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ASH POND-CCR GROUNDWATER MONITORING WELL NETWORK EVALUATION

Amos Plant
Winfield Road
Putnam County
Winfield, West Virginia

October 18, 2016

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OH015976.0007

Date:

October 18, 2016

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ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power Service Cooperation
amsl	above mean sea level
Arcadis	Arcadis U.S., Inc.
bgs	below ground surface
BAP	bottom ash pond
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
EPRI	Electric Power Research Institute
FGD	flue gas desulfurization
ft	feet
GA	Geo/Environmental Associates, Inc.

1. OBJECTIVE

This report was prepared by Arcadis U.S., Inc. (Arcadis) for American Electric Power Service Corporation (AEP) to assess the adequacy of the groundwater monitoring well network included in the Coal Combustion Residual (CCR) requirements, as specified in Code of Federal Regulations (CFR) 40 CFR 257.91, for the ash pond system (CCR Unit) at the AEP Amos Generating Plant (Plant) located on Winfield Road in Winfield, West Virginia (**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 in the uppermost aquifer and an evaluation of whether the CCR unit meets up to 5 location restrictions. The restrictions include: 1) the base of the CCR unit is 5 feet (ft) above and isolated from the uppermost aquifer, and the CCR unit may not be 2) located in a wetland, 3) within 200 ft of the damage zone of a fault that has displacement during the Holocene, 4) within a seismic impact zone, or 5) in an unstable area. The objective of this report is to present an evaluation of the adequacy of the groundwater monitoring well network in the uppermost aquifer at the onsite ash pond system (Site). The evaluation of the five location restriction criteria is not included in this report and will be completed under separate cover.

Two regulated CCR units associated with the Plant were identified for review, which include the onsite ash pond system and the offsite flue gas desulfurization (FGD) landfill (**Figure 2**). The evaluation of the FGD landfill is not included in this report and will be completed under separate cover.

Initial evaluation of the monitoring well network was completed in November 2015 and included a review of AEP-provided data associated with previously completed subsurface investigation activities in the vicinity of the ash pond system, as well as publicly-available geologic and hydrogeologic data. Gaps in the monitoring well network, as well as in the characterization of subsurface geology, were identified during this initial evaluation. An electrical resistivity geophysical survey was conducted in December 2015, and additional monitoring wells were installed from April through May 2016 to address these data gaps. Drilling activities were performed by AEP with Arcadis personnel completing borehole logging and well installation oversight. The following report presents the current Conceptual Site Model (CSM), combining the historical Site information with recently collected geologic and hydrogeologic data. This report also includes a description of the uppermost aquifer and the current monitoring well network. The monitoring well network was determined to adequately cover the up and down gradient areas of the ash pond system in the uppermost aquifer; therefore, the report objective has been met.

2. BACKGROUND INFORMATION

The following section provides background information for the AEP Amos Generating Plant ash pond system.

2.1 Facility Location Description

The AEP Amos Generating Plant is located in Putnam County, bounded by U.S. Route 35 to the west and the Kanawha River to the east. The Plant is approximately 5 miles southeast of Winfield, West Virginia. The ash pond system CCR unit is immediately northwest of the Plant. The ash pond system is located south and adjacent to Bill's Creek and less than one quarter mile southwest of the Kanawha River (**Figures 1** and **2**).

2.2 Description of Ash Pond System CCR Unit

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

2.2.1 Embankment Configuration

The ash pond system main dike extends 800 feet (ft) along the northwest side of the ash pond system. The maximum height of the dike is approximately 28 ft above ground surface with a minimum crest elevation of approximately 588 ft. Prior to 2010, the minimum crest elevation was 584 ft; however, the dike height was increased to accommodate raising the operating pool level of the ash pond system. The main dike is approximately 10 to 26 ft wide and primarily constructed of clay/shale fill above native clayey gravel and clay (GA, 2005).

Secondary splitter dikes were constructed that separate the ash pond system into individual ponds including: Pyrites Pond, Bottom Ash Pond (BAP) 1A, BAP 1B, Reclaim Pond, and Clearwater Pond. The splitter dike separating BAP 1A and BAP 1B has a minimum elevation of 585 ft, but is typically greater than 587 ft. The splitter dike separating BAP 1A and the Reclaim Pond has a minimum elevation of approximately 584 ft while the splitter dike separating the Reclaim Pond and the Clearwater Pond has a minimum elevation of approximately 583.5 ft (GA, 2005).

2.2.2 Area/Volume

The ash pond system, consisting of BAP 1A, BAP 1B, Reclaim Pond, Pyrites Pond, and Clearwater Pond occupies a total surface area of approximately 50 acres (**Figure 3**). The combined normal reservoir volume of BAP 1A and BAP 1B is 297 acre ft; the combined maximum reservoir volume of BAP 1A and BAP 1B is 312 acre ft (GA, 2008).

2.2.3 Construction and Operational History

The AEP Amos Generating Plant began operations in 1971 with Unit 1. Units 2 and 3 were brought online in 1972 and 1973, respectively. The first available design drawings of the ash pond system are dated June, 28, 1970. Fly ash and wastewater generated from Units 1, 2 and 3 were assumed to be transferred to the ash pond system as early as 1971 when Unit 1 became active. The ash pond system was constructed by excavation below natural ground surface. From 1970 to 1976 the ash pond system configuration changes included construction of a road embankment on the northwest corner of BAP 1B and removal of an emergency spillway from the northwest corner of BAP 1B. While some modifications to the ash pond system have been made since 1977, the present-day configuration of the ash pond system with respect to splitter dikes and individual pond units has remained the same since 1976 (GA, 2005; **Figure 3**). All ash ponds are unlined (EPRI, 1999). In 2010, the main dike (northwest dike) was raised 5 ft using concrete block filled with compacted soil.

Currently, bottom ash and coal mill rejects from all three generating units are sluiced to the BAP 1A and BAP 1B for settling. The BAPs are filled in an alternating fashion, with one BAP generally receiving bottom ash while the other BAP is being cleaned out. Additionally, wastewaters from the generation building sumps are pumped to BAP 1A and BAP 1B. Finally, Unit 3 coal pulverizer wastewater is pumped to the Pyrites Pond (EPRI, 1999).

2.2.4 Surface Water Control

The perimeter of the ash pond system is graded such that surface runoff is directed away from the ponds. This grading is accomplished by either natural topographic relief or constructed embankments, for example the main dike along the northwest side of ash pond system (GA, 2008). Surface runoff is directed towards storm water ponds, which are unlined and were constructed by excavating into clayey silt soil (EPRI, 1999). The nearest storm water ponds to the ash pond system are located to the southwest and northeast of the system (**Figure 3**).

Surface water flow within the ash pond system is controlled by a series of embankments and splitter dikes. Pond elevations are maintained so that surface water flows via gravity through underground pipes to ponds in the following order: Pyrites Pond, BAP 1A and BAP 1B, Reclaim Pond, and Clearwater Pond (EPRI, 1999). A majority of water in the Reclaim Pond is pumped to the Plant for re-use. Water that is not recycled into the Plant continues to the Clearwater Pond (GA, 2005). From the Clearwater Pond, water flows to the Kanawha River through a National Pollutant Discharge Elimination System permitted outfall via underground piping.

Two spillway pipes are present in the ash pond system (**Figure 3**). These spillway pipes are intended to discharge excess storm flow into Bill's Creek in the event of a large storm event. One spillway pipe is located at BAP 1B, and the other is located at the Reclaim Pond. Both pipes cross the main dike and discharge in the watershed of Bill's Creek.

2.3 Previous Investigations

From 1995 through 1998, AEP worked in coordination with Ish, Inc., META Environmental, Inc., HIS GeoTrans, Inc., and Electric Power Research Institute (EPRI) to evaluate groundwater quality associated with a number of AEP power generating facilities, including the Amos Plant. The primary objectives of these site investigations were to characterize hydrogeology and identify potential contaminant source areas, establish existing groundwater quality, and identify constituents that exceeded West Virginia Groundwater Standards (WVGS). These studies are described in detail in the report *Groundwater Quality at the John E. Amos Power Plant, Putnam County, West Virginia* (EPRI, 1999). Field work for these investigations included 41 direct push technology (DPT) groundwater sampling points, installation of 10 permanent monitoring wells (MW-1 through MW-10), surface water sampling from onsite ponds and Bill's Creek, and geotechnical soil characterization.

In 2005, Geo/Environmental Associates, Inc. (GA) performed site investigations at the direction of AEP associated with planned modifications to the main dike. Field methods involved drilling and logging 8 soil borings through the main dike (B-1 through B-8). Split-spoon samples were collected during installation of the borings for the purpose of slope stability analysis, and 3 of the borings were converted to standpipe piezometers (P1, P3, P6). Additionally, boring B-7 was converted to a 2-inch monitoring well, P7 (GA, 2005). This site investigation included numerical hydraulic and slope stability analysis.

The findings of the above-mentioned GA site investigation were submitted to West Virginia Department of Environmental Protection (WVDEP), and were subsequently returned to AEP with comments. This prompted a revision of the hydraulic analyses and construction design specification associated with the plans to raise the elevation of the main dike. No additional field work was performed as part of this scope (GA, 2008).

2.4 Hydrogeologic Setting

The Site is immediately underlain by Quaternary-aged alluvial deposits consisting of clay, silt, sand, and gravel. While there is a general coarsening downward pattern, the shallower clay matrix is interbedded with silty or sandy layers and the deeper sand matrix is interbedded with silty or clayey layers. The uppermost groundwater zone occurs in the confined to semi-confined deeper sand zones that exhibit a potential head. Maximum alluvium thickness is approximately 50 ft and thins towards the edges of the valley. Groundwater flow direction within the alluvium is towards the Kanawha River or Bill's Creek.

In the upland areas surrounding the Site, bedrock primarily consists of the Pennsylvanian age sandstones, shales, limestones, and coal of the Monongahela and Conemaugh Groups. At higher elevations, the hilltops are capped by the Permian age Dunkard Formation. The Conemaugh Group immediately underlies alluvial sediments at the Site, and gently dips to the north. Groundwater occurrence in the bedrock generally coincides with the stress relief fracture system and is not necessarily related to lithology. Bedrock groundwater flow generally mimics surface topography, flowing from ridges towards valleys.

These features are further illustrated on three lines of cross section that were prepared through the ash pond system. The cross section location map is included as **Figure 4** and the lines of cross section are

included as **Figure 5A** (A to A'), **Figure 5B** (B to B'), and **Figure 5C** (C to C'). Boring logs and well construction diagrams are included in **Appendix A**.

2.4.1 Climate and Water Budget

The climate of Winfield, West Virginia is characterized as humid continental with an average rainfall of approximately 40 inches annually. The average maximum temperature is 66 ºF and the average minimum temperature is 44 ºF based on information from Southeast Regional Climate Center (SERCC, 2015).

2.4.2 Regional and Local Geologic Setting

The Site is located in the Appalachian Plateau physiographic province, and is also situated in the Kanawha River valley along the southern bank of the Kanawha River. Alluvial sediments consist of clay, silt, sand and gravel deposits that generally coarsen downward. Unconsolidated alluvial sediments are present in thicknesses to approximately 50 ft with thinning towards the valley walls.

Bedrock is present underlying the alluvial deposits, as well as in ridges located to the west of the Site. The primary bedrock units encountered are sedimentary rocks of the Permian age Dunkard Formation and the Pennsylvanian age Monongahela and Conemaugh Formations. The depositional environment for these formations is characterized by a gradually subsiding shallow sea with alternating marine and freshwater strata; the sedimentary units associated with the Monongahela and Conemaugh Formations consists of alternating shale and sandstone units, with occasional thin limestone beds. Several coal horizons are present in the region and often serve as marker beds for unit identification (EPRI, 1999).

Unconsolidated sediments in the upland areas are generally limited to nominal thicknesses of residuum overlying the bedrock. In incised valleys, there is generally a layer of colluvium or alluvium derived from eroded up-valley bedrock on top of the colluvium.

2.4.3 Surface Water and Surface Water/Groundwater Interactions

The Site is adjacent to the Kanawha River, and the ash pond system is located approximately 1,000 ft southwest of the Kanawha River. Bill's Creek, a tributary of the Kanawha River, is immediately adjacent and north of the Reclaim Pond. Groundwater flow direction is generally to the north, northeast, and east towards the Kanawha River and Bill's Creek. The Kanawha River stage level is dam controlled and is a gaining surface water feature. Groundwater elevations on site are higher than the normal stage elevation of the Kanawha River of 566 ft.

The stage levels of the ash pond system are generally maintained no greater than the normal operating levels ranging from 583 to 583.5 ft above mean sea level (amsl) (GA, 2008). Groundwater is generally present at lower elevations at around 570 ft amsl based on recently installed wells. The ponds are unlined and likely providing recharge to the uppermost aquifer resulting in groundwater mounding in the vicinity of the ash pond system.

2.4.4 Water Users

The Amos Plant uses Putnam County Public Service Department water supply. There are no active groundwater production wells at the Site. During the development of a water well inventory for the Site by Arcadis in 2014, no information was available regarding the location of nearby public or private water supply wells.

3. GROUNDWATER MONITORING WELL NETWORK EVALUATION

An initial evaluation of the monitoring well network present at the Site was performed in November 2015 to determine if any of the wells were viable for continued use as part of the groundwater monitoring well network or also be retained as part of a larger groundwater hydraulic monitoring well network. As part of this review, hydrogeologic conditions were evaluated to determine if the uppermost aquifer unit had an adequate monitoring well network. The evaluation was completed in accordance with 40 CFR 257.91 to have an established monitoring well network that effectively monitors the uppermost aquifer up gradient and down gradient of the Site. As a result of this evaluation, a geophysical investigation was completed in December 2015 along with installation of additional borings and monitoring wells in April through May 2016. Monitoring wells included in the monitoring network are designated as up or down gradient. Up gradient wells represent background groundwater quality and the down gradient monitoring wells monitor water quality groundwater down gradient of the CCR unit.

3.1 Hydrostratigraphic Units

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

The uppermost unconsolidated aquifer consists of the saturated alluvial sediments beneath and surrounding the Site. The upper limit of the uppermost aquifer is defined by the elevation of the top of the saturated sand zone, which is highly variable across the Site. The uppermost aquifer is generally confined to semi-confined by clay and sandy clay deposits. However, alluvial sands may be semi-confined to unconfined in some areas of the Site (e.g. SB-1604, MW-1602A). The base elevation of the ash pond system varies, but ranges from approximately 559 ft amsl (SB-1604) to 584 ft amsl (SB-1603). Soil borings installed in 2016 indicate that the base of the ash pond system is in contact with the underlying uppermost aquifer. This is illustrated in cross sections A-A', B-B', and C-C' (**Figures 5A, 5B,** and **5C**).

The vertical extent of the aquifer extends to the base of the unconsolidated deposits in the valley at the bedrock interface. The uppermost unconsolidated aquifer is approximately 50 feet thick and appears laterally extensive to the north, south and east around the ash pond system. The uppermost aquifer pinches out towards the bedrock valley wall to the west.

3.1.2 Overall Flow Conditions

Groundwater recharge occurs from regional precipitation infiltration and from ash pond use. Bedrock, to a lesser extent, contributes recharge to the uppermost unconsolidated aquifer from the west of the Site were the alluvial valley is in contact with the valley wall.

Available groundwater elevations for 1995 through 1996, as well as groundwater elevations collected in July 2016 from the newly-installed wells, are summarized on **Table 1**. The average vertical hydraulic gradient from 1995 to 1996 between wells MW-2 and MW-3 was 0.008 in an upward direction from MW-2, which is screened in the shallow sandy clay, to MW-3, which is screened deeper in the basal gravel zone.

In July 2016, a similar upward vertical hydraulic gradient of 0.009 was observed. Near the ash pond system, the average vertical gradient between wells MW-4 and MW-5 from 1995 to 1996 was -0.036 in a downward direction. In July 2016, a similar downward vertical gradient of -0.046 was observed. Both of these wells are screened in the uppermost aquifer (i.e. alluvial sands), indicating likely localized recharge from the ash pond system.

The most recent groundwater data set, collected on July 25, 2016, is depicted with potentiometric surface contours on **Figure 6**. Groundwater flow is generally to the north and east towards the Kanawha River. There is also a northern component of groundwater flow towards Bill's Creek. As presented in **Table 2**, wells included in the monitoring network have been designated as up or down gradient.

3.1.3 Soil Property Testing

During unconsolidated monitoring well installation, selected split-spoon soil samples were retained for particle-size analysis by sieving and hydrometer in accordance with American Society for Testing and Materials (ASTM) D421, D422, and D4718 and moisture content in accordance with ASTM D2216. Split spoon samples selected for particle-size analysis corresponded to the final well screen interval at each boring. For each new monitoring well location, one composite soil sample was compiled from the selected split spoon samples, which was then transported to the AEP Dolan Civil Engineering Laboratory in Groveport, Ohio for particle-size analysis. The particle-size analysis indicates silty sands and poorly graded sands that make up the alluvial deposits within the screened intervals of the installed monitoring wells in 2016. Note that MW-1603A is installed in a weathered bedrock sequence adjacent to Bill's Creek. The results of this analysis are summarized in **Table 3**, and complete laboratory reports are provided in **Appendix B**.

3.1.4 Hydraulic Conductivity

Pneumatic and bail down slug tests were performed on a total of 2 up gradient wells (MW-1602A, MW-1603A) and 3 down gradient wells (MW-1604, MW-1605, MW-1606) on June 16 and 17, 2016 to provide a broader understanding of the hydraulic conductivity distribution within the alluvial sands (i.e. uppermost aquifer). Well construction details for these wells, as well as all other wells in the monitoring well network, are presented in **Table 2**. Data-logging pressure transducers were used during these tests to monitor and record water level displacement.

Three pneumatic slug tests were performed at each well except MW-1604. Two tests were performed using an identical initial pressure and one test was performed using approximately double the pressure applied in the other two tests. This protocol was implemented to verify the initial head displacement and to evaluate the reproducibility of the results. Equilibration was achieved prior to and after each pneumatic slug test in order to minimize any potential interference between tests. Equilibration was achieved when water level readings stabilized. The pressure applied to each monitor well induced head displacements ranging from approximately 0.5 to 1.5 feet.

At MW-1604, three bail-down slug tests were completed. The pneumatic tests could not be completed due to insufficient initial displacement upon pressurization. Two tests were performed by submerging and removing half the bailer (24-inches) and one test was performed by submerging and removing the entire bailer (48-inches). This protocol was implemented to verify the initial head displacement and to evaluate

the reproducibility of the results. The bailer removal induced head displacements ranging from approximately 1.1 to 2.1 feet.

For each well, one representative test was selected for analysis and analyzed using AQTESOLV® for Windows® Version 4.50 (Duffield, 2007). The hydraulic conductivity values were determined using applicable analytical solutions for a single (partially-penetrating) well under confined or unconfined conditions, as appropriate. Analytical solutions were selected based on the observed response. Results of the slug test analyses are summarized in **Table 4** and solution reports with individual curve matches are provided in **Appendix C.**

The hydraulic conductivity estimates from the five monitoring wells tested ranged from 0.7 ft per day (MW-1605) to 12.5 ft per day (MW-1602A). The overall mean hydraulic conductivity estimate was 6.8 ft per day, while the overall geometric mean was 4.6 ft per day. Estimated hydraulic conductivity values at MW-1602A, MW-1603A, and MW-1606 were consistent with silty sand. The estimated hydraulic conductivity values at MW-1604 and MW-1605 were lower, which is likely due to increased fines associated within the alluvial sand zone.

3.1.5 Geophysical Survey

In order to provide an initial characterization of the ash pond system and the hydrostratigraphic units at the Site, Arcadis completed an electrical resistivity survey from December 8 through December 11, 2015. This geophysical investigation aided in boring/monitoring well placement and provided insight on subsurface conditions between borings. Five total electrical resistivity transects (Line ER-1 through Line ER-5) were performed. Lengths of the resistivity transects ranged from 291 meters (approximately 950 ft.) to 333 meters (1,100 feet). For each survey line, up to 112 non-corrosive stainless-steel electrode stakes were used, which were separated by a distance of 3 meters (approximately 6.6 feet), and inserted into surface soils with an approximate constant spacing along a relatively straight transect. Once the electrical resistivity data set was collected, the data was downloaded for processing. Additional detail of the procedures and results of the electrical resistivity surveys are included in **Appendix D**. The locations of the transect lines are illustrated on **Figure D-1**.

There are three distinct zones of contrasting electrical resistivity apparent on all four resistivity cross-sections. As shown in **Figures D-2** through **D-5**, the uppermost resistivity zone is characterized by lower resistivity values (generally 10 to 100 Ohm-meters, shown in blue to green colors) and is interpreted as finer-grained unconsolidated native clay soils, clay fill materials, or fine-grained ash fill deposits. The second resistivity layer is characterized by higher resistivity values (generally 100 to 800 Ohm-meters, shown in green to red colors) and are interpreted as unconsolidated coarser-grained native sand or sand/gravel soils, or sandy fill materials. This coarser-grain layer is consistent with the sand saturated zone and is delineated by black dashed lines in **Figures D-2** through **D-5**. The third resistivity zone is characterized by significantly low resistivity values of less than 10 Ohm-meters (shown as dark blue to white colors). These zones of anomalous low resistivity are not likely due to naturally occurring soils/geologic conditions, but are rather interpreted to indicate saturated soils impacted by high concentrations of total dissolved solids in groundwater.

3.2 Uppermost Aquifer

3.2.1 CCR Rule Definition

Per 40 CFR 257.60(a), new CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (5 ft) above the upper limit of the uppermost aquifer, or must demonstrate there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high conditions).

The CCR rule definitions for an aquifer and the uppermost aquifer as specified in 40 CFR 257.53 indicates an aquifer is a geologic formation capable of yielding usable quantities of groundwater to wells or springs while an uppermost aquifer is defined as the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers, that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural groundwater surface to which the aquifer rises during the wet season.

3.2.1.1 Common Definitions

An aquifer is commonly defined as a geologic unit that stores and transmits water (readily or at sufficient flow rates) to supply wells and springs (USGS, 2015; Fetter, 2001). The uppermost aquifer is considered the first encountered aquifer nearest to the CCR unit.

3.2.2 Identified Onsite Hydrostratigraphic Unit

The identified Site hydrostratigraphic unit is the unconsolidated alluvial aquifer consisting of confined sands. This aquifer is not known to be used locally for groundwater supply or industrial water use.

3.3 Review of Existing Monitoring Well Network

3.3.1 Overview

Arcadis and AEP personnel visited the Site on August 11, 2015 to review existing well network conditions and locations. The well network that existed at the time of that site visit was deficient, lacking the distribution to accurately represent background water quality and the quality of groundwater passing the waste boundary of the CCR Unit, per 40 CFR 257.91. A well construction table that summarizes the location, ground surface elevation, borehole depth, installation date, and associated well construction details of the monitoring well network is included as **Table 2**. The wells that were not located or abandoned are gray shaded on **Tables 1** and **2** and **Figure 3**.

The groundwater quality monitoring well network monitors the alluvial aquifer consisting of confined to semi-confined sands. It includes 4 wells installed between 1995 and 2005 and 6 wells installed from April to May 2016. An additional 3 wells, which were pre-existing, are utilized only for the purpose of hydraulic monitoring (**Table 2**). Two well pairs, MW-2/MW-3 and MW-4/MW-5 measure vertical flow.

Spatially, the groundwater quality monitoring well network extends as far up gradient to the south as MW-1602A and up gradient along Bill's Creek to the west (MW-1603A). Down gradient, the network extends from immediately down gradient of the ash pond system (MW-4, MW-1604) to the Kanawha River (MW-1605). The current monitoring well network distribution is presented on **Figure 7**.

3.3.2 Gaps in Monitoring Network

As discussed in Section 3.3.1 of this report, gaps in the monitoring network were identified upon initial Arcadis review in 2015. Following a geophysical survey and boring/monitoring well installation described in **Appendix D** of this report, there are no gaps in the monitoring network. The recommended monitoring well network is further described in Section 4.

4. RECOMMENDED MONITORING WELL NETWORK

The groundwater monitoring well network is intended to meet specifications stated in 40 CFR 257.91. The network is discussed with respect to location to the ash pond system (up gradient or down gradient), well depth, and well construction. The recommended existing monitor well network described below will provide an adequate understanding of seasonal and temporal fluctuations in groundwater quality, hydraulics, and groundwater flow in the uppermost aquifer.

4.1 Monitoring Well Network Distribution

A total of 6 monitoring wells were installed to augment the existing network. Specifics on field methodology and other documentation on installation of the additional wells in 2015 and 2016 is provided in **Appendix D**. Monitoring well construction was targeted to monitor the saturated alluvial sands down gradient, which is identified as the uppermost aquifer. Up gradient wells were installed in the upper most alluvial aquifer and weathered bedrock (MW-1603A). The total groundwater quality monitoring network includes 4 up gradient wells and 6 down gradient wells (**Table 2** and **Figure 7**). The monitoring well distribution adequately covers down gradient and up gradient areas as detailed in the following sections. In addition to the 10 groundwater quality wells, 3 wells are used to refine the understanding of groundwater flow and hydraulic gradients in the vicinity of the ash pond system and down gradient at the Plant (**Table 2** and **Figure 7**).

4.1.1 Down Gradient Locations

Down gradient monitoring wells are located to the north and east of the ash pond system. These wells include existing wells MW-1, MW-4, and MW-5, as well as newly-installed wells MW-1604, MW-1605, and MW-1606 (**Table 2**). These wells monitor groundwater as it flows north and east past the CCR unit boundary.

4.1.2 Up Gradient Locations

Up gradient monitoring wells are located south and west of the ash pond system. These wells include existing well MW-6, as well as newly-installed wells MW-1601, MW-1602A, and MW-1603A (**Table 2**). These wells establish background groundwater quality up gradient of the CCR unit boundary.

4.2 Well Construction

Monitoring wells in the network are constructed of 2-inch Schedule 40 PVC risers with 5 to 10 ft of 0.01 inch slotted PVC screens, with the exception of MW-1606 which has 15 ft of screen. Installation details and field methods are provided in **Appendix D**. Well construction data for the monitoring well network is summarized on **Table 2**. Boring logs and the monitoring well completion diagrams are provided in **Appendix A**.

5. PROFESSIONAL ENGINEER'S CERTIFICATION

I, John W. Holm, 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, the proposed groundwater monitoring system will be adequate to meet the requirements of 40 CFR Part 257.91.

John W Holm

Printed Name of Registered Professional Engineer

Signature

17419 — Registration No.

Registration State

10/18/16 — Date

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TABLES

Table 1
Water Level Data
AEP Amos Generating Plant - Ash Pond System
Winfield, West Virginia

Well ID	Sep-95	Mar-96	Jul-96	Jul-16
	GW Elev [a] ft amsl	GW Elev [a] ft amsl	GW Elev [a] ft amsl	GW Elev ft amsl
Sandy Clay Zone Wells				
MW-2	572.27	572.97	572.90	574.80
MW-6	571.21	572.71	572.47	571.55
MW-8	575.24	576.23	576.05	577.13
MW-9	572.26	572.77	572.58	--
Sand Zone Wells				
MW-1	565.86	566.28	565.95	567.04
MW-4	569.84	570.35	570.31	570.99
MW-5	569.10	569.62	569.60	570.08
MW-7	573.84	574.84	574.88	--
MW-1601	--	--	--	574.87
MW-1602A	--	--	--	576.11
MW-1603A	--	--	--	579.14
MW-1604	--	--	--	568.10
MW-1605	--	--	--	568.79
MW-1606	--	--	--	572.73
Basal Gravel Zone Wells				
MW-3	572.45	573.28	573.21	575.10
MW-10	572.21	572.76	572.51	--

Notes:
Shaded - well abandoned or not verified
a. Source: EPRI. April 1999. Groundwater Quality at the John E. Amos Power Plant, Putnam County, West Virginia, Table 2-5.
-- - not measured
amsl - above mean sea level
Elev - elevation
ft - feet
GW - groundwater

Table 2
Well Construction Details
AEP Amos Generating Plant - Ash Pond System
Winfield, West Virginia

Well ID	Hydraulic Monitoring Only	Location Description to CCR Unit	Northing [a]	Easting [a]	Ground Surface Elevation [a]	Top of Casing Elevation [a]	Borehole Depth ft bls	Date Installed	Screen Material	Well Diameter inches	Top of Filter Pack		Bottom of Filter Pack		Top of Screen		Bottom of Screen	
											Depth ft bls	Elevation ft amsl	Depth ft bls	Elevation ft amsl	Depth ft bls	Elevation ft amsl	Depth ft bls	Elevation ft amsl
Sandy Clay Zone Wells																		
Upgradient																		
MW-6 [b]		West	539170.0	1729695.5	586.5	589.42	43.0	8/30/1995	Slotted PVC	2	27.0	559.54	42.7	543.84	31.0	555.54	41.0	545.54
MW-8 [b]	x	South	536151.9	1732199.2	584.8	587.57	24.0	9/13/1995	Slotted PVC	2	6.0	578.82	21.9	562.92	10.0	574.82	20.0	564.82
MW-9 [b]		Southeast	536983.3	1734099.7	586.8	588.54	32.0	8/29/1995	Slotted PVC	2	17.0	569.80	32.0	554.80	21.0	565.80	31.0	555.80
Downgradient																		
MW-2 [b]	x	East	539188.3	1732745.0	586.3	589.10	57.9	8/24/1995	Slotted PVC	2	9.0	577.34	24.7	561.64	13.0	573.34	23.0	563.34
Sand Zone Wells																		
Upgradient																		
MW-7 [b]		Southeast	537838.4	1731735.7	587.1	588.72	39.0	8/31/1995	Slotted PVC	2	24.0	563.10	39.0	548.10	28.0	559.10	38.0	549.10
MW-1601		Southeast	538186.6	1731490.3	586.5	589.48	42.0	5/10/2016	Slotted PVC	2	24.0	562.49	42.0	544.49	28.4	588.09	38.0	548.49
MW-1602A		South	537031.1	1730894.1	598.0	600.66	59.5	5/25/2016	Slotted PVC	2	43.4	554.56	59.5	538.46	47.9	550.06	58.0	539.96
MW-1603A		West	538963.7	1729314.5	584.1	586.81	45.0	5/24/2016	Slotted PVC	2	34.0	550.06	45.0	539.06	38.0	546.06	43.0	541.06
Downgradient																		
MW-1 [b]		Northeast	540566.9	1731165.6	582.1	584.33	56.0	9/6/1995	Slotted PVC	2	19.9	562.21	35.0	547.11	24.0	558.11	34.0	548.11
MW-4 [b]		Northeast	539605.5	1731129.0	585.7	587.96	35.0	9/8/1995	Slotted PVC	2	19.9	565.80	35.0	550.70	24.0	561.70	34.0	551.70
MW-5 [b]		Northeast	539614.2	1731120.8	585.0	587.10	55.0	9/7/1995	Slotted PVC	2	39.3	545.73	55.0	530.03	44.0	541.03	54.0	531.03
MW-1604		Northwest	539459.6	1729931.7	586.0	589.05	45.0	5/6/2016	Slotted PVC	2	29.0	557.01	45.0	541.01	33.9	552.11	44.0	542.01
MW-1605		Northeast	540038.8	1731401.7	583.4	586.40	42.5	5/4/2016	Slotted PVC	2	22.6	560.75	42.5	540.85	26.3	557.05	41.5	541.85
MW-1606		East	539197.0	1731559.3	580.8	583.88	40.5	5/3/2016	Slotted PVC	2	21.2	559.59	40.5	540.29	24.3	556.47	39.0	541.79
Basal Gravel Zone Wells																		
Upgradient																		
MW-10 [b]		Southeast	536989.9	1734094.7	586.4	588.47	59.0	8/28/1995	Slotted PVC	2	43.0	543.40	58.9	527.50	47.5	538.90	57.5	528.90
Downgradient																		
MW-3 [b]	x	East	539200.1	1732739.6	586.3	588.97	58.0	8/23/1995	Slotted PVC	2	42.7	543.64	57.9	528.44	46.9	539.44	56.9	529.44

Notes:
Shaded - well abandoned or not verified
Elevation in feet above mean sea level
a. Monitoring well coordinates and elevations were surveyed by AEP in June 2016 (1983 West Virginia State Planar Coordinates, NAVD 88).
b. Well Construction Source: EPRI. April 1999. Groundwater Quality at the John E. Amos Power Plant, Putnam County, West Virginia, Appendix B.
amsl - above mean sea level
bls - below land surface
ft - feet

Table 3
Grain Size Analysis Summary
AEP Amos Generating Plant - Ash Pond System
Winfield, West Virginia

ARCADIS Design & Consultancy for natural and built assets

		Grain Size Analysis					
Sample ID	Depth feet	% Gravel	% Sand	% Silt	% Clay	USCS Classification	Moisture Content %
MW-1601	27-39	0.6	87.8	5.3	6.3	(SP-SM) POORLY-GRADED SAND with SILT	23.0
MW-1602A	48-58	2.6	80.8	5.5	11.1	(SM) SILTY SAND	21.9
MW-1603A	38-43	10.0	60.3	16.7	13.0	(SM) SILTY SAND	20.3
MW-1604	33-43.5	0.8	80.0	7.9	11.4	(SM) SILTY SAND	23.8
MW-1605	25.5-42	0.2	83.6	4.7	11.4	(SM) SILTY SAND	25.5
MW-1606	29-39	0.4	90.4	4.3	4.8	(SP-SM) POORLY-GRADED SAND with SILT	23.4

Note:
USCS - Unified Soil Classification System

Table 4
Hydraulic Testing Results Summary
AEP Amos Generating Plant - Ash Pond System
Winfield, West Virginia

Well ID	Screen Interval ft bgs	Aquifer Thickness [a] ft	Screened Interval USCS Classification	Slug Test Type	Hydraulic Conductivity ft/day	Hydraulic Conductivity cm/sec	Slug Test Solution
MW-1602A	47.9-58.0	19	(SM) SILTY SAND	Pneumatic - Rising head	12.5	4.4E-03	Hyder et al., 1994
MW-1603A	38.0-43.0	5	(SM) SILTY SAND	Pneumatic - Rising head	8.8	3.1E-03	Hyder et al., 1994
MW-1604	33.9-44.0	27	(SM) SILTY SAND	Bail Down - Rising head	2.7	9.6E-04	Hyder et al., 1994
MW-1605	26.3-41.5	31	(SM) SILTY SAND	Pneumatic - Rising head	0.7	2.6E-04	Hyder et al., 1994
MW-1606	24.3-39.0	40	(SP-SM) POORLY-GRADED SAND with SILT	Pneumatic - Rising head	9.4	3.3E-03	Hyder et al., 1994
				Slug Test Overall Mean	**6.8**	**2.4E-03**	
				Slug Test Overall Geometric Mean	**4.6**	**1.6E-03**	
				Slug Test Minimum	**0.7**	**2.6E-04**	
				Slug Test Maximum	**12.5**	**4.4E-03**	

Notes:

a. Estimate made from boring logs

bgs - below ground surface

cm/sec - centimeters per second

ft - feet

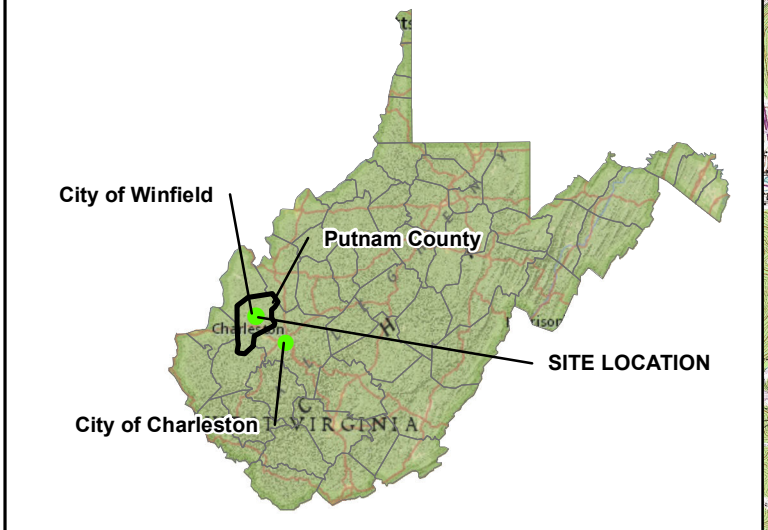
USCS - Unified Soil Classification System

References:

Butler Jr, J.J., 1998. *The design, performance, and analysis of slug tests*. CRC Press.

Hyder, Z, J.J. Butler, Jr., C.D. McElwee and W. Liu, 1994. Slug tests in partially penetrating wells, Water Resources Research, vol. 30, no. 11, pp. 2945-2957.

FIGURES



AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

SITE LOCATION MAP

ARCADIS

FIGURE
1

Document Path: Z:\GISPROJECTS_ENV\AEP\Amos\mxd\Ash Pond Report\F1_ site map.mxd

Bancroft

Flow Direction

Kanawha River

FGD Landfill

Ash Pond System

AEP Amos Plant Location

Raymond City

U.S. Highway 35

Winfield Road (WV 817)

Flow Direction

Interstate 64

0 3,000 6,000

SCALE IN FEET

Legend

Coal Combustion Residual (CCR) Unit

Rivers and Streams

NOTES:
1. 2014 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE.

2. WEST VIRGINIA 1983 STATE PLANAR COORDINATES

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

PLANT AND CCR UNIT LOCATION MAP

ARCADIS

FIGURE
2

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
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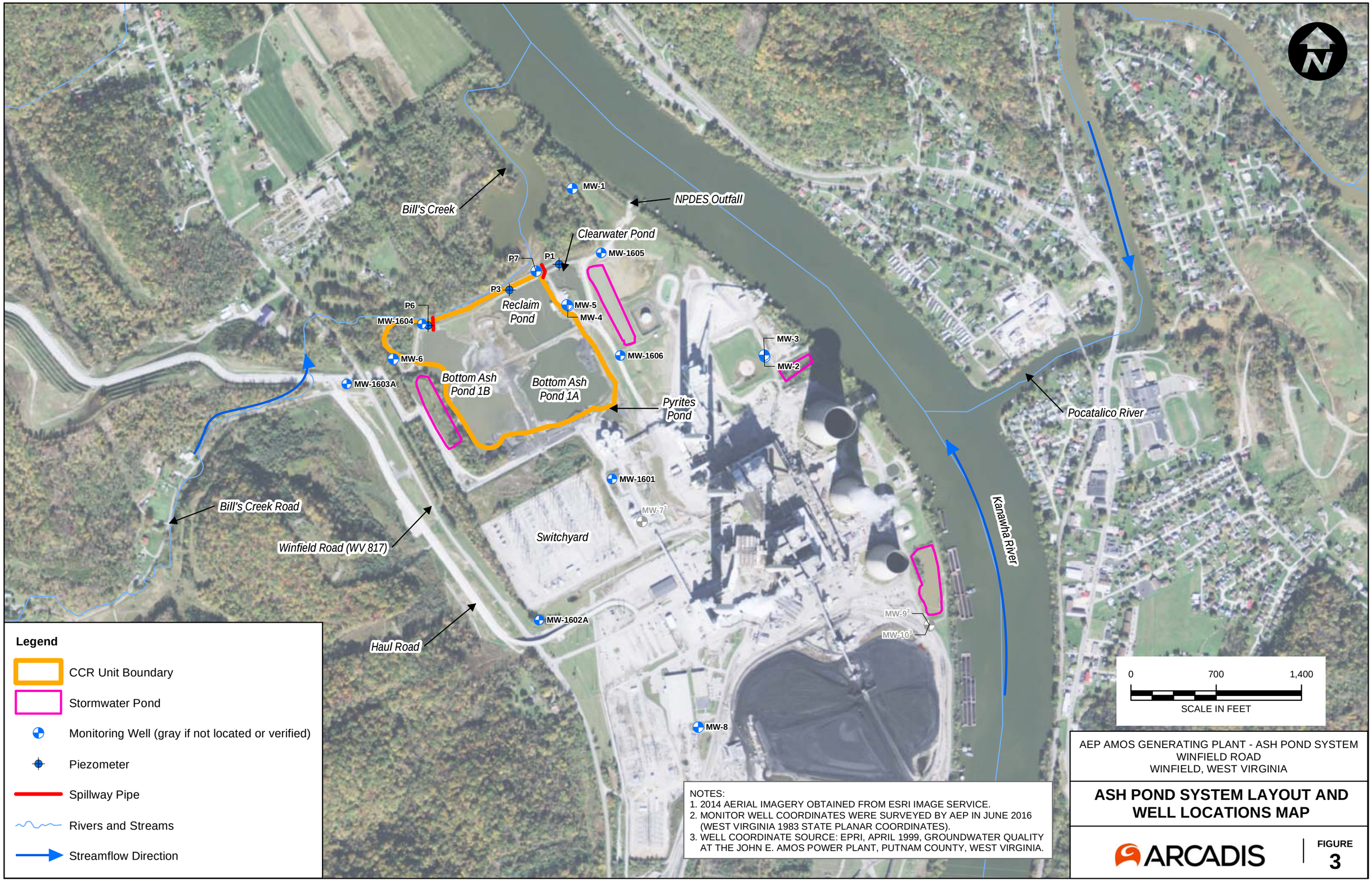

Legend

- CCR Unit Boundary
- Stormwater Pond
- Monitoring Well (gray if not located or verified)
- Piezometer
- Spillway Pipe
- Rivers and Streams
- Streamflow Direction

NOTES:
1. 2014 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE.
2. MONITOR WELL COORDINATES WERE SURVEYED BY AEP IN JUNE 2016 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES).
3. WELL COORDINATE SOURCE: EPRI, APRIL 1999, GROUNDWATER QUALITY AT THE JOHN E. AMOS POWER PLANT, PUTNAM COUNTY, WEST VIRGINIA.

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

ASH POND SYSTEM LAYOUT AND WELL LOCATIONS MAP

ARCADIS

FIGURE
3

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
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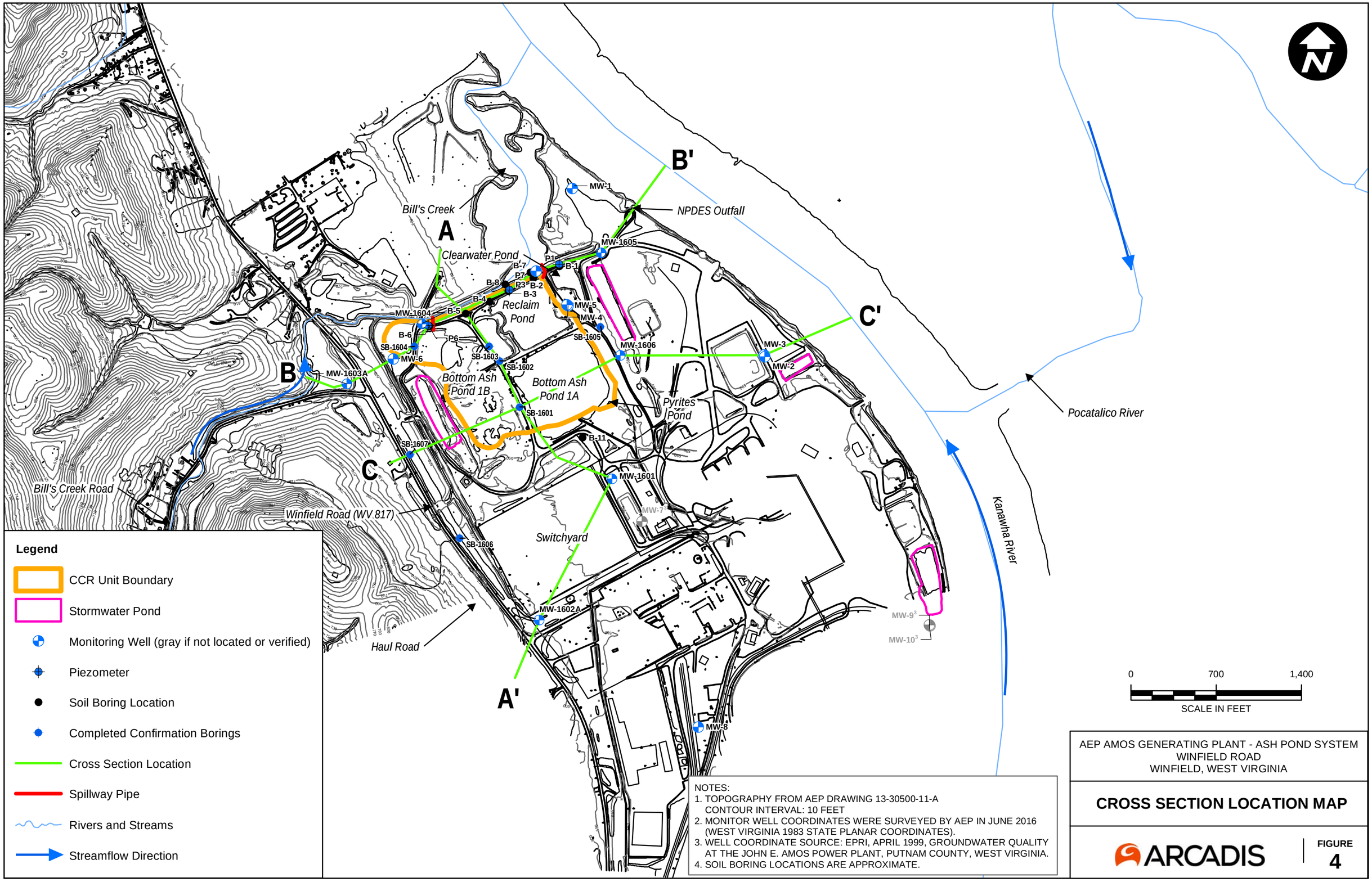

Legend

- CCR Unit Boundary
- Stormwater Pond
- Monitoring Well (gray if not located or verified)
- Piezometer
- Soil Boring Location
- Completed Confirmation Borings
- Cross Section Location
- Spillway Pipe
- Rivers and Streams
- Streamflow Direction

NOTES:
1. TOPOGRAPHY FROM AEP DRAWING 13-30500-11-A
   CONTOUR INTERVAL: 10 FEET
2. MONITOR WELL COORDINATES WERE SURVEYED BY AEP IN JUNE 2016 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES).
3. WELL COORDINATE SOURCE: EPRI, APRIL 1999, GROUNDWATER QUALITY AT THE JOHN E. AMOS POWER PLANT, PUTNAM COUNTY, WEST VIRGINIA.
4. SOIL BORING LOCATIONS ARE APPROXIMATE.

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

CROSS SECTION LOCATION MAP

ARCADIS

FIGURE
4

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
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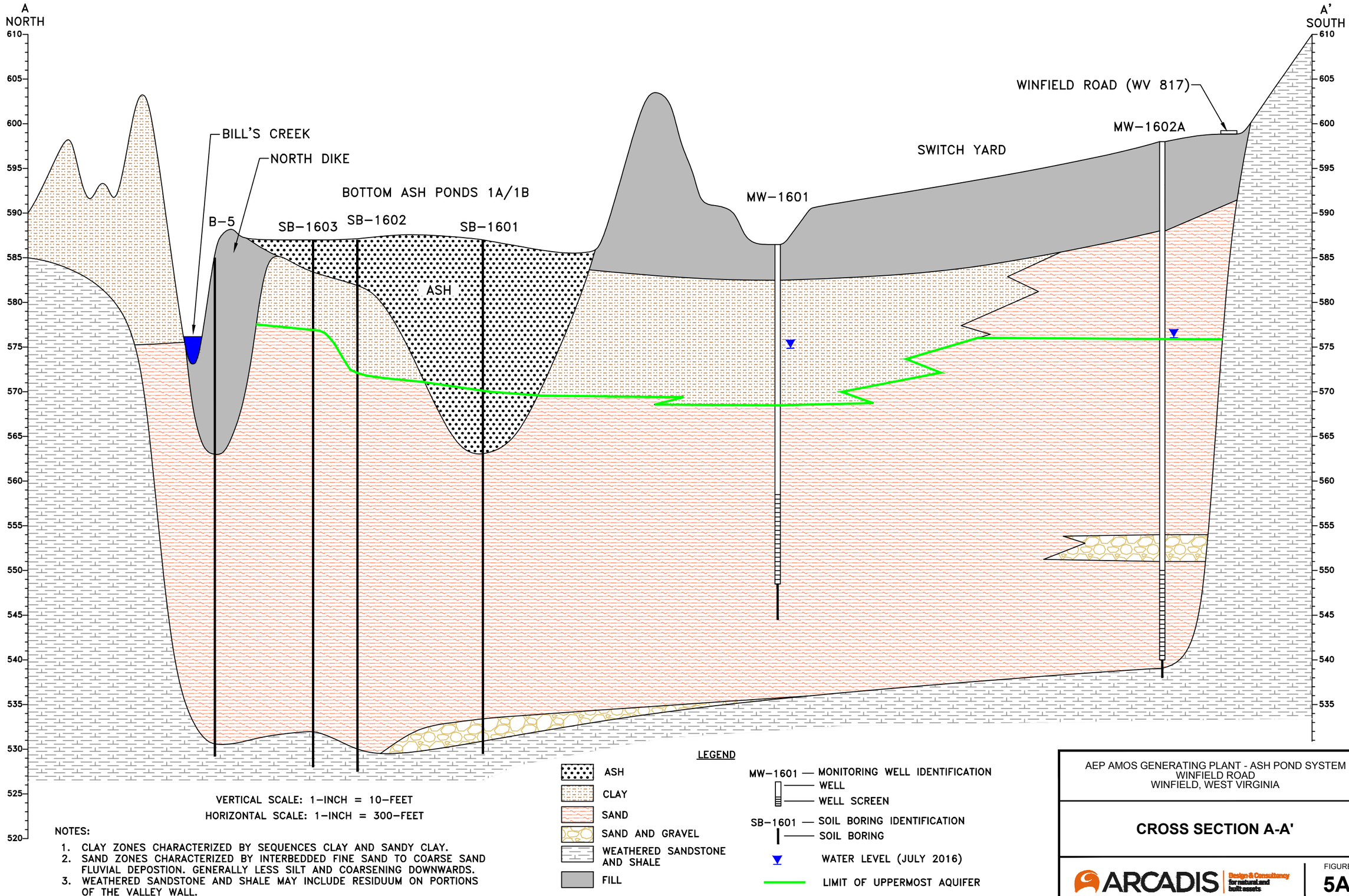


VERTICAL SCALE: 1-INCH = 10-FEET
HORIZONTAL SCALE: 1-INCH = 300-FEET

NOTES:

1. CLAY ZONES CHARACTERIZED BY SEQUENCES CLAY AND SANDY CLAY.
2. SAND ZONES CHARACTERIZED BY INTERBEDDED FINE SAND TO COARSE SAND FLUVIAL DEPOSTION. GENERALLY LESS SILT AND COARSENING DOWNWARDS.
3. WEATHERED SANDSTONE AND SHALE MAY INCLUDE RESIDUUM ON PORTIONS OF THE VALLEY WALL.

LEGEND

- ASH
- CLAY
- SAND
- SAND AND GRAVEL
- WEATHERED SANDSTONE AND SHALE
- FILL

MW-1601 — MONITORING WELL IDENTIFICATION
WELL
WELL SCREEN

SB-1601 — SOIL BORING IDENTIFICATION
SOIL BORING

WATER LEVEL (JULY 2016)

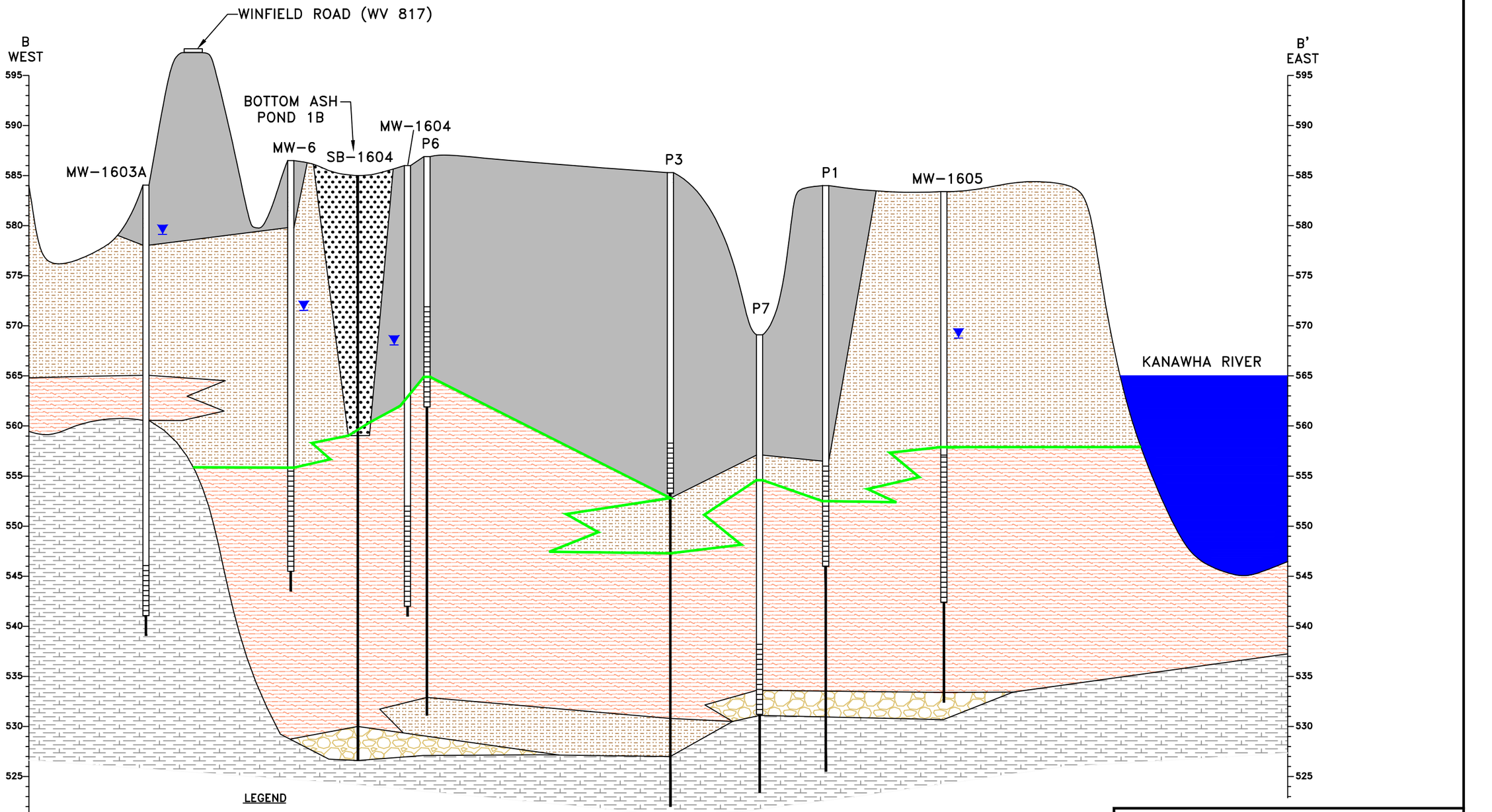
LIMIT OF UPPERMOST AQUIFER

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

CROSS SECTION A-A'

ARCADIS Design & Consultancy for natural and built assets

FIGURE
5A



LEGEND

- ASH
- CLAY
- SAND
- SAND AND GRAVEL
- WEATHERED SANDSTONE AND SHALE
- FILL

MW-1605 — MONITORING WELL IDENTIFICATION
WELL
WELL SCREEN

B-0601 — SOIL BORING IDENTIFICATION
SOIL BORING

WATER LEVEL (JULY 2016)

LIMIT OF UPPERMOST AQUIFER

VERTICAL SCALE: 1-INCH = 10-FEET
HORIZONTAL SCALE: 1-INCH = 300-FEET

NOTES:

1. CLAY ZONES CHARACTERIZED BY SEQUENCES CLAY AND SANDY CLAY.
2. SAND ZONES CHARACTERIZED BY INTERBEDDED FINE SAND TO COARSE SAND FLUVIAL DEPOSTION. GENERALLY LESS SILT AND COARSENING DOWNWARDS.
3. WEATHERED SANDSTONE AND SHALE MAY INCLUDE RESIDUUM ON PORTIONS OF THE VALLEY WALL.

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

CROSS SECTION B-B'

ARCADIS Design & Consultancy for natural and built assets

FIGURE
5B

C
WEST

C'
EAST

615
610
605
600
595
590
585
580
575
570
565
560
555
550
545
540
535
530
525

WINFIELD ROAD (WV 817)

SB-1607

SB-1601

SPLITTER DIKE

BOTTOM ASH
POND 1B

BOTTOM ASH
POND 1A

MW-1606

MW-3

KANAWHA RIVER

LEGEND

- ASH
- CLAY
- SAND
- SAND AND GRAVEL
- WEATHERED SANDSTONE AND SHALE
- FILL

MW-1606 — MONITORING WELL IDENTIFICATION
- WELL
- WELL SCREEN

SB-1607 — SOIL BORING IDENTIFICATION
- SOIL BORING

WATER LEVEL (JULY 2016)

LIMIT OF UPPERMOST AQUIFER

VERTICAL SCALE: 1-INCH = 10-FEET
HORIZONTAL SCALE: 1-INCH = 300-FEET

NOTES:
1. CLAY ZONES CHARACTERIZED BY SEQUENCES CLAY AND SANDY CLAY.
2. SAND ZONES CHARACTERIZED BY INTERBEDDED FINE SAND TO COARSE SAND FLUVIAL DEPOSTION. GENERALLY LESS SILT AND COARSENING DOWNWARDS.
3. WEATHERED SANDSTONE AND SHALE MAY INCLUDE RESIDUUM ON PORTIONS OF THE VALLEY WALL.

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

CROSS SECTION C-C'

ARCADIS Design & Consultancy for natural and built assets

FIGURE
5C

CITY:(COLUMBUS, OHIO) DIV/GROUP:(IM/DV) DB:(R. SMITH) LD:(Opt) PIC:(Opt) PM:(J. ROBERTS) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
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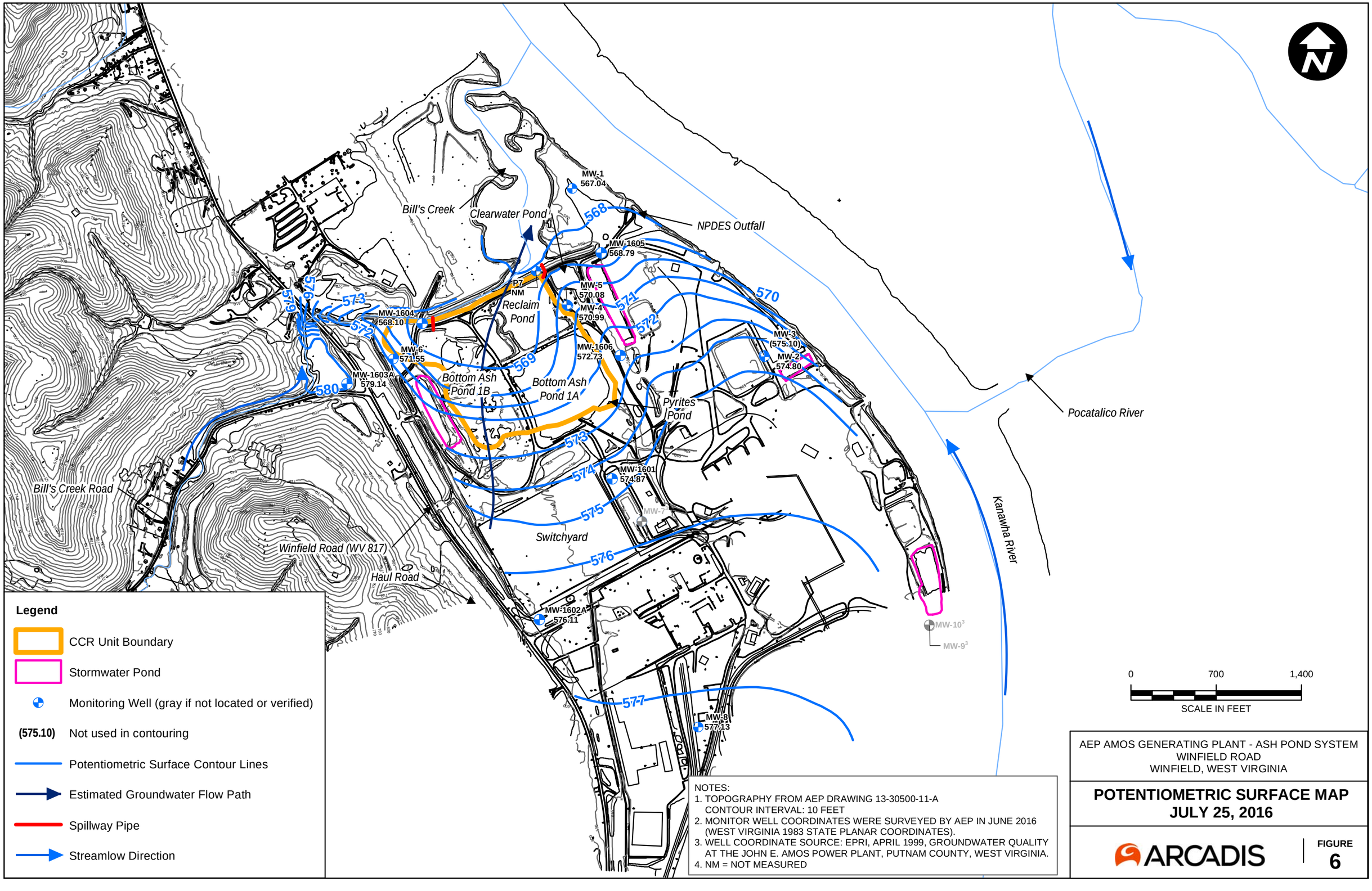

Legend

- CCR Unit Boundary
- Stormwater Pond
- Monitoring Well (gray if not located or verified)
- (575.10) Not used in contouring
- Potentiometric Surface Contour Lines
- Estimated Groundwater Flow Path
- Spillway Pipe
- Streamlow Direction

NOTES:
1. TOPOGRAPHY FROM AEP DRAWING 13-30500-11-A
   CONTOUR INTERVAL: 10 FEET
2. MONITOR WELL COORDINATES WERE SURVEYED BY AEP IN JUNE 2016 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES).
3. WELL COORDINATE SOURCE: EPRI, APRIL 1999, GROUNDWATER QUALITY AT THE JOHN E. AMOS POWER PLANT, PUTNAM COUNTY, WEST VIRGINIA.
4. NM = NOT MEASURED

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

POTENTIOMETRIC SURFACE MAP JULY 25, 2016

ARCADIS

FIGURE 6

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountainer Ash Pond)
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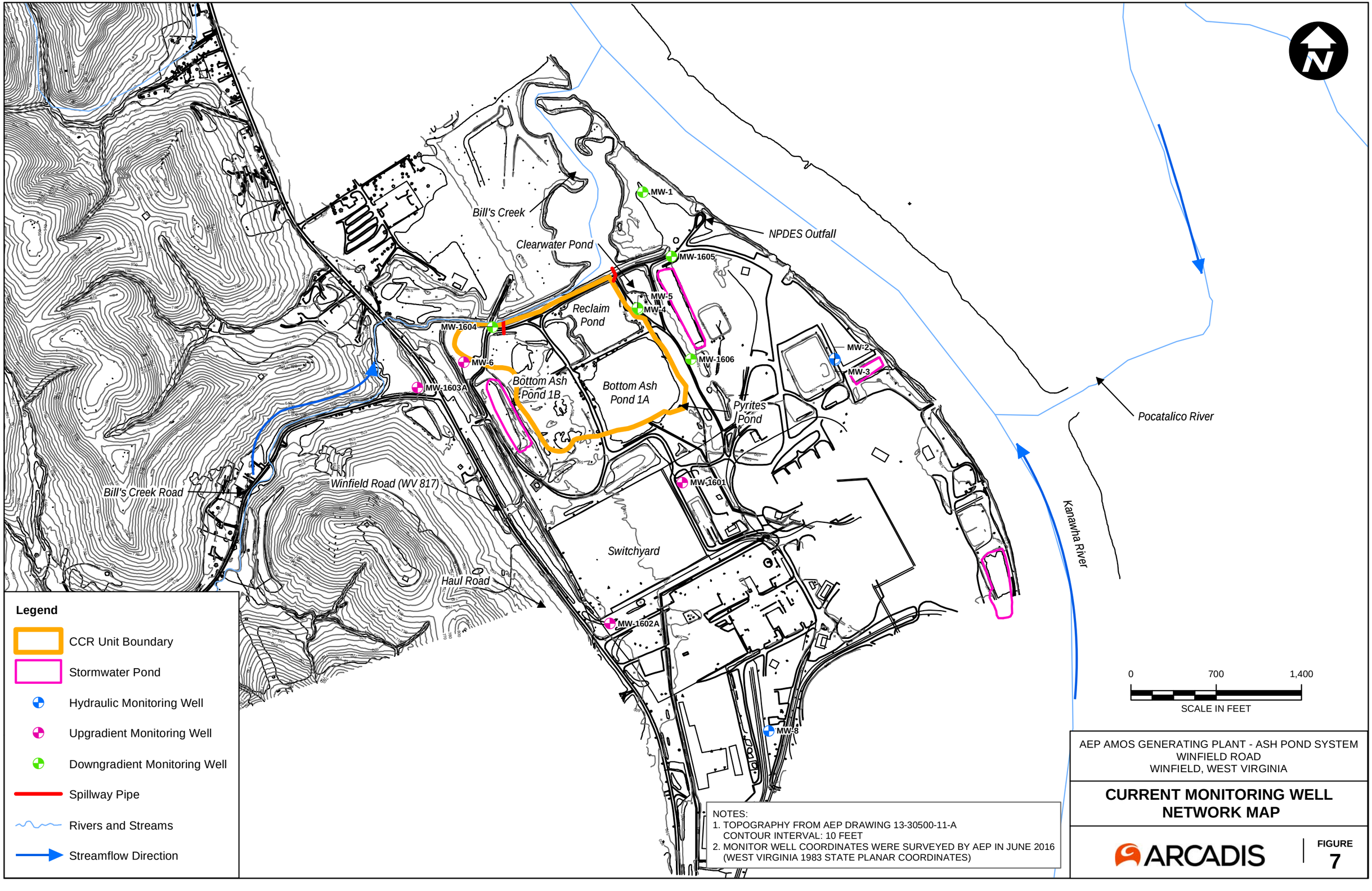

NOTES:
1. TOPOGRAPHY FROM AEP DRAWING 13-30500-11-A
   CONTOUR INTERVAL: 10 FEET
2. MONITOR WELL COORDINATES WERE SURVEYED BY AEP IN JUNE 2016
   (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

CURRENT MONITORING WELL NETWORK MAP

ARCADIS

FIGURE 7

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
Z:\GISPROJECTS_ENV\AEPAmos\mxd\Ash Pond Report\F7_Amos Ash Pond Well Network-Proposed Network Map\v21.mxd 9/2/2016 5:33:30 PM

APPENDIX A

Boring/Well Construction Logs

ARCADIS

AEP 1995

Soil Boring Logs

MW-01 to MW-10

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 540,266.8 E 1,731,165.6

GROUND ELEVATION 581.5 SYSTEM STATE PLANE

WATER LEVEL	▽	▽	▽
TIME			
DATE			

BORING NO. AMW-01 DATE 11/17/95 SHEET 1 OF 2

BORING START 09/05/95 BORING FINISH 09/06/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 2.0 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 24.0 BOTTOM 34.0

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY TJH=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	3-5-7-8	1.4				CL	GRAVELLY SANDY CLAY Mixture,4" plant fragments, hard, dry, no odor, angular-subangular, 10yr4\2, dark yellow brown, poorly sorted, second color 5yr3\2 grayish brown pebbles 4-6 mm areas, angular.		
2	SS	2.0	4.0	7-6-9-8	1.5				CL	SILTY CLAY 25%, 75%, <5% sand, moist, 5yr5\4 and10yr 6\2, hard, dry, low plasticity, fine < 1/16 mm, no odor, no reaction to HCL.		
3	SS	4.0	6.0	4-5-8-7	1.9		5					
4	SS	6.0	8.0	4-5-6-8	2.0					SILTY CLAY 10%, 90%, sand <2%, 5yr5\6 and 10yr6\2, damp, very stiff.		
5	SS	8.0	10.0	4-5-7-9	1.9					Some small irregular, black, horizontal lens, 1/4-1/2 x 1/2, damp.		
	ST	10.0	12.0				10			A few black lens, damp.		
7	SS	12.0	14.0	4-5-77	1.8					Damp SANDY CLAY 30%, 70%, Moist, 5yr5\6, fine lining, v-fine, grains 1/16-1/8 mm, sand grains, soft-medium stiff, no odor		
8	SS	14.0	16.0	3-3-2-2	1.5				SC	CLAYEY SAND 30%, 70%, v-fine-fine, angular 1/16-1/4 mm, sand grains, well sorted, poorly graded, 10yr5\2, yellowish brown, moist,		
9	SS	16.0	18.0	1-2-2-3	2.0		15		SC	loose, no odor, easy to auger, no HCL, no lens.		
10	SS	18.0	20.0	1-1-1-2	1.5					Wet		17.9 Top of seal.
11	SS	20.0	22.0	1-2-1-3	2.0				CL	SANDY CLAY 10%, 90%, Moist, 10yr5\4, v-soft, v-fine grain, sand grains, no odor, easy to auger, well sorted, no odor.		19.9 Top of sand.
12	SS	22.0	24.0	1-1-1-2	2.0		20					
13	SS	24.0	26.0	1-1-5-6	1.8				SP	10yr5\4-10yr5\2 SAND With little or no fines, medium 1/4-1/2 mm sub-angular sand grains, 5yr5\6-10yr5\6, light brown, well sorted, poorly graded, v-loose, no odor, no HCL, a clean sand, east to auger, wet to moist.		24.0 Top of screen.
14	SS	26.0	28.0	6-6-7-8	1.0					Moist		
15	SS	28.0	30.0	5-4-3-3	1.0		25			Medium course 1/2-1.0 mm sand		

TYPE OF CASING USED

	NQ-2 ROCK CORE
X	6" x 3.25 HSA
	9" x 6.25 HSA
	HW CASING ADVANCER 4"
	NW CASING 3"
	SW CASING 6"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

BORING NO. AMW-01 DATE 11/17/95 SHEET 2 OF 2

BORING START 09/05/95 BORING FINISH 09/06/95

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
16	SS	30.0	32.0	2-2-3-2	1.4							
17	SS	32.0	34.0	1-1-1-2	0							
18	SS	34.0	36.0	2-3-3-5	2.0				SC	CLAYEY SAND 50%,50%, < 2% silt, fine-medium 1/8-1/2 mm, subangular to sub-rounded sand grains, 5yr5\6 and 10yr5\4,		34.0 Bottom of screen.
19	SS	36.0	38.0	2-2-3-5	1.8		35		CL	black smear n-1, no odor, easy to auger no HCL, moist, medium stiff.		35.0 Bottom sand.
20	SS	38.0	40.0	3-4-5-8	2.0					SANDY CLAY 30%, 70%, fine 1/8-1/4 mm, sub-angular sand, medium stiff to soft, well sorted, poorly graded, black smear N\1, no odor, no HCL, 10YR4\2 and 5YR5\6M, moist.		
21	SS	40.0	42.0	5-6-8-8	1.9				SC	CLAYEY SAND 25%, 75%, fine to medium 1/8-1/2 mm, sub angular-sub-rounded, medium stiff, well graded, no odor, moist to wet, 5yr5\6, light brown, medium to very hard to auger, no HCL.		
22	SS	42.0	44.0	4-6-7-8	1.7		40			CLAY 10% SAND 90% Fines <5%, sand 95% 10yr4\2-5yr4\1 brownish gray		
23	SS	44.0	46.0	4-4-6-6	1.9							
24	SS	46.0	48.0	8-9-9-9	1.4		45		SP SC	CLAYEY GRAVELLY SAND 50%, 10%, 40%, Mixture, 5yr6\1 light olive gray, gravel pebbles 2-4 mm, medium sand 1/4-1/2 mm, angular-sub-angular, well sorted, poorly graded, no odor, moist, loose.		
25	SS	48.0	50.0	15-11-8-11	.1				GC			
26	SS	50.0	52.0	24-23-19-19	60		50			Sand 25% clay 10% gravel 65% Moist.		
27	SS	52.0	54.0	41-35-50-30	1.7					More gravel, hard to auger, loose		
28	SS	54.0	56.0	15-20-30-38	2.0					medium dense-dense, damp		
							55		CL	CLAY Hard, dense, dry, 5yt2\2 dusky brown, no odor, no HCL, hard to auger.		
										Weathered rock		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 539,188.1 E 1,732,744.9

GROUND ELEVATION 585.1 SYSTEM STATE PLANE

WATER LEVEL	▽ 13.8	▽	▽
TIME			
DATE	8-23-95		

BORING NO. AMW-02 DATE 11/17/95 SHEET 1 OF 1

BORING START 08/23/95 BORING FINISH 08/24/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 1.64 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 13.0 BOTTOM 23.0

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY TJH=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	2-3-4-5	1.5				GC	CLAYEY GRAVEL 45% 55%, first six inches includes plant material fragments, 5yr2\1, dry, <5% fines, 5yr3\2-5yr3\4, sub-angular, poorly sorted, poorly graded, no odor, no reaction to HCL, easy to auger.		
2	SS	6.0	8.0	3-4-5-4	1.7		5		CL	SANDY CLAY 20%, 80%, <5% fines, v-fine grain 1/16-1/8 mm, well sorted, poorly graded, 5YR4\2, 5YR4\4, sub-angular sand, moist, no odor, medium stiff, no reaction to HCL, wood fragments, easy to auger.		6.9 Top of seal.
3	SS	12.0	14.0	2-2-2-3	1.9		10			SANDY CLAY 40%, 60%, <2% silt, v-fine, sub-angular sub-rounded grains, well sorted, wet, soft, 5yr4\4-5yr4\6, no odor, grain size 1/16-1/8 mm, easy to auger.		9.0 Top of sand. 13.0 Top of screen.
4	SS	18.0	20.0	1-1-1-3	1.8		15					
5	SS	22.0	24.0	1-2-2-2	2.0		20			5yr5\5, medium to stiff, soft, no odor, wet.		
									SC	CLAYEY SAND 40%, 60%, wet		
									CL	SANDY CLAY 45%, 55%, wet, v-fine sand 1/16-1/8 mm, well sorted, poorly graded, 5yr5\5-5yr6\5, no odor, no reaction to HCL,		23.0 Bottom of screen. 24.7 Bottom sand.

TYPE OF CASING USED

	NQ-2 ROCK CORE
X	6" x 3.25 HSA
	9" x 6.25 HSA
	HW CASING ADVANCER 4"
	NW CASING 3"
	SW CASING 6"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 539,199.9 E 1,732,739.4

GROUND ELEVATION 585.2 SYSTEM STATE PLANE

WATER LEVEL	▽ 14.5	▼	▽
TIME			
DATE	8-23-95		

BORING NO. AMW-03 DATE 11/17/95 SHEET 1 OF 2

BORING START 08/22/95 BORING FINISH 08/23/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 2.18 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 46.9 BOTTOM 56.9

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY TJH=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	ROD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	10-15-18-20	1.6				GC	CLAYEY GRAVEL 30%, 60%, silt 10%, poorly graded, v-course angular gravels and pebbles, 2-4 mm, 5yr2\1 mm, dry, no reaction to HCL, last 1.5 very hard, first 4" plant debris.		
2	SS	2.0	4.0	7-8-10-13	1.5							
3	SS	4.0	6.0	5-6-8-9	1.5					Less gravel		
									CL	SANDY CLAY 20%, 80%, little of no silt, v-fine sand 1/16-1/8 mm well sorted, poorly graded, 5YR3\ 4-5YR2 \4, no odor, dry, hard, easy to auger.		
4	SS	6.0	8.0	4-6-9-10	1.8		5					
5	SS	8.0	10.0	4-4-6-8	1.6					Sand 30%-clay70%, 5yr3\4		
										SANDY CLAY 40%-60%, <2% silt, v-fine-fine sub-rounded grains, 1/16-1/8 mm, well sorted, 5yr4\4-5yr4\6, no odor, dry, no reaction to HCL, medium stiff to soft.		
6	SS	10.0	12.0	2-4-6-8	1.7		10					
7	SS	12.0	14.0	2-2-3-4	1.8					Moist		
8	SS	14.0	16.0	1-1-1-2	1.7					Sand 35%, moist, medium stiff.		
							15			sand 45% clay 55%, wet, medium stiff-soft.		
9	SS	16.0	18.0	1-1-1-2	1.5							
10	SS	18.0	20.0	1-1-2-2	2.0					5yr4\4-5yr4\6, wet, soft.		
										Wet		
11	SS	20.0	22.0	1-1-1-1	1.9		20			5yr4\6 medium stiff-soft.		
										5yr5\5		
									SC			
12	SS	22.0	24.0	1-1-1-1	2.0				CL	CLAYEY SAND 40%, 60%, v-fine sand, no odor.		
										SANDY CLAY 40%, 60%, Wet.		
13	SS	24.0	26.0	1-0-1-0	2.0					SANDY CLAY 40%, 60%, v-fine grain, 1/16-1/8 mm, sub-angular, well sorted, poorly graded, 5yr5\5, medium stiff-soft, no odor, no reaction to HCL, moist to wet, very easy to auger.		
							25			Clay 65%-sand 35%, wet.		
14	SS	26.0	28.0	1-1-1-1	2.0				SC	CLAYEY SAND v-fine grain 1/16-1/8 mm, wet, odor.		
									CL			
15	SS	28.0	30.0	1-1-1-1	1.9					SANDY CLAY 55%, 45%, no odor, 5yr5\6, wet, medium stiff-soft, well sorted.		
									SC			
									CL			

Continued Next Page

TYPE OF CASING USED

	NQ-2 ROCK CORE	
X	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

BORING NO. AMW-03 DATE 11/17/95 SHEET 2 OF 2

BORING START 08/22/95 BORING FINISH 08/23/95

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
16	SS	30.0	32.0	2-1-1-1	1.8					CLAYEY SAND Fine sand 1/8-1/4 mm, wet, no odor.		
17	SS	32.0	34.0	1-1-1-1	2.0					SANDY CLAY 35%, 65%, wet, easy to auger, soft, 5yr5\6-5yr6\6.		
18	SS	34.0	36.0	2-1-1-1	2.0		35			5yr5\6=5yr5\3		
19	SS	36.0	38.0	2-2-1-1	2.0				SC	CLAYEY SAND 50%, 60%, wet, pale brown, 5YR5\2.		
20	SS	38.0	40.0	2-2-3-4	2.0				CL	SANDY CLAY 50%, 50%, <2% silt, v-fine sand 1/8-1/4 mm, sub-angular, well sorted, poorly graded, v-loose, wet, faint musky odor, (swamp like), 5yr5\2-5yr5\1, no reaction to HCL.		
21	SS	40.0	42.0	2-4-4-4	1.6		40		CL	SANDY CLAY 40%, 60%, <2% silt, well sorted, poorly grade, medium stiff, moist to wet, no odor, no reaction to HCL, easy to auger.		40.0 Top of seal.
22	SS	42.0	44.0	2-2-4-5	1.7				SC	Medium dark gray n\4, moist, no odor.		
23	SS	44.0	46.0	2-4-5-6	1.5					CLAYEY SAND 35%, 65%, wet.		42.7 Top of sand.
24	SS	46.0	48.0	5-6-8-4	.8		45			CLAYEY SAND fine grain 1/8-1/4, wet sub-angular, sub-rounded,well sorted, poorly graded,n\5 medium gray, loose, no odor, no reaction to HCL.		
25	SS	48.0	50.0	4-4-12-18	1.0				SP	Small wood fragments.		
26	SS	50.0	52.0	19-19-6-4	1.5					SAND Poorly graded, little or no fines, clay 10%, well sorted, medium course sand 1/4-1.0 mm, wet, 10yr6\2, sub-angular grains, loose, no odor, no reaction to HCL, easy to auger, wood fragments.		46.9 Top of screen.
27	SS	52.0	54.0	8-12-34-17	1.8		50			SAND <2%, poorly graded, medium -course grain 1/4-1.0 mm, n\5-n\6, medium gray color, angular-sub-angular, very loose, no odor, wet, well sorted, last .5 small sub-angular gravels.		
28	SS	54.0	56.0	7-30-36-34	1.7				SP	GRAVELLY SAND With little fines or no fines, pebbles, a4-6 mm, poorly sorted, poorly graded, pebbles content 10%, loose-medium stiff, no odor, wet.		
29	SS	56.0	58.0	30-33-25-90	1.8		55		GC	Sand 60%, gravel 20%, pebbles 20%, 5yr6\1-5yr5\2, wet.		56.9 Bottom of screen.
										Sand 60%, gravel 10%, pebbles 30%		57.9 Bottom sand.
										CLAYEY GRAVELLY SAND 20%, 30%, 50%.		
										SANDY GRAVELLY CLAY Clay 40%, weathered bedrock, 5yr5\2-5yr5\6, sub-rounded-rounded, gravels and pebbles, hard to auger, refusal.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 539,605.5 E 1,731,128.7

GROUND ELEVATION 585.7 SYSTEM STATE PLANE

WATER LEVEL	▽ 26.0	▼	▼
TIME			
DATE	9-7-95		

BORING NO. AMW-04 DATE 11/17/95 SHEET 1 OF 2

BORING START 09/07/95 BORING FINISH 09/08/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 2.21 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 24.0 BOTTOM 34.0

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY JCM=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	11-15-50	1.1				SC	CLAYEY SAND AND GRAVEL 10%, 30%, 60%, mixture, first 3' plant fragments, gravels to cobbles, dry, 2-75 mm, fine to v-fine sand 1/16-1/4, very hard, 1-yr3\4=5yr3\4, hard to auger, no order.		
2	SS	6.0	6.9	4-50/.4	.8		5		CL	CLAY Lean, plant material through-out, medium stiff to soft, smooth texture, 5yr5\2-10yr4\2, moist, hard to auger, musky organic odor, low plasticity, no reaction to HCL, olive gray.		
3	SS	14.0	16.0	6-6-7-7	2.0		10					
							15					18.0 Top of seal.
4	SS	20.0	22.0	3-3-5-5	2.0		20		CL	SANDY CLAY 5%, 95%, v-fine sand, small amount of silt, small irregular horizontal blackish, two colors 5yr5\6 50%, n\6 50%, moist to wet, sand 1/16-1/8 mm, sub-angular, well sorted, poorly graded, no odor.		19.9 Top of sand.
5	SS	26.0	28.0	5-7-3-3	1.8		25		SP	SAND 95%, <5% fines, medium-fine grain sand, sub-angular-sub-rounded, 1/8-1/2 mm, poorly graded, 5yr4\4-5yr3\4, no odor, v-loose, wet.		24.0 Top of screen.

TYPE OF CASING USED		
	NQ-2 ROCK CORE	
X	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

BORING NO. AMW-04 DATE 11/17/95 SHEET 2 OF 2

BORING START 09/07/95 BORING FINISH 09/08/95

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
6	SS	32.0	34.0	3-6-9-8	1.3		35			SAND Little of no fines, sub-angular to sub-rounded, course, medium grain, 1.0-1/2 mm, two colors n\3 dark gray =20% and 5yr6\6 light brown =80%, wet, no odor.		34.0 Bottom of screen. 35.0 Bottom sand.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 539,614.1 E 1,731,120.7

GROUND ELEVATION 585.1 SYSTEM STATE PLANE

WATER LEVEL	▽ 23.8	▽	▽
TIME			
DATE	9-1-95		

BORING NO. AMW-05 DATE 11/17/95 SHEET 1 OF 2

BORING START 08/31/95 BORING FINISH 09/07/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 2.0 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 44.0 BOTTOM 54.0

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY TJH=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	3-7-12-15	1.67				GC	10YR2/4 - 5YR3/4 DK. RED BROWN CLAYEY GRAVEL, 25% CLAY, 30% FINE SAND, 45% ANGULAR, POORLY SORTED FINE TO COARSE GRAVEL, POORLY GRADED, NO HCl, NO ODOR, PLANT FRAGMENTS FIRST 4"		
2	SS	2.0	4.0	12-9-6-6	1.33				SC	5YR4/4 - 5YR4/2 CLAYEY SAND, 55% FINE SAND, 40% CLAY, 5% GRAVEL, LOOSE, NO ODOR, DAMP		
3	SS	4.0	6.0	3-3-5-5	1.91		5		CL	5YA5/2 - 5YR6/4 LEAN CLAY, 2% SAND, MED. STIFF, SMOOTH TEXTURE, NO ODOR, NO HCl, DAMP, MEDIUM PLASTICITY		
4	SS	6.0	8.0	3-2-3-3	1.67					5YR5/2 - 5YR6/4 DRY, SEMI-SMOOTH TEXTURE, MED-LOW PLASTICITY		
5	SS	8.0	10.0	2-2-4-7	1.83							
6	SS	10.0	12.0	5-6-9-11	2.0		10					
7	SS	12.0	14.0	2-5-9-11	1.83				CL	5YR5/2 - 5YR4/4 LEAN CLAY, LESS THAN 10% FINE SAND, STIFF, DRY, SMALL IRREGULAR BLACK LENSES, LOW PLASTICITY, NO ODOR		
8	SS	14.0	16.0	4-5-7-9	1.83							
9	SS	16.0	18.0	3-4-7-8	1.75		15			INCREASED No. OF VERY SMALL HORIZONTAL IRREGULAR BLACK LENSES, 5YR4/4 - 5YR5/2		
10	SS	18.0	20.0	2-4-5-7	1.75					ABSENCE OF BLACK LENSES, 5YR4/4, 5YR5/2, MOIST, NO ODOR, LESS THAN 5% FINE SAND		
11	SS	20.0	22.0	2-3-4-5	1.83		20			5YR4/4 = 20%, 5YR5/2 = 80%, MOIST-WET		
12	SS	22.0	24.0	2-2-3-3	1.91					5YR4/4 < = 10%, 5YR5/2 > = 90%, MOIST, NO ODOR		
13	SS	24.0	26.0	2-5-5-8	2.0					5YR4/4 = 20%, N5(MED GRAY) = 80%, MOIST, 5% V. FINE SAND		
14	SS	26.0	28.0	4-6-8-8	1.33		25		SP			
15	SS	28.0	30.0	5-7-7-9	1.91				SC	5YR4/4 - 5YR3/4 CLAYEY SAND, 10% CLAY, MEDIUM SAND, SUB-ANGULAR TO SUB ROUNDED, V. LOOSE, WELL SORTED, POORLY GRADED, WET, NO ODOR, NO HCl		
									SP	5YR3/4 - 5YR2/2 SAND, <2% FINES, FINE TO MEDIUM GRAIN, V. LOOSE, WET, NO ODOR, SUB ANGULAR		
										5YR5/6 LIGHT BROWN		

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TYPE OF CASING USED

	NQ-2 ROCK CORE	
X	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

BORING NO. AMW-05 DATE 11/17/95 SHEET 2 OF 2

BORING START 08/31/95 BORING FINISH 09/07/95

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
16	SS	30.0	32.0	6-7-8-9	1.67				SM	N5-N6 MED GRAY SAND WITH FINES, 10% CLAY, 10% SILT, FINE TO MEDIUM SAND ANGULAR TO SUB-ANGULAR, SOME BLACK STAINING, V. LOOSE, WELL SORTED, POORLY GRADED, UNCONSOLIDATED, WET, NO ODOR, NO HCl		
17	SS	32.0	34.0	4-4-7-9	1.83							
18	SS	34.0	36.0	6-7-13-6	1.0		35			SAND = 90%, CLAY = 5%, SILT = 5%, WET		
19	SS	36.0	38.0	3-2-3-8	1.5				SP	N6 MED LT GRAY TO 5YB6/1 SAND, FINE TO MEDIUM GRAIN, POORLY GRADED, V. LOOSE, WET, UNCONSOLIDATED, NO ODOR, NO HCl		36.2 Top of seal.
20	SS	38.0	40.0	6-5-5-4	1.17							
21	SS	40.0	42.0	3-3-8-7	1.25		40		SM	N5 - N4 SILTY SAND, 10% CLAY, 15% SILT, FINE TO MEDIUM GRAIN SAND, WELL SORTED, LOOSE, NO ODOR, WET		39.3 Top of sand.
22	SS	42.0	44.0	7-8-9-9	1.58					2" WEATHERED COAL DEPOSITS, WET		
23	SS	44.0	46.0	4-4-6-6	1.33		45					44.0 Top of screen.
24	SS	46.0	48.0	8-5-8-9	1.67					BOTTOM 6" 5YR6/1 LT. BROWNISH GRAY, WET		
25	SS	48.0	50.0	4-4-5-7	1.91					WEATHERED COAL DEPOSITS, WET, NO ODOR		
26	SS	50.0	52.0	5-10-7-7	2.0		50			WET		
27	SS	52.0	54.0	22-22-11-14	1.17				CL	5YR3/4 - 5YR2/2 SANDY CLAY, 55% CLAY, FINE GRAIN, SUB ANGULAR SAND, LOOSE, WELL SORTED, POORLY GRADED, UNCONSOLIDATED, WET, NO ODOR		
28	SS	54.0	55.0	15-63-53/3	1.0				CL	5YR3/4 - 5YR2/2 GRAVELLY CLAY, 15% SUB ANGULAR TO SUB ROUNDED GRAVEL (2 - 25 mm) POORLY SORTED, MOIST, NO ODOR, CONSOLIDATED		
							55			WEATHERED BEDROCK AT 55'		55.0 Bottom sand.
												54.0 Bottom of screen.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 539,169.8 E 1,729,695.5

GROUND ELEVATION 587.5 SYSTEM STATE PLANE

WATER LEVEL	▽ 21.0	▼	▼
TIME			
DATE	8-30-95		

BORING NO. AMW-06 DATE 11/17/95 SHEET 1 OF 2

BORING START 08/29/95 BORING FINISH 08/30/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 2.0 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 31.0 BOTTOM 41.0

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY TJH=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	3-4-5-6	1.5				OL	TOP 3" PLANT FRAGMENTS		
									CL	OLIVE GRAY SANDY LEAN CLAY, 10% FINE TO COARSE SAND, NO ODOR, NO HCl, MOIST TO DAMP		
2	SS	2.0	4.0	3-3-5-7	1.7							
3	SS	4.0	6.0	7-7-4-6	1.7				CL	MEDIUM BROWN (5YR3/4) SANDY LEAN CLAY, 20% COARSE SAND, STIFF, NO ODOR, DAMP		
4	SS	6.0	8.0	4-4-3-4	1.8		5					
5	SS	8.0	10.0									
6	SS	10.0	12.0	2-2-4-5	1.5		10		CL	10YR5/4, 5GY6/1 SANDY CLAY, 40% FINE TO MEDIUM SAND, SOFT TO MEDIUM STIFF, NO ODOR, MOIST TO WET		
7	SS	12.0	14.0	1-1-2-5	1.8							
8	SS	14.0	16.0	2-2-4-5	.83		15					
9	SS	16.0	18.0	1-2-2-3	2.0				CH	BENTONITE CHIPS, 40% HYDRATED, BACKFILL SEAL, WET, 2' THICK		
10	SS	18.0	20.0	3-3-5-5	1.83				CL	5Y6/1 LEAN CLAY, LESS THAN 5% SAND, MEDIUM STIFF TO STIFF, MOIST, NO HCL		
11	SS	20.0	22.0	2-3-3-3	1.67		20			20' - 22' 5YR5/6 AND 10YR6/2		
12	SS	22.0	24.0	3-3-3-5	1.83					22' - 24' 10% SAND		
13	SS	24.0	26.0	3-3-4-6	1.91							
14	SS	26.0	28.0	5-4-6-8	1.83		25			SOME SMALL IRREGULAR HORIZONTAL LENSES 1.0 mm H X 1/4" L, N-1-N-2.		24.6 Top of seal.
15	SS	28.0	30.0	2-2-2-4	1.83					26'-28' 5YR5/6 LT. BROWN AND N-6 LT. GRAY		27.0 Top of sand.
										28'-30' LESS THAN 2% SAND, 5Y41 OLIVE		

TYPE OF CASING USED

	NQ-2 ROCK CORE
X	6" x 3.25 HSA
	9" x 6.25 HSA
	HW CASING ADVANCER 4"
	NW CASING 3"
	SW CASING 6"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

BORING NO. AMW-06 DATE 11/17/95 SHEET 2 OF 2

BORING START 08/29/95 BORING FINISH 08/30/95

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
16	SS	30.0	32.0	2-2-3-5	2.0					GRAY, MUSKY ODOR, MOIST		
17	SS	32.0	34.0	1-1-1-2	2.0				SC	5Y4/1 CLAYEY SAND, 10% CLAY, FINE TO MEDIUM GRAIN, POORLY SORTED, NO ODOR, NO HCl		31.0 Top of screen.
18	SS	34.0	36.0	4-2-2-3	2.0				CL SW	SANDY LEAN CLAY, MOIST, 40% SAND		
19	SS	36.0	38.0	1-1-2-3	1.91		35		CL	5Y4/1 SAND FINE TO MEDIUM GRAIN, POORLY SORTED, NO ODOR, NO HCl, VERY LOOSE, WET		
20	SS	38.0	40.0	3-2-3-3	1.91					5YR4/1 SANDY CLAY, 40% FINE SAND, BROWNISH GRAY, SOFT, MOIST NO ODOR 36' - 38' 20% SAND		
21	SS	40.0	42.0	1-2-2-3	2.0		40			38' - 40' 10% SAND		
22	SS	42.0	43.0	2-3	1.0					40' 42' LESS THAN 5% SAND		41.0 Bottom of screen.
										42' - 43' LESS THAN 2% SAND, 5Y6/1, MOIST, DAMP, NO ODOR		42.7 Bottom sand.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 537,838.4 E 1,731,735.7

GROUND ELEVATION 587.1 SYSTEM STATE PLANE

WATER LEVEL	▽ 11.0	▽	▽
TIME			
DATE	8-31-95		

BORING NO. AMW-07 DATE 11/17/95 SHEET 1 OF 2

BORING START 08/30/95 BORING FINISH 08/31/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 1.62 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 28.0 BOTTOM 38.0

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY TJH=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	12-50/3	.5				OL	TOP 3" PLANT FRAGMENTS		
									SM	SILTY SAND, 50% SAND, 50% SILT, VERY FINE SAND, DRY, DUSTY, SOME GRANULES AND PEBBLES, VERY HARD, ONE LARGE COBBLE		
2	SS	2.0	4.0	10-5-5-6	1.83				CL	SANDY CLAY, 40% SAND, 40% CLAY, 20% SILT, VERY FINE (1/16-1/8) S.ANG. SAND, DAMP, 1ST COLOR 5Y6/1 LT. OLIVE GRAY, 2ND COLOR 5YRG/4 LT. BROWN, NO ODOR, NO HCI, LOOSE TO MED. DENSE		
3	SS	4.0	6.0	6-5-5-5	1.17		5					
4	SS	6.0	8.0	2-3-3-4	2.0							
5	ST	8.0	10.0						CL	10YR4/2 AND 5Y5/4 LEAN CLAY WITH SILT, DAMP, MED. STIFF TO STIFF, NO ODOR, LOW PLASTICITY		
6	SS	10.0	12.0	2-2-2-3	1.17		10		CL	SANDY CLAY, 5-10% V. FINE SAND, BOTTOM HALF OF SPOON WET, MED. PLASTICITY, SOFT TO V. SOFT, NO ODOR		
7	SS	12.0	14.0	2-2-2-3	2.0					12'-14' 10YR5/4		
8	SS	14.0	16.0	2-2-3-4	2.0							
9	SS	16.0	18.0	4-5-8-8	2.0		15			14'-16' A FEW SM. BLACK HORIZONTAL DEPOSITS, ONE BLACK (N-2) LENS, 1/2 mm H X 1/4" LONG, 10YR6/6 DK YEL-ORANGE AND N-7 LT. GRAY, MOIST		
10	SS	18.0	20.0	5-5-8-9	2.0							
11	SS	20.0	22.0	3-5-5-7	1.91					18'-20' CLAY W/V. FINE SAND AND SILTS, DAMP, NO ODOR, STIFF		
12	SS	22.0	24.0	2-3-5-5	1.75		20			20'-22' A FEW SM. IRREG. HORIZONTAL BLACK (N-2) LENSES AND DEPOSITS, DAMP		
13	SS	24.0	26.0	2-2-3-4	1.91					22'-24' (N-7) LT. GRAY = 80%, AND 5YR5/6 LT BROWN = 20%, NO DEPOSITS, DAMP		22.0 Top of seal.
14	SS	26.0	28.0	1-1-2-2	1.67		25					24.0 Top of sand.
15	SS	28.0	30.0	1-1-2-2	1.91					26' - 28' LESS THAN 2% SAND		
									SP	5YR4/1 OLIVE GRAY CLEAN SAND, MED (1/4-1/2 mm) S. ANG. SAND, WELL SORTED, POORLY GRADED, NO ODOR, NO HCI, VERY		28.0 Top of screen.

TYPE OF CASING USED

	NQ-2 ROCK CORE	
X	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

BORING NO. AMW-07 DATE 11/17/95 SHEET 2 OF 2

BORING START 08/30/95 BORING FINISH 08/31/95

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
16	SS	30.0	32.0	2-3-2-3	2.0				CL	LOOSE, MOIST LEAN CLAY, WITH MEDIUM TO FINE S. ANG. SAND, MOIST, NO ODOR		
17	SS	32.0	34.0	2-3-7-6	1.17				SW SC	N-4 MED. DK GRAY SAND, 5% SILT AND CLAY, FINE TO MEDIUM (1/8-1/2 mm) GRAIN SAND, S. ANG., POORLY SORTED, NO ODOR		
18	SS	34.0	36.0	5-3-6-8	1.67							
							35			34' - 36' MOIST TO DAMP		
19	SS	36.0	38.0	5-9-21-23	2.0					37' - 38' HARD, CLEAN, MOIST		38.0 Bottom of screen. 39.0 Bottom sand.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 536,151.7 E 1,732,198.9

GROUND ELEVATION 584.9 SYSTEM STATE PLANE

WATER LEVEL	▽ 10.3	▽	▽
TIME			
DATE	8-29-95		

BORING NO. AMW-08 DATE 11/17/95 SHEET 1 OF 1

BORING START 09/13/95 BORING FINISH 09/13/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 1.78 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 10.0 BOTTOM 20.0

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY JCM=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
1	SS	0.0	2.0	8-16-14-8	1.67	
2	SS	2.0	4.0	6-7-11-9	1.67	
3	SS	4.0	6.0	5-7-3-3	2.0	
4	SS	6.0	8.0	5-3-5-4	1.67	
5	ST	8.0	10.0			
6	SS	10.0	12.0	2-2-2-1	1.17	
7	SS	12.0	14.0	2-2-3-3	1.5	
8	SS	14.0	16.0	1-1-3-3	1.5	
9	SS	16.0	18.0	2-2-3-2	1.67	
10	SS	18.0	20.0	1-1-2-3	1.83	
11	SS	20.0	22.0	8-10-9-4	1.83	

DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
		OL	PLANT FRAGMENTS		
		CL	10RY5/4 AND 10YR5/6 GRAVELLY CLAY, 30% GRAVEL WITH SILT, 5% MEDIUM TO COARSE POORLY SORTED GRAVEL (2 - 75 mm), MOD. HARD, DRY, NO HCl, NO ODOR		
		SC	10YR6/2 AND 10YR6/4 CLAYEY SAND, 45% CLAY, SAND S. ANGULAR WITH 5% 2 TO 4 mm, LOOSE, DRY, NO ODOR, NO HCl		4.0 Top of seal.
5			4' - 6' 5YR5/6 - 5YR6/6, DRY, 5% FINES		
		CL	5YR4/4 - 5YR4/6 SANDY CLAY, 45% VERY FINE S. ANG, WELL SORTED, POORLY GRADED SAND, MOIST, NO ODOR		6.0 Top of sand.
		SC	10YR5/4 - 5YR5/6 CLAYEY SAND, 50% VERY FINE TO FINE SAND, LOOSE, WET, NO HCl, NO ODOR		
10					10.0 Top of screen.
			12'-14' SAND 65%, WET		
15			14'-16' WET		
		CL	5YR5/4 - 5YR5/2 SANDY CLAY, 50% SAND, 50% CLAY, STIFF, MOIST, NO ODOR, NO HCl		
			18'-20' SANDY CLAY, SAND 40%, MOIST		
20					20.0 Bottom of screen.
			20'-22' SAND 20%, DRY, N5 MED. GRAY = 40%, 5YR5/4 = 60%		21.9 Bottom sand.

TYPE OF CASING USED

	NQ-2 ROCK CORE	
X	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 536,983.3 E 1,734,099.7

GROUND ELEVATION 586.8 SYSTEM STATE PLANE

WATER LEVEL	▽ 13.5	▼	▽
TIME			
DATE	8-29-95		

BORING NO. AMW-09 DATE 11/17/95 SHEET 1 OF 2

BORING START 08/29/95 BORING FINISH 08/29/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 1.79 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 21.0 BOTTOM 31.0

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY TJH=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	ROD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1		0.0	2.0	8-24-45-60	1.0				GC	5YR4/4 - 5YR3/4 CLAYEY GRAVEL, 30% CLAY, S. ANG. POORLY SORTED GRAVEL 2-100 mm, VERY HARD, NO ODOR		
2		2.0	4.0									
3		4.0	6.0									
4		6.0	8.0	6-6-9-9	1.67		5		CL	5YR5/4 - 5YR5/6 SANDY CLAY, 15% S ANG. 1/16 - 18 in. WELL SORTED SAND, MED. STIFF TO STIFF, LOW PLASTICITY, DRY, NO ODOR, NO HCl		
5	ST	8.0	10.0									
6		10.0	12.0				10		CL	5YR5/4 - 5YR5/5 SANDY CLAY, FINE WELL SORTED SAND, MED. STIFF, NO ODOR, MOIST TO WET, LOW PLASTICITY 10'-12' MOIST		
7		12.0	14.0	3-4-5-6	2.0							
8		14.0	16.0									
9		16.0	18.0				15					15.0 Top of seal.
10		18.0	20.0						SC	5YR5/4 TO 5YR4/4 CLAYEY SAND, FINE GRAIN S. ANGULAR SAND (1/8 - 1/4 mm), V. LOOSE, WELL SORTED, POORLY GRADED, WET, 30% CLAY, NO ODOR, NO HCl		17.0 Top of sand.
11		20.0	22.0	1-1-1-2	2.0		20					
12		22.0	24.0									21.0 Top of screen.
13		24.0	26.0	1-1-1-2	2.0				SC	5YR4/4 CLAYEY SAND 50% CLAY, 50% MEDIUM TO FINE GRAIN ANGULAR TO SUB-ANGULAR, POORLY SORTED, POORLY GRADED SAND, LOOSE, WET, NO HCl		
14		26.0	28.0				25					
15		28.0	30.0						CL	5YR5/2 - 5YR5/4 SANDY CLAY, 15% VERY FINE TO FINE S. ANGULAR SAND, V. LOOSE, WET, NO ODOR, NO HCl		

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TYPE OF CASING USED

	NQ-2 ROCK CORE	
X	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

BORING NO. AMW-09 DATE 11/17/95 SHEET 2 OF 2

BORING START 08/29/95 BORING FINISH 08/29/95

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
16		30.0	32.0	1-1-1-1	2.0							31.0 Bottom of screen. 32.0 Bottom sand.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

COORDINATES N 536,989.9 E 1,734,094.7

GROUND ELEVATION 586.4 SYSTEM STATE PLANE

WATER LEVEL	▽ 14.8	▼	▼
TIME			
DATE	9-6-95		

BORING NO. AMW-10 DATE 11/17/95 SHEET 1 OF 2

BORING START 08/24/95 BORING FINISH 08/28/95

PIEZOMETER TYPE _____ WELL TYPE OW

HGT. RISER ABOVE GROUND 2.09 DIA 2.0

DEPTH TO TOP OF WELL SCREEN 47.5 BOTTOM 57.5

WELL DEVELOPMENT YES BACKFILL QUICK GROUT

FIELD PARTY TJH=REB RIG CME-75

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	7-17-17-38	1.5				OL	PLANT FRAGMENTS		
2	SS	2.0	4.0	20-16-14-12	1.17				GC	5YR4/4 DARK RED-BROWN CLAYEY GRAVEL, 25% CLAY, 30% FINE SAND, 45% SUB-ANGULAR TO ANGULAR GRAVEL (2 TO 64 mm), POORLY SORTED, NO HCl, NO ODOR		
3	SS	4.0	6.0	4-4-7-8	1.33				ML	N2-N3 GRAYISH BLACK SANDY SILT, 40% VERY FINE SAND, 20% CLAY, MUSKY ODOR, DAMP. A FEW SMALL IRREGULAR HORIZONTAL (N1) BLACK LENSES (20 mm L X 1 mm H) THROUGHOUT, MED. STIFF		
4	SS	6.0	8.0	5-6-6-7	1.5		5					
5	SS	8.0	10.0	5-5-5-7	1.25				CL	6'-7' FEWER LENSES, N4 - N5		
6	SS	10.0	12.0	3-3-4-4	1.33		10			5YR5/6 - 5YR4/4 SANDY CLAY, 30% VERY FINE TO FINE SAND, MED. STIFF TO STIFF, LOW PLASTICITY, NO ODOR, DAMP. 2 LARGER LENSES 5mm L X 111/8 TO 1//4 mm H.		
7	SS	12.0	14.0	2-2-2-2	1.83							
8	SS	14.0	16.0	1-1-1-2	1.91				SC	10YR5/4 YELLOW BROWN CLAYEY SAND, 35% CLAY, POORLY SORTED, GRADED FINE TO MEDIUM SAND, UNCONSOLIDATED, LOOSE. A FEW ROUND SMALL IRREGULAR BLACK (N2) DEPOSITS, WET		
9	SS	16.0	18.0	1-1-2-3	1.67		15					
10	SS	18.0	20.0	1-1-2-3	1.8.				CL	5YR4/4 - 5YR5/4 SANDY CLAY, 25% V. FINE SAND, SOFT, MED PLASTICITY, NO HCl, NO ODOR, MOIST		
11	SS	20.0	22.0	1-2-1-3	1.67		20			20'22' SAND 20%		
12	SS	22.0	24.0	1-1-3-3	1.5					22'-24' SAND 20%		
13	SS	24.0	26.0	1-1-1-2	1.0					24'-26' SAND 25%		
14	SS	26.0	28.0	1-2-1-2	1.83		25			26'-27.5' SAND 40%		
15	SS	28.0	30.0	1-1-2-2	1.5				SC	5Y4/1 OLIVE GRAY CLAYEY SAND, 40% CLAY, VERY FINE TO FINE SAND, V. LOOSE TO LOOSE, WET, NO ODOR, NO HCl		

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TYPE OF CASING USED

	NQ-2 ROCK CORE	
X	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER DG

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 5423

COMPANY APPALACHIAN POWER COMPANY

PROJECT W. VA. GROUND WATER STUDY

BORING NO. AMW-10 DATE 11/17/95 SHEET 2 OF 2

BORING START 08/24/95 BORING FINISH 08/28/95

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
16	SS	30.0	32.0	1-1-1-2	2.0	
17	SS	32.0	34.0	2-2-3-7	1.17	
18	SS	34.0	36.0	1-1-3-2	1.83	
19	SS	36.0	38.0	2-2-2-3	2.0	
20	SS	38.0	40.0	2-2-2-3	2.0	
21	SS	40.0	42.0	1-2-2-3	2.0	
22	SS	42.0	44.0	1-2-4-4	2.0	
23	SS	44.0	46.0	4-6-12-12	2.0	
24	SS	46.0	48.0	4-6-11-17	1.91	
25	SS	48.0	50.0	12-5-5-10	1.17	
26	SS	50.0	52.0	9-13-16-18	1.5	
27	SS	52.0	54.0	9-60-23-9	1.33	
28	SS	54.0	56.0	13-22-25-20	1.33	
29	SS	56.0	58.0	13-14-16-30	1.17	
30	SS	58.0	59.0	32-100/4	.67	

DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
			30'-32' 20% CLAY		
		CL	5Y4/1 OLIVE GRAY SANDY CLAY, 40% SAND		
35		SC	10YR4/2 - 5YR4/6 MODERATE BROWN CLAYEY SAND, 10% CLAY, VERY FINE TO FINE SAND, POORLY SORTED, GRADED, UNCONSOLIDATED, LOOSE, WET, NO ODOR, NO HCl		
		CL	10YR4/4 SANDY CLAY, 10% VERY FINE TO FINE WELL SORTED SAND, SOFT TO MED. STIFF, MED. PLASTICITY, MOIST, NO ODOR, NO HCl		
40			38'-40' 10YR4/2 AND 5YR5/6		
			40'-42' 30% SAND		40.8 Top of seal.
			42'-44' N4-N4 MED DARK GRAY, 40% SAND		43.0 Top of sand.
45		SC	CLAYEY SAND, 20% CLAY, FINE TO MEDIUM GRAIN SAND, ANGULAR, POORLY SORTED, WELL GRADED, WET, LOOSE TO MED.		
		SW	DENSE, NO ODOR, NO HCl		
			5Y6//1 LT. OLIVE GRAY SAND, 2% CLAY, MEDIUM TO COARSE GRAIN, WELL GRADED, MOIST TO WET, SUB-ANGULAR TO SUB-ROUNDED, NO ODOR, NO HCl		47.5 Top of screen.
50		SC	5Y4/1 - 5Y6/1 OLIVE GRAY GRAVELLY, CLAYEY SAND, CLAY 20%, 30% FINE TO COARSE SUB-ROUNDED, FRIABLE		
		GC	SANDSTONE GRAVEL, 40% FINE TO MEDIUM GRAIN SUB-ANGULAR TO SUB-ROUNDED SAND, POORLY SORTED, NO ODOR, DRY TO MOIST		
55			5Y4/1 - 5Y6/1 OLIVE GRAY SANDY, GRAVELLY CLAY, 30% SUB-ROUNDED FRIABLE SANDSTONE GRAVEL, 20% SAND 54'-56' GRAVEL 35%, SAND 10%, GRAVEL 4 - 256mm, DAMP		57.5 Bottom of screen.
			WEATHERED BEDROCK, 5YR4/4 - FFYR3/4 - MOD. BROWN, DRY		58.9 Bottom sand.

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AEP 1995

Well Construction Diagrams

MW-01 to MW-10

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

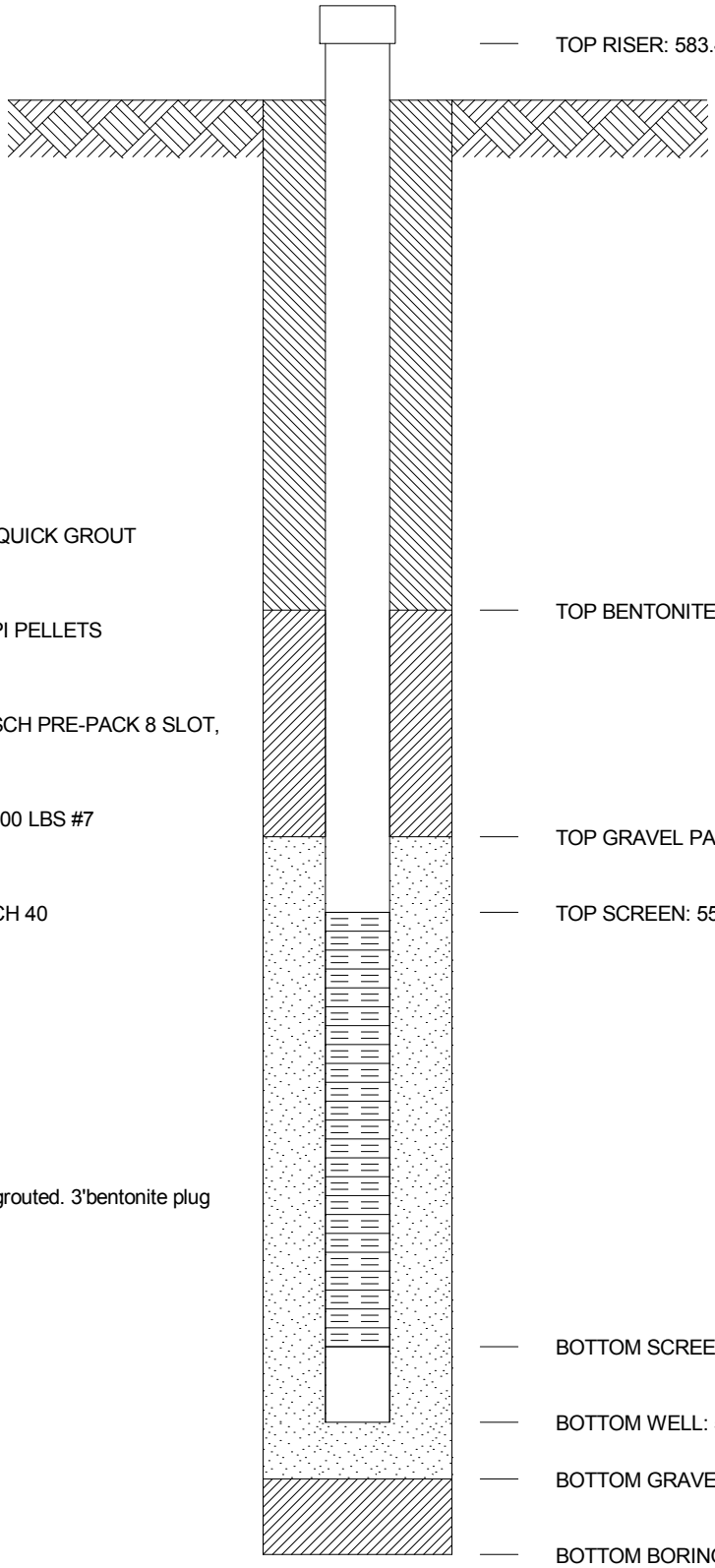
COMPANY _____ WELL No. **MW-1** BORING No. **AMW-01** INSTALLED **9/6/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 540,266.8 E 1,731,165.6**

SYSTEM **STATE PLANE**

GROUND ELEVATION 581.45 FT.



GROUT SEAL: 75 GALLONS QUICK GROUT

BENTONITE SEAL: 225 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 575 LBS #5 100 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Seal hydrated 1 hour prior to grouted. 3'bentonite plug 35' TO 38'.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

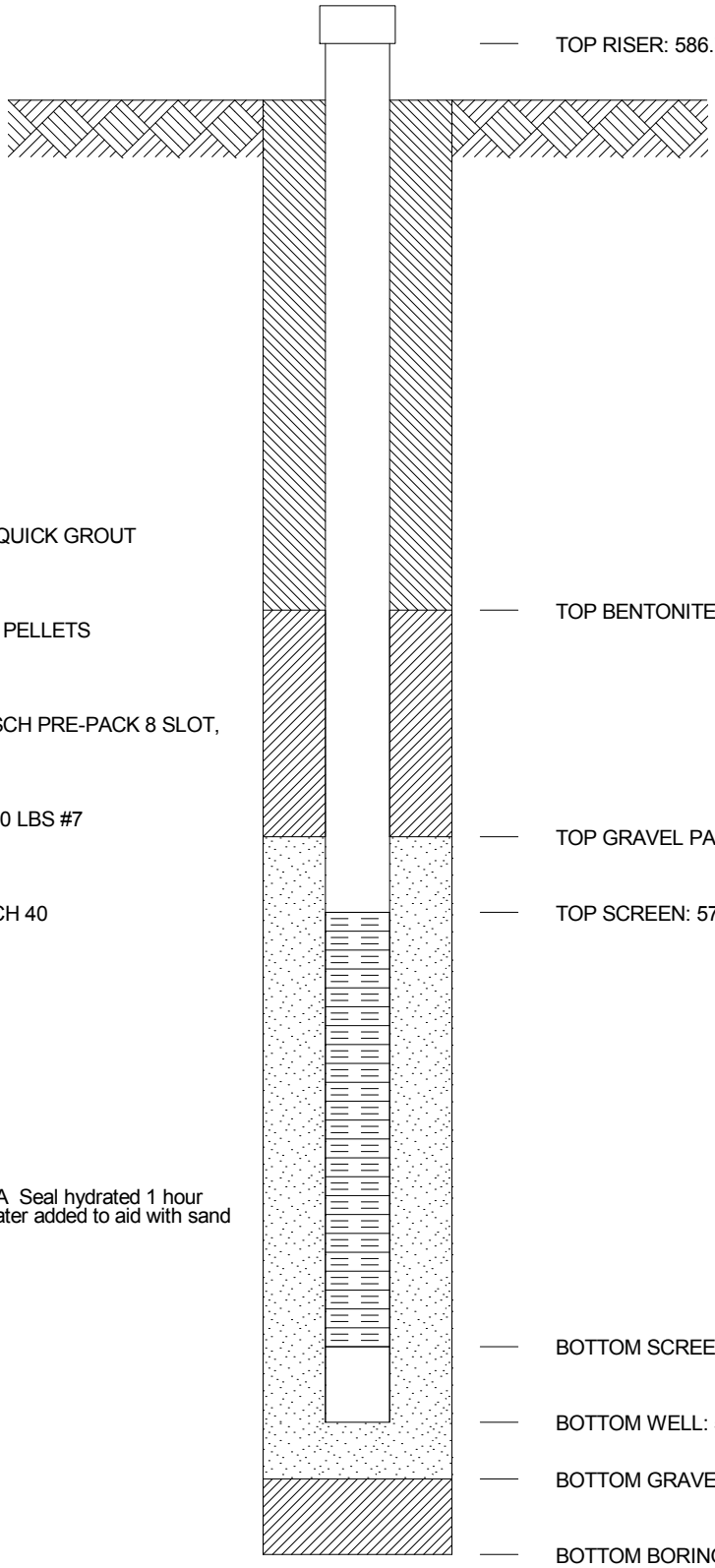
COMPANY _____ WELL No. **MW-2** BORING No. **AMW-02** INSTALLED **8/24/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 539,188.1 E 1,732,744.9**

SYSTEM **STATE PLANE**

GROUND ELEVATION 585.09 FT.



GROUT SEAL: 20 GALLONS QUICK GROUT

BENTONITE SEAL: 50 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 75 LBS #5 150 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Well installed through 4.25 HSA Seal hydrated 1 hour prior to grouting. Some water added to aid with sand placement.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

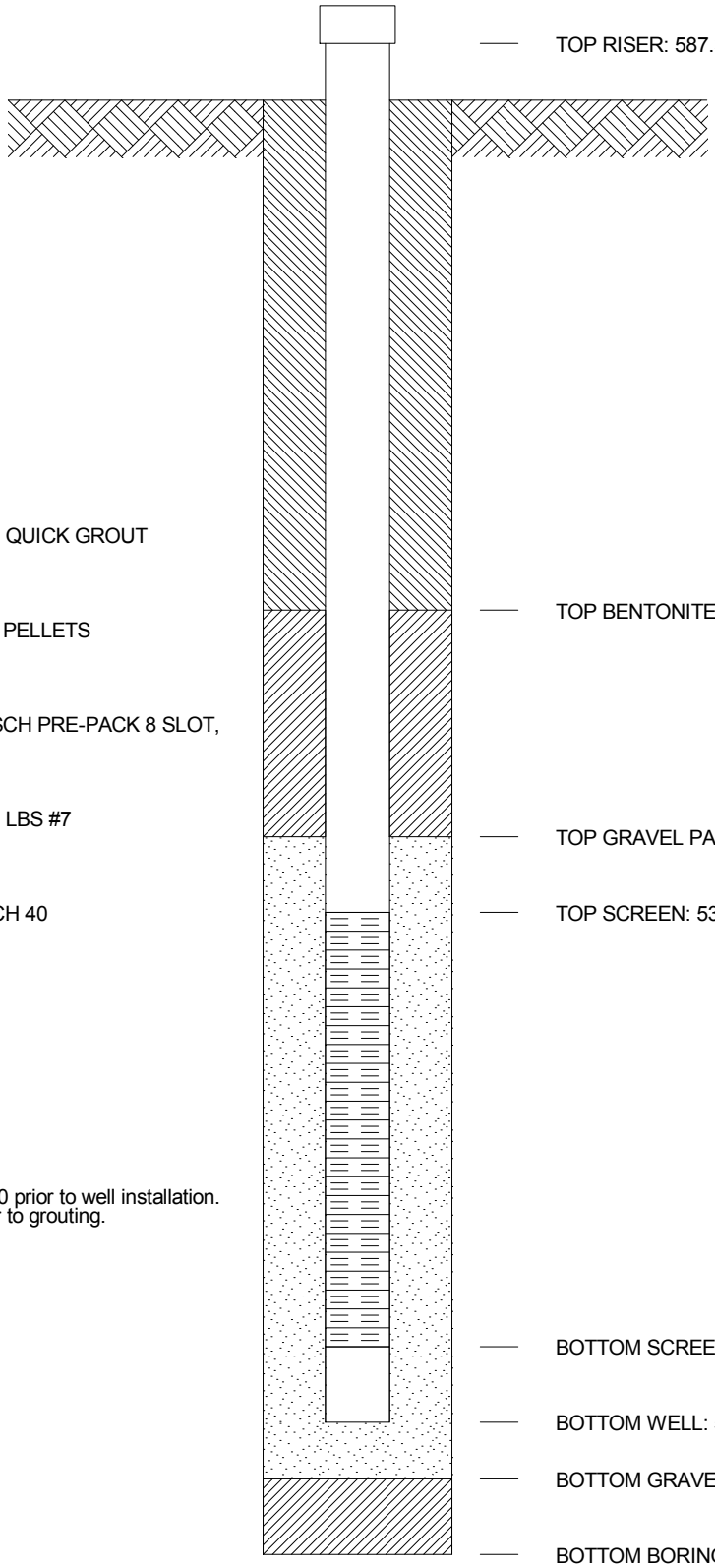
COMPANY _____ WELL No. **MW-3** BORING No. **AMW-03** INSTALLED **8/23/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 539,199.9 E 1,732,739.4**

SYSTEM **STATE PLANE**

GROUND ELEVATION 585.18 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 50 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 75 LBS# 5 50 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Bailed open boring to approx. 40 prior to well installation.
Seal hydrated 1 hour prior to grouting.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

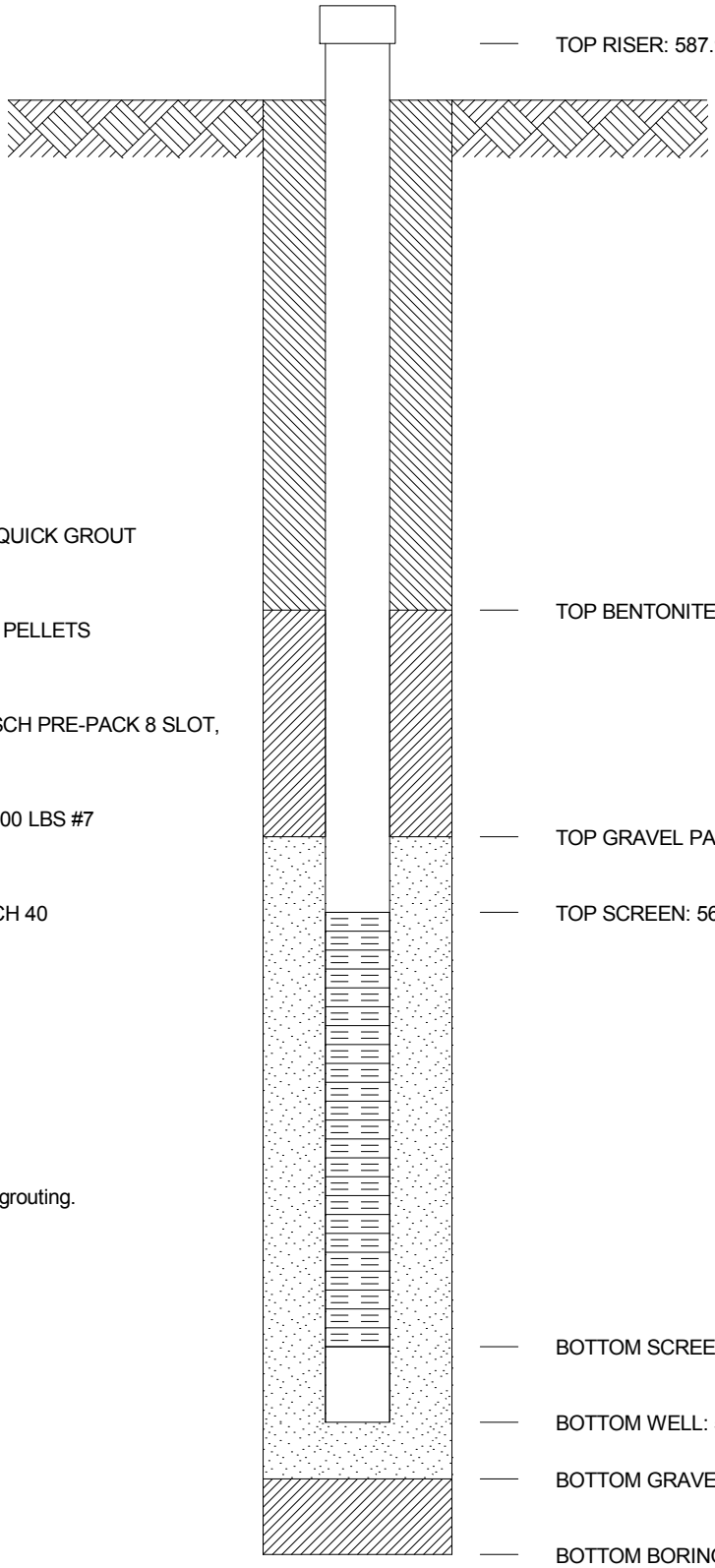
COMPANY _____ WELL No. **MW-4** BORING No. **AMW-04** INSTALLED **9/8/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 539,605.5 E 1,731,128.7**

SYSTEM **STATE PLANE**

GROUND ELEVATION 585.69 FT.



GROUT SEAL: 60 GALLONS QUICK GROUT

BENTONITE SEAL: 60 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 250 LBS #5 100 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Seal hydrated 1 hour prior to grouting.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

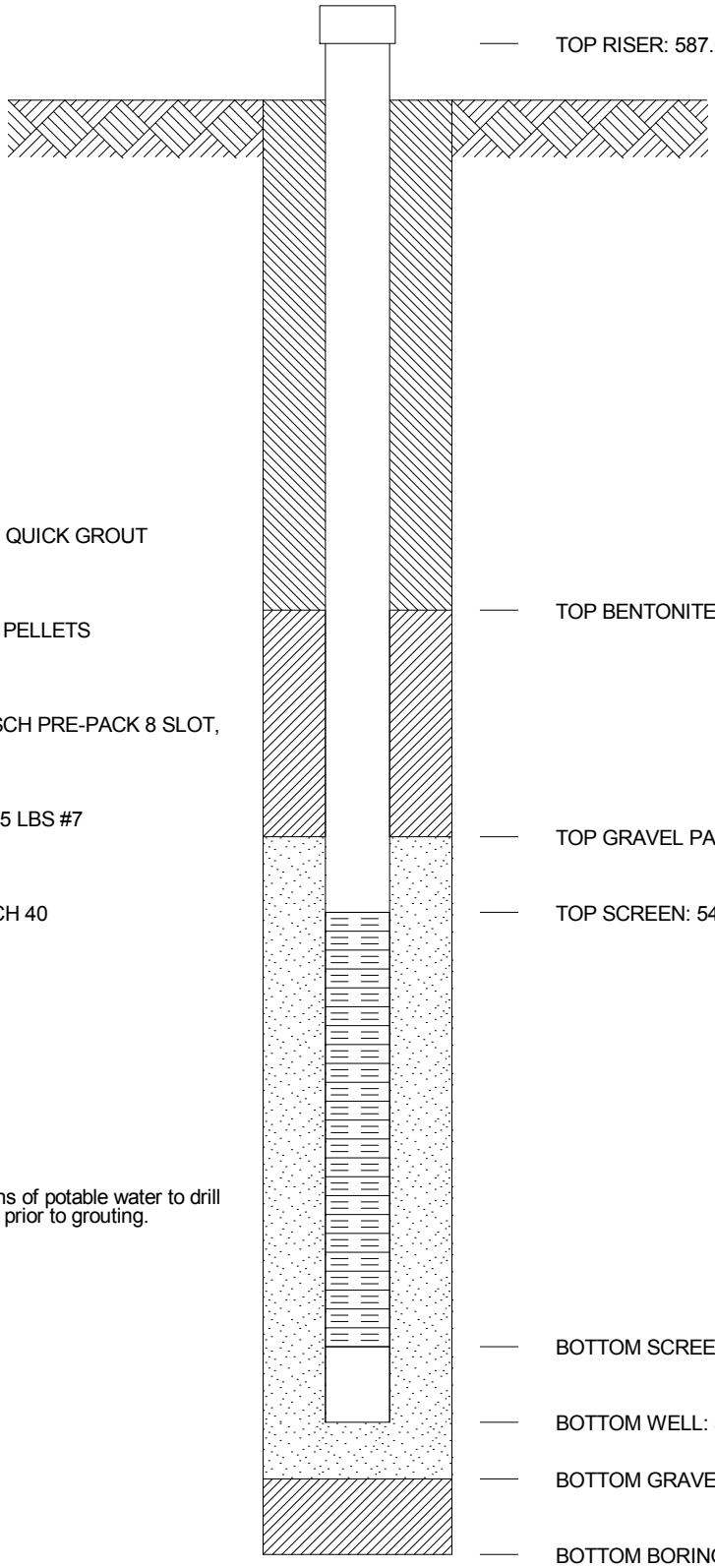
COMPANY _____ WELL No. **MW-5** BORING No. **AMW-05** INSTALLED **9/7/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 539,614.1 E 1,731,120.7**

SYSTEM **STATE PLANE**

GROUND ELEVATION 585.07 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 50 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 275 LBS #5 75 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Used approximately 500 gallons of potable water to drill hole Seal hydrated 1 hour prior to grouting.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

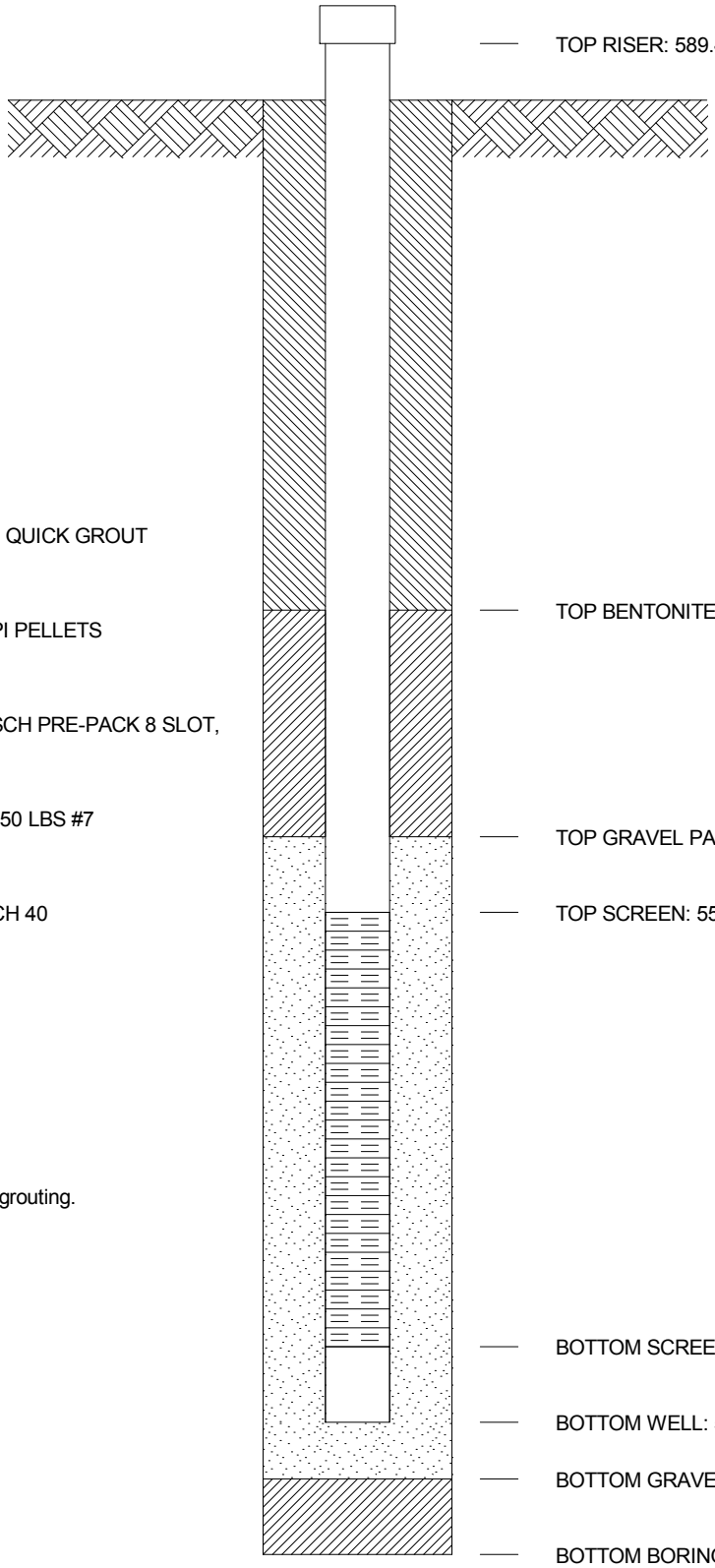
COMPANY _____ WELL No. **MW-6** BORING No. **AMW-06** INSTALLED **8/30/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 539,169.8 E 1,729,695.5**

SYSTEM **STATE PLANE**

GROUND ELEVATION 587.47 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 100 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 400 LBS #5 150 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Seal hydrated 1 hour prior to grouting.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

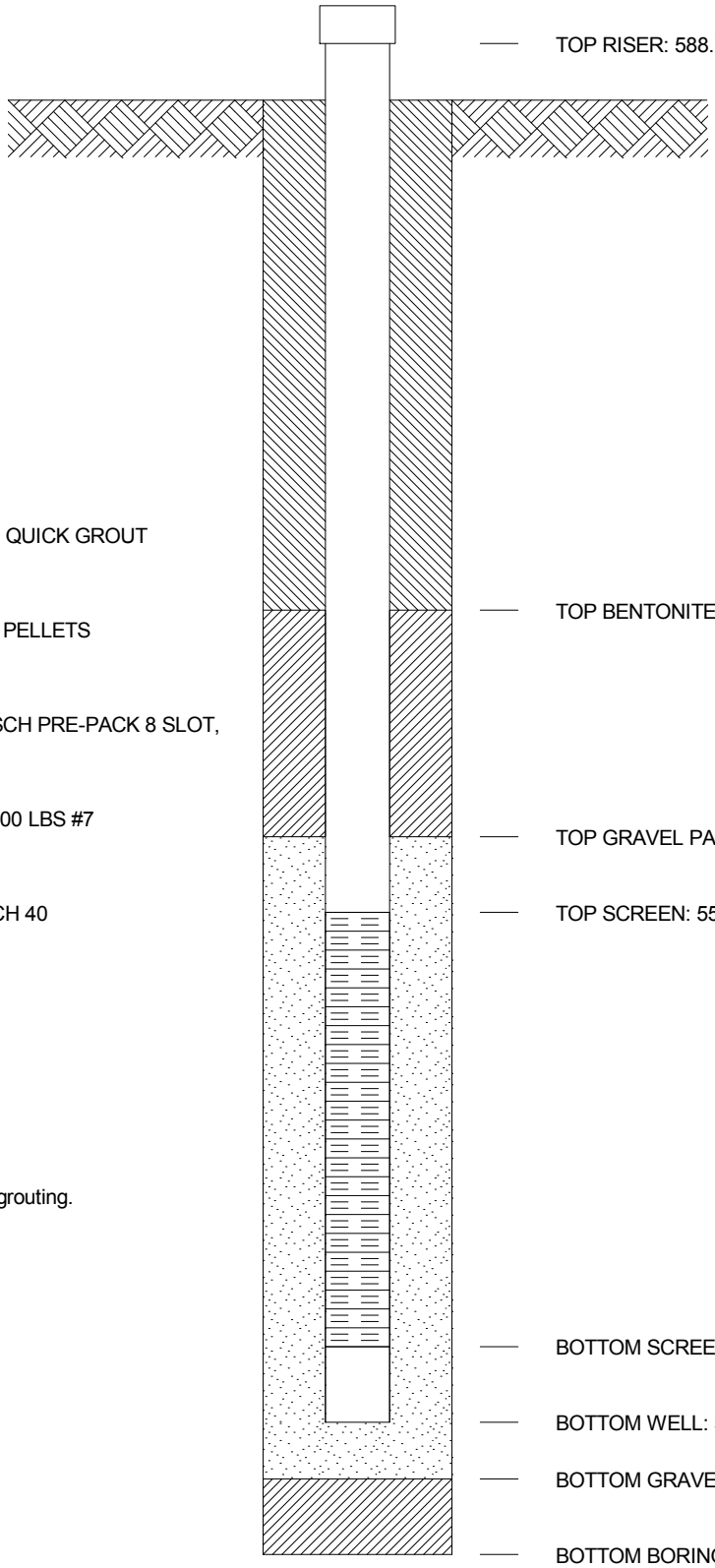
COMPANY _____ WELL No. **MW-7** BORING No. **AMW-07** INSTALLED **8/31/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 537,838.4 E 1,731,735.7**

SYSTEM **STATE PLANE**

GROUND ELEVATION 587.10 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 75 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 250 LBS #5 100 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Seal hrdrated 1 hour prior to grouting.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

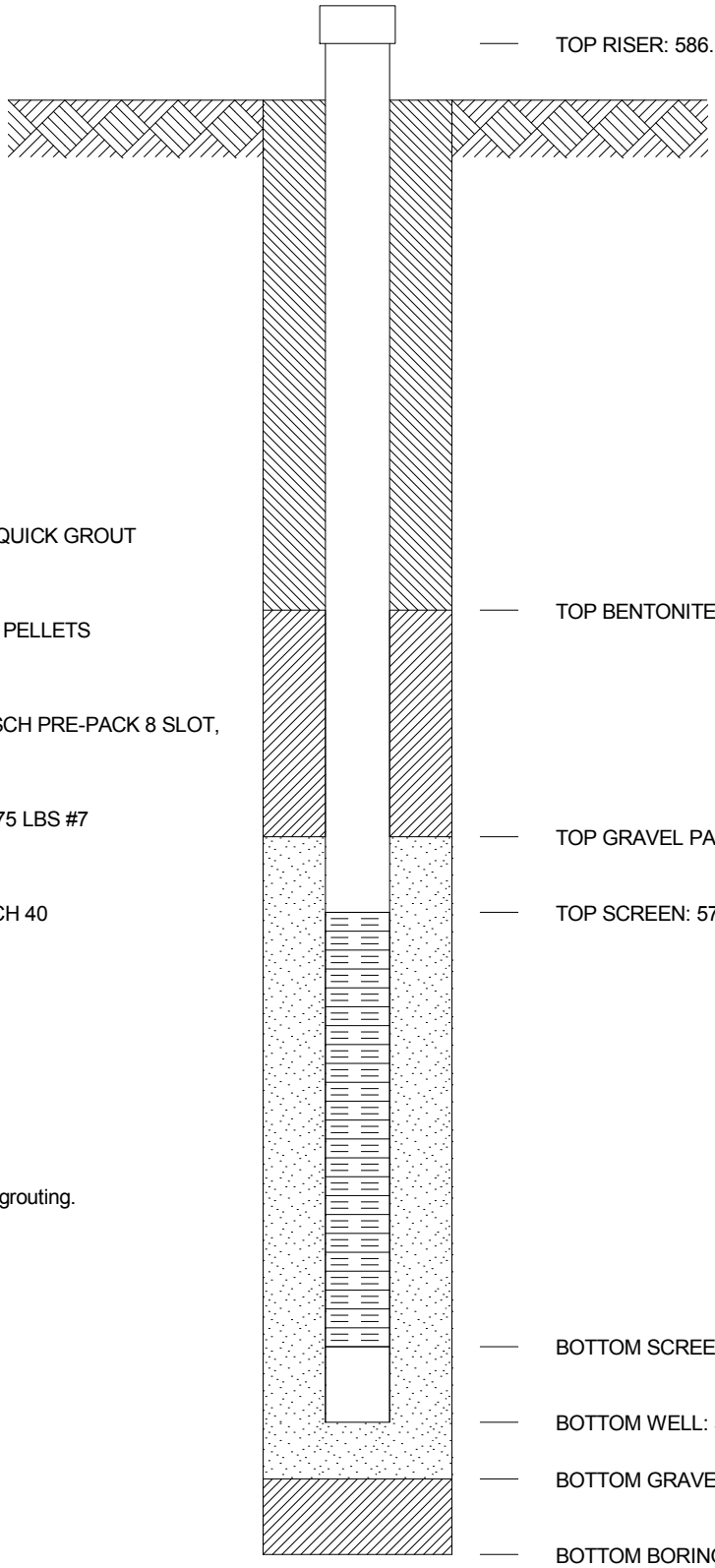
COMPANY _____ WELL No. **MW-8** BORING No. **AMW-08** INSTALLED **9/13/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 536,151.7 E 1,732,198.9**

SYSTEM **STATE PLANE**

GROUND ELEVATION 584.92 FT.



GROUT SEAL: 10 GALLONS QUICK GROUT

BENTONITE SEAL: 75 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 475 LBS #5 75 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Seal hydrated 1 hour prior to grouting.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

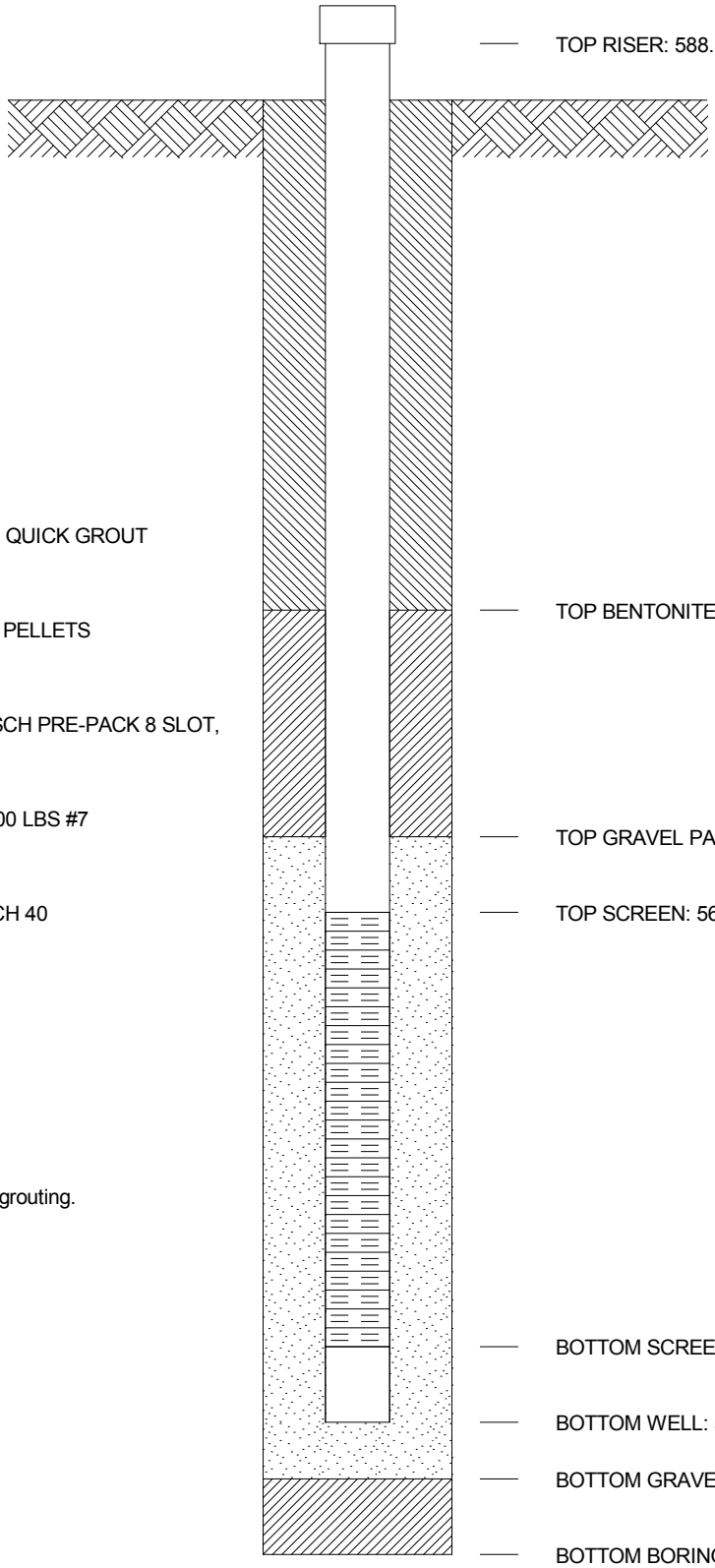
COMPANY _____ WELL No. **MW-9** BORING No. **AMW-09** INSTALLED **8/29/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 536,983.3 E 1,734,099.7**

SYSTEM **STATE PLANE**

GROUND ELEVATION 586.75 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 60 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 450 LBS #5100 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Seal hydrated 1 hour prior to grouting.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

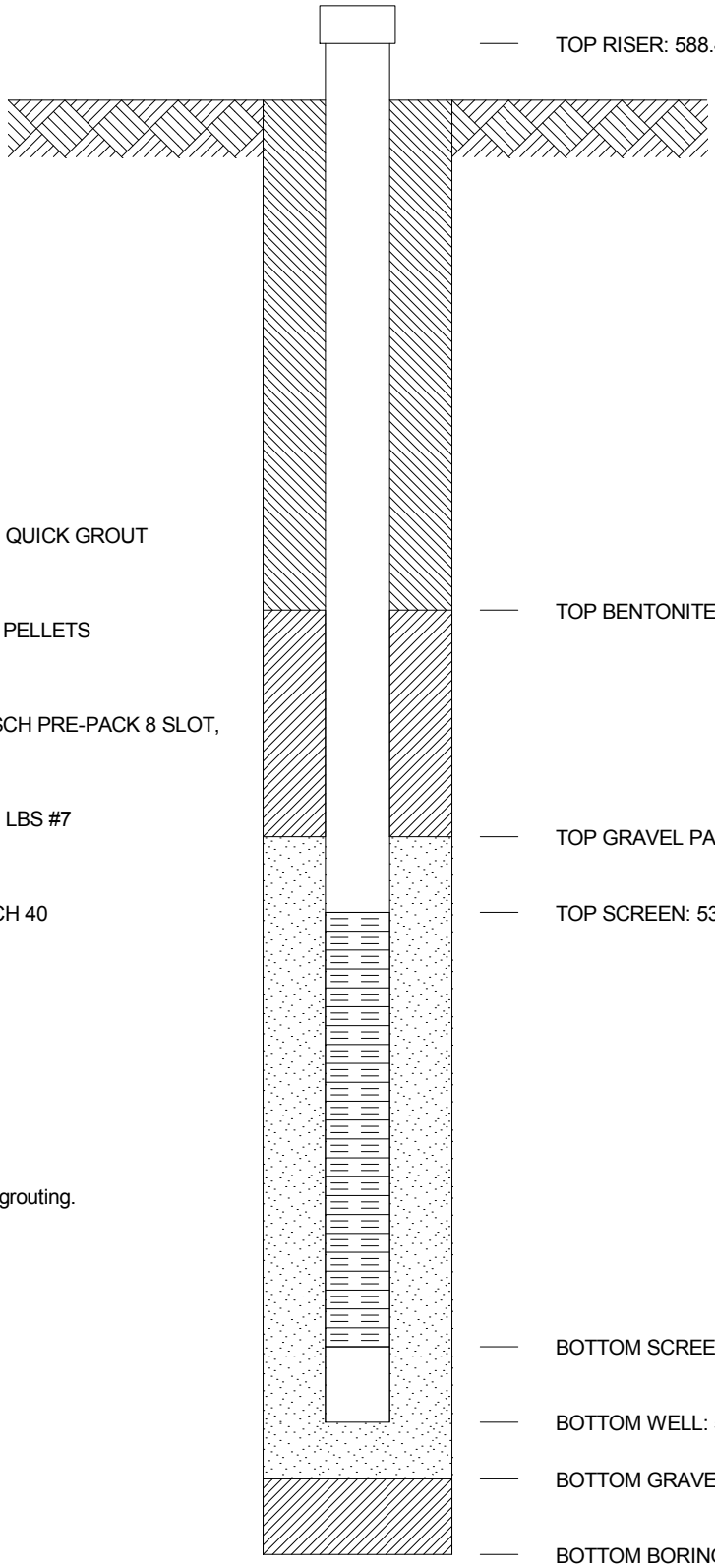
COMPANY _____ WELL No. **MW-10** BORING No. **AMW-10** INSTALLED **8/28/95**

PROJECT **EPRI GROUND WATER STUDY - AMOS**

COORDINATES **N 536,989.9 E 1,734,094.7**

SYSTEM **STATE PLANE**

GROUND ELEVATION 586.38 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 50 LBS PI PELLETS

SCREEN: 2 X 3.69 dia., PVC SCH PRE-PACK 8 SLOT, 10.0

GRAVEL PACK: 65 LBS #5 75 LBS #7

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Seal hydrated 1 hour prior to grouting.

GEOMCNST EPRI_AMOS.GPJ AEP.GDT 7/23/15

ARCADIS

Geo/Environmental Associates, Inc. 2005

Piezometer Construction Diagrams

P1, P3, & P6

PIEZOMETER P1

HCN W/O 90979-059

AEP/
PROJECT: BOTTOM ASH DAM EVALUATION PROJECT

SUMMARY ELEVATIONS (FT. MSL)

COORDINATES: 7' east of

WELL NO.: B-1 H

DATE INSTALLED: 08/09/05

REF. DATUM EL.: 586

GRADE: 583

NOTE: CASING PROTECTOR DETAILS NOT SHOWN SEE DRG—0440

TOP OF BENTONITE SEAL: 24.0

TOP OF GRAVEL PACK: 26.0

1 GROUT SEAL MATERIAL: Type I Portland Cement

2 BENTONITE SEAL MATERIAL: 3/8" Coated Tablets

3 SCREEN SIZE: .010 Slot

4 GRAVEL PACK MATERIAL: Quartz Sand

5 BOREHOLE DIAMETER: 6"

6 [illegible] CASING

TOP OF SCREEN: 28.0'

BOTTOM OF SCREEN: 38.0'

2' SUMP

BOTTOM OF BLANK SEC.: 28.0'

BOTTOM OF GRAVEL PACK: 38.0'

BOTTOM OF BOREHOLE: 38.0'

DRAFT

"No bentonite seal necessary" (KCP, 08/09/05)

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION 0	OBSERVATION WELL
APP'D.	DR. J. ACKERS	CH. JMK	DATE FEB. 6, 2006
AMERICAN ELECTRIC POWER SERVICE CORP.		DGS — 0441	SH. 1

AMERICAN ELECTRIC POWER
BOTTOM ASH DAM EVALUATION PROJECT
KANAWHA RIVER POWER PLANT, WEST VIRGINIA

GEOLOGIST/ENGINEER: Nils Cahl

7-C 9

PIEZOMETER P3

HCN W/O 90979-059

PROJECT AEP/ BOTTOM ASH DAM EVALUATION PROJECT

COORDINATES 5' east of B-3

DATE INSTALLED 08/07/05

SUMMARY ELEVATIONS (ROUND)

WELL NO. B-3 U

REF. DATUM PT. ______

REF. DATUM PT. 586

GRADE 583

NOTE: CASING PROTECTOR DETAILS NOT SHOWN SEE GDS—04C

TOP OF BENTONITE SEAL 23.0

TOP OF GRAVEL PACK 25.0

1 GROUT SEAL MATERIAL: Type I Portland

2 BENTONITE SEAL MATERIAL: Aquagel/Gold Seal 3/8" pellets

3 SCREEN SIZE: 010. Slot

4 GRAVEL PACK MATERIAL: Quartz Sand

5 BOREHOLE DIAMETER: 6" 6" MIN.

6 1" DIA. PVC CASING

TOP OF SCREEN 27.0

BOTTOM OF SCREEN 32.0'

BOTTOM OF BLANK SEC. 27.0'

BOTTOM OF GRAVEL PACK 34.0

BOTTOM OF BOREHOLE 36.0'

DRAFT

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION 0	OBSERVATION WELL
APP'D.	DR. J OKENS	CK. JMK / DATE JUL 1, 1988	
AMERICAN ELECTRIC POWER SERVICE CORP.			GDS—04A / SH. 1

AMERICAN ELECTRIC POWER
BOTTOM ASH DAM EVALUATION PROJECT
AMOS POWER PLANT, WEST VIRGINIA

GEOLOGIST/ENGINEER: Nils Guhl

PIEZOMETER PG

7 of 9

HCN W.O 90979.059

AEP/ Bottom Ash Dam Evaluation Project

PROJECT

COORDINATES 6' west of B-6

DATE INSTALLED 08/06/05

SUMMARY ELEVATIONS (ELEVATION)

WELL NO. B-6 H

REF. DATUM EL. 526

GRADE 583

NOTE: SEE CDS-004C

TOP OF BENTONITE SEAL 10.5'

TOP OF GRAVEL PACK 13.0'

1 GROUT SEAL MATERIAL: Type I Portland Cement

2 BENTONITE SEAL MATERIAL: Aquagel Gold Seal (Coarse Pellets)

3 SCREEN SIZE: 010 Slot

4 GRAVEL PACK MATERIAL: Quartz Sand

5 BOREHOLE DIAMETER: 6" MIN.

6 1" DIA. PVC CASING

TOP OF SCREEN 15.0'

BOTTOM OF SCREEN 25.0'

BOTTOM OF BLANK SEC. 15.0'

BOTTOM OF GRAVEL PACK 27.0'

BOTTOM OF BOREHOLE 27.0'

DRAFT

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION 0	OBSERVATION WELL
APP'D.	DR. J. DEERE	CK. JRK	DATE JUL 4, 2006
AMERICAN ELECTRIC POWER SERVICE CORP.			CDS — 04-A SH. 1

AMERICAN ELECTRIC POWER
BOTTOM ASH DAM EVALUATION PROJECT
KMOS POWER PLANT, WEST VIRGINIA

GEOLOGIST/ ENGINEER:
Nils Guhl

ARCADIS

H.C. Nutting Company 2005

Test Boring Logs

B-1 to B-8, B-11

H.C. NUTTING COMPANY
APPALACHIAN REGION - 912 MORRIS STREET
CHARLESTON, WV 25301 (304) 344-0821
FAX (304) 342-4711
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS SINCE 1921

CORPORATE CENTER 911 LUNKEN PARK DRIVE CINCINNATI, OH 45226 (513) 321-5816 FAX (513) 321-0294
CENTRAL OHIO REGION 793 MORRISON ROAD COLUMBUS, OH 43230 (614) 863-3113 FAX (614) 863-6475
INDIANA REGION 345 WALNUT STREET, STE 9 LAWRENCEBURG, IN 47025 (812) 539-4300 FAX (812) 539-4301
BLUEGRASS REGION 470-B CONWAY CT., STE B-4 LEXINGTON, KY 40511 (859) 455-9730 FAX (859) 455-9936

COPY

LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-1
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/8/2005
Boring Location		Date Completed	8/8/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))
583.00	0.0	
582.60	0.4	0.4 Topsoil with organics
581.00	2.0	1.6 FILL: Brownish gray, silty sand with gravel (SM) nonplastic, dry, medium dense
		FILL: Reddish brown and gray, lean clay (CL) (shale fill), dry - very moist, stiff - medium stiff
		- some semi-durable shale fragments at 6.0'
		13.0
		- little sandy shale fragments at 11.0'
		- very moist from 11.0'
568.00	15.0	
		FILL: Reddish brown, blueish gray, and yellowish gray, clayey gravel with sand (GC) (gravel=sandstone fragments), moist - very moist, loose - dense
		9.0
559.00 ▽	24.0	
		FILL: Reddish brown, lean clay (CL) (shale fill), wet, soft
		3.5
		- abundant non-durable to semidurable shale fragments
555.50	27.5	
		Gray, LEAN CLAY with SAND (CL), wet, very soft
		4.0 - trace organics (wood and peat)
551.50	31.5	
		Gray, SILTY SAND (SM) low plasticity to non-plastic, wet, very loose - loose
		4.5

SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
1	SS	0.0-1.5	7-9-9 (18)	40						
2	SS	5.0-6.5	5-6-5 (11)	100						
3	SS	10.0-11.5	1-4-4 (8)	80						2.0
1	ST	11.5-13.5		85						
4	SS	15.0-16.5	3-4-4 (8)	73						
2	ST	17.5-19.5		80						
5	SS	20.0-21.5	3-17-22 (39)	60						
6	SS	22.5-24.0	5-10-8 (18)	100						
7	SS	24.0-25.5	1-2-1 (3)	100						
8	SS	27.5-29.0	WOH-WOH-WOH	100						0.25
3	ST	29.5-31.5		100						
9	SS	31.5-33.0	1-2-2 (4)	100						

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	SS/ST
Inspector	NG

Remarks

Located boring 1' off edge of Rd. (approx. 7' off Rd. CL) on natural side of dam. Water at completion measured through the augers. Boring caved at 34' after 24 hrs. Installed MW with screen from 28' to 38' in hole 7' east of B-1.

Water Level Observations

Immediate	24.0	ft.	▽
At Completion	24.2	ft.	▼
After 24 Hrs.	33.0	ft.	▼
Water used in drilling	31.5	ft.	

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

H.C. NUTTING COMPANY
APPALACHIAN REGION - 912 MORRIS STREET
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EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS SINCE 1921

CORPORATE CENTER 911 LINKEN PARK DRIVE CINCINNATI, OH 45238 (513) 921-5818 FAX (513) 921-0994
CENTRAL OHIO REGION 780 MORRISON ROAD COLUMBUS, OH 43230 (614) 863-8113 FAX (614) 863-0475
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BLUEGRASS REGION 470-B CONWAY CT., STE B-9 LEXINGTON, KY 40511 (859) 455-8530 FAX (859) 455-8530

LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-1
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/8/2005
Boring Location		Date Completed	8/8/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
547.00	36.0	- little organics (wood framents) throughout - clayey seams	10	SS	35.0-36.5	4-6-6 (14)	100						
542.50	40.5	4.5 Gray, SILTY SAND with GRAVEL (SM) (gravel=sandstone fragments) non-plastic, wet, medium dense - loose - cobbles at 38.0' to 39.0'											
538.00	45.0	- trace organics (peat) Gray, SILTY SAND (SM) non-plastic, wet, loose 4.5 - trace coal fragments and organics (peat)	11	SS	40.0-41.5	2-2-3 (5)	67						
529.50	53.5	Gray, POORLY GRADED SAND with SILT (SP-SM), wet, loose - trace organics (peat) 8.5 - little gravel (sandy shale fragments) at 51.5'	12	SS	45.0-46.5	3-3-2 (5)	100						
			13	SS	50.0-51.5	3-3-7 (10)	100						
524.50	58.5	Blueish gray and reddish brown, LEAN CLAY with SAND (residual SHALE), wet - moist, stiff - very hard 5.0	14	SS	55.0-56.5	5-10-26 (36)	100						
		BORING COMPLETED @ 58.5'	15	SS	57.5-58.5	26-50/0.5	100						

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	SS/ST
Inspector	NG

Remarks

Located boring 1' off edge of Rd. (approx. 7' off Rd. CL) on natural side of dam. Water at completion measured through the augers. Boring caved at 34' after 24 hrs. Installed MW with screen from 28' to 38' in hole 7' east of B-1.

Water Level Observations

Immediate	24.0	ft.	▽	
At Completion	24.2	ft.	▽	
After	24 Hrs.	33.0	ft.	▼
Water used in drilling	31.5	ft.		

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

H.C. NUTTING COMPANY
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BLUEGRASS REGION
470-B CONWAY CT., STE B-8
LEXINGTON, KY 40511
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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-2
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/1/2005
Boring Location		Date Completed	8/2/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))
583.00	0.0	
		FILL: Brown, silty sand with gravel (SM) nonplastic, dry - moist, dense
	5.5	
577.50	5.5	
		FILL: Reddish brown, lean clay with sand (CL) (shale fill), dry - moist, stiff - very stiff
		- little friable sandstone fragments at 10.0'
	15.5	
		- multi-colored, moist, and trace organics (grass/roots) at 16.0'
562.00	21.0	
		FILL: Reddish brown and gray, sandy lean clay with gravel (CL) (gravel=sandstone fragments) (SPT Ns likely overstated due to coarse gravel), moist - wet, medium stiff - stiff
	7.5	- very gravelly at 21.5'
		- wet from 26.5'
554.50	28.5	
	2.0	Gray, SANDY LEAN CLAY (CL), very moist - wet, soft
552.50	30.5	
		Gray, SILTY SAND (SM) nonplastic, wet, loose
	4.5	
548.00	35.0	

NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
1	SS	0.0-1.5	28-25-17 (42)	87						
2	SS	5.0-6.5	7-6-7 (13)	67						
1	ST	6.5-8.5		100						
3	SS	10.0-11.5	5-6-10 (16)	100						
2	ST	11.5-13.5		100						
4	SS	15.0-16.5	4-11-8 (19)	100						
3	ST	16.5-18.5		100						
5	SS	20.0-21.5	3-4-14 (18)							
4	ST	21.5-23.5		60						
6	SS	25.0-26.5	8-10-7 (17)	80						
5	ST	26.5-28.5		90						
7	SS	30.0-31.5	1-2-4 (6)	100						

General Notes

Driller	HCN
Rig No.	D. Smith
Rig Type	ATV
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring 2' off Rd. CL on natural dam side. No indication of void noted in NQ2 #2. Material probably washed out due to short run.

Water Level Observations

Immediate	26.5	ft. ▽		
At Completion	18.0	ft. ▽		
After	24	Hrs.	16.0	ft. ▼
Water used in drilling	35.0	ft.		

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

H.C. NUTTING COMPANY
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BLUEGRASS REGION
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LEXINGTON, KY 40511
(859) 455-8830
FAX (859) 455-8830

LOG OF TEST BORING

Client: American Electric Power
Project: Bottom Ash Dam Evaluation - Amos Plant, WV
Boring Location:
Elevation Ref.: AEP Boring Location Plan

Boring No.: B-2
Date Started: 8/1/2005
Date Completed: 8/2/2005
Work Order No.: 90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
		Gray, POORLY GRADED SAND with SILT (SP-SM), wet, very loose - loose	8	SS	35.0-36.5	2-2-2 (4)							
			9	SS	40.0-41.5	10-10-9 (19)	80						
	15.0		10	SS	45.0-46.5	3-2-4 (6)	67						
533.00	50.0												
		Gray, SILTY SAND with GRAVEL (SM) (gravel=sandstone fragments), nonplastic, wet, medium dense	11	SS	50.0-61.5	4-5-11 (16)	80						
	4.0												
529.00	54.0												
		Gray and brown, LEAN CLAY with SAND (CL) (residual sandy SHALE), wet, very stiff - hard	12	SS	55.0-56.0	26-50/0.5	90						
	2.0												
527.00	56.0												
526.60	56.4	0.4 Gray, sandy SHALE, completely to highly weathered, extremely soft - very soft											
		Reddish brown, CLAYSTONE, completely to highly weathered, extremely soft - very soft	1	NQ2	56.0-60.4		98	0				0-1	
	4.6												
522.00	61.0		2	NQ2	60.4-61.0		0	0				0-1	
		BORING COMPLETED @ 61.0'											

General Notes

Driller	HCN
Rig No.	D. Smith
Rig Type	ATV
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring 2' off Rd. CL on natural dam side. No indication of void noted in NQ2 #2. Material probably washed out due to short run.

Water Level Observations

Immediate	28.5	ft.	▽	
At Completion	16.0	ft.	▽	
After	24 Hrs.	16.0	ft.	▼
Water used in drilling	35.0	ft.		

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

H.C. NUTTING COMPANY
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BLUEGRASS REGION 470-B CONWAY CT. STE B-4 LEXINGTON KY 40511 (859) 408-8830 FAX (859) 455-8830

LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-3
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/7/2005
Boring Location		Date Completed	8/7/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)
583.00	0.0	
		FILL: Brown, silty sand with gravel (SM) non-plastic, dry - moist, medium dense
		3.0
580.00	3.0	
		FILL: Reddish brown and multi-colored, lean clay (CL) (shale fill), moist, medium stiff - very stiff
		13.5
		- little sandstone/sandy shale fragments
566.50	16.5	
		FILL: Brown and gray, clayey gravel with sand (GC) (gravel=sandstone fragments), moist, medium dense
		5.5
		- very gravelly at 20.0'
561.00	22.0	- clay component very moist to wet and soft at 21.0' to 21.5'
		FILL: Brown and gray, silty gravel with sand (GM) (gravel=sandstone fragments) non-plastic, very moist, medium dense - very dense
		4.0
557.00 ▽	26.0	- thin clayey gravel seams
		FILL/DISTURBED Material: brown and greenish gray, clayey gravel with sand (GC) (gravel=sandstone fragments), wet - very moist, very loose
555.50	27.5	1.5
555.00	28.0	0.5
		FILL/DISTRUBED MATERIAL: gray, lean clay (CL), slight organic odor, wet, soft
553.00	30.0	2.0
		FILL/DISTRUBED MATERIAL: greenish gray, silty/clayey gravel with sand (GC/GM) (gravel=sandstone fragments), wet, very loose
550.50	32.5	2.5
		Gray, LEAN CLAY with SAND (CL), wet, very soft - soft

NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
1	SS	0.0-1.5	4-9-7 (16)	80						
2	SS	5.0-6.5	7-4-4 (8)	93						
1	ST	6.5-8.5		80						
3	SS	10.0-11.5	4-3-6 (9)	93						
2	ST	11.5-13.5		100						
4	SS	15.0-16.5	3-7-9 (16)	100						
3	ST	16.5-17.0		100						
4	ST	18.5-20.0		67						
5	SS	20.0-21.5	11-6-5 (11)	80						
6	SS	22.0-23.2	7-17-50/0.2	117						
7	SS	25.0-26.5	38-19-6 (25)	100						
8	SS	26.5-28.0	4-2-2 (4)	87						<0.25
9	SS	28.0-29.5	3-1-2 (3)	47						
5	ST	30.0-32.0		100						
10	SS	32.0-33.5	2-5-4 (9)	100						

SAMPLE

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring at edge of Rd. (approx. 6' off Rd. CL) on natural side of dam. ST#3 failed due to presence of gravel. ST#4 terminated at 20' due to presence of gravel. Installed MW with screen from 27.0' to 32.0' in hole 5' east of B-3.

Water Level Observations

Immediate	26.0			ft. ▽
At Completion	17.5			ft. ▽
After	24	Hrs.	20.5	ft. ▼
Water used in drilling	35.0			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

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BLUEGRASS REGION
470-B CONWAY CT., STE B-8
LEXINGTON, KY 40511
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LOG OF TEST BORING

Client: American Electric Power
Project: Bottom Ash Dam Evaluation - Amos Plant, WV
Boring Location:
Elevation Ref.: AEP Boring Location Plan

Boring No.: B-3
Date Started: 8/7/2005
Date Completed: 8/7/2005
Work Order No.: 90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSi	PPR tsf
		- trace wood and coal fragments at 34.0'	11	SS	35.0-36.5	3-4-2 (6)	100						
		Gray, SILTY SAND (SM) non-plastic, wet, loose *(LAYER CONTINUED DESCRIPTION REPEATED)*											
538.00	45.0	12.5 - trace peat	12	SS	40.0-41.5	2-4-6 (10)	100						
		Gray, POORLY GRADED SAND with SILT (SP-SM), wet, medium dense	13	SS	45.0-46.5	5-6-6 (12)	100						
528.50	54.5	9.5 - trace coal fragments at 50.0'	14	SS	50.0-51.5	4-6-14 (20)	100						
		Blueish gray to reddish brown, LEAN CLAY with SAND (CL) (residual SHALE), very stiff - very hard	15	SS	55.0-56.5	21-44-25 (69)	100						
524.70	58.3	3.8	16	SS	57.5-58.3	30-50/0.3	100						
		Reddish brown and blueish gray, CLAYSTONE, completely to highly weathered, extremely soft - very soft											
522.40	60.6	2.3											
		Blueish gray, SANDY SILTSTONE, slightly weathered, soft - medium hard	1	NQ2	58.3-63.3		100	26			0-3		
519.70	63.3	2.7											
		BORING COMPLETED @ 63.3'											

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring at edge of Rd. (approx. 5' off Rd. CL) on natural side of dam. ST#3 failed due to presence of gravel. ST#4 terminated at 20' due to presence of gravel. Installed MW with screen from 27.0' to 32.0' in hole 5' east of B-3.

Water Level Observations

Immediate	28.0	ft. ▽
At Completion	17.5	ft. ▽
After 24 Hrs.	20.5	ft. ▼
Water used in drilling	35.0	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

H.C. NUTTING COMPANY
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BLUEGRASS REGION 476-B CONWAY CT., STE B-6 LEXINGTON, KY 40511 (859) 455-8000 FAX (859) 455-8008

LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-4
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/2/2005
Boring Location		Date Completed	8/3/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	NO.	TYPE	DEPTH ft	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
583.00	0.0	FILL: Brown and gray, silty sand with gravel (SM) nonplastic, moist, dense - medium dense	1	SS	0.0-1.5	14-12-13 (25)	100						
578.00	5.0	FILL: Brown, sandy lean clay (CL), moist, soft	2	SS	5.0-6.5	2-1-2 (3)	87						
575.00	8.0	FILL: Brown, silty/clayey sand (SC/SM), moist, loose - very loose	1	ST	6.5-8.5		0						
			3	SS	10.0-11.5	3-4-6 (10)	100						
566.50	16.5	FILL/DISTURBED MATERIAL: Grayish brown, silty sand (SM), nonplastic, very moist - wet, very loose - loose - wet from 18.0' - trace coal fragments/peat at 21'	4	SS	15.0-16.5	2-1-2 (3)	100						
			5	SS	20.0-21.5	2-1-4 (5)	100						
556.00	27.0	- some gravel (sandstone fragments) at 27.0'	6	SS	25.0-26.5	2-3-2 (5)	0						
		Grayish brown, SILTY SAND (SM) nonplastic, wet, medium dense - trace peat	7	SS	26.5-28.0	9-8-3 (11)	67						
			8	SS	30.0-31.5	7-8-10 (18)	100						

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring 4' off Rd. CL on natural dam side. NQ2 #1 56.4'-58.5' no indication of void noted. Material probably washed out due to extremely soft HCSI. Boring caved at 18' upon completion and caved at 19' after 24 hrs.

Water Level Observations

Immediate	18.0			ft. ▽
At Completion	17.0			ft. ▽
After	24	Hrs.	18.0	ft. ▼
Water used in drilling	25.0			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-4
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/2/2005
Boring Location		Date Completed	8/3/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
		16.0 Grayish brown, SILTY SAND (SM) nonplastic, wet, medium dense *(LAYER CONTINUED DESCRIPTION REPEATED)*	9	SS	35.0-36.5	6-8-5 (13)	100						
		- little coal fragments and peat at 41.0'	10	SS	40.0-41.5	7-9-11 (20)	73						
540.00	43.0												
		Gray, POORLY GRADED SAND with SILT (SP-SM), wet, medium dense	11	SS	45.0-46.5	4-7-5 (12)	73						
		7.0 - trace coal fragments at 46.0'											
533.00	50.0												
		Gray, POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	12	SS	50.0-51.5	5-20-18 (38)	67						
530.00	53.0	3.0 (gravel=sandstone fragments), wet, dense											
		Reddish brown and gray, LEAN CLAY (CL) (residual SHALE), wet - moist, stiff - hard											
526.60	56.4	3.4	13	SS	55.0-56.4	10-27-50/0.4	100						
		Reddish brown and gray, CLAYSTONE, completely to highly weathered, extremely soft	1	NQ2	56.4-61.5		69	0				0	
521.50	61.5	5.1											
		BORING COMPLETED @ 61.5'											

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring 4' off Rd. CL on natural dam side. NQ2 #1 56.4'-58.5' no indication of void noted. Material probably washed out due to extremely soft HCSI. Boring caved at 18' upon completion and caved at 19' after 24 hrs.

Water Level Observations

Immediate	18.0	ft. ▽
At Completion	17.0	ft. ▽
After 24 Hrs.	18.0	ft. ▼
Water used in drilling	25.0	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/1/05

H.C. NUTTING COMPANY
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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-5
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/3/2005
Boring Location		Date Completed	8/13/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
583.00	0.0												
		FILL: Brownish gray, silty sand with gravel (SM) nonplastic, moist, dense - medium dense	1	SS	0.0-1.5	10-15-15 (30)	100						
	5.5												
577.50	5.5	- trace coal fragments at 5.0'	2	SS	5.0-6.5	3-4-3 (7)	100						
		Fill: Brown, poorly graded sand (SP), dry - moist, loose											
	3.5	- uniform appearance											
574.00	9.0												
		FILL: Brown, poorly graded sand with silt (SP-SM), moist, loose	3	SS	10.0-11.5	2-1-4 (5)	100						
	6.5	- uniform appearance											
567.50	15.5												
		FILL: Brown, silty/clayey sand (SC/SM), very moist - wet, loose	4	SS	15.0-16.5	4-3-2 (5)	100						
	2.5	- wet from 18.0'											
565.00	18.0	- uniform appearance											
		FILL: Grayish brown, silty sand (SM), nonplastic to low plasticity, wet, loose	5	SS	20.0-21.5	1-2-4 (6)	100						
	4.0												
561.00	22.0												
		Brown and gray, SILTY SAND (SM), nonplastic to low plasticity, moist - wet, loose - medium dense	6	SS	25.0-26.5	5-5-9 (14)	73						
		- trace peat from 26.5'											
			7	SS	30.0-31.5	4-6-9 (15)	100						

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	SS
Inspector	NG

Remarks

Located boring 3' off Rd. CL on natural dam side. Boring caved at 18' after 24 hrs.

Water Level Observations

Immediate	16.5	ft. ▽
At Completion	17.5	ft. ▼
After	24 Hrs.	NW ft.
Water used in drilling	20.0	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASHDAM.GPJ HC NUTTING.GDT 8/14/06

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-5
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/3/2005
Boring Location		Date Completed	8/13/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
		Brown and gray, SILTY SAND (SM), nonplastic to low plasticity, moist - wet, loose - medium dense *(LAYER CONTINUED DESCRIPTION REPEATED)*	8	SS	35.0-36.5	2-5-6 (11)	100						
	32.5	- clayey seam at 36.0'	9	SS	40.0-41.5	3-5-8 (13)	100						
			10	SS	45.0-46.5	6-8-8 (16)	100						
			11	SS	50.0-51.5	5-8-11 (19)	100						
		- little gravel (sandstone fragments) at 51.0'											
528.60	54.5												
527.20	55.8	1.3 Reddish brown and gray, LEAN CLAY (CL) (residual SHALE), moist, hard	12	SS	55.0-55.8	30-50/0.3	100						
		BORING COMPLETED @ 55.8'											

General Notes	
Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	SS
Inspector	NG

Remarks
Located boring 3' off Rd, CL on natural dam side. Boring caved at 18' after 24 hrs.

Water Level Observations

Immediate	16.5	ft. ▽		
At Completion	17.5	ft. ▼		
After	24	Hrs.	NW	ft.
Water used in drilling	20.0	ft.		

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-6
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/4/2005
Boring Location		Date Completed	8/5/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))
583.00	0.0	
582.50	0.5	0.5 Topsoil
582.00	1.0	0.5 FILL: Gray, silty sand (SM), nonplastic, dry - moist, loose
		FILL: Brown, sandy lean clay (CL), moist, stiff
		4.5
577.50	5.5	
		FILL: Reddish brown and multicolored, lean clay with gravel (CL) (gravel=sandstone fragments) (shale fill), moist, stiff
		5.0
572.50	10.5	
		Brown to light brown, sandy lean clay (CL), moist, stiff
		- uniform appearance
		8.0 - trace organics (hair roots)
564.50 ▽	18.5	
		FILL/DISTURBED MATERIAL, silty/clayey sand (SC/SM), wet, loose
		3.5
561.00	22.0	- uniform appearance
		Brown, LEAN CLAY with SAND (CL), wet, soft
		2.0
559.00	24.0	- logged from cuttings and ST
		Brown, SILTY SAND (SM), nonplastic, wet, loose
		11.5

SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
1	SS	0.0-1.5	3-5-4 (9)	100						
2	SS	5.0-6.5	2-5-5 (10)	87						
1	ST	6.5-8.5		85						
3	SS	10.0-11.5	4-8-7 (15)	100						
4	SS	15.0-16.5	3-4-8 (10)	100						4.5
2	ST	16.5-18.5		45						
5	SS	20.0-21.5	3-5-2 (7)	100						
3	ST	23.0-25.0		100						
6	SS	25.0-26.5	2-5-4 (9)	100						
7	SS	30.0-31.5	2-3-2 (5)	100						

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	SS/ST
Inspector	NG

Remarks

Located boring 3' off Rd. edge (approx. 8' off Rd. CL) on natural dam side. Water level at completion measured through the augers. Installed MW with screen from 15.0' to 25.0' in hole 6' west of B-6.

Water Level Observations

Immediate	18.5	ft. ▽
At Completion	24.5	ft. ▽
After	24 Hrs. BF	ft.
Water used in drilling	25.0	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-6
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/4/2005
Boring Location		Date Completed	8/5/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
547.50	35.5	Gray, POORLY GRADED SAND with SILT (SP-SM), wet, medium dense	8	SS	35.0-36.5	6-6-6 (12)	80						
		- trace peat											
537.00	46.0	10.5	9	SS	40.0-41.5	4-7-8 (15)	87						
		Gray, POORLY GRADED SAND with SILT and GRAVEL (SP-SM) (gravel=sandstone fragments), wet, medium dense	10	SS	45.0-46.5	6-7-7 (14)	80						
534.00	49.0	3.0											
		Gray, POORLY GRADED SAND (SP), wet, medium dense	11	SS	50.0-51.5	5-6-7 (13)	100						
529.00	54.0	5.0											
527.20	55.8	Blueish gray, SANDY LEAN CLAY (CL) (residual sandy SHALE), moist - dry, very stiff - very hard	12	SS	55.0-55.8	40-50/0.3	100						
		1.8 BORING COMPLETED @ 55.8'											

General Notes

Driller	HCN
Rig No.	J. Johnson
Rig Type	ATV
Method	SS/ST
Inspector	NG

Remarks

Located boring 3' off Rd. edge (approx. 8' off Rd. CL) on natural dam side. Water level at completion measured through the augers. Installed MW with screen from 15.0' to 25.0' in hole 6' west of B-6.

Water Level Observations

Immediate	18.5	ft. ▽
At Completion	24.5	ft. ▼
After	24 Hrs. BF	ft.
Water used in drilling	25.0	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-7
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/11/2005
Boring Location		Date Completed	8/11/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))
568.00	0.0	
567.70	0.3	0.3 Topsoil
		FILL: Reddish and yellowish brown, lean clay with sand (CL), dry, stiff
		3.7 - some semi-friable shale fragments
564.00 ▽	4.0	
		FILL: Gray, poorly graded gravel with silt and sand (GP-GM), wet, loose
		5.5
558.50	9.5	
		FILL/DISTURBED MATERIAL, gravelly lean clay (CL), wet, soft - very soft
		2.5
556.00	12.0	
		Gray, LEAN CLAY (CL), wet, very soft
		2.5
553.50	14.5	
		Gray, SILTY SAND (SM), wet, very loose - loose
		- trace organics (wood fragments) at 16'
		8.5
		- trace friable sandstone fragments and little coal fragments/peat at 21'
545.00	23.0	
		Gray, POORLY GRADED SAND with SILT (SP-SM), wet, loose
		- trace coal fragments/peat
		12.5

SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
1	SS	0.0-1.5	3-4-10 (14)	100						
2	SS	5.0-6.5	3-4-1 (5)	47						
3	SS	10.0-11.5	3-2-1 (3)	40						
1	ST	13.0-15.0		100						
4	SS	15.0-16.5	1-2-2 (4)	100						
5	SS	20.0-21.5	1-3-4 (7)	100						
6	SS	25.0-26.5	3-4-3 (7)	100						
7	SS	30.0-31.5	3-2-3 (5)	100						

General Notes

Driller	HCN
Rig No.	J. Williams
Rig Type	Track
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring at dam toe, appr. 3.5' above creek. Hay stick used for sediment control. Water level upon completion measured through the augers before NQ2. 24 hr. water level measured through the augers. Installed MW with screen from 40.9' to 30.9'.

Water Level Observations

Immediate	4.0	ft. ▽
At Completion	3.0	ft. ▽
After 24 Hrs.	3.0	ft. ▼
Water used in drilling	20.0	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-7
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/11/2005
Boring Location		Date Completed	8/11/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
532.50	35.5	Gray and multicolored, SILTY GRAVEL with SAND (GM) (gravel =sandstone fragments), nonplastic to low plasticity, wet, dense	8	SS	35.0-36.5	6-16-18 (34)	100						
530.00	38.0	2.5											
		Reddish brown and gray, LEAN CLAY with SAND (CL) (completely weathered sandy SHALE), moist - dry, very stiff - very hard											
527.10	40.9	2.9	9	SS	40.0-40.9	30-50/0.4	100						
		Reddish brown, CLAYSTONE, completely to highly weathered, extremely soft - very soft	1	NQ2	40.9-45.7		100	0				0-1	
522.30	45.7	4.8											
		BORING COMPLETED @ 45.7'											

DRAFT

General Notes

Driller	HCN
Rig No.	J. Williams
Rig Type	Track
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring at dam toe, appr. 3.5' above creek. Hay stick used for sediment control. Water level upon completion measured through the augers before NQ2. 24 hr. water level measured through the augers. Installed MW with screen from 40.9' to 30.9'.

Water Level Observations

Immediate	4.0	ft. ▽
At Completion	3.0	ft. ▽
After 24 Hrs.	3.0	ft. ▼
Water used in drilling	20.0	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HCNUTTING.GDT 8/14/05

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BLUEGRASS REGION 473-B CONWAY CT., STE B LEXINGTON, KY 40511 (606) 455-8630 FAX (606) 455-8690

LOG OF TEST BORING

Client: American Electric Power
Project: Bottom Ash Dam Evaluation - Amos Plant, WV
Boring Location:
Elevation Ref.: AEP Boring Location Plan

Boring No.: B-8
Date Started: 8/12/2005
Date Completed: 8/12/2005
Work Order No.: 90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))
568.00	0.0	
567.70	0.3	0.3 Topsoil
567.10	0.9	0.6 FILL: Reddish brown, lean clay with sand (CL) (shale fill), moist, medium stiff
		FILL: Greenish brown and gray, sandy shale and sandstone COBBLES (drill pressure at 8.0': 800 psi)
		8.6 - some clayey-soft seams
558.50	9.5	
		Dark gray, LEAN CLAY (CL) (mostly liquid), wet, very soft
		- trace organics (wood)
		7.0 - slight organic odor
551.50	16.5	
		Gray, SILTY SAND (SM), nonplastic, wet, loose
		- trace coal fragments at 21'
		16.0
		- trace wood, trace 0.25" coal fragments, and little gravel (sandstone fragments) at 30'
534.00	34.0	

SAMPLE

NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCS!	PPR tsf
1	SS	0.0-0.9	3-50/0.4	100						
2	SS	5.0-6.5	33-22-7 (29)	93						
3	SS	7.5-7.9	50/0.4	100						
4	SS	10.0-11.5	1-WOH-WOH	100						
1	ST	11.5-13.5		0						
5	SS	15.0-16.5	WOH-WOH-1	100						
2	ST	17.0-19.0		55						
6	SS	20.0-21.5	2-2-3 (5)	100						
7	SS	25.0-26.5	2-3-4 (7)	100						
8	SS	30.0-31.5	4-4-3 (7)	100						

DRAFT

General Notes

Driller	HCN
Rig No.	J. Williams
Rig Type	Track
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring at dam toe, appr. 3.5' above creek. Hay stick used for sediment control. Water level upon completion measured through the augers before NQ2. Recovery of ST-1 failed due to very soft material.

Water Level Observations

Immediate	6.0	ft. ▽
At Completion	1.5	ft. ▽
After	24 Hrs. NA	ft.
Water used in drilling	30	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HC NUTTING.GDT 8/14/05

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	B-8
Project	Bottom Ash Dam Evaluation - Amos Plant, WV	Date Started	8/12/2005
Boring Location		Date Completed	8/12/2005
Elevation Ref.	AEP Boring Location Plan	Work Order No.	90979.059

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
		3.5 Gray, SILTY GRAVEL with SAND (GM) (gravel=sandstone fragments), nonplastic, wet, medium dense - dense *(LAYER CONTINUED DESCRIPTION REPEATED)*	9	SS	35.0-36.5	6-16-25 (41)	100						
530.50	37.5												
		2.9 Gray and Reddish brown, LEAN CLAY with SAND (CL) (residual SHALE), moist - dry, hard - very hard											
527.60	40.4		10	SS	40.0-40.4	50/0.4	100						
		5.0 Reddish brown and gray, CLAYSTONE, completely to highly weathered, extremely soft - very soft	1	NQ2	40.4-45.4		100	0				0-1	
522.60	45.4	- bottom 2" residual soil											
		BORING COMPLETED @ 45.4'											

General Notes

Driller	HCN
Rig No.	J. Williams
Rig Type	Track
Method	NQ2/SS/ST
Inspector	NG

Remarks

Located boring at dam toe, appr. 3.5' above creek. Hay stick used for sediment control. Water level upon completion measured through the augers before NQ2. Recovery of ST-1 failed due to very soft material.

Water Level Observations

Immediate	6.0	ft.	▽
At Completion	1.5	ft.	▼
After	24 Hrs.	NA	ft.
Water used in drilling	30	ft.	

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING ASH DAM.GPJ HCNUTTING.GDT 8/14/05

H.C. NUTTING COMPANY

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LOG OF TEST BORING

Boring No. **B-11**

Client: AEP
Project: Amos RFD Retrofit
Boring Location: As Staked
Elevation Ref.: Exline Surveying

Date Started: 5/9/2005
Date Completed: 5/9/2005
Work Order No.: 90979.057

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	Qu tsf	PPR tsf
591.35	0.0	Brown SILTY CLAYEY SAND (SM), moist-loose	1	SS	0.0-1.5	3-6-3 (9)	67						
			2	SS	2.5-4.0	4-3-5 (8)	100						
		7.5	3	SS	5.0-6.5	7-4-5 (9)	67						
583.85	7.5	Brown and gray mottled SILTY CLAY (CL-ML), moist-stiff to very stiff	4	SS	7.5-9.0	5-5-7 (12)	100		19	34	12		1.75
			5	SS	10.0-11.5	6-8-11 (19)	100		19				2.75
		7.5											
576.35	15.0	Brown, fine to medium grained POORLY GRADED SAND (SP), wet-loose	6	SS	15.0-16.5	5-3-2 (5)	100		22				
		5.0											
571.35 ▽	20.0	Brown SILTY WITH SAND (SM), trace clay, saturated-very loose	7	SS	20.0-21.5	2-1-1 (2)	67						
			8	SS	25.0-26.5	1-1-1 (2)	100						
		10.0											
561.35	30.0	Brown SILTY SAND (SM), saturated-loose	9	SS	30.0-31.5	2-2-3 (5)	100						
		5.0											
556.35	35.0												

General Notes

Driller: D. Smith
Rig No.: B-57
Rig Type: Truck
Method: NQ/SS
Inspector:

Remarks

--60.9 tsf at 60.9'

Water Level Observations

Immediate: 20.0 ft. ▽
At Completion: 23.0 ft. ▼
After 0 Hrs. BF ft.
Water used in drilling: 25.0 ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

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LOG OF TEST BORING

Client	AEP	Boring No.	B-11
Project	Amos RFD Retrofit	Date Started	5/9/2005
Boring Location	As Staked	Date Completed	5/9/2005
Elevation Ref.	Exline Surveying	Work Order No.	90979.057

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	Qu tsf	PPR tsf
		Brown SANDY SILT (ML), moist to wet-loose to medium dense	10	SS	35.0-36.5	2-3-3 (6)	100						
		10.0	11	SS	40.0-41.5	4-7-7 (14)	100						
546.35	45.0												
		Brown, fine to medium grained POORLY GRADED SAND WITH WITH GRAVEL (SP), wet-dense	12	SS	45.0-46.5	17-30-10 (40)	100						
		5.0											
541.35	50.0												
		Brown, fine to medium grained POORLY GRADED SAND (SP), wet-medium dense	13	SS	50.0-51.5	5-6-8 (14)	100						
		10.0	14	SS	55.0-56.5	5-6-6 (12)	100						
531.35	60.0												
		Brown, fine to medium grained POORLY GRADED SAND WITH GRAVEL (GP), wet-dense to very dense	15	SS	60.0-61.5	23-25-27 (52)	100						
		5.0											
526.35	65.0												
		Reddish-brown to gray, fine grained SILTY CLAYSTONE, thick to masive bedded, highly weathered, very soft to soft	16	SS	65.0-65.2	50/0.2	100						
			1	NQ	62.5-70.2		39	0				1-2 HCSI	

General Notes

Driller	D. Smith
Rig No.	B-57
Rig Type	Truck
Method	NQ/SS
Inspector	

Remarks

–60.9 tsf at 60.9'

Water Level Observations

Immediate	20.0	ft. ▽
At Completion	23.0	ft. ▼
After	0 Hrs. BF	ft.
Water used in drilling	25.0	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

LOG BORING TEST BORING H.C. NUTTING.GPJ H_C_NUTTING.GDT 5/10/05

H.C. NUTTING COMPANY

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LOG OF TEST BORING

Boring No. **B-11**

Client: AEP
Project: Amos RFD Retrofit
Boring Location: As Staked
Elevation Ref.: Exline Surveying

Date Started: 5/9/2005
Date Completed: 5/9/2005
Work Order No.: 90979.057

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	Qu tsf	PPR tsf
	10.2	Reddish-brown to gray, fine grained SILTY CLAYSTONE, thick to masive bedded, highly weathered, very soft to soft ***(LAYER CONTINUED DESCRIPTION REPEATED)***	2	NQ	70.2-75.2		100	0				1-2 HCSI	
516.15	75.2	BORING COMPLETED @ 75.2'											

General Notes

Driller	D. Smith
Rig No.	B-57
Rig Type	Truck
Method	NQ/SS
Inspector	

Remarks

--60.9 tsf at 60.9'

Water Level Observations

Immediate	20.0		ft. ▽
At Completion	23.0		ft. ▼
After	0	Hrs. BF	ft.
Water used in drilling	25.0		ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

ST BORING TEST BORING LOGS.GPJ HCNUTTING.GDT 6/1/05

ARCADIS

H.C. Nutting Company 2006

Test Boring Logs

B-0601 to B-0610

H.C. NUTTING COMPANY
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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0601**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/10/2006
Boring Location	N 538,936.4 E 1,729,204.2	Date Completed	3/10/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
577.60	0.0	Brown, SILTY CLAY, moist, very soft	1	SS	0.0-1.5	0-0-1 (1)	100						
			1	ST	1.5-3.5		45						
572.60	5.0	5.0											
		Brown, SILTY CLAY, trace gravel, moist, very soft	2	SS	5.0-6.5	1-1-2 (3)	117						
			2	ST	6.5-8.5		15						
567.20	10.4	5.4											
		Gray, SILT, trace sand, trace gravel, moist, very loose	3	SS	10.0-11.5	0-2-2 (4)	80						
564.60 ▽	13.0	2.6	3	ST	11.5-13.5		100						
		Brown and gray, SILT with SAND, trace gravel, wet, loose											
561.60	16.0	3.0	4	SS	15.0-16.5	2-3-4 (7)	100						
		Gray, SILT with SAND, trace gravel, moist, loose - medium dense											
			5	SS	20.0-21.5	2-6-7 (13)	100						
552.60	25.0	9.0											
		Brown, SILT with SAND, moist, loose	6	SS	25.0-26.5	2-2-4 (6)	100						
			7	SS	30.0-31.5	2-3-4 (7)	100						
546.60	31.0	6.0											
		Gray, SILT with SAND, trace gravel, moist, loose											
542.60	35.0	4.0											

General Notes

Driller	Johnson
Rig No.	
Rig Type	ATV
Method	NQ2/SS/ST
Inspector	Venu

Remarks

Water Level Observations

Immediate	13.0	ft. ▽		
At Completion	3.0	ft. ▼		
After	NA	Hrs.	NA	ft.
Water used in drilling	41.5	ft.		

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0601**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/10/2006
Boring Location	**N** 538,936.4 **E** 1,729,204.2	Date Completed	3/10/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
		Reddish brown, SHALE, completely weathered, extremely soft	8	SS	35.0-36.5	8-6-12 (18)	80						
		6.0											
536.60	41.0		9	SS	40.0-41.5	12-18-50/6"	100						
536.10	41.5	0.5 Gray, SHALE, completely weathered, extremely soft - soft											
		2.3 Gray, SHALE, laminated, moderately weathered, soft											
533.80	43.8		1	NQ2	41.5-46.3		83	73					
		Reddish brown, SHALE, moderately weathered, soft High angle fracture at 44.3' to 44.5'											
		4.1											
529.70	47.9												
		Reddish and gray, SHALE, laminated, highly weathered, very soft	2	NQ2	46.3-51.3		74	48					
		3.4											
526.30	51.3												
		BORING COMPLETED @ 51.3'											

General Notes

Driller	Johnson
Rig No.	
Rig Type	ATV
Method	NQ2/SS/ST
Inspector	Venu

Remarks

Water Level Observations

Immediate	13.0	ft.	▽	
At Completion	3.0	ft.	▼	
After	NA	Hrs.	NA	ft.
Water used in drilling	41.5	ft.		

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC.NUTTING.GDT 10/25/11

H.C. NUTTING COMPANY
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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0602**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/9/2006
Boring Location	**N** 540,557.7 **E** 1,726,086.2	Date Completed	3/9/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
886.80	0.0												
885.50	1.3	1.3 Brown, CLAYEY SAND, little organics (roots), moist, soft	1	SS	0.0-1.5	1-1-2 (3)	100						
		Reddish brown, SANDY LEAN CLAY, trace rock fragments, moist, soft - medium stiff											
		8.7	2	SS	5.0-6.5	4-4-5 (9)	100						
876.80	10.0												
		Brown, SANDSTONE, fine grained, slightly weathered, medium hard	3	SS	10.0-10.3	50/4"	100						
			1	NQ2	10.3-11.3		70	70				3	
		3.3 High angle fractures at 11.3' to 11.5' and 12.8' to 13.1'											
873.50	13.3												
873.00	13.8	0.5 Brown, SHALE, laminated, moderately weathered, soft	2	NQ2	11.3-16.3		100	44				3-2	
		1.9 Gray, SHALE, thinly laminated, slightly weathered, soft - medium hard											
871.10	15.7												
		Gray, SANDSTONE, fine grained, micaceous, faintly weathered, medium hard - hard	3	NQ2	16.3-21.3		100	88				3-4	
			4	NQ2	21.3-26.3		100	92				3-4	
		15.6	5	NQ2	26.3-31.3		100	92				3-4	
855.50	31.3												
		BORING COMPLETED @ 31.3'											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW		ft.
At Completion	NW		ft.
After	24	Hrs. BF	ft.
Water used in drilling	10.3		ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC.NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0603**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/8/2006
Boring Location	**N** 540,310.5 **E** 1,726,267.7	Date Completed	3/8/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
940.80	0.0	Brown, fine SAND, moist, medium dense	1	SS	0.0-1.5	3-4-12 (16)	100						
935.80	5.0	5.0											
		Reddish brown, SHALE, completely weathered, soft	2	SS	5.0-6.5	14-26-30 (56)	100						
930.80	10.0	5.0											
		Brown, SANDY SHALE, laminated, highly weathered, soft	3	SS	10.0-10.8	12-50/4"	38						
925.60	15.2	5.2											
		Brown, SANDSTONE, fine to medium grained, weakly cemented, micaceous, moderately weathered - slightly weathered, soft	1	NQ2	10.8-20.8		95	52				2	
920.90	19.9	4.7											
919.40	21.4	Brown, SANDY SHALE, laminated, slightly weathered, very soft											
		1.5											
916.80	24.0	Reddish brown, SHALE, laminated, moderately weathered, soft Vertical fracture from 21.4' to 21.9'											
		2.6											
913.50	27.3	Brown and reddish brown, SHALE, laminated, slightly weathered, soft Vertical fracture from 25.9' to 26.7' High angle fracture from 26.7' to 26.9'	2	NQ2	20.8-30.8		95	46				2-1	
		3.3											
909.60	31.2	Gray, SHALE, laminated, moderately weathered, very soft - soft											
		3.9											
		Reddish brown, SHALE, slightly weathered, extremely soft - very soft											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate				ft.
At Completion				ft.
After	NA	Hrs.	NA	ft.
Water used in drilling			10.8	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0603**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/8/2006
Boring Location	**N** 540,310.5 **E** 1,726,267.7	Date Completed	3/8/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
900.00	40.8	Reddish brown, SHALE, slightly weathered, extremely soft - very soft ***(LAYER CONTINUED DESCRIPTION REPEATED)*** 9.6	3	NQ2	30.8-40.8		33	19				0-1	
896.30	44.5	Gray and reddish brown, SHALE, laminated, moderately weathered, soft 3.7											
889.90	50.9	Gray, SILTSTONE, thinly bedded, fresh, soft - medium hard 6.4	4	NQ2	40.8-50.8		98	80				2-3	
877.50	63.3	Gray, SANDSTONE, fine to medium grained, micaceous, fresh, hard 12.4	5	NQ2	50.8-60.8		100	98				4	
870.80	70.0	Brown, SANDSTONE, fine to medium grained, micaceous, fresh, hard 6.7	6	NQ2	60.8-70.8		95	95				4	

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate				ft.
At Completion				ft.
After	NA	Hrs.	NA	ft.
Water used in drilling			10.8	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0603**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/8/2006
Boring Location	**N** 540,310.5 **E** 1,726,267.7	Date Completed	3/8/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
		Gray, SANDSTONE, fine grained, micaceous, faintly weathered, hard											
	5.8		7	NQ2	70.8-75.8		100	100				4	
865.00	75.8	BORING COMPLETED @ 75.8'											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate				ft.
At Completion				ft.
After	NA	Hrs.	NA	ft.
Water used in drilling			10.8	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0604**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/8/2006
Boring Location	**N** 540,073.9 **E** 1,726,436.9	Date Completed	3/8/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
909.80	0.0	Brown, SANDY LEAN CLAY, moist, very stiff	1	SS	0.0-1.5	6-10-10 (20)	100						
904.80	5.0	5.0											
		Brown, SANDSTONE, fine grained, micaceous, highly weathered, medium hard	2	SS	5.0-5.0	50/0	0						
899.60	10.2	5.2	1	NQ2	5.0-10.6		89	20				3	
		Brown, SANDSTONE, fine to medium grained, micaceous, slightly weathered, medium hard											
895.70	14.1	3.9 Vertical fracture from 11.9' to 12.6'	2	NQ2	10.6-20.6		100	79				3	
		Brown, SANDSTONE, fine grained, micaceous, faintly weathered, medium hard											
888.20	21.6	7.5											
		Brown, SANDSTONE, fine to coarse grained, slightly weathered, medium hard - hard											
884.00	25.8	4.2	3	NQ2	20.6-30.6		0	98				3-4	
		Brown, SANDSTONE, fine grained, faintly weathered, hard											
875.70	34.1	8.3											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	NA	Hrs.	NA	ft.
Water used in drilling	5.0			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0604**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/8/2006
Boring Location	**N** 540,073.9 **E** 1,726,436.9	Date Completed	3/8/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))		SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
872.90	36.9	Gray, SANDSTONE, fine grained, faintly weathered, hard ***(LAYER CONTINUED DESCRIPTION REPEATED)***	2.8	4	NQ2	30.6-40.6		100	95				4	
867.40	42.4	Brown, SANDSTONE, fine to medium grained, slightly weathered, hard	5.5	5	NQ2	40.6-50.6		0	75				4-3	
863.10	46.7	Gray, SANDSTONE, fine to medium grained, faintly weathered, hard	4.3											
856.50	53.3	Brown, SANDSTONE, fine grained, faintly weathered, medium hard Shale interbeds from 47.4' to 47.9' and 50.1' to 50.6'	6.6	6	NQ2	50.6-60.6		100	71				4-2	
851.00	58.8	Brown, SANDSTONE, fine grained, faintly weathered, hard Vertical fracture from 56.6' to 58.2'	5.5											
849.20	60.6	Gray, SHALE, laminated, moderately weathered, soft	1.8											
847.80	62.0	Gray, SANDSTONE, fine grained, micaceous, slightly weathered, medium hard	1.4	7	NQ2	60.6-70.6		100	66				3	
		Gray, SHALE, laminated, slightly weathered, medium hard	9.3											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	NA	Hrs.	NA	ft.
Water used in drilling	5.0			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0604**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/8/2006
Boring Location	**N** 540,073.9 **E** 1,726,436.9	Date Completed	3/8/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
838.50	71.3	Gray, SHALE, laminated, slightly weathered, medium hard ***(LAYER CONTINUED DESCRIPTION REPEATED)***	8	NQ2	70.6-72.6		100	100				3	
837.60	72.2	0.9											
837.20	72.6	0.4 Reddish brown and gray, SHALE, laminated, faintly weathered, soft - medium hard											
		Gray, SANDSTONE, fine grained, micaceous, fresh, medium hard											
		BORING COMPLETED @ 72.6'											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	NA	Hrs.	NA	ft.
Water used in drilling	5.0			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0605**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/7/2006
Boring Location	**N** 539,810.0 **E** 1,726,630.7	Date Completed	3/8/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
793.70	0.0												
		Brown, SANDY LEAN CLAY, trace organics (roots), moist, soft	1	SS	0.0-1.5	1-1-2 (3)	100						
788.70	5.0	5.0											
		Reddish brown, SANDY LEAN CLAY, trace rock fragments, moist, stiff	2	SS	5.0-6.5	5-7-8 (15)	100						
		10.0	3	SS	10.0-11.5	4-2-10 (12)	100						
778.70	15.0												
778.50	15.2	0.2 Gray, SHALE, laminated, moderately weathered, soft	4	SS	15.0-15.2	50/2"	100	100				2	
			1	NQ2	15.2-15.8		100						
		Gray, SANDSTONE, fine grained, micaceous, slightly weathered, soft - medium hard	2	NQ2	15.8-20.8		100	94				2-3	
		12.8	3	NQ2	20.8-25.8		100	100				2-3	
765.70	28.0												
764.70	29.0	1.0 Gray, SANDSTONE, fine grained, micaceous, faintly weathered, medium hard	4	NQ2	25.8-30.8		100	100				2-3	
762.80	30.9	1.9 Gray, SANDSTONE, medium grained, micaceous, fresh, medium hard											
		3.4 Gray, SANDSTONE, fine to medium grained, micaceous, fresh, medium hard	5	NQ2	30.8-34.8		100	93				3-4	
759.40	34.3												
758.90	34.8	0.5 Gray, SHALE, laminated, fresh, soft											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	NA	Hrs.	NA	ft.
Water used in drilling			12.2	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0605**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/7/2006
Boring Location	**N** 539,810.0 **E** 1,726,630.7	Date Completed	3/8/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
		BORING COMPLETED @ 34.8'											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	NA	Hrs.	NA	ft.
Water used in drilling	12.2			**ft.**

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0606**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/6/2006
Boring Location	**N** 539,359.8 **E** 1,727,154.3	Date Completed	3/6/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
746.30	0.0												
		Brown, SANDY LEAN CLAY, trace rock fragments, moist, soft	1	SS	0.0-1.5	1-2-2 (4)	67						
741.30	5.0	5.0											
		Brown, SANDSTONE, fine to medium grained, completely weathered, very soft	2	SS	5.0-6.5	4-7-7 (14)	100						
735.80	10.5	5.5											
		Brown, SHALE, laminated, highly weathered, very soft	3	SS	10.0-11.5	8-12-17 (29)	100						
731.30	15.0	4.5											
		Reddish brown and gray, SHALE, laminated, moderately weathered, very soft	4	SS	15.0-16.5	9-27-36 (63)	100						
726.10	20.2	5.2											
725.30	21.0	0.8 Brown, SANDSTONE, fine grained, moderately weathered, soft - medium hard	5	SS	20.0-20.2	50/0.2	100	80				2-3	
		2.3 Gray, SHALE, laminated, faintly weathered, soft	1	NQ2	20.2-20.7		100						
723.00	23.3	Vertical fracture from 21.3' to 21.5'	2	NQ2	20.7-25.7		100	58				2	
		Reddish brown, SHALE, faintly weathered, soft											
		6.6	3	NQ2	25.7-30.7		94	72				2	
716.40	29.9												
715.60	30.7	0.8 Gray, SHALE, faintly weathered, soft											
		BORING COMPLETED @ 30.7'											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling	20.2			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0607**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/6/2006
Boring Location	**N** 539,042.2 **E** 1,727,354.8	Date Completed	3/6/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
740.60	0.0												
		Brown, SANDY LEAN CLAY, trace organics, trace cinders, moist, medium stiff	1	SS	0.0-1.5	4-2-4 (6)	100						
		5.0											
735.60	5.0												
		Brown, SHALE, completely weathered, very soft	2	SS	5.0-6.5	3-4-5 (9)	100						
		5.0											
730.60	10.0												
		Reddish brown, SHALE, completely weathered, very soft	3	SS	10.0-11.5								
		5.0											
725.60	15.0												
		Gray, SHALE, laminated, moderately weathered, soft	4	SS	15.0-15.4								
		1.6	1	NQ2	15.5-16.0		100	0				2	
724.00	16.6												
		Reddish brown, SHALE, slightly weathered, soft	2	NQ2	16.0-21.0		90	70				2	
		4.8											
719.20	21.4												
		Gray, SANDSTONE, fine grained, faintly weathered, soft - medium hard	3	NQ2	21.0-26.0		100	90				2-3	
		3.9											
		Vertical fracture from 24.6' to 24.8'											
715.30	25.3												
		Gray and reddish brown, SHALE, laminated, slightly weathered, soft	4	NQ2	26.0-31.0		100	58				3-0	
		2.2											
713.10	27.5												
712.10	28.5	1.0 Gray, SHALE, slightly weathered, extremely soft											
		Gray, SANDSTONE, fine grained, fresh, soft - medium hard	5	NQ2	31.0-35.0		98	88				2-3	
		6.5											
705.60	35.0												

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

BORING COMPLETED @ 35.0' **Remarks**

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling	15.5			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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BLUEGRASS REGION
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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0608**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	2/27/2006
Boring Location	**N** 538,877.6 **E** 1,727,472.3	Date Completed	3/3/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
825.90	0.0												
		Reddish brown, LEAN CLAY with SAND, trace gravel, moist, medium stiff	1	SS	0.0-1.5	2-2-3 (5)	100						
820.90	5.0	5.0											
		Brown, SANDSTONE, fine grained, moderately weathered, soft - medium hard	2	SS	5.0-5.2	50/0.2	100	100				2	
			1	NQ2	5.2-5.8		100						
817.60	8.3	3.3	2	NQ2	5.8-10.8		100	34				2-3	
		Brown, SHALE, laminated, highly weathered, soft Vertical fracture from 9.2' to 9.8'											
811.10	14.8	6.5	3	NQ2	10.8-15.8		100	10				2	
		Gray, SILTSTONE, moderately weathered, soft											
808.80	17.1	2.3	4	NQ2	15.8-20.8		96	74				2-4	
		Brown, SANDSTONE, fine grained, micaceous, moderately weathered, medium hard - hard											
		8.8	5	NQ2	20.8-25.8		100	90				3-4	
800.00	25.9	High angle fracture at 23.6' Shale layer at 25.2'											
799.00	26.9	1.0 Gray, SANDSTONE, fine to medium grained, micaceous, moderately weathered, medium hard											
		3.9 Brown, SHALE, laminated, moderately weathered, soft	6	NQ2	25.8-30.8		100	38				3-2	
795.10	30.8												
793.90	32.0	1.2 Brown, SANDSTONE, fine grained, moderately weathered, medium hard											
		2.4 Gray and brown, SHALE, laminated, moderately weathered, soft	7	NQ2	30.8-35.8		100	54				3-2	
791.50	34.4												

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW		ft.
At Completion	NW		ft.
After	24	Hrs. NA	ft.
Water used in drilling	5.2		ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
787.50	38.4	Brown, SANDSTONE, fine grained, micaceous, vertical fracture from 34.8' to 35.4', highly weathered, soft - medium hard ***(LAYER CONTINUED DESCRIPTION REPEATED)*** 4.0											
~~787.10~~	~~38.8~~	0.4 Gray, SILTSTONE, moderately weathered, soft	8	NQ2	35.8-40.8		100	82				3-0	
		Gray, SHALE, laminated, slightly weathered, soft - extremely soft High angle fracture at 41.9' 8.6	9	NQ2	40.8-45.8		100	90				0-2	
778.50	47.4												
775.10	50.8	Brown, CLAYSTONE, slightly weathered, soft - extremely soft 3.4	10	NQ2	45.8-50.8		100	96				0-2	
768.50	57.4	Gray, SHALE, thinly laminated, slightly weathered, soft 6.6	11	NQ2	50.8-55.8		100	84				2	
767.40	58.5	1.1 Brown, SANDSTONE, fine grained, micaceous, high angle fracture at 57.5' to 57.7', moderately weathered, soft - medium hard	12	NQ2	55.8-60.8		100	84				2-3	
762.20	63.7	Brown, SANDSTONE, fine grained, micaceous, slightly weathered, medium hard 5.2	13	NQ2	60.8-65.8		100	92				3	
759.80	66.1	Gray, SANDSTONE, fine grained, micaceous, vertical fracture from 63.8' to 64.1', faintly weathered, medium hard 2.4											
758.50	67.4	1.3 Dark gray, SHALE, thinly laminated, faintly weathered, very soft											
		Black, COAL, blocky, fresh, soft 4.4	14	NQ2	65.8-70.8		92	44				1-2	

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW		ft.
At Completion	NW		ft.
After	24	Hrs. NA	ft.
Water used in drilling	5.2		ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

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Boring Location	**N** 538,877.6 **E** 1,727,472.3	Date Completed	3/3/2006
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ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
754.10	71.8	Black, COAL, blocky, fresh, soft ***(LAYER CONTINUED DESCRIPTION REPEATED)***											
753.10	72.8	1.0 Gray, SHALE, fresh, very soft	15	NQ2	70.8-75.8		80	64				1-3	
748.70	77.2	4.4 Gray, SANDSTONE, fine grained, faintly weathered, medium hard	16	NQ2	75.8-80.8		100	100				3-2	
746.60	79.3	2.1 Gray, SHALE, laminated, fresh, soft - medium hard	17	NQ2	80.8-85.8		100	100				2-3	
743.60	82.3	3.0 Gray, SILTSTONE, fresh, medium hard	18	NQ2	85.8-90.8		100	50				2-3	
730.90	95.0	12.7 Gray, SHALE, thinly laminated, fresh, soft - medium hard Vertical fractures from 88.3' to 88.5' and 88.7' to 89.0'	19	NQ2	90.8-95.8		98	58				3-1	
727.70	98.2	3.2 Reddish brown, SHALE, fresh, very soft	20	NQ2	95.8-100.8		100	90				1-3	
723.90	102.0	3.8 Gray, SANDSTONE, fine grained, slightly weathered, medium hard	21	NQ2	100.8-105.8		98	86				3-1	
722.50	103.4	1.4 Gray, SHALE, laminated, fresh, soft											
720.90	105.0	1.6 Reddish brown, SHALE, fresh, very soft											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling	5.2			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

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Project	John Amos Plant Access Road to Dewatering Island	Date Started	2/27/2006
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ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
719.30	106.6	1.6 Gray, SHALE, laminated, fresh, soft											
717.30	108.6	2.0 Reddish brown, SHALE, laminated, few slickensided surfaces, fresh, soft - very soft	22	NQ2	105.8-110.8		98	82				2-1	
716.10	109.8	1.2 Gray, SHALE, laminated, slightly weathered, soft											
713.80	112.1	2.3 Gray, SANDSTONE, fine grained, micaceous, faintly weathered, medium hard											
		Shale interbed at 110.9' to 111.6'	23	NQ2	110.8-115.8		98	82				3-2	
710.50	115.4	3.3 Gray, SHALE, laminated, faintly weathered, soft											
		Gray, SANDSTONE, fine grained, faintly weathered - moderately weathered, medium hard - soft	24	NQ2	115.8-120.8		100	44				3-2	
		6.1 Vertical fracture from 118.6' to 120.3'											
704.40	121.5	High angle fracture (60°) from 120.8' to 121.2'											
703.30	122.6	1.1 Brownish gray to gray, SHALE, laminated, slightly weathered, soft	25	NQ2	120.8-125.8		100	72				2-1	
		Reddish brown, SHALE, laminated, slightly weathered, very soft											
		5.5											
697.80	128.1		26	NQ2	125.8-130.8		98	82				1-0	
		Reddish brown and gray, SHALE, moderately weathered, extremely soft - very soft											
		4.4											
693.40	132.5												
692.30	133.6	1.1 Brown and gray, SANDSTONE, fine grained, slightly weathered, medium hard	27	NQ2	130.8-135.8		100	88				0-3	
		Browish gray to gray, SHALE, laminated, moderately fractured, slightly weathered, soft - medium hard											
		6.9 Sandstone interbed at 135.1' to 135.8'											
		Horizontal fracture at 136.1'											
		Vertical fracture from 137.7' to 137.9'	28	NQ2	135.8-140.8		100	54				2-3	

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	**NQ2/SS**
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling			5.2	ft.

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TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0608**
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ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
~~685.40~~	~~140.5~~												
684.30	141.6	1.1 Reddish brown, SHALE, laminated, fresh, soft											
		Brown, SHALE, laminated, fresh, soft Vertical fracture from 142.1' to 142.2'	29	NQ2	140.8-145.8		100	52				2	
		4.9											
679.40	146.5												
		Reddish brown and gray, SHALE, slightly weathered, very soft - soft	30	NQ2	145.8-150.8		86	32				1-2	
		5.3 30° fracture at 149.1'											
674.10	151.8												
		Reddish brown, CLAYSTONE, moderately weathered, very soft	31	NQ2	150.8-155.8		100	26				1-2	
		11.5 No recovery from 155.8 ft to 160.8 ft (inner barrel did not latch).	32	NQ2	155.8-160.8		0	0				1	
662.60	163.3												
		Brown and reddish brown, SHALE, slightly weathered, very soft - soft Vertical fracture from 164.0' to 164.3'	33	NQ2	160.8-165.8		98	24				1-2	
		5.3 10° fracture at 166.0' and 166.9' Horizontal fracture at 167.7'	34	NQ2	165.8-170.8		96	74				1-2	
657.30	168.6												
		Gray and reddish brown, SHALE, thinly laminated, slightly weathered, soft											
		2.7											
654.60	171.3												
		Gray, SANDSTONE, fine grained, fresh, medium hard - hard	35	NQ2	170.8-175.8		100	98				3-4	
		4.1											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling	5.2			ft.

BF = BACKFILLED NW = NO WATER
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TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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650.50	175.4												
		Gray and reddish brown, SHALE, laminated, slightly weathered, soft											
		3.2											
647.30	178.6	High angle fracture (60°) at 177.7'	36	NQ2	175.8-180.8		100	80				2-3	
		Gray, SANDSTONE, fine grained, faintly weathered, medium hard											
		2.2											
645.10	180.8	High angle fracture (60°) from 178.8' to 179.1' and 179.8' to 179.9'	37	NQ2	180.8-185.8		94	50				2-1	
		Reddish brown, SHALE, laminated, slightly weathered, soft											
		4.0											
641.10	184.8	Reddish brown, CLAYSTONE, slightly weathered, very soft	38	NQ2	185.8-190.8		94	32				1	
		11.1	39	NQ2	190.8-195.8		100	42				1	
630.00	195.9	Gray, SANDSTONE, fine grained, faintly weathered, medium hard											
		4.1	40	NQ2	195.8-200.8		96	86				3	
625.90	200.0	Reddish brown, SHALE, thinly laminated, faintly weathered, soft											
		11.4	41	NQ2	200.8-205.8		100	96				2	
			42	NQ2	205.8-210.8		100	100				2	

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling	5.2			ft.

BF = BACKFILLED NW = NO WATER
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614.50	211.4	Reddish brown, SHALE, thinly laminated, faintly weathered, soft											
613.70	212.2	0.8 ***(LAYER CONTINUED DESCRIPTION REPEATED)***											
		Gray, SANDSTONE, fine grained, faintly weathered, medium hard - hard	43	NQ2	210.8-215.8		100	100				2-4	
610.90	215.0	2.8 Gray, SHALE, thinly laminated, fresh, medium hard											
		Gray, SANDSTONE, fine grained, fresh, medium hard	44	NQ2	215.8-220.8		100	96				3-2	
606.90	219.0	4.0 Shale interbed at 216.6' to 217.4'											
603.20	222.7	Reddish brown, SHALE, laminated, claystone interbed at 221.0' to 221.3', faintly weathered, soft - medium hard 3.7	45	NQ2	220.8-225.8		100	52				3-2	
597.40	228.5	Reddish brown, CLAYSTONE, slickensided surfaces, few shale interbeds, few thin clay seams, faintly weathered, soft 5.8	46	NQ2	225.8-230.8		100	74				2-4	
588.90	237.0	Gray, SANDSTONE, fine grained, micaceous, medium to thinly bedded, fresh, medium hard - hard 8.5	47	NQ2	230.8-235.8		96	100				3-4	
583.30	242.6	Reddish brown to gray, SILTSTONE, very thinly bedded, clayey upper 1.5', faintly weathered, soft - medium hard 5.6	48	NQ2	235.8-240.8		100	100				4-2	
		Gray, SANDSTONE, fine grained, medium bedded, micaceous, faintly weathered - fresh, hard	49	NQ2	240.8-245.8		100	100				2-4	

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling	5.2			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

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H.C. NUTTING COMPANY
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EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS SINCE 1921

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BLUEGRASS REGION
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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0608**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	2/27/2006
Boring Location	**N** 538,877.6 **E** 1,727,472.3	Date Completed	3/3/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
		Gray, SANDSTONE, fine grained, medium bedded, micaceous, faintly weathered - fresh, hard ***(LAYER CONTINUED DESCRIPTION REPEATED)***	50	NQ2	245.8-250.8		100	100				4	
			51	NQ2	250.8-255.8		100	100				4	
			52	NQ2	255.8-260.8		100	100				4	
564.40	261.5	18.9											
		Light gray, SANDSTONE, medium to coarse grained, medium bedded, conglomeratic, faintly weathered, hard	53	NQ2	260.8-265.8		88	74				4-2	
561.40	264.5	3.0											
		Reddish brown, CLAYSTONE, slickensided surfaces, slightly weathered, soft	54	NQ2	265.8-270.8		84	42				2	
			55	NQ2	270.8-275.8		100	20				2	
		20.5											
			56	NQ2	275.8-280.8		92	72				2	

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling	5.2			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0608**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	2/27/2006
Boring Location	**N** 538,877.6 **E** 1,727,472.3	Date Completed	3/3/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted)	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
540.90	285.0	Reddish brown, CLAYSTONE, slickensided surfaces, slightly weathered, soft ***(LAYER CONTINUED DESCRIPTION REPEATED)***	57	NQ2	280.8-285.8		90	82				2-3	
534.10	291.8	Reddish brown to gray, SILTSTONE, medium bedded, slickensided surfaces, clayey, faintly weathered, soft - medium hard (6.8)	58	NQ2	285.8-290.8		100	66				2-3	
529.10	296.8	Gray, SANDSTONE, very fine grained, thinly bedded, faintly weathered, medium hard - hard (5.0)	59	NQ2	290.8-295.8		100	100				3-4	
525.90	300.0	Gray to reddish brown, CLAYSTONE, slickensided surfaces, slightly weathered, soft (3.2)	60	NQ2	295.8-300.0		90	64				4-2	
		BORING COMPLETED @ 300.0'											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu/B.B.

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	24	Hrs.	NA	ft.
Water used in drilling	5.2			ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

H.C. NUTTING COMPANY
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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0609**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/9/2006
Boring Location	**N** 538,813.6 **E** 1,728,060.6	Date Completed	3/9/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
664.00	0.0	Reddish brown, LEAN CLAY with SAND, moist, soft	1	SS	0.0-1.5	1-1-2 (3)	100						
660.00	4.0	4.0											
		Reddish brown and brown, SANDY SHALE, highly weathered, soft	2	SS	5.0-6.5	17-17-13 (30)	100						
653.00	11.0	7.0	3	SS	10.0-11.4	18-36-50/5"	100						
650.40	13.6	Brown, SANDY SHALE, laminated, highly weathered - moderately weathered, soft 2.6	1	NQ2	11.4-16.4		98	58				2-0	
		Reddish brown, SHALE, laminated, moderately weathered, extremely soft - soft	2	NQ2	16.4-21.4		100	84				2-0	
640.60	23.4	9.8	3	NQ2	21.4-23.4		100	95				2-0	
		BORING COMPLETED @ 23.4'											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW		ft.
At Completion	NW		ft.
After	24	Hrs. BF	ft.
Water used in drilling	11.4		ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

H.C. NUTTING COMPANY
APPALACHIAN REGION - 912 MORRIS STREET
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LOG OF TEST BORING

Client	American Electric Power	Boring No.	**B-0610**
Project	John Amos Plant Access Road to Dewatering Island	Date Started	3/7/2006
Boring Location	**N** 538,986.3 **E** 1,728,717.8	Date Completed	3/7/2006
Elevation Ref.	Provided by American Electric Power	Work Order No.	90979.067

ELEV. ft.	DEPTH ft.	DESCRIPTION OF MATERIALS (color, material description, moisture, stiffness/density/hardness (visual classification unless otherwise noted))	SAMPLE NO.	TYPE	DEPTH ft.	BLOWS/6" (N Value)	REC. %	RQD %	W %	LL %	PI %	HCSI	PPR tsf
638.20	0.0												
		Brown, SANDY LEAN CLAY, trace organics (roots), moist, medium stiff	1	SS	0.0-1.5	1-4-5 (9)	100						
633.20	5.0	5.0											
		Reddish brown, SHALE, completely weathered, very soft	2	SS	5.0-6.5	14-21-25 (46)	100						
628.20	10.0	5.0											
		Brown, SANDSTONE, fine grained, weakly cemented, moderately weathered, soft	3	SS	10.0-10.4	50/5"	100						
			1	NQ2	10.4-15.4		74	40				2	
		9.3	2	NQ2	15.4-20.4		100	72				2-1	
618.90	19.3												
617.80	20.4	1.1 Brown, SANDY SHALE, laminated, slightly weathered, very soft - soft											
		Brown, SANDSTONE, fine grained, micaceous, slightly weathered, soft	3	NQ2	20.4-25.4		92	54				2	
612.10	26.1	5.7											
		Reddish brown, SHALE, slightly weathered, very soft - soft	4	NQ2	25.4-30.4		94	70				2-1	
606.60	31.6	5.5											
605.80	32.4	0.8 Gray, SANDY SHALE, laminated, faintly weathered, soft	5	NQ2	30.4-32.4		100	100				2	
		BORING COMPLETED @ 32.4'											

General Notes

Driller	Williams
Rig No.	
Rig Type	Track
Method	NQ2/SS
Inspector	Venu

Remarks

Water Level Observations

Immediate	NW			ft.
At Completion	NW			ft.
After	NA	Hrs.	NA	ft.
Water used in drilling			10.4	ft.

BF = BACKFILLED NW = NO WATER
(Measured from ground surface)

TEST BORING JOHN AMOS DEWATERING PLANT ACCESS ROAD.GPJ HC NUTTING.GDT 10/25/11

ARCADIS

Arcadis 2016

Soil Boring Logs

MW-1601 to MW-1606, SB-1601 to SB-1607

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES **N 538,186.6 E 1,731,490.3**

GROUND ELEVATION **586.5** SYSTEM

Water Level, ft	▽ 18.5	▼	▼
TIME			
DATE	4/26/2016		

BORING NO. **MW-1601** DATE **7/19/16** SHEET **1** OF **2**

BORING START **4/25/16** BORING FINISH **4/26/16**

PIEZOMETER TYPE **NA** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.0'** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **28.61'** BOTTOM **38.0'**

WELL DEVELOPMENT **5/18 & 6/13/16** BACKFILL **NA**

FIELD PARTY **NA** RIG **Diedrich**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1/2"	0					No recovery.		
2	SS	1.5	3.0	1/2"	3					Ash, fine sand, trace silt, trace medium and coarse angular sand and slag, saturated, very soft, dark grayish brown (10YR 4/2).		
3	SS	3.0	4.5	1/2"	5							
4	SS	4.5	6.0	1-2-4/0"	7		5		CL / ML	Clay, little silt, trace ash sand and gravel, moist, soft, reddish brown (5YR 4/3). Silt, little clay, medium stiff, low plasticity, moist, no dilatancy, dark gray (10YR 4/1).		
5	SS	6.0	7.5	2-5-5/0"	13				CL	Clay, little silt, medium stiff, medium plasticity, moist, dark yellowish brown (10YR 4/4).		
6	SS	7.5	9.0	2-2-4/0"	12							
7	SS	9.0	10.5	1-1-2/0"	12							
8	SS	10.5	12.0	2-4-5/0"	16		10		CL	Clay, little silt, trace sand, very soft, medium plasticity, wet, dark yellowish brown with gray mottling (10YR 5/1).		
9	SS	12.0	13.5	4-6-9/0"	16				CL	Note: dark yellowish brown (10YR 4/3) with <1mm thick black laminations from 10.5 to 10.7 feet. Clay, some silt, trace sand, stiff, low plasticity, moist, dark yellowish brown with dark brown and gray (10YR 4/6).		
10	SS	13.5	15.0	4-7-11/0"	14							
11	SS	15.0	16.5	3-5-7/0"	16		15		ML	Silt and very fine sand, little clay, moist, medium stiff, non plastic, strong brown and gray (7.5YR 9/6). Note: stiff from 16.5 to 18.0 feet.		
12	SS	16.5	18.0	2-4-7/0"	16							
13	SS	18.0	19.5	4-4-6/0"	21						▽	
14	SS	19.5	21.0	3-2-1/0"	15				SP	Sand, fine grain, well sorted, angular to round little silt and decreasing to trace at 19.0 feet, stiff, wet (7.5YR 4/6).		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **K. Eldridge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1601** DATE **7/19/16** SHEET **2** OF **2**

PROJECT **John E. Amos Plant CCR** BORING START **4/25/16** BORING FINISH **4/26/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	2-1-3/0"	17					Note: trace silt and clay from 19.5 to 21.0 feet. Note: some clay from 20.7 to 20.9 feet. Note: trace silt and clay from 21.0 to 22.5 feet.		
16	SS	22.5	24.0	2-2-3/0"	15					Note: trace silt and clay from 22.5 to 23 feet.		
17	SS	24.0	25.5	3-4-7/0"	15		25			Note: <2% silt and clay, trace small black subrounded gravel from 24.3 to 25.5 feet.		
18	SS	25.5	27.0	3-5-6/0"	15					Note: black lenses 1-2 mm thick at 24.5 and 25 feet. Note: trace small black subrounded gravel, <2% silt and clay from 25.5 to 27 feet.		
19	SS	27.0	28.5	3-6-13/0"	14					Note: dark brown to black horizontal lamination from 26.0 to 27.0 feet.		
20	SS	28.5	30.0	6-10-13/0"	13					Note: 5% silt and clay, dark yellowish brown from 27 to 27.5 feet. Note: sand, fine grain, well sorted, loose, 2% silt and clay, wet, strong brown, from 27.5 to 28.0 feet.		
21	SS	30.0	31.5	9-8-10/0"	20		30			Note: lighter in color from 29.5 to 30.0 feet. Note: <2% silt and clay from 30.0 to 31.5 feet.		
22	SS	31.5	33.0	2-3-8/0"	15					Note: 2-3 mm thick laminations of gray clay from 32.5 to 32.6 feet. Note: sand, fine to medium grain, well sorted, loose, wet, gray, angular to round from 32.6 to 33.0 feet.		
23	SS	33.0	34.5	2-5-11/0"	7					Note: 2-3 mm lamination of brown clay from 34.0 to 34.3 feet. Note: trace coarse sand, granules of coal from 34.5 to 36.0 feet.		
24	SS	34.5	36.0	4-7-10/0"	12		35			Note: trace coarse sand sized pieces of coal from 36.0 to 37.5 feet. Note: trace angular fine to coarse gravel from 37.5 to 39.0 feet.		
25	SS	36.0	37.5	2-3-12/0"	2							
26	SS	37.5	39.0	4-7-7/0"	9							
27	SS	39.0	40.5	6-6-9/0"	14				SP	Sand, fine grained well-sorted, angular to round, loose, grayish brown, wet (10YR 5/2).		
28	SS	40.5	42.0	6-6-8/0"	14		40			Note: 1-2 mm thick lamination of black coal from 40.0 to 40.5 feet. End of boring at 42.0 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES **N 537,031.1 E 1,730,894.1**

GROUND ELEVATION **598.0** SYSTEM

Water Level, ft	▽ 15.8	▼	▼
TIME			
DATE	5/25/2016		

BORING NO. **MW-1602A** DATE **7/19/16** SHEET **1** OF **3**

BORING START **5/25/16** BORING FINISH **5/25/16**

PIEZOMETER TYPE **NA** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.0'** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **48.4'** BOTTOM **58.0'**

WELL DEVELOPMENT **6/14/2016** BACKFILL **NA**

FIELD PARTY **NA** RIG **Diedrich**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5							Hydro-Vac 0.0 to 6.0 feet.		
2	SS	1.5	3.0									
3	SS	3.0	4.5									
4	SS	4.5	6.0				5					
5	SS	6.0	7.5	4-4-3/0"	6				GM	Small subangular gravel, some silt, trace medium sand, trace gravel, fine sand, stiff, moist, red brown, non plastic, no dilatancy (5YR 4/6).		
6	SS	7.5	9.0	2-2-6/0"	0					Note: gravel clogged in shoe from 7.5 to 9.0 feet.		
7	SS	9.0	10.5	4-6-7/0"	13							
8	SS	10.5	12.0	3-2-3/0"	12		10		SP	Fine sand, very uniform grain size, trace silt (3-5%), moist, medium stiff, no dilatancy, non plastic, moist (5YR 4/6).		
									CL ML	Silty clay, little silt, mottled red brown/gray, stiff, high plasticity, no dilatancy (5YR 4/6-5YR 5/1).		
9	SS	12.0	13.5	2-1-1/0"	0				SP	Fine sand, very uniform grain size, trace silt (3-5%), moist, medium stiff, no dilatancy, non plastic, moist (5YR 4/6).		
10	SS	13.5	15.0	1-1-0/0"	16							
11	SS	15.0	16.5	1-1-1-0/0"	16		15		SP SM	Fine sand, some silt, trace organics, roots, wood, soft, moist, medium dilatancy, low-no plasticity (5YR 5/1). Note: color change 5YR 3/1 at 14.5 feet.	▽	
12	SS	16.5	18.0	1-1-2/0"	10					Note: water at 15.75 feet, very soft and rapid dilatancy. Note: trace organics from 16.3 to 16.5 feet. Note: color shift 0.5-10 mm alternating laminate of fine sand, trace silt at 16.5 feet.		
13	SS	18.0	19.5	1-2-2/0"	12							
14	SS	19.5	21.0	2-2-2/0"	0				SP	Fine sand, trace silt, very soft, wet, uniform grain size, poorly sorted, gray, trace black sand, medium dilatancy, non plastic (7.5YR 5/1).		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1602A** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **5/25/16** BORING FINISH **5/25/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										Note: subrounded sandstone gravel clogged shoe from 19.5 to 21.0 feet.		
16	SS	21.0	22.5	1-1-1/0"	18					Note: very fine sand, trace silt, wet from 21.5 to 22.5 feet.		
17	SS	22.5	24.0	1-1-2/0"	5.5					Note: trace (1 piece) of small subrounded gravel in run at 16.5 feet.		
18	SS	24.0	25.5	1-1-1/0"	11				ML	Very fine sand, little silt (2%), very soft, moist-wet, medium dilatancy, no plasticity, gray, poorly graded (7.5YR 5/1).		
19	SS	25.5	27.0	1-2-2/0"	12.5		25			Note: trace clay, low plasticity from 25.9 to 28.0 feet.		
20	SS	27.0	28.5	1-1-1/0"	16							
21	SS	28.5	30.0	3-2-4/0"	4.5					Note: clay content no longer present, no plasticity, wet at 28.0 feet.		
22	SS	30.0	31.5	2-3-4/0"	16.5		30			Note: addition of trace clay, moist, medium stiffness from 30.4 to 31.9 feet.		
23	SS	31.5	33.0	3-4-5/0"	15.5					Note: moist not wet, slow dilatancy from 31.9 to 33.0 feet.		
24	SS	33.0	34.5	3-3-5/0"	14							
25	SS	34.5	36.0	3-3-4/0"	17				ML	Very fine sand, some silt, trace (8-10%) clay, soft, moist-wet, low-medium plasticity, slow dilatancy, gray, grains of micah/muscovite visible (7.5YR 5/1).		
26	SS	36.0	37.5	2-3-4/0"	13		35		ML	Very fine sand, little silt (2%), very soft, moist-wet, medium dilatancy, no plasticity, gray, poorly graded (7.5YR 5/1).		
27	SS	37.5	39.0	2-2-4/0"	17					Note: 3-5 mm laminate of fine sand in shoe, silt, trace frequency at 34.8 feet. Note: trace amounts of clay, low plasticity from 37.5 to 38.7 feet.		
28	SS	39.0	40.5	2-2-3/0"	19.5							
29	SS	40.5	42.0	2-2-2/0"	17		40		SW	Fine sand, trace silt (10%), very soft, wet, medium-rapid dilatancy, no plasticity, gray, muscovite grains visible (7.5YR 5/1). Note: 5-10 mm laminations of silt rich deposits, fine sand with little silt (25%) at 41.0 feet. Note: wet from 42.0 to 43.5 feet.		
30	SS	42.0	43.5	1-1-3/0"	13							
31	SS	43.5	45.0	3-14-14/0"	14				SW	Fine sand with little subangular to angular small sandstone gravel, trace silt (5%), wet, stiff, no dilatancy, non plastic, sandstone, fine sand clast size (7.5YR 5/1).		
32	SS	45.0	46.5	6-7-11/0"	10.5		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1602A** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **5/25/16** BORING FINISH **5/25/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
33	SS	46.5	48.0	10-10-13/0"	13				SP	Note: less sandstone gravel, trace (5-8%), very wet, rapid dilatancy from 46.0 to 46.5 feet.		
34	SS	48.0	49.5	8-9-13/0"	9.5					Fine sand, trace silt, uniform sand grain size, soft, wet, rapid dilatancy, no plasticity, gray (7.5YR 5/1). Note: 3-4 mm bands/laminate of black sand, same grain size, trace frequency from 48.0 to 49.5 feet.		
35	SS	49.5	51.0	6-5-10/0"	12.5		50			Note: 1" black bank/lamination of black material (small gravel to fine sand in size) within band there is no regular material at 49.5 feet. Note: slight color shift (7.5YR 5/2), silt (3-5%) contains dispersed in run, black material in trace amounts 3-5% from 51.0 to 52.5 feet.		
36	SS	51.0	52.5	14-11-7/0"	10							
37	SS	52.5	54.0	6-5-6/0"	7							
38	SS	54.0	55.5	4-7-8/0"	9		55			Note: laminae 2-3mm of black sand (fine size) present from 54.5 to 55.7 feet.		
39	SS	55.5	57.0	7-8-10/0"	9.5							
40	SS	57.0	58.5	6-8-14-3/0"	14					Note: trace amounts (3%) of small angular sandstone gravel from 57.0 to 58.5 feet.		
41	SS	58.5	60.0	9-10-23/0"	7							
							60			Weathered sandstone.		
										End of boring at 60 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES **N 538,963.7 E 1,729,315.5**

GROUND ELEVATION **584.1** SYSTEM

Water Level, ft	▽ 19.1	▼	▼
TIME			
DATE	5/24/2016		

BORING NO. **MW-1603A** DATE **7/19/16** SHEET **1** OF **2**

BORING START **5/23/16** BORING FINISH **5/24/16**

PIEZOMETER TYPE **NA** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.0'** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **38.0'** BOTTOM **43.0'**

WELL DEVELOPMENT **6/14/2016** BACKFILL **NA**

FIELD PARTY **NA** RIG **Diedrich**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5							Hydrovac from 0.0 to 6.0 feet. Fill materials, large cobbles to small gravel, limestone.		
2	SS	1.5	3.0									
3	SS	3.0	4.5									
4	SS	4.5	6.0				5					
5	SS	6.0	7.5	5-3-3/0"	7				CL	Clay with little silt, soft, high plasticity, moist, gray (7YR 4/1), no dilatancy. Note: sandstone plug from sluff in shoe for first 1/2 of run (6.0 to 7.5 and 7.5 to 9.0 feet).		
6	SS	7.5	9.0	3-2-3/0"	4.5							
7	SS	9.0	10.5	2-2-2/0"	9					Note: gray (7YR 4/1) mottling, trace (1%) grains of medium to coarse sand.		
8	SS	10.5	12.0	2-1-2/0"	20		10					
9	SS	12.0	13.5	1-1-1/0"	22				SW	Sand, medium to fine with little silt, soft, wet, gray (10YR 4/1), rapid dilatancy, no plasticity, trace amounts of oxidized mudstone.		
10	SS	13.5	15.0	1-1-1/0"	12				ML	Silt with trace clay, medium plasticity, very uniform, moist gray (10YR 4/1), trace organics (wood, organics, roots), soft, dilatancy.		
11	SS	15.0	16.5	3-1-1/0"	15		15					
12	SS	16.5	18.0	1-2-2/0"	10					Note: little clay from 16.0 to 16.5 feet.		
13	SS	18.0	19.5	1-1-2/0"	15						▽	
14	SS	19.5	21.0	2-2-2/0"	15.5				SW	Fine sand, little silt, well sorted, poorly graded, soft, wet, gray, uniform, grain size, trace oxidized		

Continued Next Page

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1603A** DATE **7/19/16** SHEET **2** OF **2**

PROJECT **John E. Amos Plant CCR** BORING START **5/23/16** BORING FINISH **5/24/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
									ML	sandstone pieces. Note: water at 19.1 feet.		
15	SS	21.0	22.5	1-1-2/0"	13				ML	Silt with little clay, medium plasticity, moist, stiff, no diltancy, trace root structures.		
16	SS	22.5	24.0	4-4-6/0"	22				SM	Silt with little clay, medium plasticity, moist, stiff, no diltancy, trace root structures.		
17	SS	24.0	25.5	4-3-6/0"	22					Fine sand with some silt, trace medium sand, wet, soft, non plastic, rapid dilatancy, trace amounts of black/oxidized material, coarse sand sized subangular.		
18	SS	25.5	27.0	2-2-2/0"	7		25			Weathered sandstone, small gravel sized, angular clasts with fine sand with some silt, stiff, moist, wet, no dilatancy, non plastic.		
19	SS	27.0	28.5	1-2-2/0"	10					Note: yellow (2.5Y 6/6) fine sand seam at 26.7 feet.		
20	SS	28.5	30.0	3-3-4/0"	17.5				ML	Note: oxidized sandstone, angular, small gravel, wet from 28.0 to 28.2 feet. Silt with little clay, stiff, moist, no dilatancy, moderate plasticity, uniform texture.		
21	SS	30.0	31.5	4-5-6/0"	20		30					
22	SS	31.5	33.0	2-3-4/0"	16				SM	Weathered sandstone, small angular gravel with little fine sane, little silt, wet, no dilatancy, no plasticity, well graded, stiff.		
23	SS	33.0	34.5	2-2-3/0"	23					Sandy silt, some fine sand, wet, stiff, trace amount of clay, low to no plasticity, slow dilatancy.		
24	SS	34.5	36.0	2-2-5/0"	21				SM	Silty sand, fine with some silt, wet, fast dilatancy, very soft, poorly graded, very uniform, grain size, some 1-2" bands of more silt, rich sediment, these are slightly stiff and more moist/wet.		
25	SS	36.0	37.5	3-1-5/0"	22		35		ML	Silt with trace clay, trace fine sand bands (some 30%) of more clay rich sediment 1/2 to 1" thick laminae, moist, moderately stiff, no dilatancy, medium plasticity.		
26	SS	37.5	39.0	3-6-6/0"	14					Note: trace fine sand, wet (saturated) at 38.3 with 2" band of fine sand with trace silt.		
27	SS	39.0	40.5	3-5-5/0"	14					Weathered sandstone, small, angular gravel with trace silt, little fine sand, trace coarse sand, stiff, wet, non plastic, no dilatancy. Note: trace small oxizided gravel at 39.0 feet.		
28	SS	40.5	42.0	3-5-5/0"	14		40			Note: some fine sand and trace oxidized sand veins at 40.5 feet.		
29	SS	42.0	43.5	4-7-44/0"	14							
30	SS	43.5	45.0	50-3/0"	15					Weathered sandstone (fairly competent) dry with some moisture (localized).		
							45			End of boring at 45.0 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES **N 539,459.6 E 1,729,931.7**

GROUND ELEVATION **586.0** SYSTEM

Water Level, ft	▽ 18.8	▼	▼
TIME			
DATE	5/6/2016		

BORING NO. **MW-1604** DATE **7/19/16** SHEET **1** OF **3**

BORING START **5/5/16** BORING FINISH **5/6/16**

PIEZOMETER TYPE **NA** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.0'** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **33.9'** BOTTOM **43.5'**

WELL DEVELOPMENT **5/18/2016** BACKFILL **NA**

FIELD PARTY **NA** RIG **Diedrich**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1-0-0/0"	0					No recovery, rock (limestone), clogged shoe.		
2	SS	1.5	3.0	1-1-1/0"	5				GM	Silty gravel and sand, silt some fine sand, little small subangular gravel, soft, wet, slow dilatancy, non plastic, brown, trace organics and root fibers.		
3	SS	3.0	4.5	1-1-1/0"	5							
4	SS	4.5	6.0	2-2-3/0"	11.5		5		ML	Silt with fine sand, very fine sand, soft, moist, no diltancy, moderate plasticity, brown (10YR 4/4), uniform texture, trace small black sand inclusions (1 mm).		
5	SS	6.0	7.5	2-3-5/0"	16							
6	SS	7.5	9.0	3-4-6/0"	15.5					Note: more stiff, trace root fibers, trace small (2-3 mm) areas of gray (10YR 4/4) coloration from 7.5 to 9.0 feet.		
7	SS	9.0	10.5	3-4-4/0"	0					Note: sandstone (very fine grain) clogged shoe on run from 9.0 to 10.5 feet, subangular medium gravel size.		
8	SS	10.5	12.0	3-4-6/0"	16.5		10		ML	Silty sand, fine, little silt, stiff, uneven distribution of sand, moist, no diltancy, non plastic, gray brown (10YR 4/2).		
9	SS	12.0	13.5	9-15-13/0"	18					Ash mixture (small black gravel inclusions-angular).		
10	SS	13.5	15.0	5-7-10/0"	11.5				ML	Silt with very fine sand, little very fine sand, stiff, red brown (5YR 4/3), no dillatancy, no to low plasticity.		
11	SS	15.0	16.5	5-8-14/0"	12		15			Platy mudstone, interbedded with silt and very fine sand.		
12	SS	16.5	18.0	5-8-8/0"	15					Silty sand, fine, little to trace silt, very soft, moist, non plastic, brown, gray (2.5Y 4/2), no dilatancy, trace small, soft, sandstone, rounded gravel.	▽	
13	SS	18.0	19.5	4-4-5/0"	13					Note: water at 18.75 feet, rapid dilatancy.		
14	SS	19.5	21.0	5-7-11/0"	19							

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TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1604** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **5/5/16** BORING FINISH **5/6/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	3-4-5/0"	16.5					Note: color change to 7.5YR 4/2 at 19.9 feet. Note: oxidation/iron staining, color change to 7.5YR 5/8 at 20.7 feet.		
16	SS	22.5	24.0	3-7-10/0"	17							
17	SS	24.0	25.5	5-6-9/0"	15.5				SP	Poorly graded sand, fine, trace silt (5-8%), very soft, rapid dilatancy, brown, no plasticity, poorly graded.		
18	SS	25.5	27.0	9-7-6/0"	12		25			Note: 0.2' layer of silt with fine sand at 24.7 feet. Note: color change to 7.5YR 5/8 at 24.8 feet. Note: heaving sand at 25.5 feet.		
19	SS	27.0	28.5	3-4-4/0"	15.5					Note: small (1mm) layers of black sand (2 layers) at 26.9 feet.		
20	SS	28.5	30.0	2-2-1/0"	19					Note: contains trace small (5mm) layers of sandy silt, color change to 7.5YR 4/3 from 27.0 to 28.5 feet. Note: black material from 28.8 to 28.9 feet.		
21	SS	30.0	31.5	1-2-3/0"	11.5		30			Note: band of oxidation/iron staining at 29.25 feet, 0.4' thick, 7.5YR 5/8.		
22	SS	31.5	33.0	3-2-3/0"	15					Note: 0.3' band of 10YR 6/6 coloration at 31.0 feet.		
23	SS	33.0	34.5	3-3-4/0"	16					Note: colored bands (5-10mm) 7.5YR 4/1 at 33.0 feet.		
24	SS	34.5	36.0	3-4-10/0"	10		35			Note: very soft, very wet, trace silt (3-5%) at 34.5 feet.		
25	SS	36.0	37.5	4-5-8/0"	12					Note: slightly stiff, 3% silt, very poorly graded, well sorted from 36.0 to 37.5 feet.		
26	SS	37.5	39.0	4-5-6/0"	11.5					Note: trace angular sandstone, small gravel (one clast per 18"), slight stiff, 3% silt from 37.5 to 39.0 feet.		
27	SS	39.0	40.5	7-10-11/0"	17					Note: color grey 1 5G-/1, poorly cemented (3-5% silt) from 39.0 to 40.5 feet.		
28	SS	40.5	42.0	5-6-8/0"	12.5		40					
29	SS	42.0	43.5	7-11-10/0"	7.5					Note: trace silt (3-4%) from 42.0 from 43.5 feet. Note: rock stuck in shoe (sandstone) at 42.5 feet.		
30	SS	43.5	45.0	6-5-4/0"	14.5					Note: 10mm thick bands of higher concentration of silt and little amount of silt, 25% of run at 43.5 feet.		
31	SS	45.0	46.5	3-5-8/0"	16		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1604** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **5/5/16** BORING FINISH **5/6/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										End of boring at 46.5 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES **N 540,038.8 E 1,731,401.7**

GROUND ELEVATION **583.4** SYSTEM

Water Level, ft	▽ 18.0	▼	▼
TIME			
DATE	5/2/2016		

BORING NO. **MW-1605** DATE **7/19/16** SHEET **1** OF **3**

BORING START **4/29/16** BORING FINISH **5/2/16**

PIEZOMETER TYPE **NA** WELL TYPE **NA**

HGT. RISER ABOVE GROUND **3.0'** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **26.3'** BOTTOM **41.0'**

WELL DEVELOPMENT **5/18/2016** BACKFILL **NA**

FIELD PARTY **NA** RIG **Diedrich**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	0-1-0/0"	4				SM	Sandy silt, little fine sand, trace coarse sand, moist, soft, no dilatancy, low plasticity, 2.5YR 4/6.		
2	SS	1.5	3.0	1-0-0/0"	2					Note: trace amounts of small angular limestone gravel (roadbed) from 1.5 to 3.0 feet.		
3	SS	3.0	4.5	1-0-0/0"	5.5					Note: wet, slightly stick from 3.0 to 4.5 feet.		
4	SS	4.5	6.0	2-2-4/0"	5.5		5					
5	SS	6.0	7.5	5-11-8/0"	12.5					Note: at 6.75 feet rock fragment stuck in spoon, from 6.0 to 6.76 wet, from 6.76 to 7.5 dry.		
6	SS	7.5	9.0	4-5-7/0"	7.5					Note; trace small rounded gravel (3%) from 7.0 to 7.5 feet.		
7	SS	9.0	10.5	2-3-6/0"	13					Note: root structures (2-3%) from 7.3 to 9.0 feet. Note: little small gravel from 7.9 to 9.0 feet.		
									SM	Note: sandstone lodged in spoon at 8.8 feet.		
8	SS	10.5	12.0	3-4-6/0"	16.5		10			Silt, trace medium sand, little fine sand, stiff, brown, moist, no dilatancy, 10YR 3/1.		
9	SS	12.0	13.5	2-4-7/0"	13.5				ML	Silt, very fine sand, stiff, moist, grey mottling (3%), non plastic, no dilatancy 2.5Y 5/6.		
10	SS	13.5	15.0	5-5-7/0"	19					Note: slightly more stiff from 13.0 to 13.5 feet. Note: higher silt concentration, little amount of very fine sand (20%).		
11	SS	15.0	16.5	2-2-3/0"	17		15		ML	Silt, little fine sand (25%), moderate stiff, moist, low plasticity, 2.5Y 5/6. Note: moisture increases from 15.0 to 16.5 feet.		
12	SS	16.5	18.0	2-1-3/0"	21.5					Note: 2" thick layers of higher dilatancy, silt concentration more stiff, less moisture (40% of total run) from 16.5 to 18.0 feet.		
13	SS	18.0	19.5	1-2-2/0"	14					Note: wet, medium dilatancy, very soft, no water in spoon from 18.0 to 19.5 feet. Note: water at 18.0 feet.	▽	
14	SS	19.5	21.0	2-1-2/0"	16.5							

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1605** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/29/16** BORING FINISH **5/2/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	1-2-2/0"	16				SM	Sandy silt with some fine sand, wet, soft, rapid dilatancy, low plasticity, high quantity of water in spoon, 2.5Y 5/6.		
16	SS	22.5	24.0	1-2-2/0"	15.5							
17	SS	24.0	25.5	3-4-9/0"	12				SM	Note: saturated, slightly less silt and more sand, very soft from 23.5 to 24.0 feet.		
							25			Silty sand, fine sand, trace silt (10%), very soft, wet, rapid dilatancy, non plastic, poorly graded, 2.5Y 5/6. Rock lodged into shoe at 25.5 feet. Chert fractures, no cleavage, angular, all fresh breaks from split spoon. Chalky inclusions. Heaving sand encountered at 25.5 feet.		
18	SS	25.5	27.0	2-5-6/0"	11.5				SP			
19	SS	27.0	28.5	4-5-9/0"	12					Poorly graded fine sand, trace (3%) silt, very soft, brown, wet, non plastic, rapid dilatancy, poorly graded, 2.5Y 5/6.		
20	SS	28.5	30.0	4-7-7/0"	16.5					Note: trace 5mm layers of black sand from 28.5 to 30.0 feet.		
21	SS	30.0	31.5	4-5-8/0"	16		30			Note: 2.5" band of silty sand, wet, stiff to moderately stiff, fine sand, little silt at 30.4 feet.		
22	SS	31.5	33.0	3-4-4/0"	18					Note: 5mm layers of black sand (trace amounts) from 30.8 to 31.5 feet.		
23	SS	33.0	34.5	4-3-6/0"	16					Note: oxidation/iron staining, 5YR 5/8 at 32.6 feet. Note: color change at 32.8 feet 5Y 5/1. Note: very abrupt and clear color shift to Gley 1 4N at 33.3 feet.		
24	SS	34.5	36.0	4-5-6/0"	16.5		35			Note: color change to 7.5YR 4/1 at 35.25 feet.		
25	SS	36.0	37.5	6-3-6/0"	10.5					Note: 2-3" trace/little amounts of black material in 2mm bands at 36.8 feet.		
26	SS	37.5	39.0	2-3-4/0"	12.5					Note: little black material, slightly more stiff, 10YR 2/1 at 38.2 feet. Note: color change at 38.5 feet to 10YR 5/8.		
27	SS	39.0	40.5	3-3-2/0"	14							
28	SS	40.5	42.0	6-2-6/0"	17		40		SP	Poorly graded, fine sand, trace to little silt (10-12%), very soft, wet, brown, no plasticity, rapid dilatancy. Note: sand grain size slightly larger at 40.5 feet. Note: trace silt from 42.0 to 43.5 feet.		
29	SS	42.0	43.5	10-6-7/0"	24					Note: angular piece of sandstone matching sand in color, small gravel size at 43.0 feet. Note: heaving sand encountered at 43.5 feet.		
30	SS	43.5	45.0	5-3-4/0"	3							
31	SS	45.0	46.5	8-4-6/0"	10		45			Note: pieces of platy mudstone within sand in shoe, small gravel sized, very soft rock, subangular at 44.7 feet.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1605** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/29/16** BORING FINISH **5/2/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
32	SS	46.5	48.0	2-6-8/0"	11.5					Note: color change to 7.5YR 4/1 at 45.0 feet. Note: 2" band of silt with very fine sand layered 50/50. Note: heaving sand encountered at 46.5 feet.		
33	SS	48.0	49.5	6-5-7/0"	14.5					Note: trace small gravel, subangular from 47.8 to 48.0 feet.		
34	SS	49.5	51.0	4-7-10/0"	20		50			Note: 0.5mm seam of black material, coarse to fine sand size and slight color change from 48.0 to 49.0 feet. Note: well graded, little rounded small gravel from 50.4 to 51.0 feet. End of boring at 51.0 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES **N 539,197.0 E 1,731,559.3**

GROUND ELEVATION **580.8** SYSTEM

Water Level, ft	▽ 12.0	▼	▼
TIME			
DATE	5/3/2016		

BORING NO. **MW-1606** DATE **7/19/16** SHEET **1** OF **3**

BORING START **5/2/16** BORING FINISH **5/3/16**

PIEZOMETER TYPE **NA** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.0** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **24.32** BOTTOM **39.0**

WELL DEVELOPMENT **NA** BACKFILL **NA**

FIELD PARTY **NA** RIG **Diedrich**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1-0-0/0"	0					No recovery.		
2	SS	1.5	3.0	1-0-0/0"	4				ML	Note: grade is sandy silt, topsoil, silt, trace fine sand, trace medium sand, root structures (5%), soft, low plasticity, no dilatancy, moist, brown (5YR 3/1).		
3	SS	3.0	4.5		2					Note: only recovery is inside shoe from 3.0 to 4.5 feet.		
4	SS	4.5	6.0	9-10-14/0"	0		5			Note: rock lodged in shoe, sandstone, no recovery from 4.5 to 6.0 feet.		
5	SS	6.0	7.5	8-9-7/0"	6.5				ML	Silt, trace fine sand, brown, moist, moderate plasticity, no dilatancy, soft, very uniform texture (10YR 4/4).		
6	SS	7.5	9.0	2-2-4/0"	15				SM	Some fine sand, trace medium sand, soft, moist, no dilatancy, low plasticity, root structures (3%) (10YR 3/3).		
7	SS	9.0	10.5	4-4-7/0"	17				SM			
8	SS	10.5	12.0	1-1-2/0"	21		10		SM	Silt, some fine sand, stiff, moist, low plasticity, no dilatancy (10YR 3/3).		
9	SS	12.0	13.5	2-2-3/0"	22					Fine sand, little silt, soft, moist, no dilatancy, no plasticity, higher moisture content at bottom of 10.5 feet (10YR 5/6).	▽	
10	SS	13.5	15.0	2-2-3/0"	22					Note: wet, very soft from 12 to 13.5 feet. Note: water at 12.0 feet.		
11	SS	15.0	16.5	2-1-3/0"	14		15					
12	SS	16.5	18.0	3-5-4/0"	14					Note: very soft from 16.5 to 18 feet. Slight color shift to 10YR 4/6 at 16.7 feet.		
13	SS	18.0	19.5	5-4-7/0"	14					Note: heaving sand encountered at 18 feet. Flushed with water, not enough to push down added mud.		
14	SS	19.5	21.0	5-7-10/0"	12							

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TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

AEP - AEP.GDT - 7/19/16 15:50 - C:\USERS\SBREWER\DOCUMENTS\AEP\AEP WINFIELD WV.GPJ

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1606** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **5/2/16** BORING FINISH **5/3/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	5-8-10/0"	13					Note: band of black/dark brown and, 1 cm thick (5Y 3/2), trace silt, same characteristics. Note: same band of dark brown/black sand, trace silt from 21.0 to 21.1 feet. Color change to 7.5YR 5/6 with band layers of 5YR 5/3 (25%) heavily oxidized.		
16	SS	22.5	24.0	5-10-13/0"	13							
17	SS	24.0	25.5	7-10-13/0"	12.5		25			Note: abrupt color change to 10YR 6/6 at 23.7 feet. Note: slight shift in color, back to 7.5YR 5/8 oxidized slightly paler at 25.5 feet (10YR 6/6).		
18	SS	25.5	27.0	3-8-8/0"	10							
19	SS	27.0	28.5	3-3-6/0"	1				SM	Note: color change to 10YR 4/8, trace silt at 26.5 feet.		
20	SS	28.5	30.0	6-4-4/0"	12.5					Silty sand, fine sand, trace silt, trace medium sand, little medium sand size subangular bits of black material (coal 15%), wet, soft-medium stiff, no dilatancy, no plasticity, gray, small bands of oxidation (5 mm) (5Y 5/1).		
21	SS	30.0	31.5	7-3-3/0"	17.5		30			Note: slightly darker coloration, no oxidation coloration, trace amounts of medium sand sized coal fragments from 30 to 31.5 feet.		
22	SS	31.5	33.0	9-7-7/0"	17				SP	Poorly graded sand, fine sand, little medium sand, subangular, trace silt (3%), gray, wet, no dilatancy, soft, no plasticity (5Y 5/1).		
23	SS	33.0	34.5	4-3-3/0"	15.5							
24	SS	34.5	36.0	3-3-5/0"	13.5				SP	Poorly graded sand, fine sand, trace silt (3%), soft, wet, no plasticity, no dilatancy, red-gray (7.5YR 5/3).		
25	SS	36.0	37.5	2-3-3/0"	13.5		35					
26	SS	37.5	39.0	2-3-6/0"	18					Note: 5 mm bands of trace medium sand with fine sand from 37.5 to 39.0 feet.		
27	SS	39.0	40.5	4-4-6/0"	10							
28	SS	40.5	42.0	4-7-8/0"	13		40			Note: 10 mm band of black sand at 39.9 feet. Note: red streak on side of spoon (10YR 4/6), very fine sand from 40.5 to 42.0 feet.		
29	SS	42.0	43.5	3-4-5/0"	12.5					Note: trace medium sand (5-7%), slight color change to 10YR 5/8 from 42.8 to 43.5 feet.		
30	SS	43.5	45.0	3-3-6/0"	13.5							
31	SS	45.0	46.5	3-4-9/0"	16		45			Note: 0.3" layer of little amount of coal bits ranging in size from fine to coarse, fine-little medium coarse sand at 44.25 feet.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **MW-1606** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **5/2/16** BORING FINISH **5/3/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
32	SS	46.5	48.0	12-19-22/0"	11.5				SW	Note: trace rounded small gravel at 46.4 feet.		
									SW	Well graded sand, fine sand, little medium sand, trace coarse sand, little small rounded gravel, wet, soft, non plastic, no dilatancy.		
33	SS	48.0	49.5	50-4/0"	0					Well graded sand, fine sand, trace medium sand, trace coarse sand (5Y 5/1), little angular to subangular small gravel sized pieces of sandstone (Gley 1 5/N) and mudstone (2.5YR 3/6). Note: nothing in shoe or spoon, likely a medium to large cobble from 48.0 to 49.5 feet.		
34	SS	49.5	51.5	50-2/0"	0					End of boring at 49.7 feet due to refusal.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES

GROUND ELEVATION SYSTEM

Water Level, ft	▽ 9.0	▼	▼
TIME			
DATE	4/26/2016		

BORING NO. **SB-1601** DATE **7/19/16** SHEET **1** OF **3**

BORING START **4/25/16** BORING FINISH **4/26/16**

PIEZOMETER TYPE **NA** WELL TYPE **NA**

HGT. RISER ABOVE GROUND **NA** DIA **NA**

DEPTH TO TOP OF WELL SCREEN **NA** BOTTOM **NA**

WELL DEVELOPMENT **NA** BACKFILL **Sandpack/Grout**

FIELD PARTY **NA** RIG **Hollow Stem Auger 2"**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1-0-0/0"	0.2					Ash, fine sand, trace medium angular sand, greenish gray, moist, very soft, no dilatancy, moderate plasticity (Gley 1 5/N).		
2	SS	1.5	3.0	1-1-0/0"	0.2					Note: trace organics, root fibers from 1.8 to 3.0 feet.		
3	SS	3.0	4.5	5-5-10/0"	1.1				CL	Clay, little silt, trace medium sand sized coal and ash bits (angular) very stiff, moist, greenish gray, no dilatancy, low placticity (Gley 1 5/N).		
5	SS	4.5	6.0	14-9-10/0"	1.3		5			Ash, some fine sand, trace medium subangular sand, very stiff, moist, greenish gray, no dilatancy, low plasticity (Gley 1 5/N).		
6	SS	6.0	7.5	5-7-5/0"	0.1					Note: addition of organics, root fibers and trace coarse sand-subangular from 6.2 to 7.5 feet.		
7	SS	7.5	9.0	5-3-3/0"	0.8					Ash, some fine sand, trace medium subangular sand, soft, trace silt, moist, slow dilatancy (Gley 1 5/N).	▽	
8	SS	9.0	10.5	2-2-2/0"	0.7		10			Note: saturation encountered from 9.0 to 10.5 feet.		
9	SS	10.5	12.0	2-2-3/0"	0.8					Note: small-medium sand, pieces of brick from 10.5 to 12.0 feet.		
10	SS	12.0	13.5	3-3-5/0"	0.7							
11	SS	13.5	15.0	6-9-10/0"	0.7					Note: layer of finer material, some fine sand (70%), little medium sand (15%), little silt (25%) from 13.1 to 13.5 feet. Note: laminae/layers of black "bottom ash" admist gray ash 0.75/1.0 cm spacing (approximately) 0.25 cm thick.		
12	SS	15.0	16.5	5-5-7/0"	0.9		15					
13	SS	16.5	18.0	6-9-10/0"	1.1							
14	SS	18.0	19.5	8-10-9/0"	0.9							
15	SS	19.5	21.0	7-8-9/0"	1					Note: black layers are not present from 19.5 to		

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TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1601** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/25/16** BORING FINISH **4/26/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										21.0 feet.		
16	SS	21.0	22.5	4-8-5/0"	1.1							
17	SS	22.5	24.0	5-2-1/0"	0.8							
18	SS	24.0	25.5	2-2-3/0"	0.9				ML	Silt, some clay, soft, medium sized pieces of muscovite, brown-gray, moist, dilatancy, high plasticity, uniform texture (Gley 1 6/N).		
19	SS	25.5	27.0		0		25			No recovery.		
20	SS	27.0	28.5	1-1-0/0"	1.4				SP	Medium sand, some fine sand, trace silt, moderate dilatancy, low plasticity, moist, very soft (Gley 1 5/N.		
21	SS	28.5	30.0	1-1-5/0"	1							
22	SS	30.0	31.5	2-3-3/0"	1.3		30					
23	SS	31.5	33.0	3-4-6/0"	1.1							
24	SS	33.0	34.5	9-2-1/0"	0.9							
25	SS	34.5	36.0	2-3-3/0"	1.73				SM	Medium sand, subangular, trace fine sand, trace silt, brown, wet, rapid dilatancy, low plasticity, very soft (7.5YR 4/2).		
26	SS	36.0	37.5	4-5-5/0"	1.55		35			Note: higher concentration of silt (15%) from 36.8 to 37.1 feet.		
27	SS	37.5	39.0	2-2-5/0"	1.45							
28	SS	39.0	40.5	3-2-6/0"	1.25				ML SM	Silt, trace fine sand, trace medium angular sand, little organics, root fibers, bits of wood (0.25 - 0.75 cm) (7.5YR 4/2).		
29	SS	40.5	42.0	3-7-9/0"	1.25		40			Medium sand, subangular, trace fine sand, trace silt, brown, wet, rapid dilatancy, low plasticity, very soft (7.5YR 4/2). Note: layer of silt, trace fine sand, very uniform from 39.3 to 39.5 feet. Note: stiff from 40.5 to 42.0 feet. Note: trace subrounded gravel (small) from 41.7 to 42.0 feet. Note: medium gravel, piece plugged shoe briefly at 43.0 feet.		
30	SS	42.0	43.5	7-8-10/0"	0.95							
31	SS	43.5	45.0	6-6-6/0"								
32	SS	45.0	46.5	3-6-9/0"	17		45			Note: brown laminae/layers at 45.0 feet.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1601** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/25/16** BORING FINISH **4/26/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
33	SS	46.5	48.0	6-7-11/0"	14.5					Note: color change to Gley 1 5/N at 46.8 feet.		
34	SS	48.0	49.5	5-7-6/0"	16.25							
35	SS	49.5	51.0	3-6-5/0"	0		50		SW	No recovery.		
36	SS	51.0	52.5	3-5-14/0"	16.25				SW	Medium sand, little fine sand, soft, wet, no plasticity, no dilatancy, gray, sand, subangular (Gley 1 5/104).		
37	SS	52.5	54.0	10-17-17/0"	6				SW	Medium sand, little fine sand, subangular, little coarse subangular sand, trace subrounded small gravel, well graded (Gley 1 5/GN). Note: more small gravel (litle) from 53.0 to 54.5 feet.		
38	SS	53.0	54.5	20-20-38/0"	15				SW			
39	SS	54.5	56.0	20-20-38/0"	15							
40	SS	55.0	56.5	18-40-50-4/0"	10.5		55		SW	Medium sand, some fine sand, trace coarse sand, subangular, wet, soft, low plasticity, no dilatancy, gray (Gley 1 5/GN).		
										Medium sand, little coarse sand, trace small subangular gravel, trace medium subangular gravel, soft, trace fine sand (Gley 5/N).		
										Weathered sandstone, moist, very stiff, no plasticity, no dilatancy, uniform texture, gray mottling throughout (10R 3/6).		
										End of boring at 57.5 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES

GROUND ELEVATION SYSTEM

Water Level, ft			
TIME			
DATE			

BORING NO. **SB-1602** DATE **7/19/16** SHEET **1** OF **3**

BORING START **4/26/16** BORING FINISH **4/27/16**

PIEZOMETER TYPE **NA** WELL TYPE **NA**

HGT. RISER ABOVE GROUND **NA** DIA **NA**

DEPTH TO TOP OF WELL SCREEN **NA** BOTTOM **NA**

WELL DEVELOPMENT **NA** BACKFILL **NA**

FIELD PARTY **NA** RIG **Hollow Stem Auger 2"**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1-0-0/0"	1					Ash, fine sand, little medium sand, some silt, very soft, moist, gray (Gley 1 6/N) no plasticity, no dilatancy.		
2	SS	1.5	3.0	1-0-0/0"	2					Ash, fine sand, some silt, trace medium sand, trace coarse sand, subangular, moist, gray (Gley 1 6/N), low plasticity, no dilatancy.		
3	SS	3.0	4.5	1-1-0/0"	15					Note: little wood pieces 0.50-1.0cm in size, trace amounts rounded small gravel from 3.4 to 4.5 feet.		
4	SS	4.5	6.0	3-3-6/0"	14.5		5		SM	Silt, little fine sand, trace medium subangular sand, brown (2.5Y 3/3), medium stiffness, no plasticity, moist, well graded.		
5	SS	6.0	7.5	2-3-4/0"	12.5					Note: color change to 10YR 5/6, from 6.0 to 7.5 feet.		
6	SS	7.5	9.0	2-3-5/0"	12					Note: micaceous from 7.5 to 9.0 feet. Note: hardness change from 7.7 to 8.7 feet.		
7	SS	9.0	10.5	3-5-9/0"	14					Note: stiff, gray mottling (Gley 1 7/N) from 9.3 to 12.0 feet.		
8	SS	10.5	12.0	3-6-8/0"	14		10			Note: trace amounts of organics/roots from 11.3 to 12.0 feet.		
9	SS	12.0	13.5	3-5-7/0"	16					Note: interbedded layers of silty clay, grey (10YR 5/6), stiff, moist from 12.3 to 13.5 feet.		
10	SS	13.5	15.0	2-3-7/0"	15					Note: no grey mottling from 13.5 to 15.0 feet.		
11	SS	15.0	16.5	3-4-5/0"	18		15		SM	Fine sand, little silt, trace medium sand, soft, brown, moist, low plasticity, no dilatancy.		
12	SS	16.5	18.0	3-3-3/0"	24					Note: uniform texture, poorly graded, well sorted from 16.5 to 18.0 feet.		
13	SS	18.0	19.5	2-2-2/0"	18							
14	SS	19.5	21.0	2-2-2/0"	20							

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/26/16** BORING FINISH **4/27/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	1-1-1/0"	20				SM	Fine sand, some silt, very soft, wet, rapid dilatancy, brown (10YR 4/6), no plasticity. Note: silt (30%), very wet, very soft from 21.0 to 22.5 feet.		
16	SS	22.5	24.0	1-1-1/0"	19				SM	Fine sand, some silt, very wet, very soft.		
17	SS	24.0	25.5	3-2-4/0"	18				SP	Fine sand, trace silt, soft, brown (10YR 4/6), rapid dilatancy, no plasticity, wet, silt ~10%.		
18	SS	25.5	27.0	4-4-7/0"	14		25			Note: heaving sand encountered (1' up auger) at 25.5 feet, trace medium sand subrounded from 25.8 to 26.4 feet.		
19	SS	27.0	28.5	9-11-12/0"	15				SW	Fine sand, little subangular medium sand, trace coarse sand, silt 5%, soft, wet, no plasticity.		
20	SS	28.5	30.0	6-7-11/0"	17.5					Note: small laminate of fine sand only, 1-1.5 cm thick from 28.5 to 30.0 feet.		
21	SS	30.0	31.5	5-6-16/0"	19		30			Note: fine medium sand, trace coarse sand from 30.0 to 39.0 feet.		
22	SS	31.5	33.0	10-12-9/0"	10.5					Note: color change to 10YR 4/6 at 32.1 feet.		
23	SS	33.0	34.5	3-3-8/0"	11							
24	SS	34.5	36.0	8-7-5/0"	16		35			Note: black staining present, piece of sandstone was lodged in shoe from 34.1 to 34.5 feet. Note: 0.5-1.5 cm layers of black staining present, very wet from 34.5 to 35.8 feet.		
25	SS	36.0	37.5	4-5-12/0"	13					Note: color change to 5YR 5/8 from 36.5 to 37.5 feeet.		
26	SS	37.5	39.0	6-7-8/0"	17							
27	SS	39.0	40.5	5-3-5/0"	16		40			Fine sand, trace medium sand, trace silt, wet, soft, no plasticity, rapid dilatancy, piece of sandstone in shoe. Note: color change to Gley1 6/N at 39.7 feet.		
28	SS	40.5	42.0	7-7-6/0"	14.5							
29	SS	42.0	43.5	3-3-7/0"	15					Note: color change to 2.5Y 4/2 from 42.3 to 43.5 feet.		
30	SS	43.5	45.0	3-4-5/0"	9.5				SW	Fine sand, trace medium sand, trace silt, wet, soft, no plasticity, no dilatancy, trace very coarse sand, subangular.		
31	SS	45.0	46.5	5-1-5/0"	11.5		45		SW	Fine sand, trace medium sand, trace silt, trace subangular coarse sand, wet, slow dilatancy, soft,		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/26/16** BORING FINISH **4/27/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										brown gray (7YR 5/2), no plasticity.		
32	SS	46.5	48.0	4-3-4/0"	20				SP	Fine sand, trace medium sand, trace silt, wet, soft, rapid dilatancy, brown gray (7YR 5/2).		
33	SS	48.0	49.5	7-5-7/0"	22							
34	SS	49.5	51.0	8-7-10/0"	18		50			Note: black laminated/stained sand layers 0.25-0.5 cm in thickiness from 49.2 to 49.5 feet. Note: black mottling (7YR 5/2) from 49.5 to 51.0 feet.		
35	SS	51.0	52.5	8-7-9/0"	16					Note: color change to 10YR 5/3 at 51.0 feet.		
36	SS	52.5	54.0	7-9-12/0"	19							
37	SS	53.0	54.5	4-4-9/0"	11.5				SW	Fine sand, trace medium sand, trace silt, trace coarse sand, trace small subangular gravel, brown (10YR 5/3), soft, well graded, wet, no plasticity, rapid dilatancy.		
38	SS	54.5	56.0	9-11-16/0"	18				SP			
39	SS	55.0	56.5	4-23-28/0"	14		55			Fine sand, trace silt, trace medium sand, wet, soft, poorly graded, no plasticity, moderate dilatancy, brown (10YR 5/3).		
40	SS	57.5	59.0	12-58-4/0"	6				SW	Fine sand, trace medium sand, little subangular, small gravel, wet, soft, rapid dilatancy, no plasticity, brown (10YR 5/3), well graded. Note: trace silt from 57.3 to 58.4 feet.		
										Red and gray (10YR 3/4) weathered mudstone, weathered. Weathered gray (Gley1 6/N) sandstone at 59.5 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES

GROUND ELEVATION SYSTEM

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **SB-1603** DATE **7/19/16** SHEET **1** OF **3**

BORING START **4/27/16** BORING FINISH **4/28/16**

PIEZOMETER TYPE **NA** WELL TYPE **NA**

HGT. RISER ABOVE GROUND **NA** DIA **NA**

DEPTH TO TOP OF WELL SCREEN **NA** BOTTOM **NA**

WELL DEVELOPMENT **NA** BACKFILL **NA**

FIELD PARTY **NA** RIG **Hollow Stem Auger 2"**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1-1-1/0"	6.5					Ash, fine sand, trace medium sand, little silt, soft, moist, non sticky, gray, no dilatancy, no plasticity, Gley 1 4/N.		
2	SS	1.5	3.0	1-0-0/0"	3.5					Note: some inclusions of brown sand in small spots (medium) 5Y 5/4 from 1.5 to 3.0 feet.		
3	SS	3.0	4.5	1-2-3/0"	14				SM	Silt, some fine sand, little medium sand, subangular, soft, brown, no dilatancy, moist, medium plasticity 5Y 4/4.		
4	SS	4.5	6.0	2-1-2/0"	15.5		5		SM	Silt, fine sand, little silt, trace medium sand, brown, soft, moist, no dilatancy, low plasticity, 5Y 4/4.		
5	SS	6.0	7.5	3-2-4/0"	14				SM	Silt, fine sand, some silt, brown, soft, moist, no diltancy, moderate plasticity, 5Y 4/4.		
6	SS	7.5	9.0	3-4-5/0"	15.5					Note: color change to 2.5Y 5/6, gray fine sand seams (5%) from 7.5 to 9.8 feet.		
7	SS	9.0	10.5	3-3-5/0"	17							
8	SS	10.5	12.0	4-4-7/0"	17		10		SM	Silt, little fine sand, brown, grey mottling, trace root fibers/organics, soft, moist, gray, medium plasticity, no dilatancy, 2.5Y 5/6.		
9	SS	12.0	13.5	3-5-8/0"	17				SM	Silty sand, fine sand, some silt, veins of oxidation, black veins (5%), soft, brown, moist, no diltancy, moderate plasticity, 2.5Y 5/6.		
10	SS	13.5	15.0	3-4-7/0"								
11	SS	15.0	16.5	3-4-5/0"	16.5		15		SM	Fine sand, little silt, soft, veins of oxidized sand/silt (5%), gray, no dilatancy, moderate plasticity, trace black sand (5%), 2.5Y 4/3. Note: bottom 0.1' was wet. Note: 10YR 3/2 band, approximately 2" thick at 21.9 feet.		
12	SS	16.5	18.0	2-3-3/0"	17							
13	SS	18.0	19.5	2-2-4/0"	16.5					Note: medium dilatancy, more moisture from 18.0 to 19.5 feet.		
14	SS	19.5	21.0	2-2-3/0"	18							

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

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PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1603** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/27/16** BORING FINISH **4/28/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
16	SS	21.0	22.5	4-5-6/0"	21							
17	SS	22.5	24.0	3-2-3/0"	16				SM	Fine sand, little silt, medium stiff, grey, slow dilatancy, moderate plasticity, 7.5YR 5/2. Note: 10YR 3/2 band approximately 2" thick at 21.9 feet.		
18	SS	24.0	25.5	3-3-9/0"	22		25			Note: no oxidation indicators, wet, very soft, color change to 10YR 5/4 at 24.0 feet.		
19	SS	25.5	27.0	3-3-5/0"	18				SM	Fine sand, trace silt, trace medium subangular sand, medium stiff, wet, black, 0.50-0.25 cm veins, medium dilatancy, low plasticity, interbedded layers 1-3 cm containing little silt, 10YR 5/4.		
20	SS	27.0	28.5	2-2-6/0"	13							
21	SS	28.5	30.0	5-7-10/0"	15					Note: heaving sand at 28.5 feet.		
22	SS	30.0	31.5	4-8-9/0"	13		30					
23	SS	31.5	33.0	3-4-9/0"	17					Note: seams of black sand 0.5-1 cm thick from 32.1 to 33.0 feet.		
24	SS	33.0	34.5	10-9-15/0"	14					Note: color band (oxidized) 7YR 5/8 from 33.1 to 33.3 feet.		
25	SS	34.5	36.0	6-9-9/0"	13		35			Note: oxidized color change 7YR 5/8 at 35.25 feet.		
26	SS	36.0	37.5	5-5-7/0"	17							
27	SS	37.5	39.0	4-4-6/0"	14					Note: color change to 7YR 4/2 at 38.7 feet.		
28	SS	39.0	40.5	3-4-6/0"	15							
29	SS	40.5	42.0	6-6-11/0"	6		40			Note: 0.75" layer of weathered shale encountered, slight color shift 7YR 4/1 at 39.7 feet. Note: piece of sandstone lodged in shoe and another small gravel sized piece at 40.6 feet.		
30	SS	42.0	43.5	7-8-11/0"	11							
31	SS	43.5	45.0	5-6-9/0"	11.5							
32	SS	45.0	46.5	3-6-9/0"	18		45		SM	Silty sand, fine sand, little medium sand, trace silt, very soft, wet, no dilatancy, no plasticity, 1 cm		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1603** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/27/16** BORING FINISH **4/28/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
33	SS	46.5	48.0	5-7-9/0"	17					bands of higher concentrations of medium sand, gray brown 10YR 4/1. Note: trace rounded small gravel from 46.5 to 47.2 feet.		
34	SS	48.0	49.5	6-5-6/0"	19							
35	SS	49.5	51.0	4-6-8/0"	10		50			Note: trace coarse sand, subrounded from 49.5 to 51.0 feet.		
36	SS	51.0	52.5	3-4-8/0"	12							
37	SS	52.5	54.0	5-6-9/0"	13					Note: black/stained sand in end of shoe at 52.5 feet.		
38	SS	54.0	55.5	7-10-12/0"	12.5		55					
39	SS	55.5	57.0	11-13-10/0"	14				SW	Well graded sand, fine sand, some medium sand, little coarse subangular sand, little small subrounded gravel, soft, no dilatancy, no plasticity, 10YR 4/1.		
40	SS	57.0	58.5	16-50-4/0"	10.5					Weathered mudstone with small gravel sized pieces of gray sandstone (trace amount), Gley 1 6/N.		
41	SS	58.5	67.5	50-2/3"	5.5							
										End of boring at 59 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES

GROUND ELEVATION SYSTEM

Water Level, ft	▽ 10.5	▼	▼
TIME			
DATE	4/29/2016		

BORING NO. **SB-1604** DATE **7/19/16** SHEET **1** OF **3**

BORING START **4/28/16** BORING FINISH **4/29/16**

PIEZOMETER TYPE **NA** WELL TYPE **NA**

HGT. RISER ABOVE GROUND **NA** DIA **NA**

DEPTH TO TOP OF WELL SCREEN **NA** BOTTOM **NA**

WELL DEVELOPMENT **NA** BACKFILL **NA**

FIELD PARTY **NA** RIG **Hollow Stem Auger 2"**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5		2					Ash, fine sand, some silt, trace small angular gravel, soft, moist, no dilatancy, low plasticity, gray (Gley 1 5/N).		
2	SS	1.5	3.0	1-1-0/0"	4							
3	SS	3.0	4.5	1-1-0/0"	3					Note: no angular gravel present from 3 to 4.5 feet.		
4	SS	4.5	6.0	2-4-8/0"	13.5		5		ML	Silt, trace fine sand, trace coarse subangular sand (3%), brown, stiff, moist, no dilatancy, low plasticity, sandstone chunk in shoe (2.5Y 4/3).		
5	SS	6.0	7.5	8-14-15/0"	16.5					Ash, fine sand, trace medium sand, little silt, soft, grey, no dilatancy, low plasticity, moist (Gley 1 5/N).		
6	SS	7.5	9.0	6-8-15/0"	12							
7	SS	9.0	10.5	4-6-7/0"	14.5					Note: concentrated area of fine sand and silt from 8.7 to 8.9 feet. Note: wet, slow dilatancy at 9.3 feet.		
8	SS	10.5	12.0	2-3-4/0"	13.5		10			Note: wet from 10.5 to 12 feet. Note: water at 10.5 feet.	▽	
9	SS	12.0	13.5	3-2-2/0"	16.5							
10	SS	13.5	15.0	1-1-2/0"	19.5					Note: black angular bottom ash, trace amount, coarse sand to small gravel size subangular to angular from 13.5 to 14.7 feet.		
11	SS	15.0	16.5	9-3-2/0"	14		15			Ash, fine sand, little silt, trace medium sand, trace angular coarse sand, wet, gray, soft, moderate dilatancy, low plasticity (Gley 1 5/N).		
12	SS	16.5	18.0	2-1-2/0"	24					Note: coarse sand (3%) from 16.5 to 18 feet.		
13	SS	18.0	19.5	2-1-1/0"	20							
14	SS	19.5	21.0	1-1-1/0"	21.5					Note: trace silt present, moderate stiffness from		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

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PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1604** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/28/16** BORING FINISH **4/29/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										19.5 to 21 feet.		
16	SS	21.0	22.5	3-1-1/0"	22					Note: very wet and slightly less angular coarse sand (bottom ash) 3-5% from 21 to 22.5 feet.		
17	SS	22.5	24.0	4-1-1/0"	24							
18	SS	24.0	25.5	2-3-5/0"	21					Note: moderate stiffness from 24 to 25.4 feet.		
							25					
19	SS	25.5	27.0	3-6-4/0"	12					Note: color change to Gley 1 2.5/10GY at 25.4 feet.		
									SM	Note: heaving sand encountered at 25.5 feet.		
20	SS	27.0	28.5	3-3-2/0"	16.5					Fine sand, little medium sand, trace coarse angular sand, trace silt, soft, wet, no dilatancy, no plasticity (Gley 1 5/10Y).		
21	SS	28.5	30.0	2-1-2/0"	16					Note: trace angular-subangular small gravel (Gley 1 4/5G 2) from 26.5 to 26.8 feet.		
									SM	Note: no coarse sand and little silt, stiff from 27.3 to 28.7 feet.		
							30					
22	SS	30.0	31.5	1-1-2/0"	0					Silty sand, fine sand, trace medium sand, trace silt, medium stiff, wet, rapid dilatancy, brown gray (5Y 4/3).		
23	SS	31.5	33.0	1-2-3/0"	12					Note: no recovery from 30 to 31.5 feet.		
										Note: little silt from 31.5 to 31.7 feet.		
24	SS	33.0	34.5	2-1-1/0"	10					Note: color change to 2.5Y 5/4 from 32.1 to 32.9 feet.		
25	SS	34.5	36.0	2-3-4/0"	10.5				SM	Fine sand, little silt, soft, very wet, rapid dilatancy, moderate plasticty, brown gray (5Y 4/3).		
							35					
26	SS	36.0	37.5	3-2-9/0"	15							
										Note: trace medium sand from 36.9 to 37.4 feet.		
27	SS	37.5	39.0	6-8-6/0"	12.5							
28	SS	39.0	40.5	7-8-6/0"	14.5				SM	Fine sand, trace silt, soft, rapid dilatancy, wet, low-moderate plasticity, gray, poorly graded (5Y 4/3).		
							40					
29	SS	40.5	42.0	5-6-6/0"	5					Note: end of boring at 45.0 feet on 4/28/2016.		
30	SS	42.0	43.5	2-2-6/0"	18							
31	SS	43.5	45.0	5-3-5/0"	16							
							45					
32	SS	45.0	46.5	5-5-7/0"	16.5				SM	Fine sand, trace medium sand, trace siilt, medium stiff, wet, rapid dilatancy, moderate plasticity, gray		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1604** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/28/16** BORING FINISH **4/29/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
33	SS	46.5	48.0	2-6-13/0"	15.5					(5Y 4/3).		
34	SS	48.0	49.5	6-6-14/0"	11							
35	SS	49.5	51.0	9-10-9/0"	12		50			Note: no medium sand, 0.5 cm black sand veins at 48.7 feet.		
36	SS	51.0	52.5	2-2-3/0"	22							
37	SS	52.5	54.0	3-3-10/0"	22							
38	SS	54.0	55.5	19-26-28/0"	17.5							
							55		SW	Fine sand, little medium sand, trace coarse angular sand, trace (sandstone), small gravel, subrounded, few layers of sandstone 2-3 cm, sandstone (Gley 1 6N).		
39	SS	55.5	57.0	9-11-21/0"	2				SW			
40	SS	57.0	58.5	9-30-50-3/0"	17					Fine sand, trace (sandstone), small subrounded gravel, little silt, moist, soft to medium stiff, low plasticity, no dilatancy (5Y 4/3).		
41	SS	58.5	67.5	9-30-50-3/0"	3.5					Note: weathered sandstone, little small subrounded gravel from 57.4 to 58.4 feet.		
										End of boring at 58.4 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES

GROUND ELEVATION SYSTEM

Water Level, ft	▽ 17.8	▼	▼
TIME			
DATE	5/2/2016		

BORING NO. **SB-1605** DATE **7/19/16** SHEET **1** OF **3**

BORING START **4/29/16** BORING FINISH **5/2/16**

PIEZOMETER TYPE **NA** WELL TYPE **NA**

HGT. RISER ABOVE GROUND **NA** DIA **NA**

DEPTH TO TOP OF WELL SCREEN **NA** BOTTOM **NA**

WELL DEVELOPMENT **NA** BACKFILL **NA**

FIELD PARTY **NA** RIG **Hollow Stem Auger 2"**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5						SM	Sandy silt, little fine sand, trace medium sand, moist, wet, very soft, brown, no dilatancy (7YR 5/6).		
2	SS	1.5	3.0	1-1-0/0"	3					Note: trace coarse angular sand, very wet from 1.5 to 3.0 feet.		
3	SS	3.0	4.5	1-1-2/0"	7.5					Road base fill, limestone, small/medium gravel (7YR 4/6).		
4	SS	4.5	6.0	6-6-8/0"	11.5		5		SM	Silt, some fine sand, moist, medium stiff, brow/dark brown, no dilatancy, low plasticity (7YR 4/6). Note: layer of black/dark brown 7YR from 4.2 to 4.4 feet.		
5	SS	6.0	7.5	8-4-2/0"	12				SM	Note: color change to gray at 5.5 feet. Silt, trace fine sand, stiff, low plasticity, no dilatancy, gray mottling, moist (7YR 4/6).		
6	SS	7.5	9.0	3-7-9/0"	14.5							
7	SS	9.0	10.5	8-6-9/0"	2					Note: color shift to 2.54 at 9.22 feet and gray fine sand veins (5%).		
8	SS	10.5	12.0	2-3-5/0"	15		10					
9	SS	12.0	13.5	3-4-5/0"	21					Note: lower recovery, rock jammed shoe from 12.0 to 13.5 feet.		
10	SS	13.5	15.0	3-3-4/0"	1.5					Note: higher moisture content from 14.5 to 15.0 feet.		
11	SS	15.0	16.5	5-2-3/0"	10		15		ML	Silt, trace fine sand, stiff, brown, moist, low plasticity, no dilatancy ((Gley 1 4/10Y). Note: color change to 10YR 5/6, higher moisture content and little fine sand from 15.6 to 15.9 feet.		
12	SS	16.5	18.0	3-2-3/0"	18						▽	
13	SS	18.0	19.5	2-2-2/0"	18					Note: wet at 17.75 feet.		
14	SS	19.5	21.0	4-2-2/0"	14.5							

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **T. Runge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1605** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/29/16** BORING FINISH **5/2/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	6-4-3/0"	12				SM	Fine sand, trace medium sand, trace silt (10%), soft, wet, rapid dilanacy, no plasticity (10YR 5/6).		
16	SS	22.5	24.0	5-5-5/0"	10.5					Note: slightly more silt (15%) from 21.7 to 22.0 feet.		
17	SS	24.0	25.5	4-4-5/0"	8					Note: low recovery due to rock stuck in shoe, sandstone (cobble size) from 24.0 to 25.0 feet.		
18	SS	25.5	27.0	10-8-10/0"	3		25			Note: color change to 10YR 3/2 from 25.5 to 26.7 feet.		
19	SS	27.0	28.5	9-13-15/0"	15					Note: color change to 10YR 5/8 from 26.7 to 27.0 feet.		
20	SS	28.5	30.0	5-8-10/0"	7					Note: color change to 10YR 6/8 from 27.2 to 28.0 feet.		
21	SS	30.0	31.5	8-9-9/0"	24		30			Note: color change to 5YR 5/8 from 30.0 to 31.6 feet.		
22	SS	31.5	33.0	6-5-8/0"	16					Note: color change to 5Y 5/2 from 31.6 to 33.0 feet.		
23	SS	33.0	34.5	9-6-7/0"	12				SM	Fine sand, trace silt, trace medium sand, wet, brown/tan/gray, soft, rapid dilatancy, no plasticity.		
24	SS	34.5	36.0	6-5-6/0"	24		35			Note: heaving sand encountered at 34.5 feet.		
25	SS	36.0	37.5	6-3-4/0"	7.5					Note: color shift to 10YR 4/3 at 36.0 feet.		
26	SS	37.5	39.0	2-3-4/0"	21.5							
27	SS	39.0	40.5	2-4-5/0"	8							
28	SS	40.5	42.0	4-3-5/0"	11		40					
29	SS	42.0	43.5	3-4-6/0"	16					Note: slight color shift to 10YR 4/4 at 42.0 feet. Note: end of boring at 42.0 feet 4/29/2016.		
30	SS	43.5	45.0	10-3-5/0"	10.5							
31	SS	45.0	46.5	4-5-6/0"	10		45		SM	Fine sand, trace silt, trace medium sand (1 to 3%), wet, brown/gray, soft to medium stiff, rapid		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1605** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/29/16** BORING FINISH **5/2/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										dilatancy, no plasticity (10YR 4/3).		
32	SS	46.5	48.0	8-4-6/0"	17					Note: color change to 10YR 5/1 from 46.5 to 48.0 feet.		
33	SS	48.0	49.5	2-3-4/0"	10.5							
34	SS	49.5	51.0	3-2-3/0"	13.5					Note: little black pieces of medium size sand, angular coal from 48.7 to 49.4 feet.		
							50			Note: trace medium sand from 50.3 to 51.0 feet.		
35	SS	51.0	52.5	10-6-12/0"	14					Weathered sandstone, gray with some red/oxidized inclusions, fine sand throughout sand (25%), sandstone (75%).		
36	SS	52.5	54.0	18-38-43/0"	12					Mudstone/shale, dark gray (2.5YR 7/4).		
										Weathered sandstone (2.5YR 7/4).		
37	SS	54.0	55.5	35-21-17/0"	11					Weathered red sandstone (2.5YR 7/4).		
										Weathered mudstone/shale, dark gray (2.5YR 7/4).		
							55					
38	SS	55.5	57.0	20-21-25/0"	11.5					Weathered red mudstone with sandstone inlusions.		
										Wethered sandstone/mudstone/shale, moist (2.5YR 7/4).		
39	SS	57.0	58.5	8-22-50/0"	20					Weathered shale, dark gray, dry (2.5YR 7/4).		
										Red weathered mudstone.		
										Gray sandstone, very fine grain (2.5YR 7/4).		
40	SS	59.5	61.0	23-43-52/0"	13					End of boring at 59.5 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES

GROUND ELEVATION SYSTEM

Water Level, ft	▽ 8.2	▼	▼
TIME			
DATE	5/12/2016		

BORING NO. **SB-1606** DATE **7/19/16** SHEET **1** OF **3**

BORING START **5/11/16** BORING FINISH **5/12/16**

PIEZOMETER TYPE **NA** WELL TYPE **NA**

HGT. RISER ABOVE GROUND **NA** DIA **NA**

DEPTH TO TOP OF WELL SCREEN **NA** BOTTOM **NA**

WELL DEVELOPMENT **NA** BACKFILL **NA**

FIELD PARTY **NA** RIG **Diedrich**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1/2"	3				ML	Poor recovery due to air knife, silt, some clay and sand, fine to medium, topsoil (10YR 5/6).		
2	SS	1.5	3.0	1-1-1/0"	9							
3	SS	3.0	4.5	1/2"	5.5							
4	SS	4.5	6.0	1-3-4/0"	18		5		SP	Sand, little clay, little silt, subround, poorly sorted, well graded, very loose, moist, dark gray mottling (10YR 5/6). Note: no mottling from 6.0 to 7.5 feet.		
5	SS	6.0	7.5	3-7-5/0"	18							
6	SS	7.5	9.0	2-3-5/0"	18					Note: wet at 8.2 feet.	▽	
7	SS	9.0	10.5	1-2-3/0"	13					Note: wet, minor dark gray mottling from 9.0 to 10.5 feet.		
8	SS	10.5	12.0	1-2-2/0"	18		10		CL	Clay and fine sand, some silt. Note: some sand from 11.3 to 12 feet.		
9	SS	12.0	13.5	1-1-2/0"	18							
10	SS	13.5	15.0	2-2-2/0"	15				CL	Clay, some silt, little sand (fine), medium to high plasticity, slow dilatancy, wet, grayish brown (10YR 5/2).		
11	SS	15.0	16.5	1-1-1/0"	18		15			Note: more silt and trace very fine sand, rapid dilatancy, low plasticity from 15.0 to 16.5 feet.		
12	SS	16.5	18.0	1-1-2/0"	18					Note: more silt than clay and some very fine sand, still wet from 16.5 to 18.0 feet. End of boring at 16.5 feet (5-11-2016).		
13	SS	18.0	19.5	1-1-2/0"	18							
14	SS	19.5	21.0	2-1-3/0"	16					Note: very thin zone of micaceous minerals, sandstone at 18.9 feet.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

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PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **L. Martin**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1606** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **5/11/16** BORING FINISH **5/12/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
16	SS	21.0	22.5	1-2-2/0"	18				CL	Clay, little silt, little very fine sand, moist, medium plasticity (10YR 5/2). Note: very soft, almost vesicles present "spongy" appearance, possibly lacustrine from 15.0 to 22.5 feet.		
17	SS	22.5	24.0	2-3-3/0"	18					Note: minor mottling, very dark gray from 22.5 to 24.0 feet. Note: some very fine sand from 23.2 to 23.5 feet.		
18	SS	24.0	25.5	1-1-1/0"	18		25			Note: moist from 24.0 to 25.5 feet.		
19	SS	25.5	27.0	1-1-2/0"	18					Note: small white spots, very soft, possible weathered shell fragments from 26.0 to 27.0 feet.		
20	SS	27.0	28.5	1-2-4/0"	18							
21	SS	28.5	30.0	3-4-6/0"	18		30			Note: large pebbles of sandstone, weathered from 29.5 to 30.0 feet. Note: soft to medium stiff (10YR 4/4) from 30.0 to 31.5 feet.		
22	SS	30.0	31.5	3-4-6/0"	18							
23	SS	31.5	33.0	3-5-6/0"	18					Note: minor oxidation staining around sandstone, 10YR 5/2 at 32.0 feet.		
24	SS	33.0	34.5	3-3-5/0"	18					Note: ~5% sand/sandstone inclusions smaller ~1-2mm from 33.0 to 34.5 feet.		
25	SS	34.5	36.0	4-7-9/0"	18		35			Note: medium stiff to stiff from 34.5 to 36.0 feet.		
26	SS	36.0	37.5	4-6-8/0"	15					Note: color change to reddish gray (5YR 5/2) at 35.5 feet. Note: sandstone, weathered at 36.6 feet.		
27	SS	37.5	39.0	3-5-9/0"	18					Note: sandstone ~5% at 37.5 feet. Note: sandstone ~25% from 38 to 38.7 feet.		
28	SS	39.0	40.5	6-6-9/0"	18		40			Note: large weathered sandstone at 39.2 feet. Note: small cobble inclusions at 39.5 feet.		
29	SS	40.5	42.0	5-6-9/0"	18					Note: color change to dark yellowish brown (10YR 4/4) from 40.5 to 42.0 feet.		
30	SS	42.0	43.5	4-6-9/0"	18					Note: few weathered sandstone inclusions <1% and very small from 42.0 to 43.5 feet.		
31	SS	43.5	45.0	4-7-9/0"	18		45					
32	SS	45.0	46.5	4-6-10/0"	18							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1606** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **5/11/16** BORING FINISH **5/12/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
33	SS	46.5	48.0	4-6-10/0"	18				CL	Clay, some silt, some sand (very fine to fine), stiff, low plasticity, moist-dry, no dilatancy (10YR 4/4). Note: minor mottling ~15% from 46.5 to 48.0 feet.		
34	SS	48.0	49.5	5-7-10/0"	18					Note: no more weathered sandstone inclusions from 48.0 to 49.5 feet.		
35	SS	49.5	51.0	5-7-9/0"	18		50					
36	SS	51.0	52.5	3-4-8/0"	18					Note: soft from 51 to 51.9 feet. Note: zone of very fine to fine sand and silt, trace clay, wet, loose, subround, well sorted.		
37	SS	52.5	54.0	6-11-16/0"	18					Note: stiff to very stiff, reddish brown (5YR 4/3) with brownish yellow (10YR 6/8), mottling ~5%, very dark gray mottling ~3%, and red (2.5YR 4/6) mottling ~2% from 52.5 to 54 feet.		
38	SS	54.0	55.5	5-10-19/0"	18					Note: trace sand stone cobbles and large pebbles from 54.0 to 55.5 feet.		
39	SS	55.5	57.0	7-18-48/0"	18		55		ML	Silt, clay, very soft, slow dilatancy, wet, medium plasticity (2.5YR 3/4).		
									SP			
40	SS	57.0	58.5	25-44-50-3/0"	13				ML	Sand, medium, subround, well sorted, wet, loose. Silt, some clay, non plastic, no dilatancy, dry, hard, dark reddish brown (2.5YR 3/4). Note: trace very fine sand from 57.0 to 58.5 feet.		
41	SS	58.5	67.5	24-50-4/0"	10					Very weathered shale/siltstone, reddish brown.		
										Refusal at 59.4 feet, augered to 60.0 feet.		
							60			Weathered bedrock, dry.		
										End of boring at 61.9 feet.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power**

PROJECT **John E. Amos Plant CCR**

COORDINATES

GROUND ELEVATION SYSTEM

Water Level, ft			
TIME			
DATE			

BORING NO. **SB-1607** DATE **7/19/16** SHEET **1** OF **3**

BORING START **4/27/16** BORING FINISH **4/28/16**

PIEZOMETER TYPE **NA** WELL TYPE **NA**

HGT. RISER ABOVE GROUND **NA** DIA **NA**

DEPTH TO TOP OF WELL SCREEN **NA** BOTTOM **NA**

WELL DEVELOPMENT **NA** BACKFILL **NA**

FIELD PARTY **NA** RIG **Diedrich**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1/2"						No recovery.		
2	SS	1.5	3.0	1/2"	6				ML	Poor recovery, slow from air knife. Silt and clay, some sand, medium plasticity, slow dilatancy, moist, very soft, yellowish brown (10YR 5/6).		
3	SS	3.0	4.5	1/2"	3.5							
4	SS	4.5	6.0	1-1-4/0"	11					Note: some very dark grayish brown ~15% mottled (10YR 4/2).		
							5			No recovery.		
5	SS	6.0	7.5	1-1-5/0"	18				SP CL	Silt and clay, some sand, medium plasticity, slow dilatancy, moist, very soft, yellowish brown (10YR 5/6).		
6	SS	7.5	9.0	4-5-9/0"	12					Sand, trace silt, very fine grain, very loose, well sorted, moist, subangular.		
7	SS	9.0	10.5	2-3-3/0"	18				SP	Clay, little silt, small slough.		
							10			Sand, very fine to fine, subangular, well sorted, little clay, trace silt, moist, loose, yellowish brown (10YR 5/6). Note: compacted from 7.5 to 8.0 feet.		
8	SS	10.5	12.0	3-3-3/0"	18					Sand, trace silt, very fine grain, very loose, well sorted, moist, subangular. Note: little clay and silt from 9.2 to 9.5 feet.		
9	SS	12.0	13.5	3-3-2/0"	18					Note: little clay, oxidation at 10.8 feet. Note: little clay, oxidation at 11.2 feet. Note: little clay, oxidation at 11.3 feet.		
10	SS	13.5	15.0	2-2-2/0"	18					Note: sand, very fine to medium, mottled 7.5YR at 11.4 feet.		
11	SS	15.0	16.5	2-1-3/0"	18				CL SP	Note: some clay, little silt, grayish brown (10YR 5/2) from 12.1 to 12.3 feet.		
							15					
									CL SP	Note: some clay, little silt, grayish brown (10YR 5/2) from 12.6 to 12.7 feet. Note: some clay, little silt, grayish brown (10YR 5/2) from 13.4 to 13.5 feet.		
12	SS	16.5	18.0	2-2-3/0"	18				CL	Clay, some silt, little very fine sand, medium plasticity, no dilatancy, moist, soft, gray (10YR 5/1).		
13	SS	18.0	19.5	2-2-3/0"	18					Sand, medium, well sorted, dry, loose, wet. Clay.		
14	SS	19.5	21.0	2-3-3/0"	18				CH	Sand, medium, well sorted, dry, loose, wet.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

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PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER **L. Martin**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1607** DATE **7/19/16** SHEET **2** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/27/16** BORING FINISH **4/28/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										Sand, fine-medium, trace clay and silt, subangular, well sorted, wet, loose.		
15	SS	21.0	22.5	2-4-5/0"	16				CL	Clay, little silt, trace fine sand, high plasticity, no dilatancy, moist, soft, dark gray brown (10YR 4/2). Note: very soft, little, wet from 18.0 to 18.5 feet.		
16	SS	22.5	24.0	2-5-7/0"	13				CL ML	Note: little silt and sand, very soft, wet from 18.5 to 19 feet. Note: clay from 19.0 to 19.5 feet.		
17	SS	24.0	25.5	3-5-10/0"	15		25			Clay, some silt, medium plasticity. Note: <5% light olive (10YR 5/4), medium grained, very small ~0.3" from 20.7 to 21.0 feet.		
18	SS	25.5	27.0	4-6-9/0"	18					Clay, large sand inclusions, fine to coarse sand, medium stiff at 21.8 feet.		
19	SS	27.0	28.5	3-13-11/0"	18					Silt and fine sand, clay, little fine sand, ????, stiff, non plastic, oxidized with dark yellowish brown mottling (10YR 4/6). Note: some sand, stiff, no-low plasticity, mottled, grayish brown (10YR 4/2) 50%, dark yellowish brown (10YR 4/6) 33%, brownish gray (10YR 6/8) 10%, grayish (Gley 1 6/10GY) 5% from 25.5 to 27.0 feet. Note: dry-moist from 27.0 to 28.0 feet.		
20	SS	28.5	30.0	6-7-10/0"	18				CL ML			
21	SS	30.0	31.5	5-6-8/0"	18		30			Sand, subangular, well sorted, loose, dry, yellowish brown (10YR 5/8).		
22	SS	31.5	33.0	3-4-7/0"	18					Clay and silt. Note: trace gravel (large pebble-small pebble) from 28.5 to 30.0 feet. Note: silt and clay at 29.8 feet. Note: more mottled ~20% 7.5YR 5/8 from 30.5 to 31.5 feet. Note: large micaceous sandstone at 30.4 feet.		
23	SS	33.0	34.5	4-6-9/0"	18							
24	SS	34.5	36.0	9-6-9/0"	16		35					
25	SS	36.0	37.5	3-4-7/0"	18					Note: large pebble, weathered micaceous sandstone at 36.0 feet.		
26	SS	37.5	39.0	3-5-7/0"	18							
27	SS	39.0	40.5	12-50-4/0"	18					Weathered sandstone, 0.7' cobbles (2.5Y 5/6).		
28	SS	40.5	42.0	8-6-14/0"	13		40		CL ML	Clay and silt, large sandstone pebbles.		
29	SS	42.0	43.5	4-8-12/0"	18							
30	SS	43.5	45.0	5-8-11/0"	18							
31	SS	45.0	46.5	6-8-50-4/0"	16		45			Note: large cobble sandstone from 45.5 to 45.9		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0007**

COMPANY **American Electric Power** BORING NO. **SB-1607** DATE **7/19/16** SHEET **3** OF **3**

PROJECT **John E. Amos Plant CCR** BORING START **4/27/16** BORING FINISH **4/28/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										feet.		
32	SS	46.5	48.0	50-3/0"	3					Weathered sandstone (2.5Y 5/6). No recovery, cobble.		
33	SS	48.0	49.5	17-9-15/0"	18				CL ML	Clay and silt, large sandstone pebbles (2.5Y 5/6). Note: cobbles from 48.7 to 49.1 feet.		
34	SS	49.5	51.0	7-5-9/0"	14		50			Note: cobbles from 50.0 to 50.2 feet.		
35	SS	51.0	52.5	4-8-44/0"	18							
36	SS	52.5	54.0	3-36-16/0"	17					Note: very large pebble from 52.3 to 52.4 feet. Note: cobble, weathered sandstone from 53.1 to 53.6 feet.		
37	SS	54.0	55.5	10-13-14/0"	18		55			Note: cobble, weathered sandstone or schist (highly micaceous) from 54.9 to 55.3 feet. Note: cobbles/pebbles more common and less weathered from 55.5 to 57.0 feet.		
38	SS	55.5	57.0	4-7-10/0"	18							
39	SS	57.0	58.5	8-10-15/0"	18					Note: less gravel and sand from 57.0 to 57.4 feet.		
40	SS	58.5	60.0	5-8-12/0"	18							
41	SS	60.0	61.5	8-26-50-5/0"	18		60		ML	Silt, some sand, little clay, no plasticity, dry, hard (2.5Y 5/6).		
42	SS	61.5	63.0	14-27-50-3/0"	18					Note: trace granules, reddish brown (2.4YR 4/3) from 61.5 to 63.0 feet.		
43	SS	63.0	64.5	29-50-3/0"	18					Note: shale/siltstone, very weathered, dry from 63.5 to 64.2 feet.		
44	SS	64.2	65.4		14					End of boring at 64.2 feet. No water detected in borehole.		

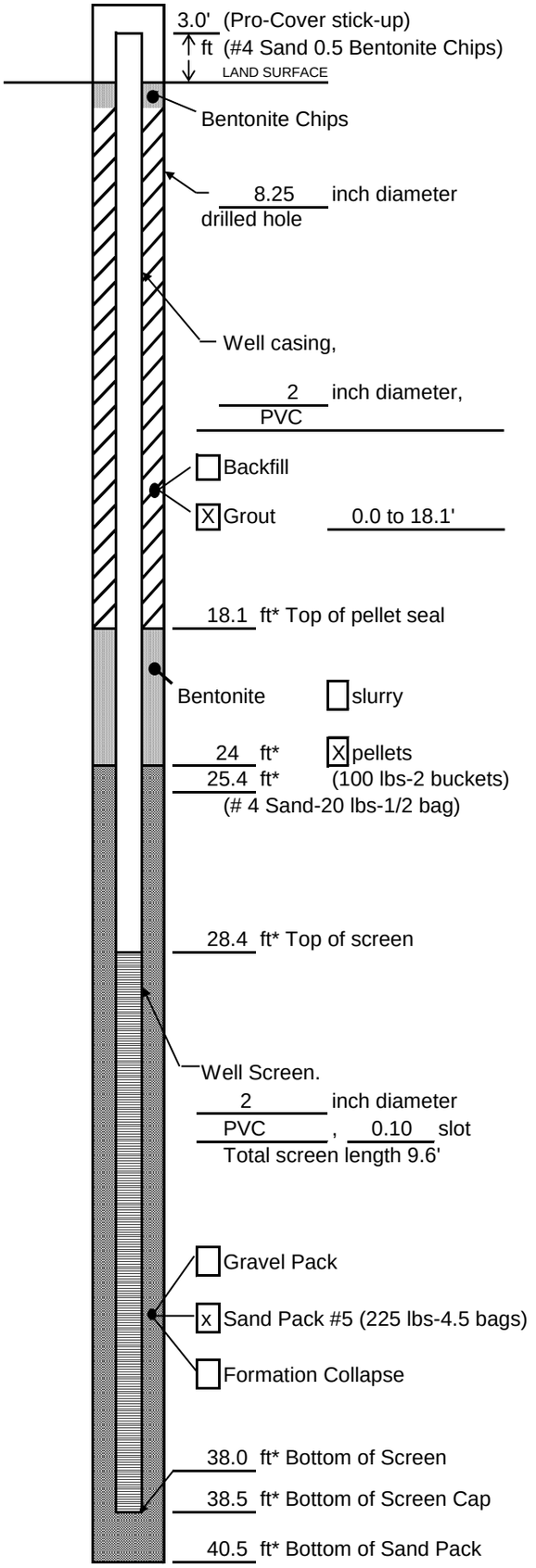
Arcadis 2016

Well Construction Diagrams

MW-1601 to MW-1606

WELL CONSTRUCTION LOG
(Unconsolidated)

ARCADIS Design & Consultancy for natural and built assets



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.
* Depth Below Land Surface

Project AEP - Amos Plant Well MW-1601

Town/City Winfield

County Putnam State Ohio

Permit No.

Land-Surface (LS) Elevation and Datum:

TOC 589.48 feet [X] Surveyed

[ ] Estimated

Installation Date(s) 5/10/2016

Drilling Method Hollow Stem Auger

Drilling Contractor AEP Service Corp.

Drilling Fluid Water ~300 gallon for drilling

~400 gallons for well installation (amount of return water not measured).

Development Technique(s) and Date(s)
Foot valve and surge block with centrifugal pump 5/18/16 and 6/13/16.

Fluid Loss During Drilling NM gallons

Water Removed During Development 44.6 (5/18/16) 44.1 (6/13/16) gallons

Static Depth to Water 14.60 feet below M.P.

Pumping Depth to Water 14.62 feet below M.P.

Pumping Duration 1 hr 10 min hours

Yield NM gpm Date NA

Specific Capacity NM gpm/ft

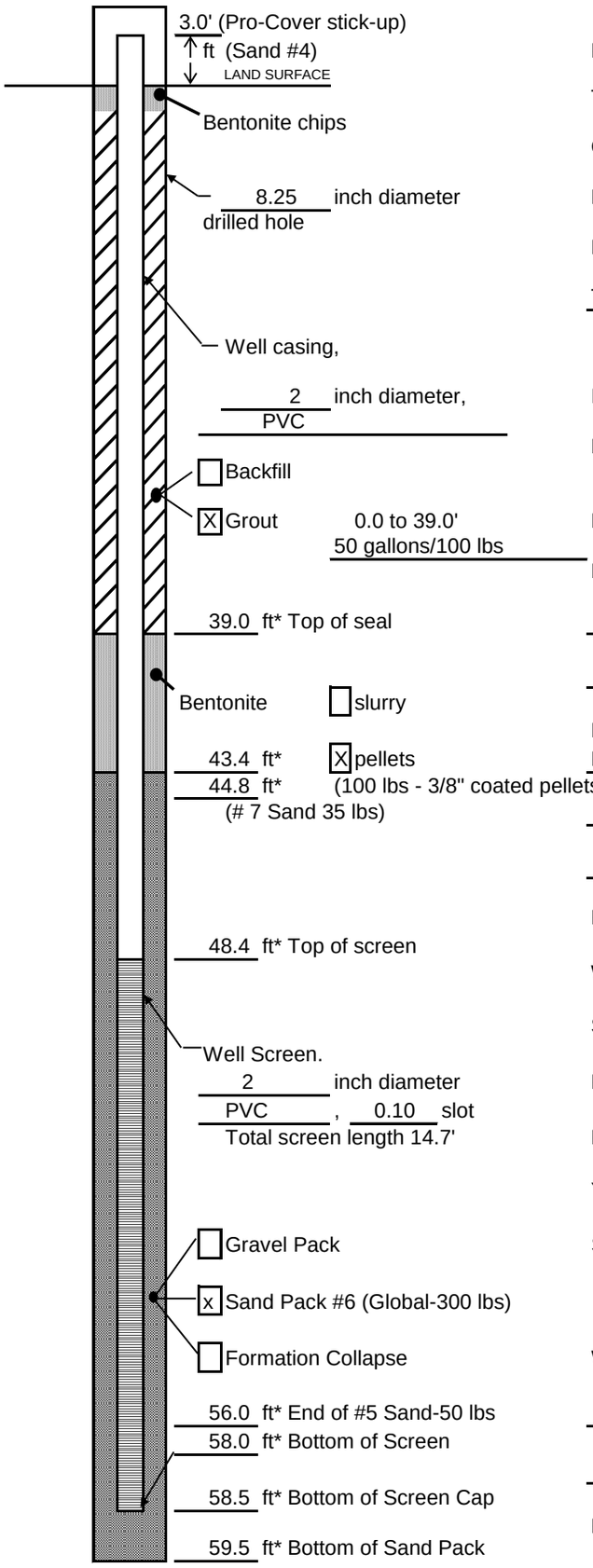
Well Purpose Monitoring well

Remarks Square aluminum stick-up casing. Used 100 # of quick grout about 45 gallons total for grout. Global sand used.

Prepared by Kari Eldridge

WELL CONSTRUCTION LOG
(Unconsolidated)

ARCADIS Design & Consultancy for natural and built assets



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.
* Depth Below Land Surface

Project AEP - Amos Plant Well MW-1602A

Town/City Winfield

County Putnam State Ohio

Permit No.

Land-Surface (LS) Elevation and Datum:

TOC 601.40 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/25/2016

Drilling Method Hollow Stem Auger

Drilling Contractor AEP Service Corp.

Drilling Fluid Water ~250 gallons used

Development Technique(s) and Date(s)
Foot valve and surge block with centrifugal pump 6/14/16.

Fluid Loss During Drilling NM gallons

Water Removed During Development 67.0 gallons

Static Depth to Water 24.56 feet below M.P.

Pumping Depth to Water 24.92 feet below M.P.

Pumping Duration 50 min hours

Yield NM gpm Date NA

Specific Capacity NM gpm/ft

Well Purpose Monitoring well

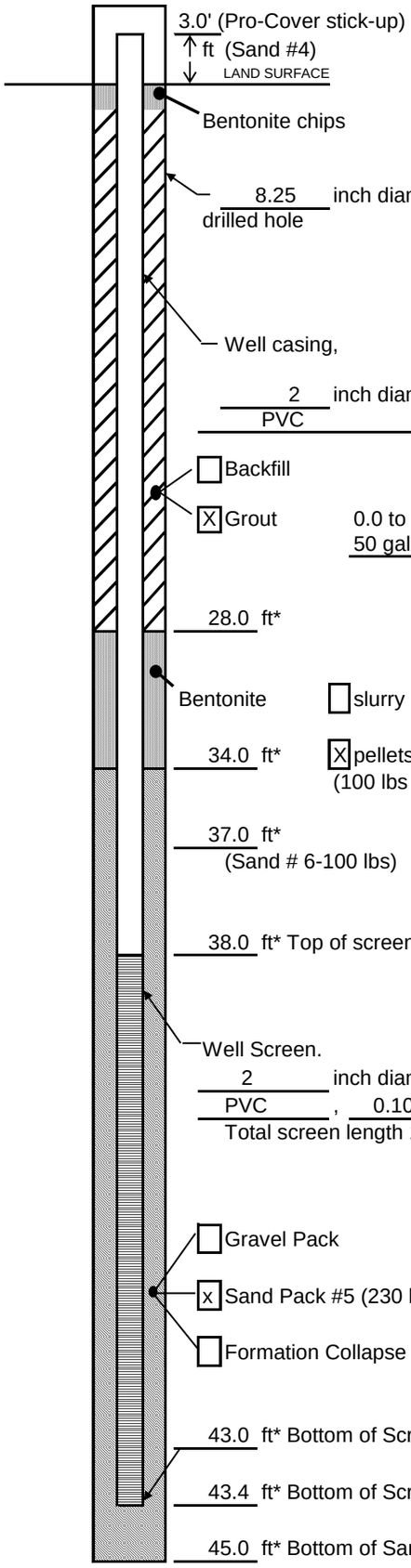
Remarks Square aluminum stick-up casing. 8x8' pad.

Sand #5 used from 56.0 to 59.5'

Sand #6 used fom 44.8 to 56.0'

Prepared by Taylor Runge

WELL CONSTRUCTION LOG
(Unconsolidated)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.
* Depth Below Land Surface

Project AEP - Amos Plant Well MW-1603A

Town/City Winfield

County Putnam State Ohio

Permit No.

Land-Surface (LS) Elevation and Datum:

TOC 586.86 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/24/2016

Drilling Method Hollow Stem Auger

Drilling Contractor AEP Service Corp.

Drilling Fluid Water ~300 gallons used

Development Technique(s) and Date(s)
Foot valve and surge block with centrifugal pump 6/14/16.

Fluid Loss During Drilling NM gallons

Water Removed During Development 60.9 gallons

Static Depth to Water 7.60 feet below M.P.

Pumping Depth to Water 9.75 feet below M.P.

Pumping Duration 40 min hours

Yield NM gpm Date NA

Specific Capacity NM gpm/ft

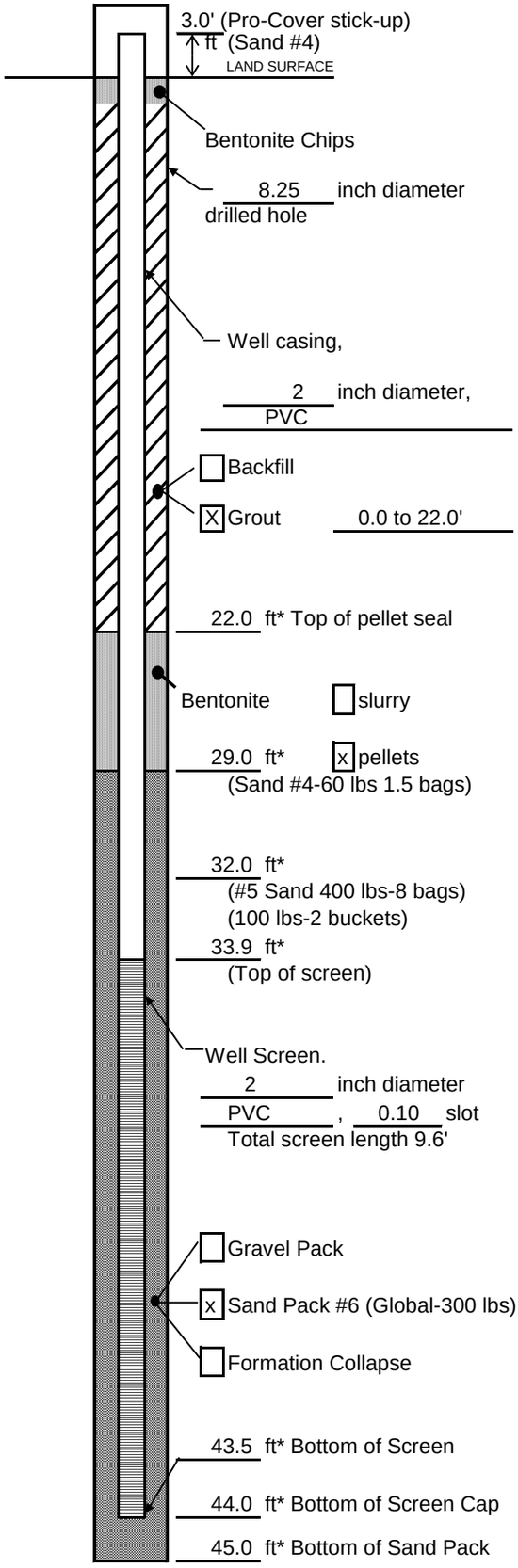
Well Purpose Monitoring well

Remarks Square aluminum stick-up casing. 8x8' pad.

Global sand used. 50 gallons/100 lbs of grout was used.

Prepared by Taylor Runge

WELL CONSTRUCTION LOG
(Unconsolidated)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.
* Depth Below Land Surface

Project AEP - Amos Plant Well MW-1604

Town/City Winfield

County Putnam State Ohio

Permit No.

Land-Surface (LS) Elevation and Datum:

TOC 589.05 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/6/2016

Drilling Method Hollow Stem Auger

Drilling Contractor AEP Service Corp.

Drilling Fluid Water ~500 gallons used

Development Technique(s) and Date(s)
Foot valve and surge block with centrifugal pump 5/18/16.

Fluid Loss During Drilling NM gallons

Water Removed During Development 51.7 gallons

Static Depth to Water 20.81 feet below M.P.

Pumping Depth to Water 21.78 feet below M.P.

Pumping Duration 1 hr 15 min hours

Yield NM gpm Date NA

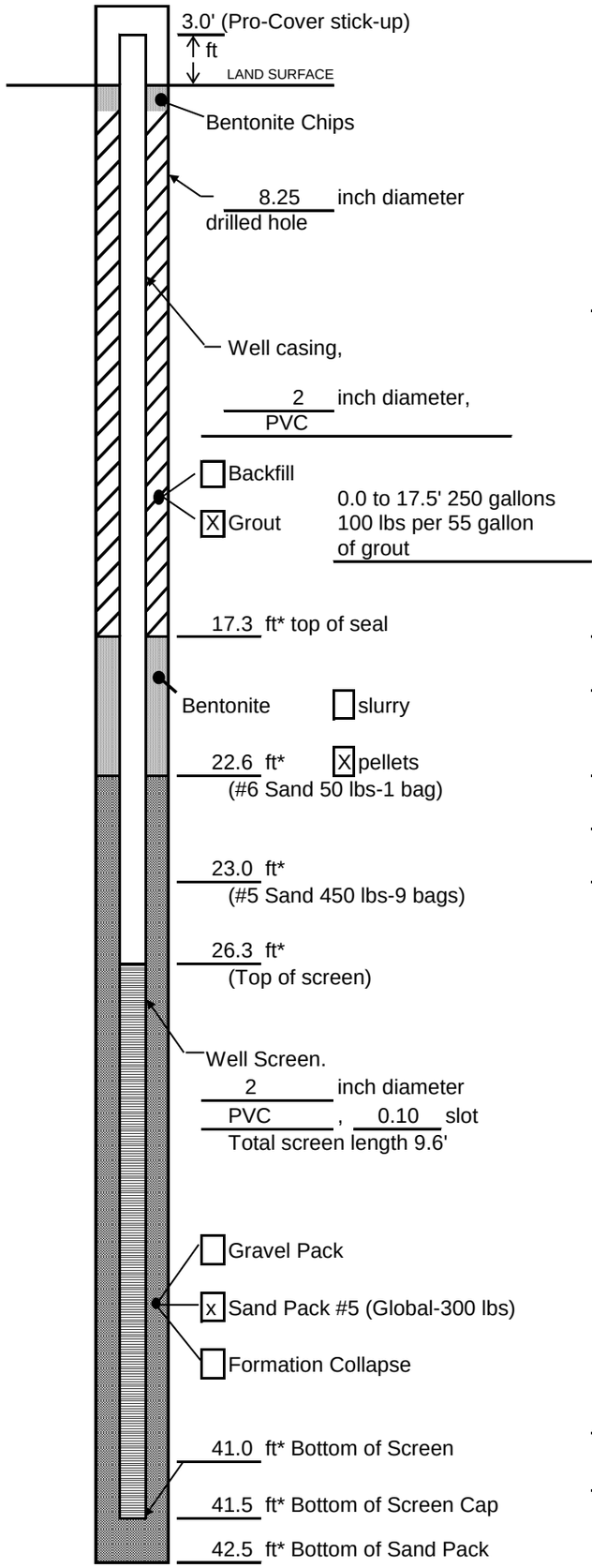
Specific Capacity NM gpm/ft

Well Purpose Monitoring well

Remarks Square aluminum stick-up casing. 8x8' pad.
Formation collapse (45.0 to 48.0') water pressure in
screened interval required #4 Sand to settle out
sandpack.

Prepared by Taylor Runge

WELL CONSTRUCTION LOG
(Unconsolidated)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.
* Depth Below Land Surface

Project AEP - Amos Plant Well MW-1605

Town/City Winfield

County Putnam State Ohio

Permit No.

Land-Surface (LS) Elevation and Datum:

TOC 586.40 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/4/2016

Drilling Method Hollow Stem Auger

Drilling Contractor AEP Service Corp.

Drilling Fluid Water ~500 gallons used

Development Technique(s) and Date(s)
Foot valve and surge block with centrifugal pump 5/17/16.

Fluid Loss During Drilling NM gallons

Water Removed During Development 43.03 gallons

Static Depth to Water 17.39 feet below M.P.

Pumping Depth to Water 33.89 feet below M.P.

Pumping Duration 1hr 15 min hours

Yield NM gpm Date NA

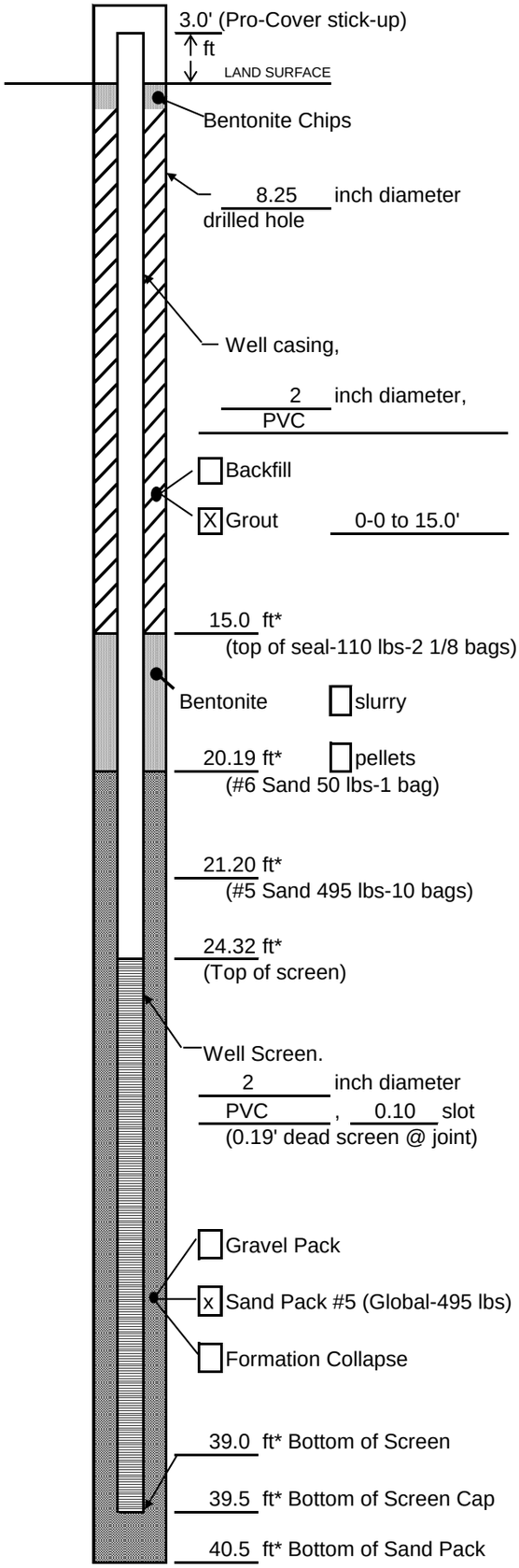
Specific Capacity NM gpm/ft

Well Purpose Monitoring well

Remarks Square aluminum stick-up casing. 8x8' pad.
Global sand used.

Prepared by Taylor Runge

WELL CONSTRUCTION LOG
(Unconsolidated)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.
* Depth Below Land Surface

Project AEP - Amos Plant Well MW-1606

Town/City Winfield

County Putnam State Ohio

Permit No.

Land-Surface (LS) Elevation and Datum:

TOC 583.88 feet [x] Surveyed

[ ] Estimated

Installation Date(s) 5/3/2016

Drilling Method Hollow Stem Auger

Drilling Contractor AEP Service Corp.

Drilling Fluid Water ~500 gallons/mud when needed (quick gel 50 lbs per 35 gallons) ~35 gallons used.

Development Technique(s) and Date(s)
Foot valve and surge block with centrifugal pump 5/17/16.

Fluid Loss During Drilling NM gallons

Water Removed During Development 68.14 gallons

Static Depth to Water 11.23 feet below M.P.

Pumping Depth to Water 11.78 feet below M.P.

Pumping Duration 1.5 hours

Yield NM gpm Date N/A

Specific Capacity NM gpm/ft

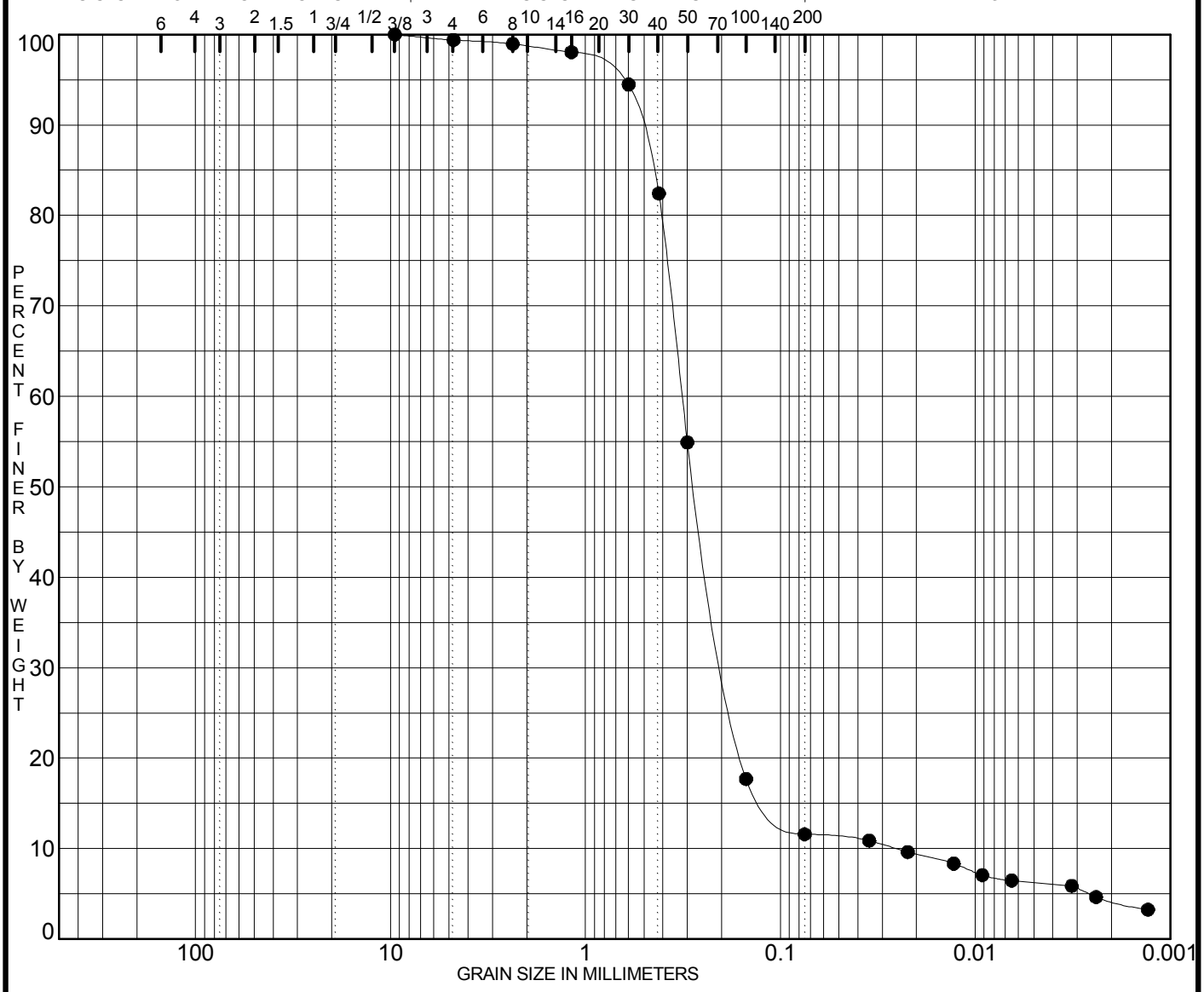
Well Purpose Monitoring well

Remarks Square aluminum stick-up casing. 8x8' pad.
Global sand used.

Prepared by Taylor Runge

APPENDIX B

Grain Size Analysis Lab Reports



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.
● **MW-1601 27-39**		**23.0**	**NP**	**NP**	**NP**	
	POORLY GRADED SAND with SILT SP-SM					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1601 27-39**	**9.500**	**0.319**	**0.189**	**0.025**	**0.6**	**87.8**	**5.3**	**6.3**

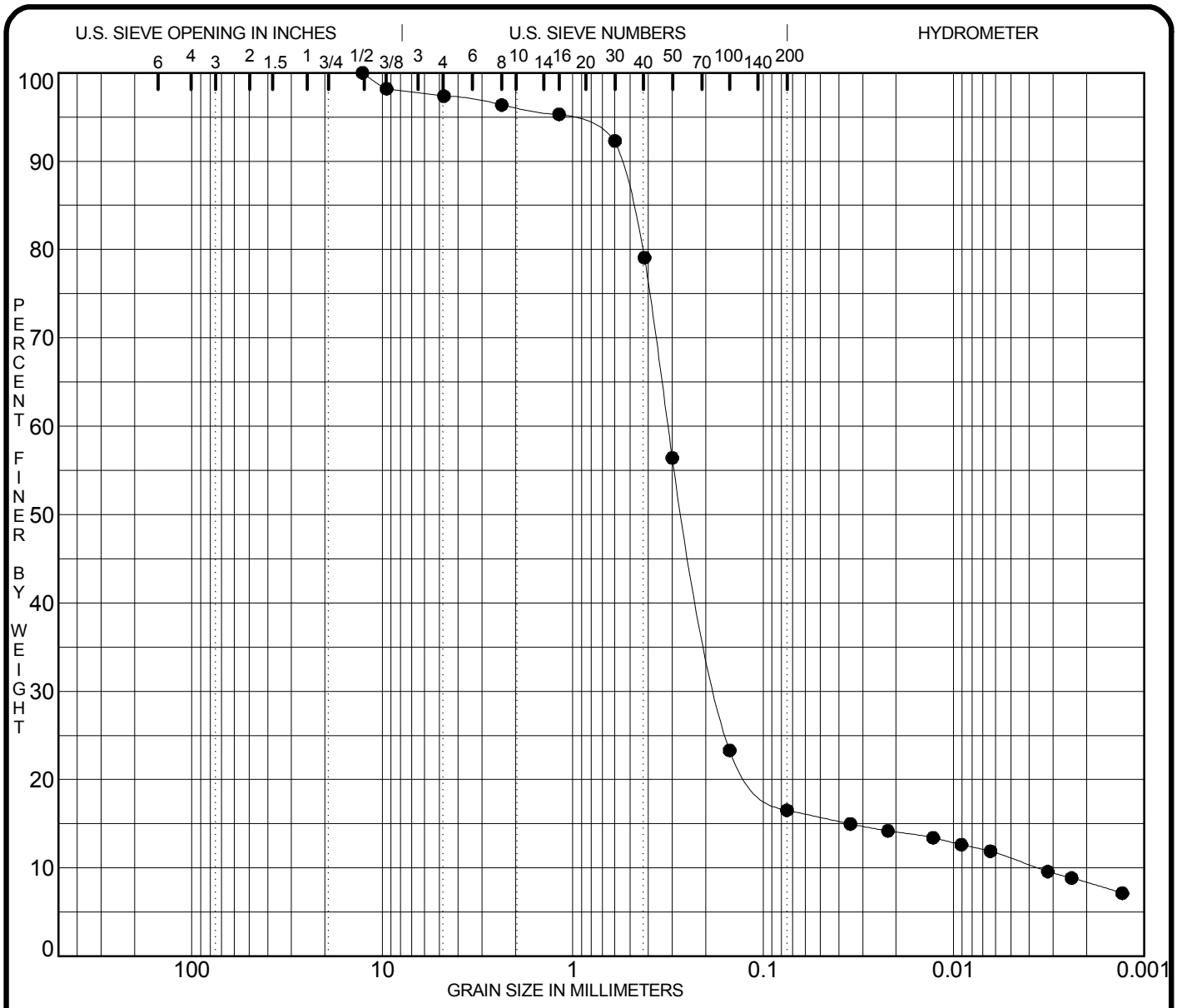
PROJECT **AM BAC CCR Compliance - Amos**

JOB NO.

DATE **7/15/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.
● **MW-1602a 48-58**		**21.9**	**NP**	**NP**	**NP**	
	SILTY SAND SM					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1602a 48-58**	**12.700**	**0.316**	**0.173**	**0.004**	**2.6**	**80.8**	**5.5**	**11.1**

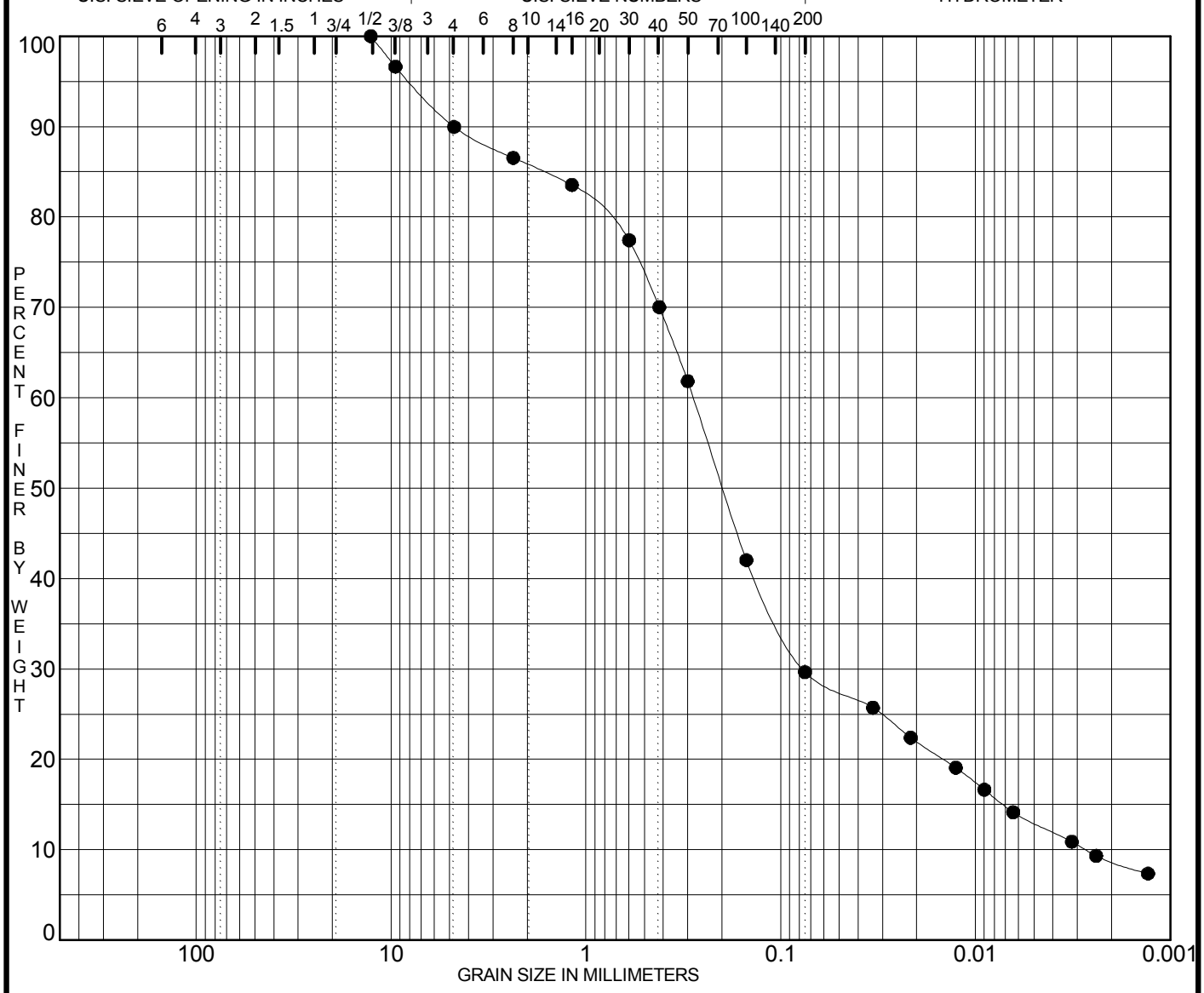
PROJECT **AM BAC CCR Compliance - Amos**

JOB NO.

DATE **7/15/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.
● **MW-1603 38.0-43.0**		**20.3**	**NP**	**NP**	**NP**	
	SILTY SAND SM					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1603 38.0-43.0**	**12.700**	**0.281**	**0.076**	**0.003**	**10.0**	**60.3**	**16.7**	**13.0**

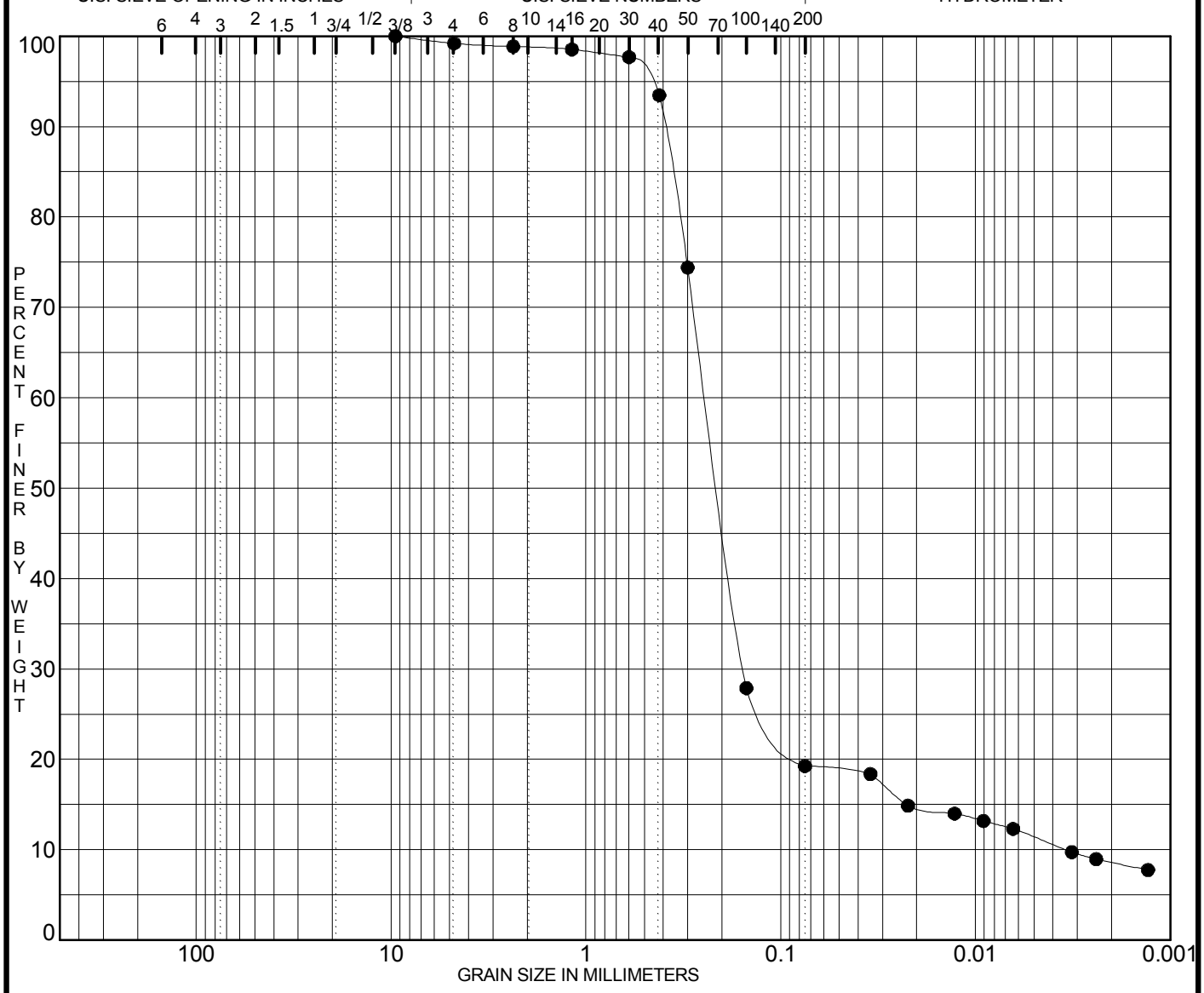
PROJECT **AM BAC CCR Compliance - Amos**

JOB NO.

DATE **7/15/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.
●	**MW-1604 33.0-43.5**		**23.8**	**NP**	**NP**	**NP**	
		SILTY SAND SM					
		ELEVATION					

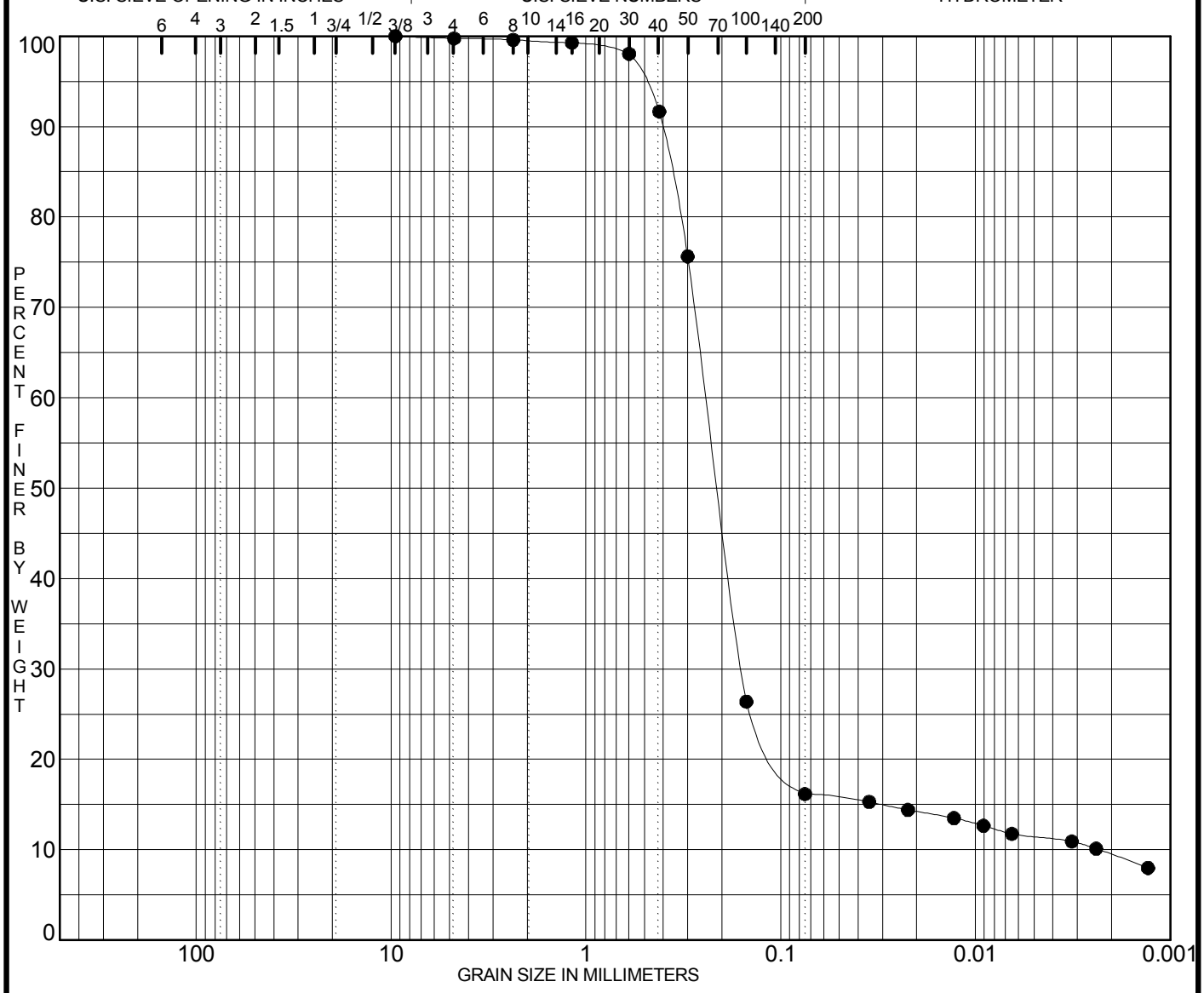
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
●	**MW-1604 33.0-43.5**	**9.500**	**0.242**	**0.155**	**0.003**	**0.8**	**80.0**	**7.9**	**11.4**

PROJECT **AM BAC CCR Compliance - Amos** JOB NO.

DATE **7/15/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.
● **MW-1605 25.5-42.0**		**25.5**	**NP**	**NP**	**NP**	
	SILTY SAND SM					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1605 25.5-42.0**	**9.500**	**0.241**	**0.158**	**0.002**	**0.2**	**83.6**	**4.7**	**11.4**

PROJECT **AM BAC CCR Compliance - Amos**

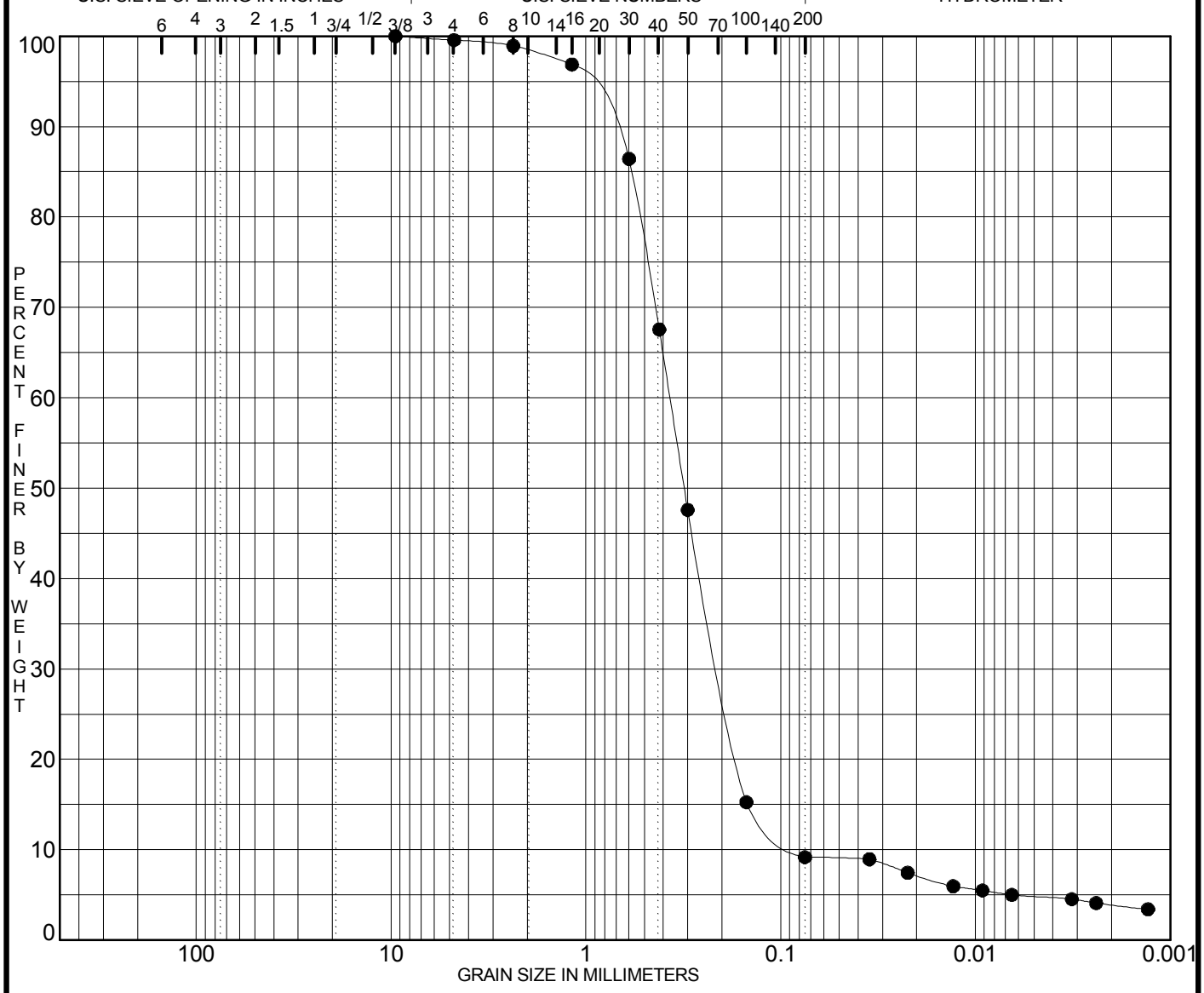
JOB NO.

DATE **7/15/16**

GRADATION CURVES

American Electric Power Service Corp.

AEP



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.
●	**MW-1606 29.0-39.0**		**23.4**	**NP**	**NP**	**NP**	
		POORLY GRADED SAND with SILT SP-SM					
		ELEVATION					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
●	**MW-1606 29.0-39.0**	**9.500**	**0.370**	**0.206**	**0.082**	**0.4**	**90.4**	**4.3**	**4.8**

PROJECT **AM BAC CCR Compliance - Amos**

JOB NO.

DATE **7/15/16**

GRADATION CURVES

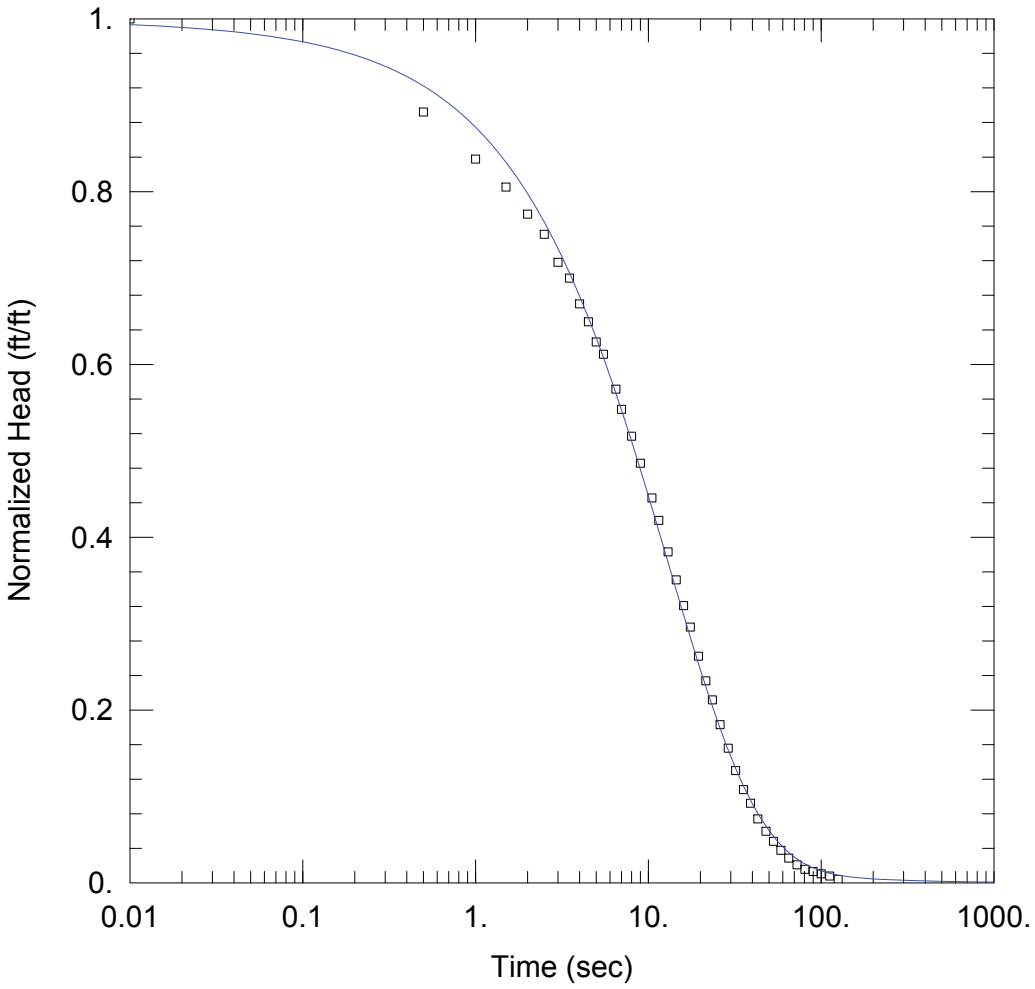
American Electric Power Service Corp.

APPENDIX C

Hydraulic Testing Reports

MW-1602A Rising Head Test 2

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0007	Amos, WV



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0044 cm/sec Ss = 7.5E-5 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 19. ft

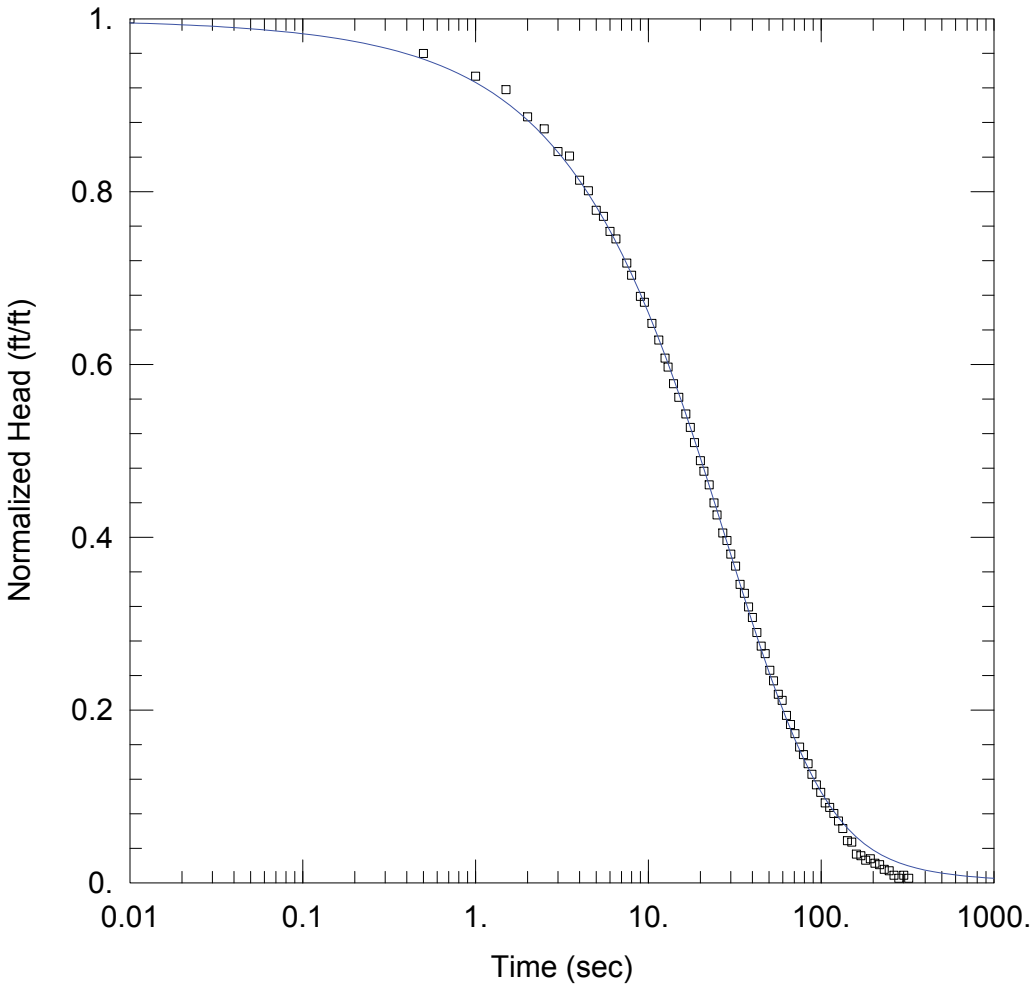
WELL DATA (MW-1602A Test 2)

Initial Displacement: 0.77 ft
Static Water Column Height: 40.95 ft
Total Well Penetration Depth: 40.95 ft
Screen Length: 10. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1603A Rising Head Test 2

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0007	Amos, WV



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0031 cm/sec Ss = 0.00022 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 5. ft

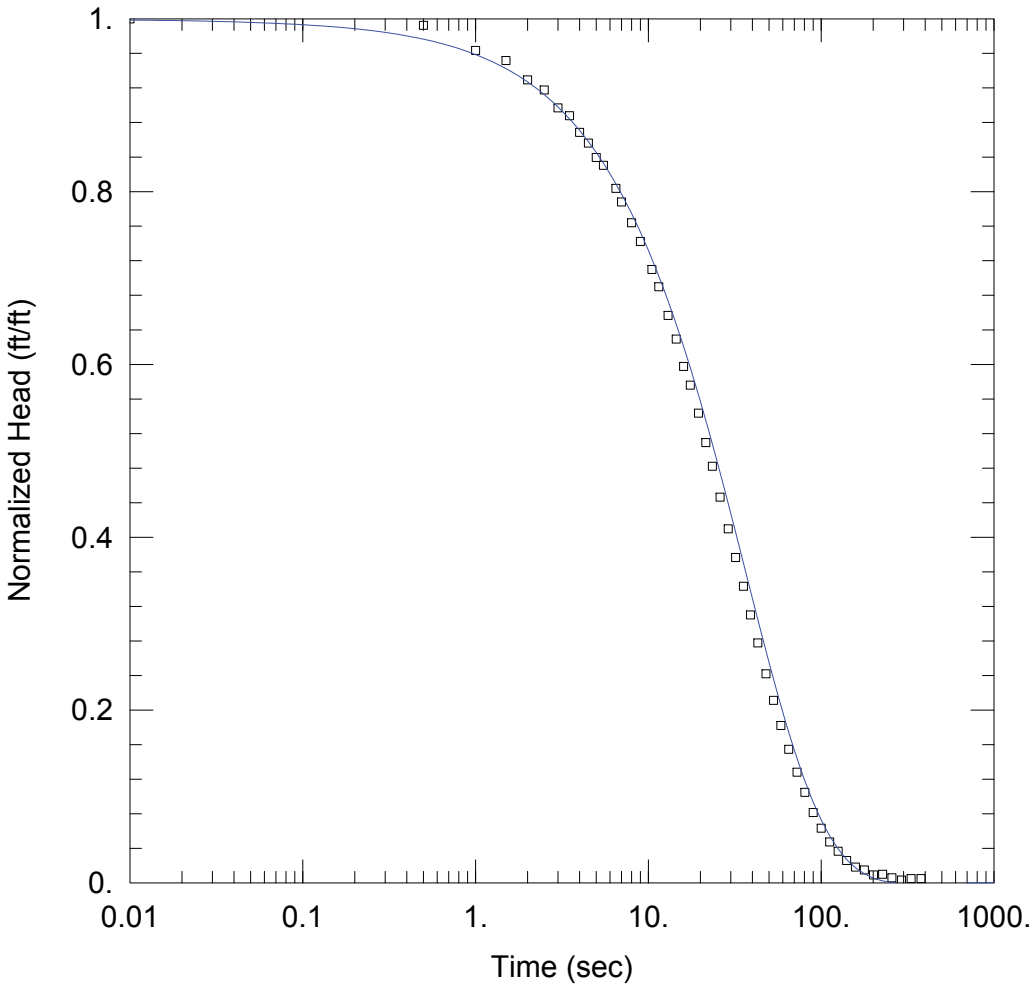
WELL DATA (MW-1603A Test 2)

Initial Displacement: 0.573 ft
Static Water Column Height: 39.04 ft
Total Well Penetration Depth: 39.04 ft
Screen Length: 5. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1604 Rising Head Test 3

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0007	Amos, WV



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.00096 cm/sec Ss = 2.4E-6 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 27.25 ft

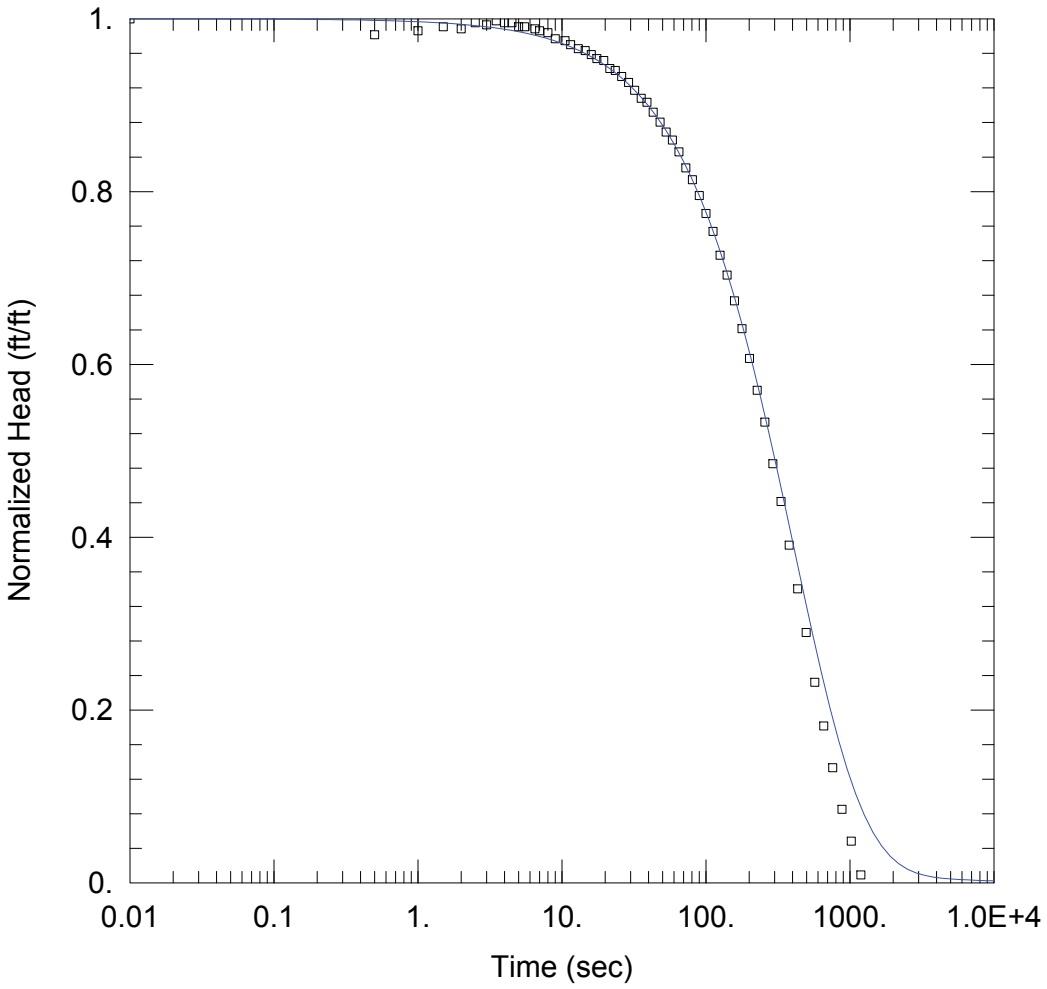
WELL DATA (MW-1604 Test 3)

Initial Displacement: 1.203 ft
Static Water Column Height: 25.95 ft
Total Well Penetration Depth: 25.95 ft
Screen Length: 10. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1605 Rising Head Test 1

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0007	Amos, WV



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.00026 cm/sec Ss = 3.8E-9 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 31. ft

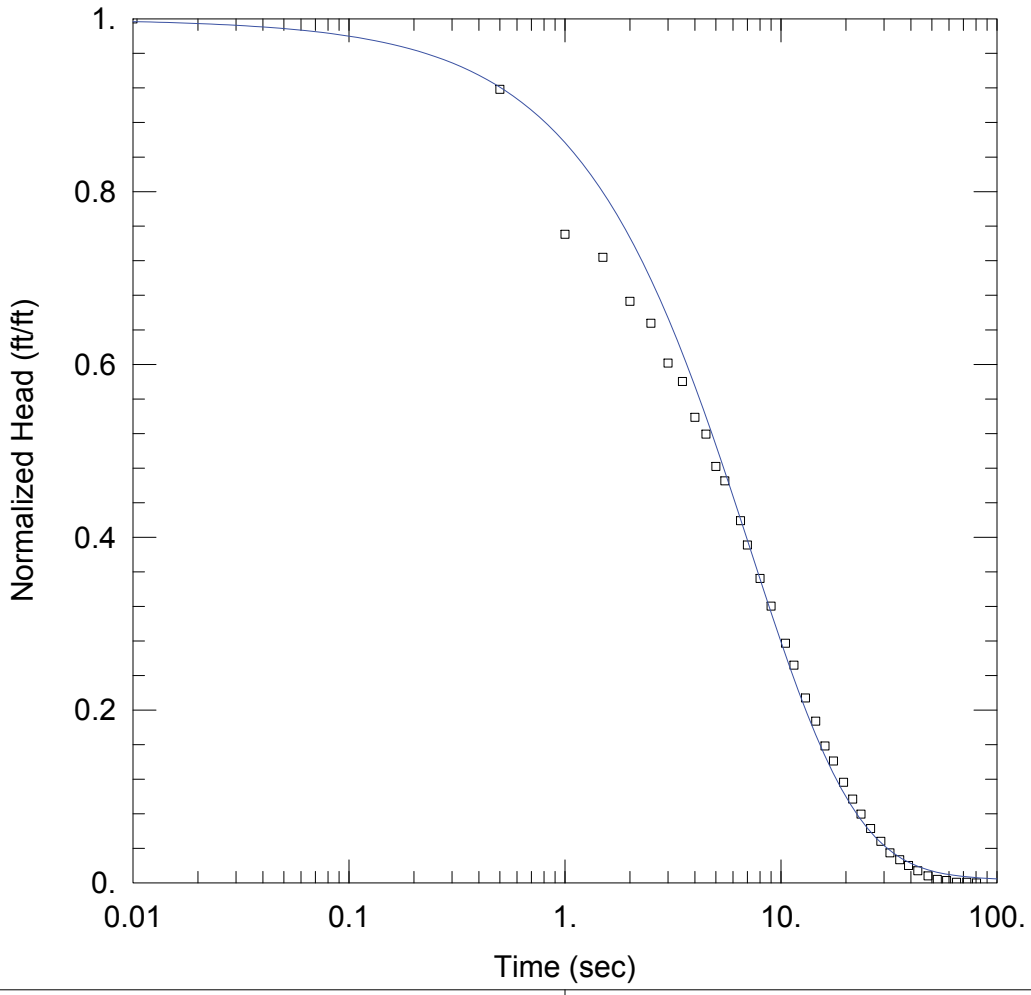
WELL DATA (MW-1605 Test 1)

Initial Displacement: 0.435 ft
Static Water Column Height: 27.3 ft
Total Well Penetration Depth: 27.3 ft
Screen Length: 15. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1606 Rising Head Test 1

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0007	Amos, WV



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0033 cm/sec Ss = 6.1E-7 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 39.7 ft

WELL DATA (MW-1606 Test 1)

Initial Displacement: 1.496 ft
Static Water Column Height: 32.39 ft
Total Well Penetration Depth: 32.39 ft
Screen Length: 15. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

APPENDIX D

Field Methodology and Geophysical Investigation

APPENDIX D

FIELD METHODOLOGY AND GEOPHYSICAL INVESTIGATION

Based on the recommended well network modifications, the following generalized tasks were completed:

- Installation and development of 6 new monitoring wells
- Installation of 6 confirmatory soil borings
- Redevelopment and repair of 8 existing monitoring wells
- Electrical resistivity survey of ash pond system

Field activities began with the electrical resistivity survey, performed by Arcadis from December 7 to December 11, 2016. Utility clearance activities were conducted from April 4 to April 6, 2016 in preparation for well installation. Arcadis provided oversight for the installation of 6 monitoring wells by an AEP drilling crew, which began on April 25, 2016 and ended on May 26, 2016. Well development activities began on May 17, 2016 and were completed on June 15, 2016. The following sections provide detail on methodology for each component of field activities.

Staking, Surveying, and Utilities Clearance

All proposed new monitoring well locations were staked by an AEP surveyor prior to drilling. AEP surveyed the spatial northing and easting coordinates as well as the ground surface elevation of each staked monitoring well location prior to drilling. The accuracy of elevation measurements was at least to the nearest 0.01 foot. An Arcadis representative contacted 8-1-1 to assess the presence of underground utilities near the new monitoring well and boring locations prior to drilling activities. AEP completed a plant dig permit, which identified private plant utilities near the new monitoring well and borings locations. Arcadis retained the services of a utility locating subcontractor to perform a geophysical survey (e.g. ground penetrating radar, electromagnetic survey, etc.) over an area of 25 feet by 25 to locate utilities at each new monitoring well location. An Arcadis representative will completed a visual inspection of the proposed well sites prior to drilling to assess the presence of any previously unidentified subsurface utilities. Prior to drilling, the new monitoring well locations were soft cleared using hand augering or air knife techniques to a diameter at least 10 percent larger than the largest diameter tooling to be used during drilling. Soft digging was completed to a minimum depth of 5 feet below ground surface (bgs).

Decontamination

All down-hole tools or equipment were decontaminated in accordance with ASTM D5088 prior to the start of drilling and between each borehole location. At a minimum, the tooling was washed with detergent solution followed by a potable water rinse within the decontamination pad. The use of a pressure washer was used when possible. A decontamination was constructed for decontamination of the down-hole tools. The decontamination pad was constructed at a location near the existing AEP Amos Plant ash ponds in a manner such that all decontamination water would flow to the existing ash pond system. Containerization was not required for decontamination water, if directed to the ash pond system. Water for decontamination or drilling was potable and obtained from the AEP Amos Plant.

Drilling – New Unconsolidated Monitoring Wells

Boreholes for unconsolidated monitoring wells were drilled using standard hollow-stem auger methods in accordance with ASTM D5784. Augers with a hollow-stem inside diameter of 4 and ¼ inches were used to drill and install the unconsolidated monitoring wells. Continuous spit-spoon sampling and standard penetration testing was performed in accordance with ASTM D1586 to the total boring depth. An Arcadis representative logged, classified, and recorded all samples in accordance with ASTM D5434 and D2488. No petroleum based lubricants or other VOC based liquids were used on down-hole tools.

Drilling – Confirmatory Soil Borings

Six boreholes to verify depth of ash were drilled using standard hollow-stem auger methods in accordance with ASTM D5784. Augers with a hollow-stem inside diameter of 4 and ¼ inches were used to drill and install the boreholes. Continuous spit-spoon sampling and standard penetration testing was performed in accordance with ASTM D1586 to the total boring depth. All borings were backfilled upon completion. Borings deeper than 20 feet were tremmie grouted using Benseal or equivalent bentonite grout. Borings less than 20 feet were backfilled with drill cuttings, provided drill cuttings did not show visual signs of potential impact. An Arcadis representative logged, classified, and recorded all samples in accordance with ASTM D5434 and D2488 using USCS classification. Soil boring logs are included in **Appendix A**. No petroleum based lubricants or other VOC based liquids will be used on down-hole tools.

Geologic Sample Analysis

An Arcadis representative retained selected split-spoon soil samples from the unconsolidated monitoring well locations for particle-size analysis by sieving and hydrometer in accordance with ASTM D421, D422, and D4718 and moisture content in accordance with ASTM D2216. Split spoon samples selected for particle-size analysis corresponded to the final screened interval for the given unconsolidated monitoring well. For each new monitoring well location, the selected split spoon samples from the screened interval were composited into a single 16-ounce glass sample container, which was appropriately labeled according to the monitoring well identification number. Samples were transported to the AEP Dolan Civil Engineering Laboratory in Groveport, Ohio for particle-size analysis.

New Monitoring Well Construction

All monitoring wells were constructed with 2-inch nominal diameter casing consisting of schedule 40 PVC pipe extending 3.0 feet above ground surface. All wells were constructed with 10-slot, schedule 40 PVC well screen. All monitoring wells used a primary filter pack consisting of a Global No. 5 to No. 7 brand or equivalent sand based on field observations. The filter pack was placed in the annular space between the borehole and the screened interval, extending from 1.0 feet below the bottom of the screen to 3.0 feet above the top of the screen. A secondary filter pack consisting of Global No. 6 or No. 7 brand sand or equivalent was placed in all wells. The secondary filter pack was placed in the annulus, extending from the top of the primary filter pack to 1.0 feet above the primary filter pack. Final placement of the primary and secondary filter packs were modified at some wells based on field conditions. Complete well construction details are provided in **Appendix A**. If backfilling of the borehole was necessary to set the monitoring well, the backfill consisted of bentonite pellets. A minimum of one foot of filter sand separated the bottom of the well screen and the backfill material.

A bentonite pellet seal was placed in the annulus immediately above the secondary filter pack in all monitoring wells. The bentonite pellet seal extended from the top of the secondary filter pack to at least 3.0 feet above the top of the secondary filter pack, which was below the water table. The bentonite pellet seal was allowed to hydrate for two hours prior to placing the overlying grout. A high-solids bentonite grout was placed using a tremmie pipe in the remaining annulus to near ground surface. The high-solids bentonite grout consisted of bentonite grout and water mixture with a minimum of 20 percent solids, mixed and placed in accordance with the manufacturer's written instructions (i.e. 66.75 lbs of grout to 40 gallons of water for Halliburton quick grout). Placement of bentonite grout was done in a controlled manner so as not to contaminate the well.

Lockable steel protective casings were installed over the PVC casings in accordance with ASTM D5787. The protective casing was at least 2 inches in diameter greater than the PVC casing above grade and was centered in a concrete pad measuring 4 feet by 4 feet and 6-inches thick. The steel outer casing was 3-inches in diameter greater than the well casing (5-inches) and extended 4 feet below the ground surface and at least 2 feet above the ground surface. There were no signs of grout or concrete on the steel protective casing. The concrete pad was constructed so that there is slope away from the protective casing. Two weep holes were drilled on opposite sides at the base of the protective cap. The annular space between the PVC casing above grade and the steel protective casing was filled with washed pea gravel up to 4 inches below the top of the PVC casing. A watertight locking well cap was placed at the top of the PVC casing. A minimum of four concrete-filled barrier posts/bollards were installed around monitoring wells located in high-traffic areas to protect the monitoring wells from damage. The barrier posts were installed either at each corner of the pad or the midpoint of each side of the pad. The barrier posts were painted a high-visibility yellow color. An Arcadis representative produced a typed log of geologic materials encountered and of borehole and monitoring well construction details. A log was also filed with the West Virginia Department of Environmental Protection (WVDEP) in accordance with their recordkeeping requirements.

Monitoring Well Development

Well development was completed at all newly-installed wells, as well as existing wells to be retained in the monitoring well network. At existing wells, the well screens and casings were brushed using a tight fitting brush to dislodge encrusted materials prior to beginning the surge and pump cycles described below. The well was then purged with a pump or by air-lifting to remove dislodged material from the well. Well development at new wells was performed a minimum of 48 hours after the completion of well construction. The static water level was measured in the well prior to initiation of development. All wells were developed through a pump and surge method in accordance with West Virginia Department of Environmental Protection Title 47 Series 60 Monitoring Well Design Standards dated June 21, 2011. The well was initially purged with a pump to remove loose material and fines from the well. A surge cycle was then be performed across the screen using a surge block. A second pumping cycle shall be performed until the discharge water has good visual clarity, followed by second surge cycle with the double disk surge block.

A final pumping cycle was performed to the following criteria: 1) a minimum of 10 casing volumes were purged from the well, and 2) field water quality parameters including temperature, pH, conductivity, oxidation-reduction potential, and turbidity were stable within applicable criteria (temperature stabilizes

within ±0.50C, pH stabilizes within ±0.2 units, conductivity stabilizes within ±3 percent, and turbidity is less than 10 nephelometric turbidity units). Well development logs are included as an attachment to **Appendix D**.

Monitoring Well Restoration

Surface completions (e.g. concrete pads, steel protective casings) of existing wells that were to be retained in the monitoring well network were inspected by Arcadis personnel. If the surface completions were not in good condition as described above in the Monitoring Well Construction section, then actions were taken to improve the deficiencies and to be consistent with new monitor well construction.

FIELD METHODOLOGY – ELECTRICAL RESISTIVITY SURVEY

Electrical Resistivity Method

The electrical resistivity method consists of injecting electrical current into the subsurface and simultaneously measuring the potential difference along the subsurface within the vicinity of where the current is being injected using a series of electrodes at the ground surface - generally two current electrodes and two potential electrodes in various arrangements and separations called arrays. The injected current and measured potential values are quantified and recorded by the instrument. From these data the electrical resistance (in Ohms) is calculated using Ohm's Law (R = V/I). The apparent electrical resistivity (in Ohm-meters) is calculated from the resistance using volumetric geometrical scale factors related to the electrode arrangement (array). These geometric factors are what distinguish the various array types. The horizontal and vertical sensitivities, as well as the penetration ability vary between array types, and the array type choice is dependent on the project objectives. For this project, a dipole-dipole array was selected as a suitable option. This array type offers rapid data acquisition, a data-dense profile, good subsurface penetration, high data collection efficiency, and good sensitivity to both lateral and vertical variations in electrical resistivity.

Electrical resistivity is an intrinsic property of materials that varies widely in the subsurface and is often correlative with lithology and geochemistry. For soils and rock, resistivity is a function of porosity, ionic content of the pore fluids (usually groundwater), and electrically conductive/reactive minerals such as pyrite and some clay minerals. By measuring the distribution of resistivity values in the subsurface, the presence and structure of geologic features can be inferred.

Once the electrical resistivity data set was collected, the data is downloaded to a computer for processing. Since the true resistivity structure of the earth is the desired outcome, the apparent resistivity data were inverse-modeled using the software Earth Imager v 2.42 to obtain true resistivity[1] cross-sections of the subsurface.

[1] The terms apparent versus true resistivity refers to whether the value is essentially a vertical average of the measured quantity, represented as an apparently equivalent uniform value, or whether the values are a portrayal of the actual resistivity or conductivity of the earth materials.

Data Acquisition Procedures

For the 2-dimensional (2D) ER survey conducted at the AEP Amos Plant, five ER transect lines ranging from 291 meters (approximately 950 ft.) to 333 meters (1,100 feet) long were installed to assess the ash pond system area (**Figure D-1**). The lines were identified as Line ER-1, Line ER-2, Line ER-3, Line ER-4, and Line ER-5. For each survey line, up to 112 non-corrosive stainless-steel electrode stakes were used, which were separated by a distance of three meters (approximately 6.6 feet), and inserted into surface soils with an approximate constant spacing along a relatively straight transect. The electrode stakes penetrated the subsurface from approximately 4 to 6 inches bgs to make electrical contact with the soil. The electrode stakes were connected to a specially designed cable that allowed contact with various combinations of electrodes from the meter controlling the data collection process. During the survey, current was injected into the subsurface through two of the electrodes and the potential difference (voltage) created by the flow of current was measured between one or more pairs of voltage electrodes along the survey transect. The pairs of electrodes were arranged in an approximately straight transect, although obstructions and topographic differences prevented perfectly straight transects. The spacing between the electrodes and the geometry of the current electrodes to the voltage electrodes are referred to as an “array type.”

Various array types have advantages and disadvantages depending on the site setting and the objective(s). For this project the dipole-dipole array was used, which generally produces high resolution for both lateral and vertical heterogeneities but may have a limited depth penetration and is susceptible to electrical noise from metallic structures such as pipes.

“Apparent resistivity” is reported in units of ohm-meters and is defined as the bulk, average resistivity of all subsurface materials influencing the current, not the true resistivity of a material at a specific depth, and once the apparent resistivity data set is acquired, the data must be processed using an inversion modelling program to resolve an estimate of the true resistivity distribution of the subsurface.

ER equipment used during this investigation consisted of an Advanced Geosciences, Inc. (AGI) (Austin, Texas), SuperSting™ R8/IP earth resistivity system with a 56 electrode switch box, electrode cables with 3-meter connector spacing, and stainless-steel electrodes. Resistivity data were stored in the internal memory of the SuperSting™ R8/IP and downloaded to a laptop computer. Field data files were assigned a name that included transect name and array type. After each survey was complete, the downloaded data were processed (i.e., inverted) in the field using AGI’s proprietary EarthImager 2D software (Lagmanson and Yang 2002) to evaluate data quality and provide preliminary images to guide subsequent transect alignments.

Data Position Control

The locations of the EMI and resistivity data points were controlled using a Hemisphere A325 mapping grade GPS receiver, equipped with real-time differential correction (i.e., OmniSTAR). The accuracy of this GPS receiver is one meter or less under typical conditions.

Data Processing and Presentation

Once the data are acquired, they are transferred to a computer and processed to create modelled cross-sections that are prepared for geologic interpretation by an experience geophysicist. The 2D ER data were

processed using the program EarthImager™ 2D v2.4.2. Build 627 software program by AGI (Lagmanson and Yang 2002). Prior to data modelling, a number of pre-processing steps were completed, including removal of data with voltage spikes, poor voltage decay, and low data quality readings in the raw field data.

Resistivity data were processed using a damped least-squares or smooth model inversion method using a finite element mesh to generate a 2D model of resistivity versus depth. The primary objective of inversion is to reduce data misfits between field measurements and calculated data of a reconstructed model.

Data from resistivity lines ER-1, ER-2, ER-4, and ER-5 are depicted graphically as cross-sectional images with annotations of the interpreted geologic conditions (**Figures D-2** through **D-5**). Note that output from Line ER-3 was omitted from this report due to poor data quality. The cross-sections were made using the inverted ERI model resistivity data output from the EarthImager™ modeling program; they were gridded and contoured using Golden Software Surfer® 12 software. The descriptive geologic information from previous borings and Spring 2016 confirmation borings (SB-1601 through SB-1605, MW-1604, MW-1606) were superimposed on the cross-sections and interpretations made of the aquifer boundaries and other geologic information.

Sources of ER Data Interference

Some of the ERI datasets contained interference potentially caused by a combination of such factors as: 1) poor electrical contact between electrode and soil; 2) high contact resistance; 3) the presence of conductive subsurface infrastructure including metallic piping; and, 4) stray electrical currents and spontaneous potentials in the subsurface. Data artifacts attributed to interference caused by buried metal piping are shown in **Figure D-3** and **Figure D-5,** with the approximate extent of the affected data marked in gray fill.

ER RESULTS AND GEOLOGIC INTERPRETATIONS

Typically, lithologies can be distinguished by their ranges of electrical resistivity values. In freshwater environments, native sand and gravel are usually the most resistive material, and silt and clay are the least resistive materials. Non-native fill materials, such as those observed at the site, can also display a range of electrical resistivity values with coarser sand/gravel fill materials typically displaying higher resistivity values compared to finer-grained clayey fill materials that typically display lower resistivity values. Fly ash fill materials in particular are generally observed to have an elevated electrical conductivity in comparison to most native soils due to the fine grained nature of the fly ash (large amount of surface area) and the leachable materials such as iron and aluminum oxides and other elements such as Ca, K, Mg, Mn, Na, Sr, Ti, and S that are in large enough concentration to potentially increase total dissolved solids (TDS) levels and electrical conductivity if dissolved. Groundwater quality can also be assessed using electrical resistivity, with impacts associated with fly ash being significantly more electrically conductive (less resistive) than ambient groundwater conditions.

The electrical resistivity cross-section provides the foundation for the geoelectrical structure of the subsurface at the site, with the presumption that the bulk soil response approximates variations in lithologic materials and groundwater conductivity (see table below).

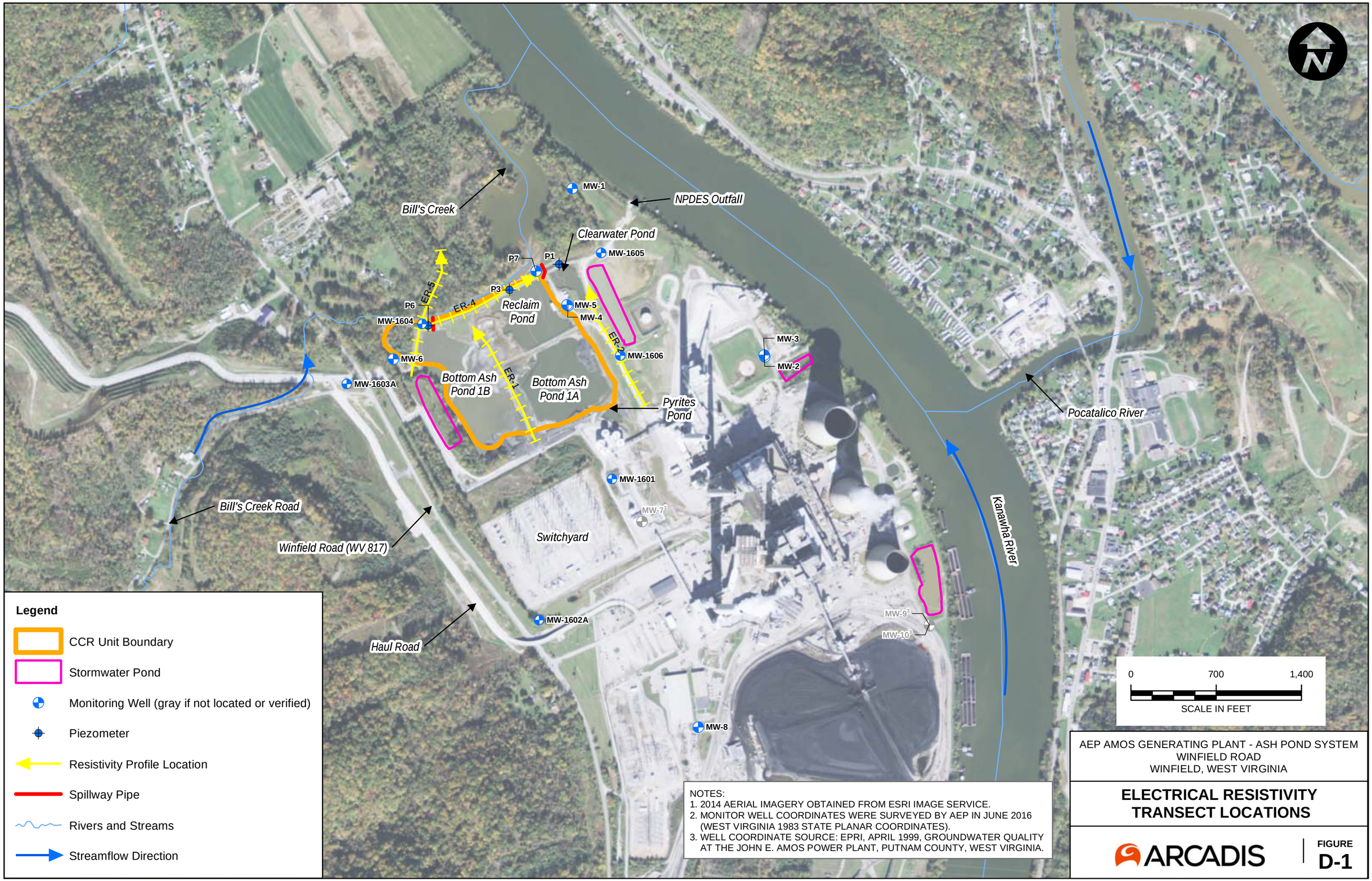
Material Types	Electrical Resistivity Cross-section (Ohm-meters)
Competent sandstone bedrock (background)	>800
Unconsolidated native sand/gravel soils, sand/gravel fill materials, (background)	100 to 800
Fly ash fill materials, clayey fill materials, unconsolidated native clay soils, shale bedrock (background)	10 to 100
Soil containing increasing total dissolved solids (anomalous)	<5.0

The calculated apparent resistivity values ranged over four orders of magnitude at the site from approximately 1 Ohm-meters to greater than 1000 Ohm-meters. Background resistivity values for sandstone bedrock observed in Line ER-5 data (**Figure D-5**) are greater than Ohm-meters (red to purple color range) which is consistent for competent sedimentary bedrock. Unconsolidated native sand/gravel soils or sandy fill materials fall in the range of about 100 to 800 Ohm-meters (green to red color range), which is consistent with fill materials and native soils with varying sand, silt, and gravel content. Unconsolidated native clay soils, clay fill materials, or fine-grained fly ash fill deposits fall in the range of about 10 to 100 Ohm-meters (blue to green color range). As depicted in **Figure D-2** and **Figure D-5,** anomalous zones of significantly low anomalous resistivity less than 10 ohm-meters are shown (dark blue to white color range). These zones of anomalous low resistivity are not likely due to naturally occurring soils/geologic conditions, but are rather due to man-made external influences, such as the presence of geochemically impacted groundwater or metallic features (site structures or subsurface utility lines). Based on the presence of fly ash deposits above the significantly low resistivity zones observed in **Figure D-2** and **Figure D-5**, these zones are interpreted to indicate saturated soils impacted by high TDS groundwater. Furthermore, the coarser-grained sand (SA) and sandy gravel (SG) soils observed at boring SB-1602 and SB-1603 (**Figure D-2**) and boring SB-1604 (**Figure D-5**) that lie at depths intersecting the interpreted high TDS zones, suggest a likely preferential pathway for groundwater flow. As noted in **Figure D-5**, the origin of coarser-grained material shown at SB-1604 is likely channel fill based on the depiction of a historic stream channel shown in 1909, 1931, and 1958 site topographic maps.

The geologic framework at the site has been previously reported to be an unconsolidated aquifer consisting of saturated alluvial sediments beneath and surrounding the site. The upper limit of the uppermost aquifer is defined by the elevation of the sand saturated zone, which ranges from approximately 550 to 560 ft. Using both boring log observations and resistivity values, the interpreted upper and lower extent of sand

saturated zone is delineated by black dashed lines as shown in **Figures D-2** through **D-5**. An interpreted groundwater surface is also shown as a blue dashed line in **Figures D-2** through **D-5.**

It should be noted that known fly ash deposits at the site, confirmed by Spring 2016 soil borings, exhibit resistivity values that fall in same range as native soils and therefore the sole use of resistivity values displayed in the cross-section cannot be used to distinguish ash deposits from native soils.



Legend

- CCR Unit Boundary
- Stormwater Pond
- Monitoring Well (gray if not located or verified)
- Piezometer
- Resistivity Profile Location
- Spillway Pipe
- Rivers and Streams
- Streamflow Direction

NOTES:
1. 2014 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE.
2. MONITOR WELL COORDINATES WERE SURVEYED BY AEP IN JUNE 2016 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES).
3. WELL COORDINATE SOURCE: EPRI, APRIL 1999, GROUNDWATER QUALITY AT THE JOHN E. AMOS POWER PLANT, PUTNAM COUNTY, WEST VIRGINIA.

AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

ELECTRICAL RESISTIVITY TRANSECT LOCATIONS

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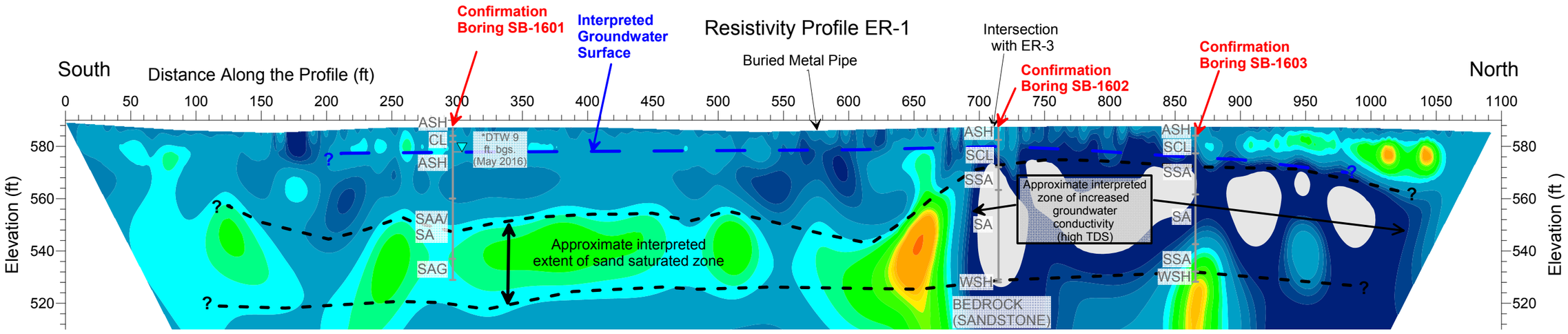
FIGURE
D-1

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
Z:\GISPROJECTS_ENVVAEPVAmos\mxd\Ash Pond Report\D1_ Amos Ash Pond Well Network-Ash Pond Layout and Well Location Map_ResistivityTransects.mxd 9/2/2016 8:19:32 AM



Horizontal Scale: 1" = 80'
Vertical Scale: 1" = 40'

Vertical Exaggeration = 2x

LITHOLOGY

CL - Clay
SCL - Sandy Clay
SSA - Silty Sand
SA - Sand
SAG - Sandy Gravel
GR - Gravel
WSS - Weathered Sandstone
WSH - Weathered Shale

Possible Controlling Variables

Increasing Moisture Content
Decreasing Grain Size
Increasing Total Dissolved Solids

0 5 10 20 35 60 80 100 150 200 220 240 260 280 450 500 650 800 1000 1500 2000 2500

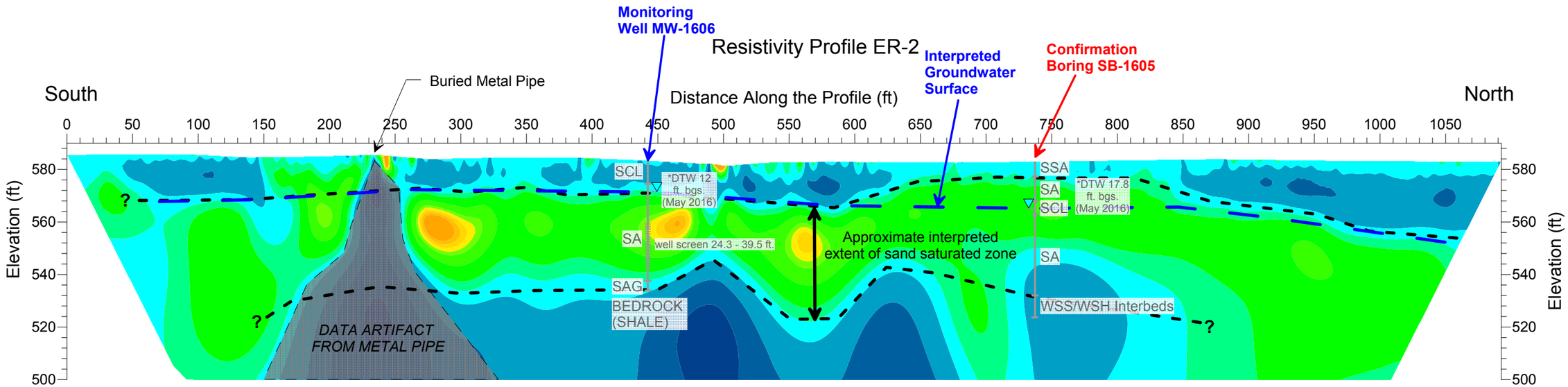
Resistivity (Ohm-meters)

ARCADIS Design & Consultancy for natural and built assets

Line ER-1 2D Electrical Resistivity Modeling Results

AEP AMOS Generating Plant - Ash Pond Complex
Winfield Road
Winfield, West Virginia

FIGURE D-2



Horizontal Scale: 1" = 80'
Vertical Scale: 1" = 40'

Vertical Exaggeration = 2x

LITHOLOGY

CL - Clay
SCL - Sandy Clay
SSA - Silty Sand
SA - Sand
SAG - Sandy Gravel
GR - Gravel
WSS - Weathered Sandstone
WSH - Weathered Shale

Possible Controlling Variables

Increasing Moisture Content
Decreasing Grain Size
Increasing Total Dissolved Solids

0 5 10 20 35 60 80 100 150 200 220 240 260 280 450 500 650 800 1000 1500 2000 2500

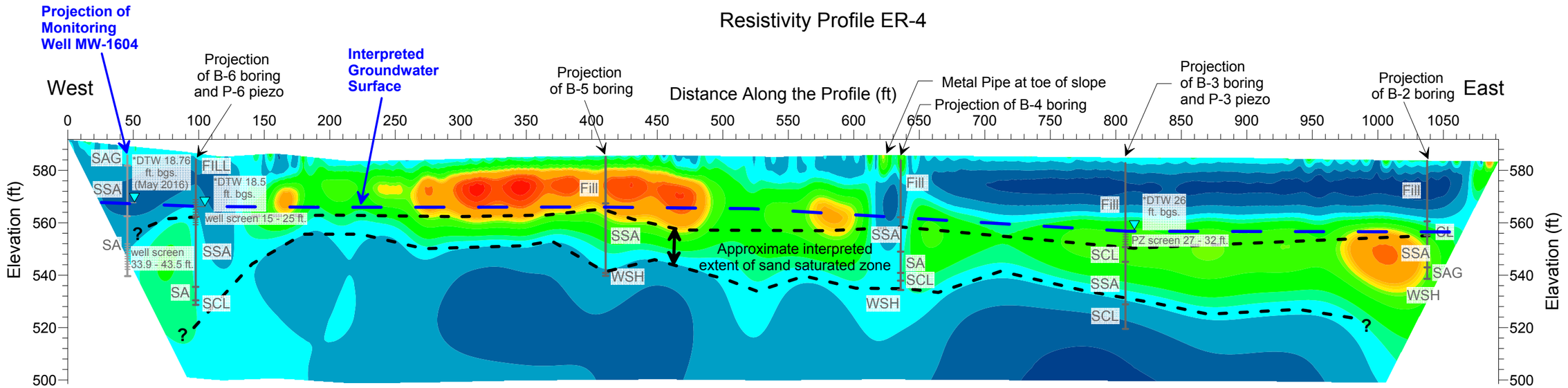
Resistivity (Ohm-meters)

ARCADIS Design & Consultancy for natural and built assets

Line ER-2 2D Electrical Resistivity Modeling Results

AEP AMOS Generating Plant - Ash Pond Complex
Winfield Road
Winfield, West Virginia

FIGURE D-3



Horizontal Scale: 1" = 80'
Vertical Scale: 1" = 40'

Vertical Exaggeration = 2x

LITHOLOGY

CL - Clay	SAG - Sandy Gravel
SCL - Sandy Clay	GR - Gravel
SSA - Silty Sand	WSS - Weathered Sandstone
SA - Sand	WSH - Weathered Shale

Possible Controlling Variables

Increasing Moisture Content
Decreasing Grain Size
Increasing Total Dissolved Solids

0 5 10 20 35 60 80 100 150 200 220 240 260 280 450 500 650 800 1000 1500 2000 2500

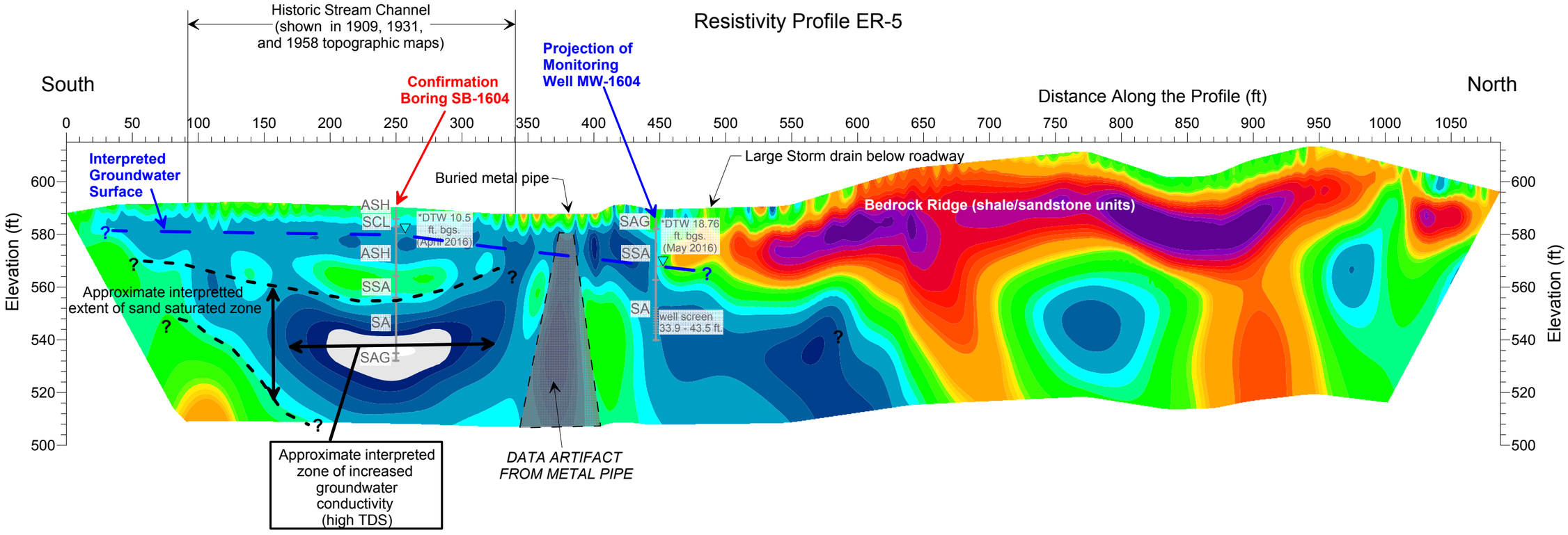
Resistivity (Ohm-meters)

ARCADIS Design & Consultancy for natural and built assets

Line ER-4 2D Electrical Resistivity Modeling Results

AEP AMOS Generating Plant - Ash Pond Complex
Winfield Road
Winfield, West Virginia

FIGURE D-4



Horizontal Scale: 1" = 80'
Vertical Scale: 1" = 40'

Vertical Exaggeration = 2x

LITHOLOGY

CL - Clay
SCL - Sandy Clay
SSA - Silty Sand
SA - Sand
SAG - Sandy Gravel
GR - Gravel
WSS - Weathered Sandstone
WSH - Weathered Shale

Possible Controlling Variables

Increasing Moisture Content
Decreasing Grain Size
Increasing Total Dissolved Solids

0 5 10 20 35 60 80 100 150 200 220 240 260 280 450 500 650 800 1000 1500 2000 2500

Resistivity (Ohm-meters)

ARCADIS Design & Consultancy for natural and built assets

Line ER-5 2D Electrical Resistivity Modeling Results

AEP AMOS Generating Plant - Ash Pond Complex
Winfield Road
Winfield, West Virginia

FIGURE D-5

ARCADIS

Well Development Logs

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Date

Weather Development Time Begin 6/15/16 09:20 AM End 6/15/16 10:05 AM

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	
MP Elevation (ft)	N/A	Pumping Rate (gpm)	190
Land Surface Elevation (ft)		Evacuation Method	Submersible Proactive Pump
Sounded Well Depth (ft bmp)	36.35	Volumes Purged	
Depth to Water (ft bmp)	17.21		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	19.14	Color	Clear
Casing Diameter/Type	2	Odor	None
Gallons in Well	3.06	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
9:20	0:00	29.00	17.53	190	0.464	20.40	18.64	4.91	217	8.77	Initial		Clear; no odor
9:25	0:05	29.10	17.60	190	0.507	19.90	15.48	5.00	228	5.38	1st		Clear; no odor
9:30	0:10	29.20	17.60	180	0.506	7.60	15.39	4.92	238	4.20	2nd		Clear; no odor
9:35	0:15	29.30	17.60	180	0.500	4.30	15.33	4.90	245	3.60	3rd		Clear; no odor
9:40	0:20	29.40	17.60	180	0.496	3.90	15.44	4.97	244	3.30	4th		Clear; no odor
9:50	0:30	29.50	17.60	180	0.487	1.80	15.79	5.01	249	2.50	5th		Clear; no odor
9:55	0:35	29.60	17.54	180	0.476	2.30	15.62	5.04	254	2.30	6th		Clear; no odor
10:00	0:40	29.70	17.40	180	0.470	1.40	15.70	5.07	260	2.22	7th		Clear; no odor
10:05	0:45	29.80	17.33	180	0.466	1.90	15.74	5.05	213	2.15	8th		Clear; no odor

Development Personnel: K. Swiadek

Notes: Removed 30 gallons with surge block and proactive pump. Turb never high during development.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	mililiter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride		
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-2

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/20/2016

Weather 66F, Sunny Development Time Begin 10:20 End 11:31

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	55.00
MP Elevation (ft)	N/A	Pumping Rate (gpm)	580
Land Surface Elevation (ft)		Evacuation Method	Foot Valve Proactive Pump
Sounded Well Depth (ft bmp)	59.05	Volumes Purged	
Depth to Water (ft bmp)	13.07		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	45.98	Color	Tan
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	7.36	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
10:25	0:00	65.77	14.11	580	0.651	87.40	20.72	6.45	-69	0.56	Initial		Tan; no odor
10:30	0:05	66.54	14.00	580	0.614	32.90	19.13	6.60	-71	3.15	1st		Clear; no odor
10:35	0:10	67.31	13.90	580	0.616	27.80	19.08	6.55	-65	1.02	2nd		Clear; no odor
10:40	0:15	68.08	13.95	580	0.616	17.60	18.36	6.60	-67	2.40	3rd		Clear; no odor
10:45	0:20	68.85	13.95	580	0.623	15.10	18.55	6.69	-63	2.58	4th		Clear; no odor
10:50	0:25	69.62	13.95	580	0.633	8.45	18.47	6.68	-62	3.01	5th		Clear; no odor
10:55	0:30	70.39	13.95	580	0.643	6.12	18.44	6.72	-61	2.61	6th		Clear; no odor
11:00	0:35	71.16	13.95	580	0.638	4.07	18.67	6.69	-62	3.22	7th		Clear; no odor
11:10	0:45	71.93	13.95	580	0.605	5.36	18.69	6.67	-57	0.80	8th		Clear; no odor
11:15	0:50	72.70	13.95	580	0.603	4.97	18.71	6.68	-61	0.90	9th		Clear; no odor
11:20	0:55	73.47	13.95	580	0.603	5.23	19.13	6.67	-55	0.96	10th		Clear; no odor
11:25	1:00	74.34	13.95	580	0.309	3.92	18.33	6.74	-62	0.23	11th		Clear; no odor
11:30	1:05	75.01	13.95	580	0.604	1.97	18.23	6.74	-62	2.09	12th		Clear; no odor

Development Personnel: T. Runge

Notes: Sheen observed on purge water. 65 gallons removed with a foot valve/surge block & proactive pump (40 surged). Lid and stick-up bent and broken. Not 3' tall; no sand, pad dimensions/condition unkown. Bollards need painted.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-3

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/19/2016

Weather 64F, Sunny Development Time Begin 15:05 End 16:05

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	
MP Elevation (ft)	N/A	Pumping Rate (gpm)	580
Land Surface Elevation (ft)		Evacuation Method	Foot Valve Proactive Pump
Sounded Well Depth (ft bmp)	25.38	Volumes Purged	12
Depth to Water (ft bmp)	12.70		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	12.68	Color	clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	2.02	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
15:10	0:05	16.77	13.42	580	0.393	12.60	19.91	6.05	136	3.26	Initial		Clear; no odor
15:15	0:10	17.54	13.31	580	0.431	7.20	19.49	6.13	116	1.61	1st		Clear; no odor
15:20	0:15	18.31	13.23	580	0.416	12.30	17.88	6.12	113	3.16	2nd		Clear; no odor
15:25	0:20	19.08	13.21	580	0.416	8.70	18.50	6.10	130	1.93	3rd		Clear; no odor
15:30	0:25	19.85	13.21	580	0.418	6.40	17.52	6.15	133	2.64	4th		Clear; no odor
15:35	0:30	20.02	13.21	580	0.405	5.30	20.04	6.15	155	2.10	5th		Clear; no odor
15:40	0:35	21.39	13.20	580	0.410	4.80	19.28	6.31	144	3.14	6th		Clear; no odor
15:50	0:45	22.16	13.21	580	0.405	5.10	19.16	6.19	156	2.89	7th		Clear; no odor
15:55	0:50	22.93	13.20	580	0.411	3.00	18.89	6.14	153	1.00	8th		Clear; no odor
16:00	0:55	23.70	13.20	580	0.408	2.10	18.46	6.16	156	2.38	9th		Clear; no odor
16:05	1:00	24.47	13.20	580	0.405	0.70	18.57	6.18	152	2.79	10th		Clear; no odor

Development Personnel: T. Runge

Notes: 16 gallons purged with foot valve and surge block. Well stick-up lid is bent and broken; well stickup is less than 3' tall; cannot see/tell what size pad is, if it's even present. No sand in stickup; bollards need repainting.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

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WELL DEVELOPMENT LOG

Site/Well No. MW-4

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/19/2016

Weather 64F, Sunny Development Time Begin 11:25 End 12:05

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	30.00
MP Elevation (ft)	N/A	Pumping Rate (gpm)	880
Land Surface Elevation (ft)		Evacuation Method	Foot Valve Proactive Pump
Sounded Well Depth (ft bmp)	36.93	Volumes Purged	10
Depth to Water (ft bmp)	17.05		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	19.8	Color	clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	3.18	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
11:25	0:05	28.16	17.23	880	0.225	24.30	18.77	5.68	65	2.39	Initial		Clear; no odor
11:30	0:10	29.19	17.23	780	0.219	21.20	18.81	5.71	61	2.47	1st		Clear; no odor
11:35	0:15	30.09	17.26	680	0.219	39.00	18.48	5.60	78	0.96	2nd		Clear; no odor
11:40	0:20	30.90	17.27	680	0.219	32.60	18.51	5.62	80	0.60	3rd		Clear; no odor
11:45	0:25	31.89	17.27	680	0.219	30.80	18.41	5.61	79	0.54	4th		Clear; no odor
11:50	0:30	32.79	17.28	680	0.222	23.50	18.69	5.66	73	1.22	5th		Clear; no odor
11:55	0:35	33.69	17.27	680	0.219	31.80	18.60	5.62	76	1.83	6th		Clear; no odor
12:00	0:40	34.59	17.27	680	0.218	15.40	18.57	5.66	76	0.99	7th		Clear; no odor
12:05	0:45	35.49	17.28	680	0.219	9.60	19.21	5.65	74	0.97	8th		Clear; no odor

Development Personnel: T. Runge

Notes: 27 gallons pumped via foot valve. Stick-up less than 3' tall; 2x2' pad, stick-up lid hinge broken. No sand in stick-up.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-5

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/19/2016

Weather 61F, Sunny Development Time Begin 9:55 End 11:17

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	50.50
MP Elevation (ft)	N/A	Pumping Rate (gpm)	580
Land Surface Elevation (ft)		Evacuation Method	Proactive Pump
Sounded Well Depth (ft bmp)	55.5	Volumes Purged	10
Depth to Water (ft bmp)	16.99		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	38.51	Color	clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	6.16	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
10:00	0:05	48.77	17.17	580	0.197	23.30	16.39	5.69	23	1.65	Initial		Clear; no odor
10:05	0:10	49.67	17.16	680	0.194	6.84	16.68	5.82	18	1.58	1st		Clear; no odor
10:10	0:15	50.87	17.16	680	0.191	6.31	17.24	5.88	13	2.54	2nd		Clear; no odor
10:15	0:20	51.34	17.16	580	0.192	6.90	17.30	5.86	16	1.75	3rd		Clear; no odor
10:20	0:25	52.11	17.16	580	0.191	4.20	17.44	5.81	23	2.99	4th		Clear; no odor
10:25	0:30	52.88	17.16	580	0.191	3.50	17.43	5.72	26	1.74	5th		Clear; no odor
10:30	0:35	53.78	17.16	680	0.191	4.75	17.45	5.69	24	1.58	6th		Clear; no odor
10:35	0:40	54.68	17.16	680	0.190	3.88	17.85	5.70	24	1.86	7th		Clear; no odor
10:40	0:45	55.58	17.16	680	0.191	2.37	17.70	5.74	28	1.26	8th		Clear; no odor
10:45	0:50	56.61	17.16	780	0.190	2.89	17.71	5.75	28	1.01	9th		Clear; no odor
10:50	0:55	57.64	17.16	780	0.190	3.00	17.70	5.75	28	0.99	10th		Clear; no odor
10:55	1:00	58.67	17.16	780	0.191	4.11	17.76	5.76	27	1.78	11th		Clear; no odor
11:00	1:05	59.70	17.16	780	0.192	2.67	17.84	5.78	26	1.91	12th		Clear; no odor
11:10	1:15	60.73	17.16	780	0.192	3.49	17.79	5.77	27	3.64	13th		Clear; no odor
11:15	1:20	61.76	17.16	780	0.190	4.01	17.69	5.74	28	5.15	14th		Clear; no odor

Development Personnel: T. Runge

Notes: Well stick-up <3' and lid hinge rusted off/broken. 2'x2' pad; no sand in stick-up.

40 gal removed with foot valve and surge block.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-6

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/19/2016

Weather 64F, Sunny Development Time Begin 13:35 End 14:25

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	
MP Elevation (ft)	N/A	Pumping Rate (gpm)	580
Land Surface Elevation (ft)		Evacuation Method	Foot Valve Proactive Pump
Sounded Well Depth (ft bmp)	43.82	Volumes Purged	10
Depth to Water (ft bmp)	16.76		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	27.06	Color	clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	4.33	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
13:35	0:05	40.77	28.87	580	0.226	24.20	19.10	6.31	-76	3.04	Initial		Clear; no odor
13:40	0:10	41.54	28.90	580	0.229	21.30	19.08	6.20	-65	1.86	1st		Clear; no odor
13:45	0:15	42.31	27.85	580	0.223	7.00	17.92	6.25	-68	1.89	2nd		Clear; no odor
13:50	0:20	43.08	27.05	580	0.222	2.50	17.18	6.10	-57	1.55	3rd		Clear; no odor
13:55	0:25	43.85	26.96	580	0.222	2.10	16.94	6.22	-63	2.30	4th		Clear; no odor
14:00	0:30	44.62	26.91	580	0.224	1.50	16.55	6.28	-66	1.58	5th		Clear; no odor
14:05	0:35	45.34	26.84	580	0.223	0.50	16.78	6.23	-64	1.89	6th		Clear; no odor
14:10	0:40	46.16	26.80	580	0.224	0.50	16.91	6.19	-62	1.94	7th		Clear; no odor
14:15	0:45	46.43	26.79	580	0.222	0.30	16.81	6.34	-70	1.60	8th		Clear; no odor
14:20	0:50	47.70	26.71	580	0.224	0.10	16.79	6.32	-70	1.49	9th		Clear; no odor
14:25	0:55	48.47	26.65	580	0.225	1.10	16.31	6.33	-71	1.38	10th		Clear; no odor

Development Personnel: T. Runge

Notes: Bollards in bad condition - 1 bent. Stick-up lid broken and stick-up <3' tall. 2x2' pad. In swamp; poor access,

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

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WELL DEVELOPMENT LOG

Site/Well No. MW-8

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/20/2016

Weather 64F, Sunny Development Time Begin 12:00 End 13:06

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	
MP Elevation (ft)	N/A	Pumping Rate (gpm)	580
Land Surface Elevation (ft)		Evacuation Method	Foot Valve Proactive Pump
Sounded Well Depth (ft bmp)	43.82	Volumes Purged	10
Depth to Water (ft bmp)	16.76		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	27.06	Color	clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	4.33	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
12:04	0:05	15.77	10.50	580	0.446	530.00	18.60	6.63	68	3.45	Initial		Tan; no odor
12:09	0:10	16.54	10.25	580	0.386	146.00	17.81	6.59	89	2.68	1st		Tan; no odor
12:14	0:15	17.31	10.14	580	0.304	98.80	17.44	6.32	623	0.15	2nd		Clear; no odor
12:19	0:20	18.08	10.09	580	0.312	42.30	17.15	6.29	1023	0.17	3rd		Clear; no odor
12:24	0:25	18.85	10.08	580	----------	15.58	----------	--------	------	----------	4th		Clear; no odor
12:29	0:30	19.62	10.15	580	----------	9.10	----------	--------	------	----------	5th		Clear; no odor
12:34	0:35	20.39	10.18	580	----------	4.09	----------	--------	------	----------	6th		Clear; no odor
12:39	0:40	21.16	10.21	580	----------	3.18	----------	--------	------	----------	7th		Clear; no odor
12:44	0:45	21.93	10.20	580	----------	2.16	----------	--------	------	----------	8th		Clear; no odor
12:49	0:50	22.70	10.20	580	----------	1.20	----------	--------	------	----------	9th		Clear; no odor
12:54	0:55	23.47	10.20	580	----------	1.09	----------	--------	------	----------	10th		Clear; no odor
12:59	1:00	24.24	10.21	580	----------	0.97	----------	--------	------	----------	11th		Clear; no odor
13:04	1:05	25.01	10.21	580	----------	0.70	----------	--------	------	----------	12th		Clear; no odor

Development Personnel: T. Runge

Notes: 15.0 gallons removed via proactive/foot valve/surge. Horiba not functioning at 1220. Stick-up below 3', hinge broken, 2'x2' pad.
ORP at 1214 and 1219 likely an error with probe.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

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WELL DEVELOPMENT LOG

Site/Well No. MW-1601

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/18/2016

Weather 54F, Rain Development Time Begin 16:32 End 17:54

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	36.0
MP Elevation (ft)	N/A	Pumping Rate (gpm)	608
Land Surface Elevation (ft)		Evacuation Method	Proactive Pump
Sounded Well Depth (ft bmp)	41.70	Volumes Purged	10.18
Depth to Water (ft bmp)	14.60		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	27.1	Color	Clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	4.34	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
16:37	0:05	40.16	14.62	608	0.164	659.0	16.55	5.78	32	1.42	Initial		Tan; no odor
16:42	0:10	40.32	14.62	608	0.164	618.0	16.21	5.77	52	2.80	1st		Tan; no odor
16:57	0:25	40.64	14.62	608	0.164	604.0	16.28	5.74	56	1.65	2nd		Tan; no odor
17:02	0:30	40.96	14.63	608	0.173	614.0	16.52	5.78	53	1.64	3rd		Tan; no odor
17:07	0:35	41.28	14.63	608	0.173	605.0	16.25	5.78	54	2.04	4th		Tan; no odor
17:12	0:40	41.60	14.62	608	0.172	417.0	16.24	5.81	50	2.56	5th		Tan; no odor
17:17	0:45	41.92	14.62	608	0.171	312.0	16.18	5.80	50	2.50	6th		Tan; no odor
17:22	0:50	42.24	14.63	608	0.172	302.0	16.18	5.81	51	2.60	7th		Tan; no odor
17:27	0:55	42.56	14.63	608	0.171	206.0	16.17	5.81	48	2.58	8th		Tan; no odor
17:32	1:00	42.88	14.63	608	0.173	114.0	16.15	5.89	52	2.66	9th		Tan; no odor
17:37	1:05	43.20	14.61	608	0.174	90.0	16.16	5.84	53	1.64	10th		Milky; no odor
17:42	1:10	43.52	14.61	608	0.173	63.0	16.22	5.86	51	1.53	11th		Milky; no odor
17:47	1:15	43.84	14.61	608	0.175	42.0	16.18	5.87	54	1.40	12th		Milky; no odor
17:52	1:20	44.16	14.61	608	0.174	39.0	16.19	5.83	51	1.81	13th		Clear; no odor
					.								

Development Personnel: T. Runge

Notes: 40 gal removed with foot valve/surge block. Pump rate would not go lower.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	mililiter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

WELL DEVELOPMENT LOG

Site/Well No. MW-1602A

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 6/14/2016

Weather 80F, Sunny Development Time Begin 10:05 End 12:30

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	
MP Elevation (ft)	N/A	Pumping Rate (gpm)	250
Land Surface Elevation (ft)		Evacuation Method	Submersible Proactive Pump
Sounded Well Depth (ft bmp)	60.40	Volumes Purged	
Depth to Water (ft bmp)	24.56		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	35.84	Color	Clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	5.7	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
11:40	0:05	65.00	25.12	250	0.458	151.0	17.25	6.39	-19	13.56	Initial		Clear; no odor
11:45	0:10	65.20	25.69	270	0.437	112.0	17.24	6.32	-16	3.88	1st		Clear; no odor
11:50	0:15	65.40	25.30	200	0.444	82.6	16.15	6.35	-34	2.26	2nd		Clear; no odor
11:55	0:20	65.60	25.21	200	0.441	74.3	16.22	6.48	-59	1.64	3rd		Clear; no odor
12:00	0:25	65.80	25.00	180	0.426	68.4	16.94	6.50	-68	1.38	4th		Clear; no odor
12:05	0:30	66.00	24.92	180	0.430	60.2	17.11	6.53	-74	1.22	5th		Clear; no odor
12:10	0:35	66.20	29.88	180	0.438	48.9	17.18	6.56	-78	1.02	6th		Clear; no odor
12:15	0:40	66.40	29.88	180	0.441	36.0	17.40	6.58	-80	1.02	7th		Clear; no odor
12:20	0:45	66.60	29.85	180	0.430	34.3	17.56	6.61	-83	0.97	8th		Clear; no odor
12:25	0:50	66.80	29.85	180	0.445	33.6	17.36	6.62	-85	0.90	9th		Clear; no odor
12:30	0:55	67.00	29.86	180	0.446	33.4	17.54	6.64	-88	0.86	10th		Clear; no odor

Development Personnel: K. Swiadek

Notes: Removed 65 gallons with Waterra and proactive pump. Very fine sand/silt.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	mililiter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1603A

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 6/14/2016

Weather 80F, Sunny Development Time Begin 14:10 End 16:10

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	
MP Elevation (ft)	N/A	Pumping Rate (gpm)	260
Land Surface Elevation (ft)		Evacuation Method	Submersible Proactive Pump
Sounded Well Depth (ft bmp)	46.40	Volumes Purged	
Depth to Water (ft bmp)	7.60		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	38.8	Color	Clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	6.2	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
15:30	0:00	60.00	11.30	260	0.267	116.0	16.78	6.29	-12	10.80	Initial		Clear; no odor
15:35	0:05	60.20	11.23	260	0.269	97.5	16.66	6.45	-65	3.60	1st		Clear; no odor
15:40	0:10	60.30	10.33	220	0.264	79.9	16.65	6.63	-87	2.50	2nd		Clear; no odor
15:45	0:15	60.40	9.81	210	0.262	45.4	16.55	6.68	-96	1.9	3rd		Clear; no odor
15:50	0:20	60.50	9.75	210	0.262	31.9	16.61	6.73	-101	1.60	4th		Clear; no odor
15:55	0:25	60.60	9.75	210	0.261	26.8	16.63	6.79	-107	1.35	5th		Clear; no odor
16:00	0:30	60.70	9.73	210	0.261	19.8	16.74	6.83	-112	1.16	6th		Clear; no odor
16:05	0:35	60.80	9.72	210	0.261	11.7	16.99	6.77	-106	1.10	7th		Clear; no odor
16:10	0:40	60.90	9.73	210	0.261	9.7	17.08	6.79	-109	1.03	8th		Clear; no odor
					.								

Development Personnel: K. Swiadek

Notes: Removed 60 gallons with surge block and pump.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

WELL DEVELOPMENT LOG

Site/Well No. MW-1604

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/18/2016

Weather 54F, Rain Development Time Begin 13:18 End 14:45

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	42.0
MP Elevation (ft)	N/A	Pumping Rate (gpm)	591
Land Surface Elevation (ft)		Evacuation Method	Proactive Pump
Sounded Well Depth (ft bmp)	47.33	Volumes Purged	12.19
Depth to Water (ft bmp)	20.81		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	26.52	Color	Tan
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	4.24	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
13:23	0:05	40.78	21.89	591	0.212	239.0	17.29	5.90	-16	4.60	Initial		Tan; no odor
13:28	0:10	41.56	21.71	591	0.211	178.0	17.68	6.14	-15	3.06	1st		Tan; no odor
13:33	0:15	42.34	21.58	591	0.211	161.0	17.91	6.15	-16	3.91	2nd		Tan; no odor
13:38	0:20	43.12	21.43	591	0.207	138.0	18.05	6.19	-21	2.06	3rd		Tan; no odor
13:43	0:25	43.90	21.91	591	0.216	103.0	18.23	6.13	-14	2.19	4th		Tan; no odor
13:48	0:30	44.68	21.95	591	0.218	141.0	18.23	6.14	-15	1.66	5th		Tan; no odor
13:53	0:35	45.46	21.96	591	0.209	129.0	18.19	6.13	-14	1.88	6th		Tan; no odor
13:58	0:40	46.24	21.98	591	0.216	134.0	18.21	6.15	-15	1.60	7th		Tan; no odor
14:03	0:45	47.02	21.78	591	0.213	176.0	18.24	6.08	-8	2.27	8th		Tan; no odor
14:08	0:50	47.80	21.70	591	0.142	159.0	18.07	6.07	-11	8.77	9th		Tan; no odor
14:13	0:55	48.58	21.73	591	0.219	109.0	18.11	6.09	-12	8.74	10th		Tan; no odor
14:18	1:00	49.36	21.75	591	0.219	118.0	18.05	6.06	-14	8.63	11th		Tan; no odor
14:23	1:05	50.14	21.72	591	0.219	90.0	18.13	6.07	-13	2.49	12th		Tan; no odor
14:28	1:10	50.92	21.68	591	0.217	167.0	18.14	6.09	-14	3.65	13th		Tan; no odor
14:32	1:14	51.70	21.69	591	0.215	151.00	18.17	6.08	-17	4.51	14th		Tan; no odor

Development Personnel: T. Runge

Notes: 40 gal removed with foot valve and surge block.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	mililiter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1605

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/18/2016

Weather 54F, Rain Development Time Begin 10:45 End 12:00

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	34.0
MP Elevation (ft)	N/A	Pumping Rate (gpm)	993.6
Land Surface Elevation (ft)		Evacuation Method	Proactive Pump
Sounded Well Depth (ft bmp)	44.76	Volumes Purged	12.19
Depth to Water (ft bmp)	17.39		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	27.37	Color	Tan
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	4.37	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
10:50	0:05	40.26	36.97	993.6	0.485	358.0	16.18	6.30	24	8.81	Initial		Tan; no odor
10:55	0:10	40.52	35.89	993.6	0.473	218.0	16.33	6.24	27	9.96	1st		Tan; no odor
11:00	0:15	40.75	35.58	869.4	0.479	163.0	16.32	6.18	29	1.24	2nd		Tan; no odor
11:05	0:20	40.94	35.29	709.8	0.481	150.0	16.34	6.01	30	7.18	3rd		Tan; no odor
11:10	0:25	41.13	35.18	709.8	0.489	115.0	16.32	5.96	32	6.43	4th		Tan; no odor
11:15	0:30	41.32	35.01	709.8	0.488	110.0	16.29	5.81	49	6.26	5th		Tan; no odor
11:20	0:35	41.51	34.97	709.8	0.473	30.7	16.32	6.06	36	2.80	6th		Clear; no odor
11:25	0:40	41.70	34.96	709.8	0.473	13.7	16.35	6.11	28	2.58	7th		Clear; no odor
11:30	0:45	41.89	32.90	725	0.491	34.8	16.34	6.23	21	10.13	8th		Clear; no odor
11:35	0:50	42.08	32.85	725	0.492	25.9	16.27	6.03	33	10.01	9th		Clear; no odor
11:40	0:55	42.27	32.74	725	0.474	15.3	16.33	6.21	33	4.41	10th		Clear; no odor
11:45	1:00	42.46	32.69	725	0.472	10.9	16.35	6.11	34	3.41	11th		Clear; no odor
11:50	1:05	42.65	32.59	725	0.462	7.7	16.43	6.09	31	2.61	12th		Clear; no odor
11:55	1:10	42.84	32.51	725	0.464	19.7	16.41	6.10	36	4.80	13th		Clear; no odor
12:00	1:15	43.03	32.56	725	0.461	12.20	16.44	6.05	32	2.78	14th		Clear; no odor

Development Personnel: T. Runge

Notes: 40 gal removed with foot valve and surge block.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1606

Project AEP Amos Plant Project No. OH015976.0007 Page 1 of 1

Site Location Winfield, WV Date 5/17/2016

Weather 61F, Clouds/Rain Development Time Begin 13:30 End 15:00

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	
MP Elevation (ft)	N/A	Pumping Rate (gpm)	300oz/min (8872.06 ml/min)
Land Surface Elevation (ft)		Evacuation Method	Proactive Pump
Sounded Well Depth (ft bmp)	42.48	Volumes Purged	13.63
Depth to Water (ft bmp)	11.23		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	31.25	Color	Tan
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	5.00	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
1:30	0:05	32.34	11.81	8872	0.454	883.0	15.71	5.57	37	10.13	Initial		----------
1:35	0:10	34.68	11.70	8872	0.415	737.0	15.71	5.69	19	10.09	1st		----------
1:40	0:15	37.02	11.62	8872	0.394	498.0	15.67	5.78	22	1.38	2nd		----------
1:45	0:20	39.36	11.50	8872	0.392	334.0	15.60	5.78	39	2.33	3rd		----------
1:50	0:25	41.70	11.41	8872	0.382	235.0	15.51	5.81	39	5.84	4th		----------
1:55	0:30	44.04	11.85	8872	0.376	213.0	15.62	5.80	38	1.90	5th		----------
2:00	0:35	46.38	11.79	8872	0.376	190.0	16.62	5.77	39	2.88	6th		----------
2:05	0:40	48.72	11.81	8872	0.384	174.0	15.63	5.76	38	1.97	7th		----------
2:10	0:45	51.06	11.80	8872	0.384	157.0	15.63	5.76	38	1.28	8th		----------
2:15	0:50	53.40	11.78	8872	0.386	141.0	15.63	5.74	32	3.12	9th		----------
2:20	0:55	55.74	11.71	8872	0.386	121.0	15.62	5.77	36	2.27	10th		----------
2:25	1:00	58.08	11.54	8872	0.373	111.0	15.59	5.78	40	1.02	11th		----------
2:30	1:05	60.42	11.34	8872	0.371	102.0	15.62	5.78	40	0.57	12th		----------
2:35	1:10	62.76	11.31	8872	0.383	92.1	15.65	5.77	47	10.51	13th		----------
2:40	1:15	65.10	11.35	8872	0.384	103.0	15.57	5.77	47	10.43	14th		----------
2:45	1:20	65.80	11.33	2957	0.382	76.4	15.57	5.76	42	8.79	15th		----------
2:50	1:25	66.58	11.30	2957	0.382	63.8	15.54	5.75	42	9.30	16th		----------
2:55	1:30	67.36	11.29	2957	0.383	75.1	15.55	5.76	42	9.15	17th		----------
3:00	1:35	68.14	11.33	2957	0.384	73.20	15.58	5.76	44	6.17	18th		----------

Development Personnel: T. Runge

Notes: Parameters were collected when centrifugal/proactive pump was used

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	mililiter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

WELL DEVELOPMENT LOG

Site/Well No. MW-1605

Project AEP Amos Plant | Project No. OH015976.0007 | Page 1 of 1

Site Location Winfield, WV | Date 6/15/2016

Weather 80F, Cloudy | Development Time Begin ______ End ______

Evacuation Data

Measuring Point	TOC	Sample Pump Intake Setting (ft bmp)	
MP Elevation (ft)	N/A	Pumping Rate (gpm)	
Land Surface Elevation (ft)		Evacuation Method	Bailer
Sounded Well Depth (ft bmp)	43.15	Volumes Purged	
Depth to Water (ft bmp)	3.60		
Water-Level Elevation (ft)		**Field Parameters**	
Water Column in Well (ft)	39.55	Color	Tan
Casing Diameter/Type	1" PVC	Odor	None
Gallons in Well	2.37	Appearance	

Time	Min Elapsed	Total Gallons Removed	Depth To Water (ft btoc)	Rate (mL/min)	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°F/°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Well Volume (Gal)		Remarks
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Development Personnel: K. Swiadek

Notes: Removed 25 gallons with Waterra. Turbidity >1000 throughout.

Well Casing Volumes (gallon/feet)

1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	mililiter	NTU	Nephelometric Turbidity Units	ORP	Oxidation-Reduction Potentia
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride	mV	millivolts
ft	feet	msl	mean sea-level	s.u.	Standard units		
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter		
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		