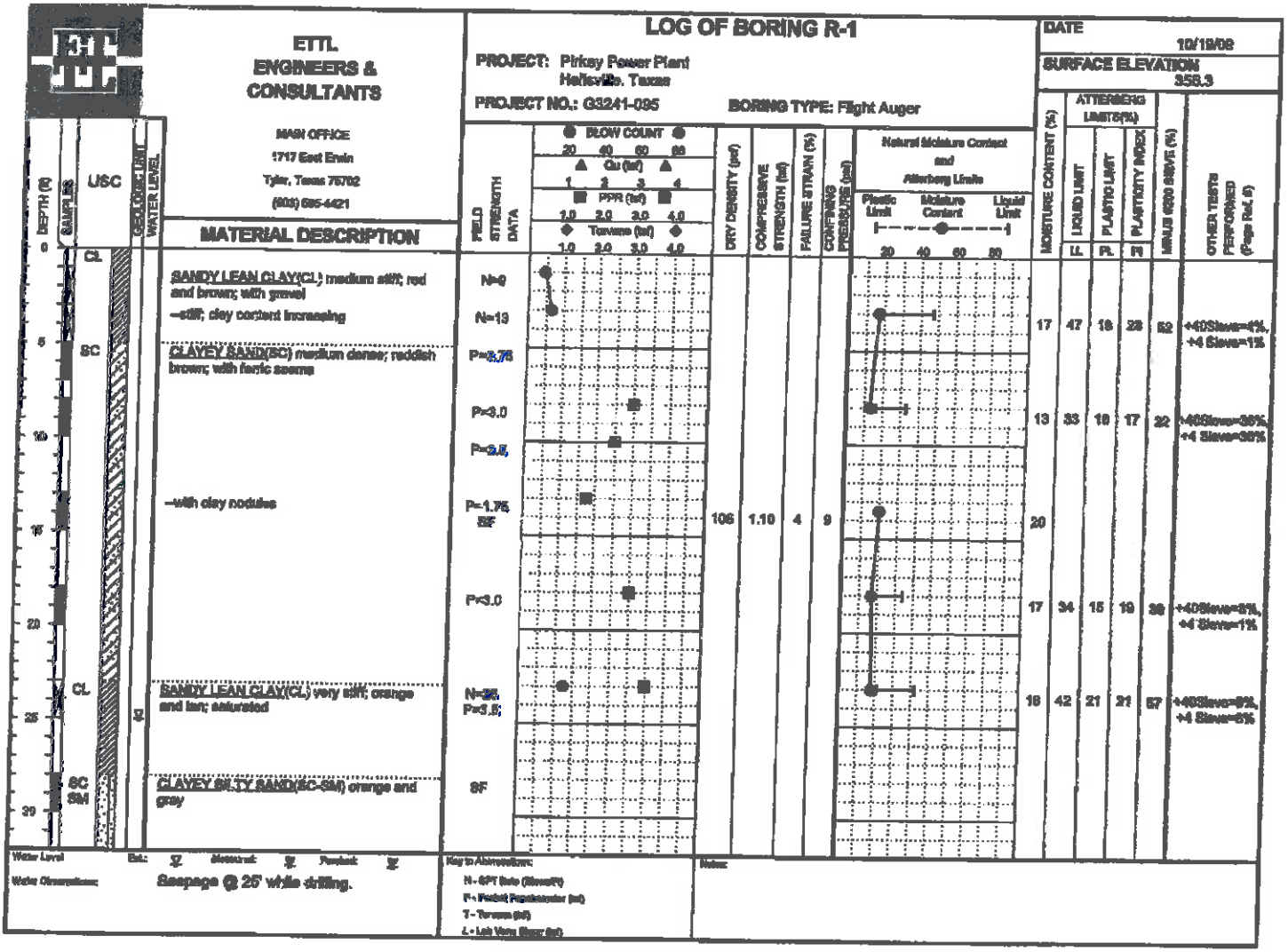
ENGINEERS &
CONSULTANTS
MAIN OFFICE
1717 East Elvik
Tyler, Texas 75702
(903) 595-4421
LOG OF BORING L-2
PROJECT: Pirkey Power Plant
Hallsville, Texas
PROJECT NO.: G3241-005
BORING TYPE: Flight Auger
DATE
10/19/09
SURFACE ELEVATION
291.4
DEPTH (ft)
SAMPLES
USC
GROUNDWATER LEVEL
WATER LEVEL
MATERIAL DESCRIPTION
FIELD STRENGTH DATA
BLOW COUNT
Qu (tsf)
PP (tsf)
Torvane (tsf)
DRY DENSITY (psf)
COMPRESSIVE STRENGTH (psf)
FAILURE STRAIN (%)
CONFINING PRESSURE (psi)
Natural Moisture Content and Atterberg Limits
Plastic Limit
Moisture Content
Liquid Limit
MOISTURE CONTENT (%)
ATTERBERG LIMITS(%)
LIQUID LIMIT
PLASTIC LIMIT
PLASTICITY INDEX
LL
PL
PI
MINUS #200 SIEVE (%)
OTHER TESTS PERFORMED (Page No.'s)
SM
SILTY SAND(SM) loose; tan
SM
SILTY SAND(SM) loose; tan
--red and gray
--with gravel
--dark gray
ML
SANDY SILT(ML) dark gray
LIGNITE very dense; black
SM-SC
SILTY CLAYEY SAND(SM-SC) very dense; dark gray; laminated with gray silt
Bottom of Boring @ 30'
N=6
N=8
N=6
SF
SF
N=50/4"
N=50/3"
N=66
14
13
22
17
28
25
3
45
+40 Sieve=22%, +4 Sieve=17%
16
+40 Sieve=61%, +4 Sieve=46%
61
+40 Sieve=6%, +4 Sieve=6%
21
15
6
49
+40 Sieve=0%, +4 Sieve=0%
Seepage @ 8' while drilling. Water level @ 25' next open to 26' upon completion. Water level @ 11' next open to 26' after
N - SPT Blow (Blows/ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
GPS Coordinates: N 32°27.034', W 94°29.952'



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MAIN OFFICE
1717 East Elvin
Tyler, Texas 75702
(903) 595-4421

LOG OF BORING R-1

PROJECT: Pirkey Power Plant
Hallsville, Texas

PROJECT NO.: G3241-095

BORING TYPE: Flight Auger

DATE: 10/19/09

SURFACE ELEVATION: 355.3

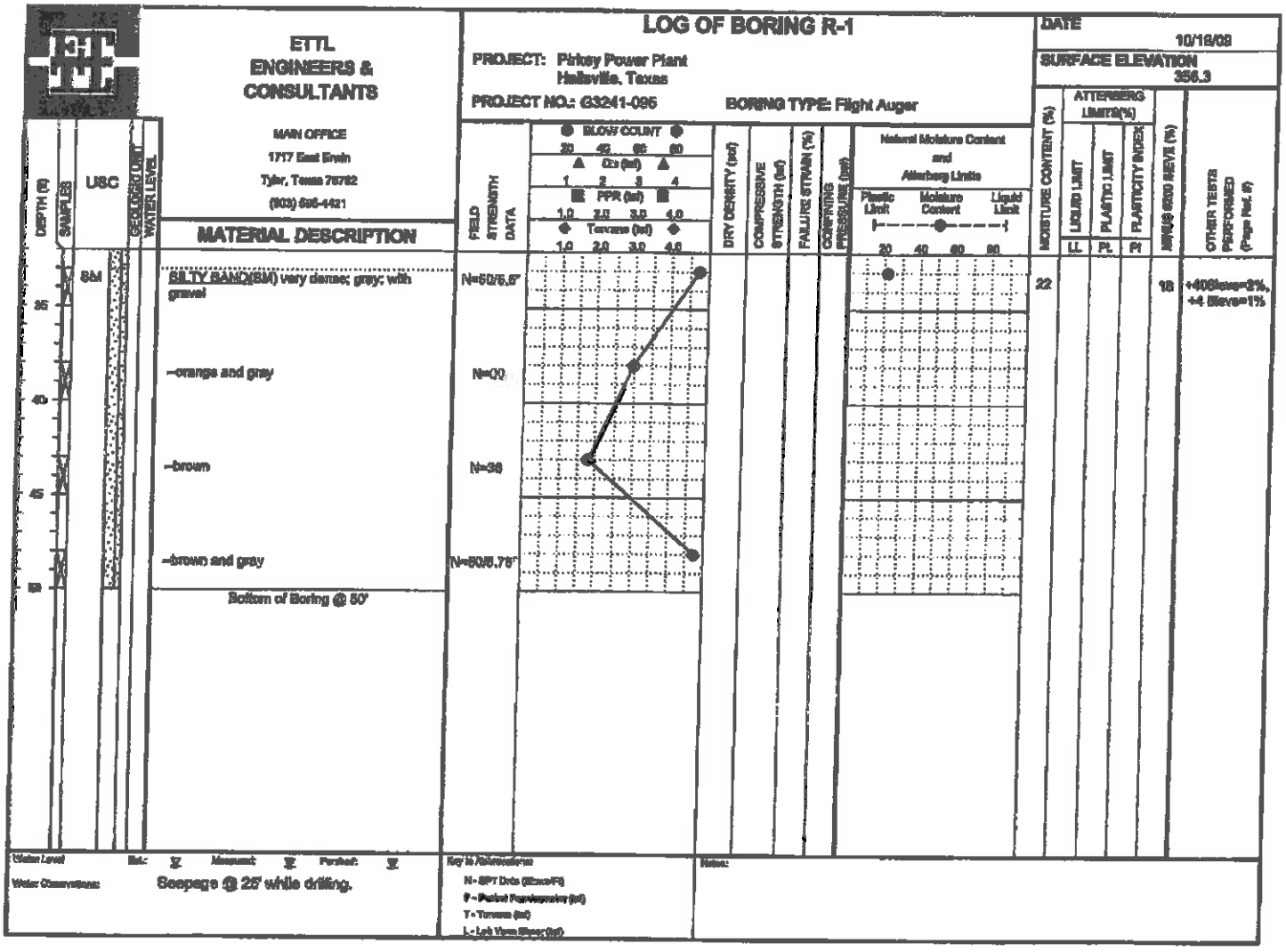
DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (psf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (tsf)	Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LL	PL	PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
0		CL			SANDY LEAN CLAY(CL) medium stiff; red and brown; with gravel	N=9											
5					—stiff; clay content increasing	N=13						17	47	19	28	52	+40Sieve=4%, +4 Sieve=1%
		SC			CLAYEY SAND(SC) medium dense; reddish brown; with ferric seams	P=2.75											
10						P=3.0						13	33	16	17	22	+40Sieve=30%, +4 Sieve=22%
					—with clay nodules	P=2.5											
15						P=1.75 SF	106	1.10	4	9		20					
20						P=3.0						17	34	15	19	38	+40Sieve=3%, +4 Sieve=1%
25		CL			SANDY LEAN CLAY(CL) very stiff; orange and tan; saturated	N=32 P=3.5						18	42	21	21	57	+40Sieve=9%, +4 Sieve=6%
		SC SM			CLAYEY SILTY SAND(SC-SM) orange and gray	SF											

Water Level — Est.: ▽ Measured: ▽ Perched: ▽

Water Observations: Seepage @ 25' while drilling.

Key to Abbreviations:
N - SPT Blow (Density)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes: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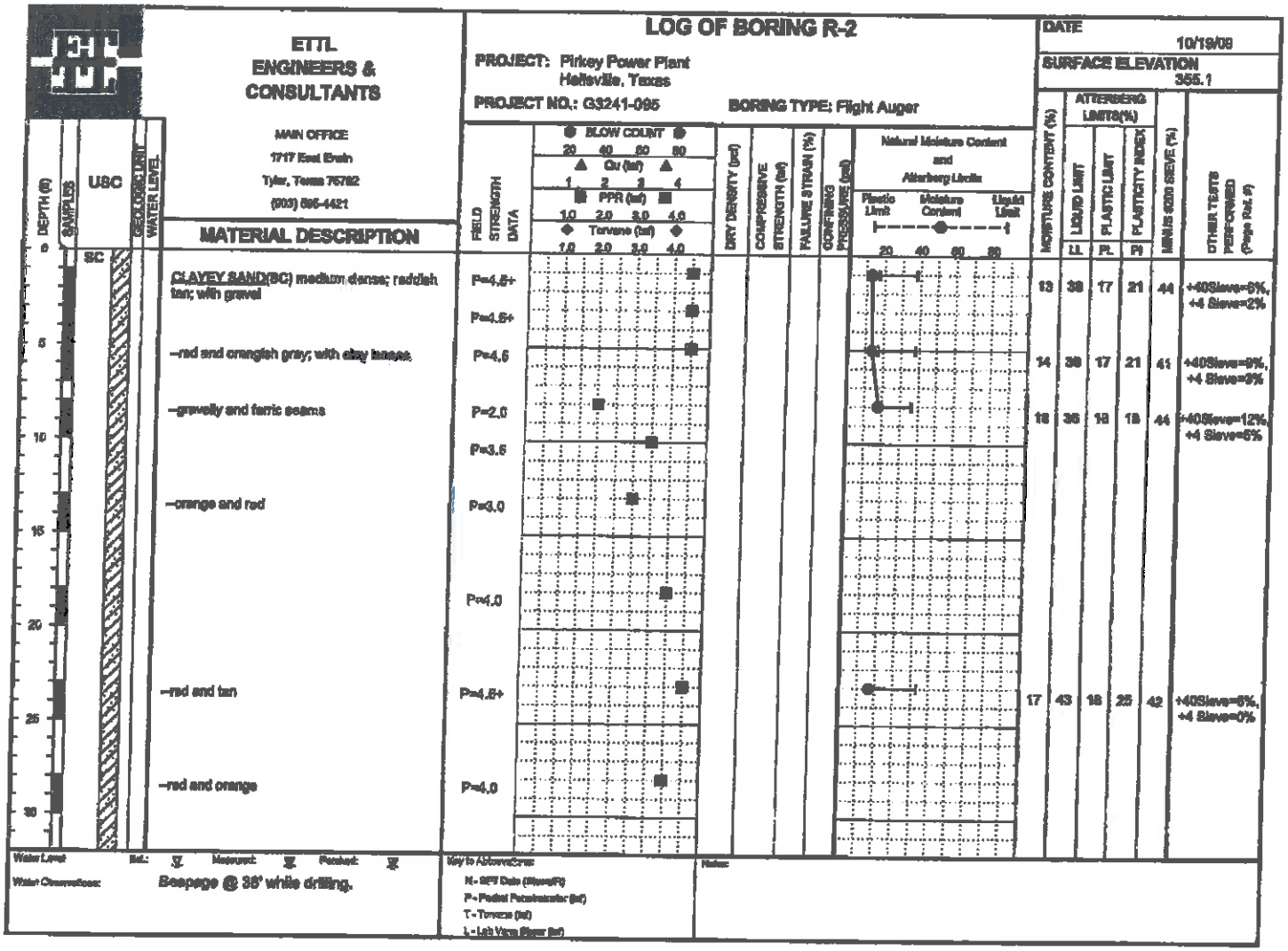
ENGINEERS &
CONSULTANTS
MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421
LOG OF BORING R-1
PROJECT: Pirkey Power Plant
Hallsville, Texas
PROJECT NO.: G3241-095
BORING TYPE: Flight Auger
DATE
10/16/09
SURFACE ELEVATION
356.3
DEPTH (ft)
SAMPLES
USC
GEOLOGIC UNIT
WATER LEVEL
MATERIAL DESCRIPTION
FIELD STRENGTH DATA
BLOW COUNT
Qu (tsf)
PPR (tsf)
Torvane (tsf)
DRY DENSITY (pcf)
COMPRESSIVE STRENGTH (psf)
FAILURE STRAIN (%)
CONFINING PRESSURE (psi)
Natural Moisture Content and Atterberg Limits
Plastic Limit
Moisture Content
Liquid Limit
MOISTURE CONTENT (%)
ATTERBERG LIMITS(%)
LIQUID LIMIT
PLASTIC LIMIT
PLASTICITY INDEX
#200 SIEVE (%)
OTHER TESTS PERFORMED (Page Ref. #)
SM
SILTY SAND(SM) very dense; gray; with gravel
N=50/6.5"
22
18
+#200sieve=2%, +#4 Sieve=1%
–orange and gray
N=50
–brown
N=39
–brown and gray
N=50/5.75"
Bottom of Boring @ 50'
Water Level
Bit:
Measured:
Packer:
Water Observations:
Seepage @ 25' while drilling.
Key to Abbreviations
N - SPT Data (Blows/Ft)
T - Torvane (tsf)
Notes:



ETTL
ENGINEERS &
CONSULTANTS

MAIN OFFICE
1717 East Elvin
Tyler, Texas 75702
(903) 595-4421

LOG OF BORING R-2

PROJECT: Pirkey Power Plant
Hallsville, Texas

PROJECT NO.: G3241-095

BORING TYPE: Flight Auger

DATE 10/19/09

SURFACE ELEVATION 355.1

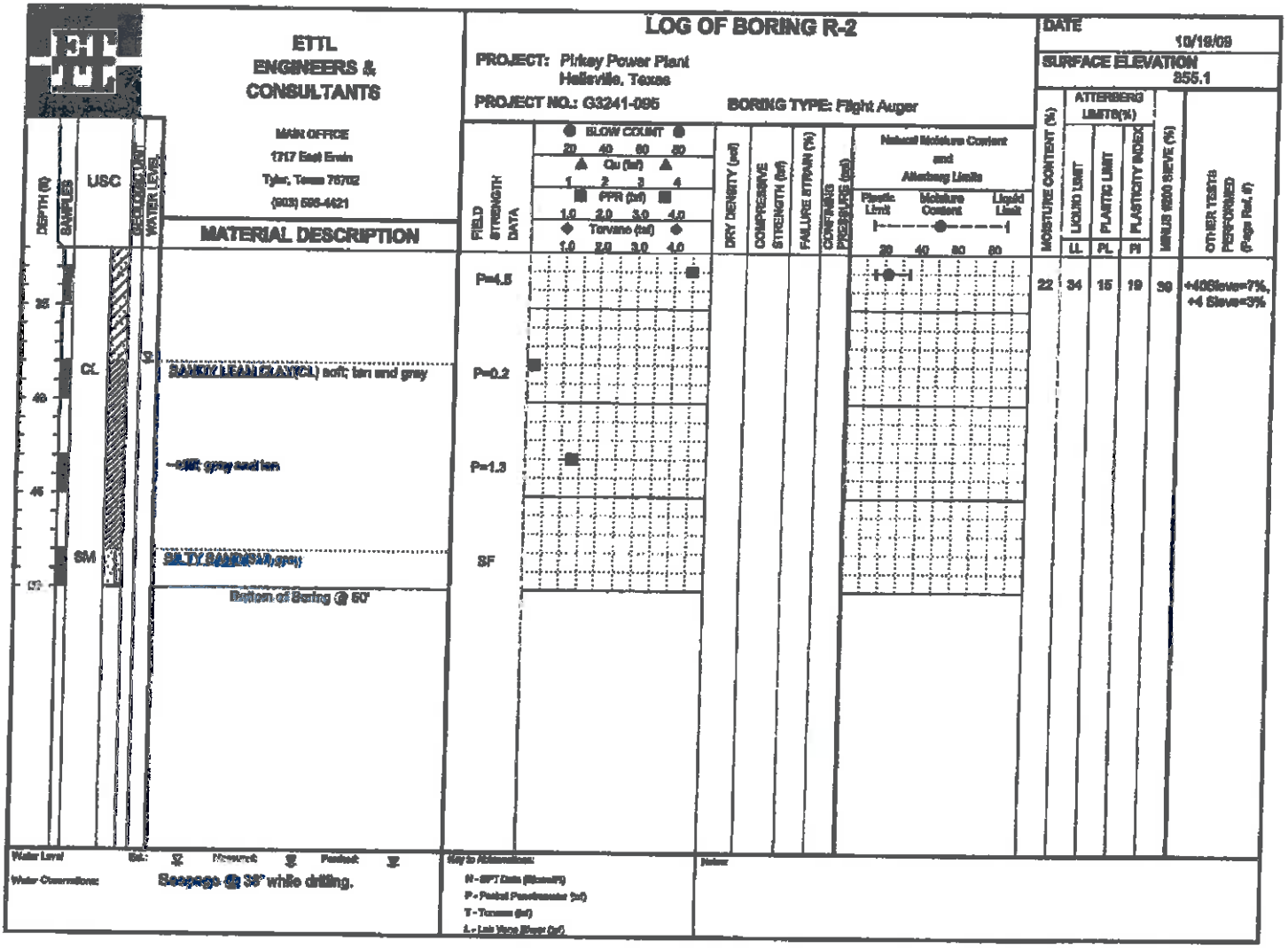
DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT / WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	Natural Moisture Content and Atterberg Limits	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LL	PL	PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
0		SC		CLAYEY SAND(SC) medium dense; reddish tan; with gravel	P=4.5+						13	38	17	21	44	+40Sieve=6%, +4 Sieve=2%
5				–red and orangish gray; with clay lenses	P=4.5+											
					P=4.5						14	39	17	21	41	+40Sieve=9%, +4 Sieve=3%
				–gravelly and ferric seams	P=2.0						18	36	18	18	44	+40Sieve=12%, +4 Sieve=6%
10					P=3.5											
				–orange and red	P=3.0											
15																
					P=4.0											
20																
				–red and tan	P=4.5+						17	43	18	25	42	+40Sieve=6%, +4 Sieve=0%
25																
				–red and orange	P=4.0											
30																

Water Level: Bd.: ▽ Measured: ▽ Perched: ▽

Water Observations: Seepage @ 35' while drilling.

Key to Abbreviations:
N - SPT Data (Blows/ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes: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ENGINEERS &
CONSULTANTS
MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421
LOG OF BORING R-2
PROJECT: Pirkey Power Plant
Hallsville, Texas
PROJECT NO.: G3241-095
BORING TYPE: Flight Auger
DATE
10/19/09
SURFACE ELEVATION
355.1
DEPTH (ft)
SAMPLES
USC
GEOLOGIC UNIT
WATER LEVEL
MATERIAL DESCRIPTION
FIELD STRENGTH DATA
BLOW COUNT
Cu (tsf)
PPR (tsf)
Torvane (tsf)
DRY DENSITY (pcf)
COMPRESSIVE STRENGTH (tsf)
FAILURE STRAIN (%)
CONFINING PRESSURE (psi)
Natural Moisture Content and Atterberg Limits
Plastic Limit
Moisture Content
Liquid Limit
MOISTURE CONTENT (%)
ATTERBERG LIMITS(%)
LIQUID LIMIT
PLASTIC LIMIT
PLASTICITY INDEX
MINUS #200 SIEVE (%)
OTHER TESTS PERFORMED (Page Ref. #)
CL
SM
SANDY LEAN CLAY(CL) soft; tan and gray
-silt; gray and tan
SILTY SAND(SM) (gray)
Bottom of Boring @ 50'
P=4.5
P=0.2
P=1.3
SF
22
34
15
19
30
+40Sieve=7%,
+4 Sieve=3%
Water Level
Seepage @ 38' while drilling.
Key to Abbreviations
Notes

ETTL ENGINEERS & CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

LOG OF BORING R-3

PROJECT: Pirkey Power Plant
Hallsville, Texas

PROJECT NO.: G3241-095 **BORING TYPE:** Flight Auger

DATE 10/19/09

SURFACE ELEVATION 342.5

Plot legend: ● SLOW COUNT ● (20, 40, 60, 80); ▲ Qu (tsf) ▲ (1, 2, 3, 4); ■ PPR (tsf) ■ (1.0, 2.0, 3.0, 4.0); ◆ Torvane (tsf) ◆ (1.0, 2.0, 3.0, 4.0); Natural Moisture Content and Atterberg Limits: Plastic Limit, Moisture Content, Liquid Limit (20, 40, 60, 80)

DEPTH (ft)	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	MINUS #200 SIEVE (%)	OTHER TESTS PERFORMED (Page Ref. #)
0	SC	CLAYEY SAND(SC) medium dense; tan	N=15										
	CL	LEAN CLAY(CL) very stiff; tan and gray; laminated	P=2.8					16	30	16	14	88	+40Sieve=5%, +4 Sieve=1%
5	SM	SILTY SAND(SM) tan; with gravel	SF					17				30	+40Sieve=16%, +4 Sieve=6%
	ML	SANDY SILT(ML) very loose; tan	P=0.8										
10	CL	LEAN CLAY(CL) very stiff; tan	P=2.5 P=2.9	108	1.80	7	7	19 20	33	17	16	86	+40Sieve=1%, +4 Sieve=0%
	SC-SM	SILTY CLAYEY SAND(SC-SM) medium dense; tan and gray	P=3.0										
15													
	SM	SILTY SAND(SM) very dense; tan and gray	N=68										
20													
25			N=50/6"					20				21	+40Sieve=1%, +4 Sieve=0%
			N=50/4"										
30		Bottom of Boring @ 30'											

Water Level: Est.: ▽ Measured: ▽ Perched: ▽

Water Observations: Seepage @ 6' while drilling. Water level @ 1' and open to 28' upon completion.

Key to Abbreviations:
N = SPT Data (Blows/Ft)
P = Pocket Penetrometer (tsf)
T = Torvane (tsf)
L = Lab Vane Shear (tsf)

Notes:
GPS Coordinates: N 32°27.313', W 94°29.240'

Appendix B

Photographic Log

ARCADIS

PHOTOGRAPHIC LOG

Project Name:	Location:	Project No.
AEP – Pirkey Power Plant	Hallsville, Harrison County, Texas	OH015976.0001

Photo No.	Date:
1	8/19/2015

Direction Photo Taken:

South

Description:

P8190454
Upland drainage area along southeastern side of Landfill.

ARCADIS

PHOTOGRAPHIC LOG

Project Name:	Location:	Project No.
AEP – Pirkey Power Plant	Hallsville, Harrison County, Texas	OH015976.0001

Photo No.	Date:
2	8/19/2015

Direction Photo Taken:

South

Description:

P8190467
Lining for new landfill expansion cell

ARCADIS

PHOTOGRAPHIC LOG

Project Name:	Location:	Project No.
AEP – Pirkey Power Plant	Hallsville, Harrison County, Texas	OH015976.0001

Photo No.	Date:
3	8/19/2015

Direction Photo Taken:

East Northeast

Description:

P8190470
Lining for new landfill expansion cell

ARCADIS

PHOTOGRAPHIC LOG

Project Name:	Location:	Project No.
AEP – Pirkey Power Plant	Hallsville, Harrison County, Texas	OH015976.0001

Photo No.	Date:
4	8/19/2015

Direction Photo Taken:

East Northeast

Description:

P8190475
Upland ditch on east side of landfill.